BRITISH STANDARD

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500-2:2006
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Mobile road construction machinery — Safety —

Part 2: Specific requirements for road-milling machines

ICS 93.080.10

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 500-2:2006+A1:2008. It supersedes BS EN 500-2:2006 which will be withdrawn on 30 November 2009.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1] 〈A1〉.

The UK participation in its preparation was entrusted by Technical Committee B/513, Construction equipment and plant and site safety, to Subcommittee B/513/1, Earth moving machinery (International).

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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Machines mobiles pour la construction de routes - Sécurité - Partie 2: Prescriptions spécifiques pour fraiseuses routières

Bewegliche Straßenbaumaschinen - Sicherheit - Teil 2: Besondere Anforderungen an Straßenfräsen

This European Standard was approved by CEN on 17 August 2006 and includes Amendment 1 approved by CEN on 11 September 2008.

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Foreword

This document (EN 500-2:2006+A1:2008) has been prepared by Technical Committee CEN/TC 151 “Construction equipment and building material machines — Safety”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document supersedes [A1] EN 500-2:2006 [A1].

This document includes Amendment 1, approved by CEN on 2008-09-11.

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This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

[A1] For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. [A1]

EN 500 “Mobile road construction machinery — Safety” comprises the following parts:

— Part 1: Common requirements;

— Part 2: Specific requirements for road-milling machines;

— Part 3: Specific requirements for soil-stabilising machines and recycling machines;

— Part 4: Specific requirements for compaction machines;

— Part 6: Specific requirements for paver-finishers.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This European Standard is a type C standard as stated in EN ISO 12100-1.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this European Standard.

When provisions of this type C standard are different from those stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

1 Scope

This part of EN 500 specifies the safety requirements for road-milling machines as defined in Clause 3 and deals with all significant hazards, hazardous situations and events relevant to these machines, when they are used as intended and under conditions of misuse which are reasonably foreseeable.

This part of EN 500 contains additional requirements to EN 500-1 ”Common requirements”.

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.

EN 500-1:2006, *Mobile road construction machinery — Safety — Part 1: Common requirements.*

EN 811:1996, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs.*

EN 953:1997, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards.*

EN 61310-1:1995, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1:1995).*

EN ISO 3744:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994).*

EN ISO 11201:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane (ISO 11201:1995).*

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003).*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100-1:2003 and the following apply.

3.1
road-milling machines
mobile road construction machines used to mill material from paved surfaces

3.2
milling equipment
power-driven cylindrical bodies on which the milling tools are fitted. The cylindrical bodies rotate during the milling operation

4 List of significant hazards

Annex F of EN 500-1:2006 applies with the following exception:

Table 1

5	**Hazards generated by vibration**
5.1	Hand-arm vibrations

5 Safety requirements and/or protective measures

5.1 Lighting, signalling and marking lights and reflex-reflector devices

5.2 of EN 500-1:2006 applies.

5.2 Operation and handling

5.3 of EN 500-1:2006 applies with the following addition:

— to minimise the risk of dust, appropriate provisions (e.g. a water sprinkling system) shall be made.

5.3 Operator's station

5.4 of EN 500-1:2006 applies. with the following exception:

5.4.2 of EN 500-1:2006, first paragraph, does not apply for road-milling machines.

5.4 Operator's seat

5.5 of EN 500-1:2006 applies.

5.5 Controls and indicators

5.6 of EN 500-1:2006 applies.

5.6 Starting

5.7 of EN 500-1:2006 applies.

5.7 Stopping

5.8 of EN 500-1:2006 applies with the following addition:

— it shall be possible to stop the milling equipment, even while the power unit (engine) is running;

— where additional controls to operate the machine are provided, an emergency stop shall be available.

5.8 Access system to operator's station and to maintenance points

5.9 of EN 500-1:2006 applies with the following addition:

— provisions shall be made to minimise hazards if wheels and tracks are in the vicinity of the operator's station and/or in the access areas. If there are guards, they shall comply with Clauses 5 and 6 of EN 953:1997.

5.9 Protection

5.9.1 General

5.10.1 to 5.10.3 of EN 500-1:2006 apply with the following additions:

5.9.2 Milling equipment

5.9.2.1 General

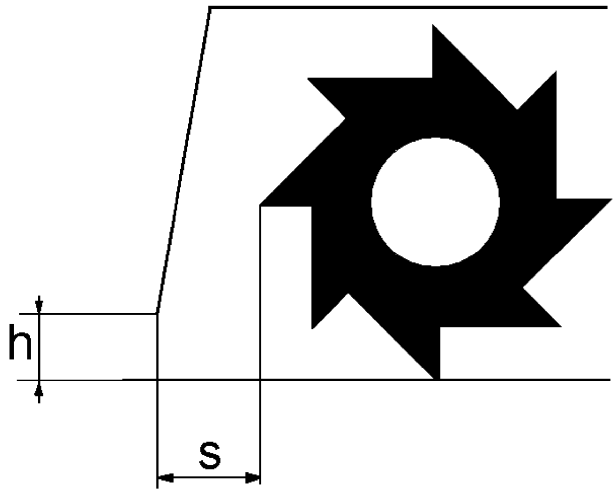
The milling equipment shall be safeguarded to