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**Road vehicles — Ergonomic  
requirements for the driver's workplace in  
line-service buses —**

**Part 3:  
Information devices and controls**

*Véhicules routiers — Exigences ergonomiques du poste de conduite  
dans les bus de ville —*

*Partie 3: Systèmes de contrôle et d'information*



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## 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16121-3 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 13, *Ergonomics applicable to road vehicles*.

This second edition cancels and replaces the first edition (ISO 16121-3:2005), which has been editorially revised.

ISO 16121 consists of the following parts, under the general title *Road vehicles — Ergonomic requirements for the driver's workplace in line-service buses*:

- *Part 1: General description, basic requirements*
- *Part 2: Visibility*
- *Part 3: Information devices and controls*
- *Part 4: Cabin environment*

## Introduction

Poor ergonomics in the driver's workplace in buses designed to provide scheduled urban and interurban services increase the already high physical and mental strains on the drivers.

It is the aim of this part of ISO 16121 to supply the designer of line-service buses with information about how to develop an overall ergonomic concept for the driver's workplace. The recommended requirements on the driver's workplace for line-service buses made in this part of ISO 16121 are based on the scientific conclusions of the research project "Driver's workplace in the line-service bus". This was conducted in Germany and summarized in the recommendation VDV 234<sup>[1]</sup>. Further comprehensive ergonomic studies related to the design of an enhanced driver workplace conducted in the United States, Canada, the Netherlands, Sweden and the United Kingdom<sup>[2][3][4][5][6]</sup> have been considered and found to provide recommendations covering similar areas.

This part of ISO 16121 sets out to consider the practical implications for all ranges of drivers, but particularly those with statures from 1,55 m (small female) to 2,0 m (large male). These statures include shoes (~30 mm).

It is also essential that the designer refers to the specifications and requirements of all parts of ISO 16121 (1 to 4) before completing the design of a driver's workplace.

It should be noted that where there is also national legislation covering any of the subjects contained herein, then both should be complied with. However, if a contradiction between the two should arise in any specific area, then the legislation shall prevail for that specific point only.



# Road vehicles — Ergonomic requirements for the driver's workplace in line-service buses —

## Part 3: Information devices and controls

### 1 Scope

This part of ISO 16121 specifies requirements for the location of information devices and controls.

It applies to the driver's workplace in low-floor buses designed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum weight exceeding five metric tonnes and a maximum width exceeding 2,30 m.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 16121-1, *Road vehicles — Ergonomic requirements for the driver's workplace in line-service buses — Part 1: General description, basic requirements*

ISO 2575, *Road vehicles — Symbols for controls, indicators and tell-tales*

ISO 4040, *Road vehicles — Location of hand controls, indicators and tell-tales in motor vehicles*

### 3 Terms, definitions and abbreviated terms

#### 3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

##### 3.1.1

##### **low-floor**

vehicle in which at least 35 % of the area available for standing passengers (or of its forward section in the case of an articulated vehicle) forms a single area without steps, reached through at least one service door by a single step from the ground

##### 3.1.2

##### **early warning**

visual signal, no immediate action required

##### 3.1.3

##### **alert**

visual signal alarm, immediate action required

**3.1.4**

**Zone A**

zone on the dashboard beneath the steering wheel, bounded by a horizontal tangent to the top of the steering column at its uppermost position, a vertical line projected from the left- and right-hand extremities of the wheel rim and the top of the dashboard (see Figure 1)

**3.1.5**

**Zone B**

zone to the left of the steering wheel limited to the right by outer diameter of steering wheel, limited to the left and front by the hand reach R (see Figures 1 and 2), limited to the rear by the plane transverse to the length axis of the seat up to a maximum of 60 mm below steering wheel centre (central position) as advised by the manufacturer

**3.1.6**

**Zone C**

same shape as Zone B, but mirrored to the right of the steering wheel (see Figure 1)

**3.1.7**

**Zone B<sub>1</sub>**

supplementary plane, starting nearest to the driver at the end of Zone B with the same width and continuing spreading downwards (see Figure 1)

NOTE Zone B<sub>1</sub> may be integrated into Zone B.

**3.1.8**

**Zone C<sub>1</sub>**

supplementary plane mirrored to Zone B<sub>1</sub>, adjacent to Zone C (see Figure 1)

NOTE Zone C<sub>1</sub> may be integrated into Zone C.

**3.1.9**

**Zone D**

side console to the left of the driver, limited to the right by the distance to the seat (minimum 100 mm), to the front by the rear border of Zone B, and to the left and rear by the cabin walls (see Figure 1)

**3.1.10**

**Zone E**

side console to the right of the driver, limited to the left by the distance to the seat (minimum 100 mm), limited to the front by the rear border of Zone C, limited to the right depending on regulations about gangways, and limited to the rear by the cabin walls (see Figure 1)

**3.1.11**

**Zone F**

roof console over driver's workplace, out of the hand reach of a seated driver (see Figure 2)

**3.1.12**

**hand reach range**

range bounded by two forward-facing hemispheres of 750 mm radius constructed from both the left and right shoulder points

**3.13**

**shoulder point**

**SP**

points located on the left and right, 530 mm vertically above the H-point of the seat when it is in its furthest forward and lowest position, and 170 mm either side of the centreline of the seat

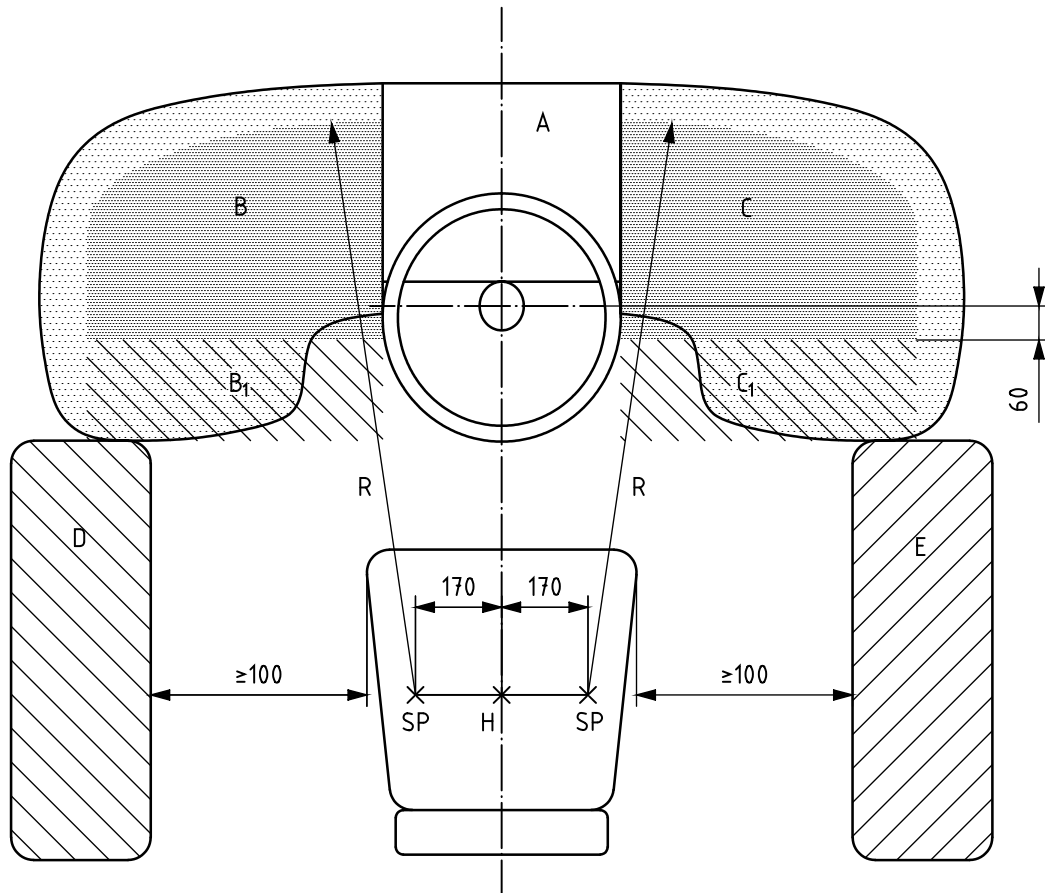


### 3.2 Abbreviated terms

LHD left-hand driven vehicle

RHD right-hand driven vehicle

Dimensions in millimetres

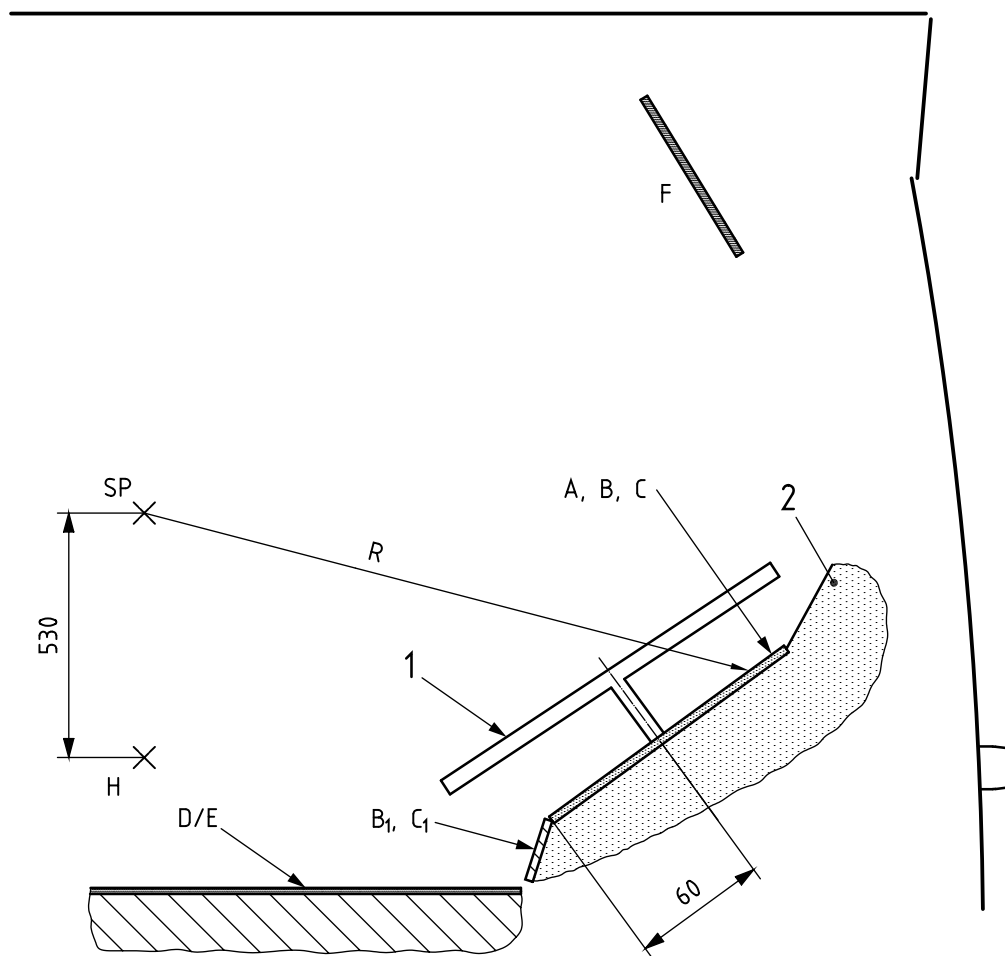


#### Key

- A Zone A (3.1.4)
- B Zone B (3.1.5)
- B<sub>1</sub> Zone B<sub>1</sub> (3.1.7)
- C Zone C (3.1.6)
- C<sub>1</sub> Zone C<sub>1</sub> (3.1.8)
- D Zone D (3.1.9)
- E Zone E (3.1.10)
- H small person
- R hand reach range = 750 mm
- SP shoulder point

Figure 1 — Definition of zones, top view

Dimensions in millimetres



**Key**

- 1 steering wheel
- 2 dashboard
- A Zone A (3.1.4)
- B Zone B (3.1.5)
- B<sub>1</sub> Zone B<sub>1</sub> (3.1.7)
- C Zone C (3.1.6)
- C<sub>1</sub> Zone C<sub>1</sub> (3.1.8)
- D Zone D (3.1.9)
- E Zone E (3.1.10)
- F Zone F (3.1.11)
- H small person
- R hand reach range = 750 mm
- SP shoulder point

**Figure 2 — Definitions of zones, side view**

## 4 Checking and information devices

### 4.1 Basic ergonomic principles

The design of the information units (instruments) shall be based on the following ergonomic principles:

- accessibility of controls from the normal driving position without bending the upper part of the body forward;
- convenient operation of cash register and ticket printer;
- no visibility limitations to the front and side;
- unobstructed view of the display, keyboard, cash register, change machine and change tray for the driver (if provided);
- source of information clearly indicated by pictograms;
- as few indicator lamps as possible, but as many as required by national regulations;
- minimum effort required by driver to identify faults and take rectifying action;
- large, clear symbols (ISO 2575);
- the use of a graphic-capable display, for centralized data representation;
- red lamp or colour screen for alert;
- yellow lamp or colour screen for early warning; and
- fault messages that distinguish between “early warning” and “alert”.

Information presented to the driver shall be relevant, unambiguous, causing the minimum amount of distraction. This will require information to be ranked, which will have to take into account the following:

- a) relevance (safety, resultant damage);
- b) origin; and
- c) addressee (driver, maintenance personnel).

The degree of priority shall be determined by the manufacturer, taking into account the mode of operation.

As part of the information priority, it will be necessary to store information for later display. Manual recall of this information by the appropriate personnel shall be possible.

### 4.2 ISO 4040 compatible location

It is recommended that the following controls on the dashboard and the side consoles be positioned as specified in ISO 4040 for road vehicles in general:

- speed indicator;
- direction indicator;
- change-over of headlights/headlamp flasher;
- windscreen wiper/windscreen washer; and
- horn.

#### 4.3 Zone A

The following instrumentation shall be located in Zone A:

- indicator lamps;
- central information display; and
- the warning and alert indicators.

#### 4.4 Zone B

The following should be located in Zone B:

- hazard flasher (LHD);
- any equipment for automatic vehicle monitoring system and ticketing or similar devices for RHD (may be located alternatively in Zone B<sub>1</sub>);
- headlights (optional for Zone B<sub>1</sub>, if fitted);
- front fog lamps (optional for Zone B, or, if fitted, for Zone B<sub>1</sub>);
- rear fog lamps (optional for Zone B<sub>1</sub>, if fitted);
- interior lighting in the passenger compartment (optional for Zone B<sub>1</sub>, if fitted); and
- alternative position for video monitors.

Hand reach limitation may be ignored for the location of tell tales and video monitors.

#### 4.5 Zone B<sub>1</sub> (where available)

The following may be located in Zone B<sub>1</sub>:

- alternative position for headlights (see 4.4);
- alternative position for front fog lamps (optional) (see 4.4);
- alternative position for rear fog lamps (see 4.4); and
- alternative position for interior lighting in the passenger compartment (see 4.4).

#### 4.6 Zone C

The following should be located in Zone C:

- door control switch (optionally in Zone E for RHD);
- bus stop brake, if fitted;
- kneeling control, if fitted (optionally in Zone E for RHD);
- hazard flasher (RHD);
- lowering lift/ramp (optional), if provided (optionally Zone E for RHD);

- any equipment for automatic vehicle monitoring system and ticketing or similar devices for LHD vehicles (may be located alternatively in Zone E); and
- alternative position for video monitors.

#### 4.7 Zone C<sub>1</sub> (where available)

The following may be located in Zone C<sub>1</sub>:

- alternative location for actuators under 4.6 (lift/ramp, etc.).

#### 4.8 Zone D

The following should be located in Zone D:

- alternative location for equipment used for automatic vehicle monitoring system and ticketing or similar devices for RHD vehicles (see 4.4);
- parking brake actuated by an adjustable, manually operated brake valve for LHD vehicles; and
- heating/ventilation for LHD vehicles.

No controls for operation while driving of the vehicle shall be behind the H-point of the small person.

#### 4.9 Zone E

The following should be located in Zone E:

- alternative location for any equipment used for automatic vehicle monitoring system and ticketing or similar devices for LHD (see 4.6);
- parking brake, actuated by an adjustable, manually operated brake valve for RHD vehicles;
- heating/ventilation for RHD vehicles;
- alternative location for door control switch, kneeling control and lowering lift/ramp for RHD vehicles (see 4.6).

No controls for normal operation of the vehicle shall be behind the H-point of the small person.

#### 4.10 Zone F

The following may be located in Zone F:

- controls for equipment, not frequently operated, e.g.:
  - video monitors; and
  - controls for the video system.

For the best ergonomic operation, all previously defined areas may be inclined towards the driver (10° up to 20° is recommended).

## 5 Adjustable dashboard

When the complete unit, including areas A, B, C, is adjustable, the following design criteria shall be applied:

- adjustment carried out simultaneously with the optional steering wheel adjustment;
- control areas accessible from the normal driving position, without bending the upper part of the body forward;
- sufficient distance to the plane of the steering wheel, according to ISO 4040;
- no operation of devices “through the steering wheel”;
- sufficient leg room clearance between the instrument panel and seat for all seating positions (see ISO 16121-1 for adjustment range);
- no interference condition arising with adjacent components during adjustment; and
- no jamming or crushing of parts of the body.

It is recommended that the steering wheel and dashboard be designed as a combined adjustable unit. Suitable construction measures shall be taken to minimize the influence of the steering system (vibrations, shocks, etc.) on the instruments so low that quick, easy, error-free reading and operation is possible.

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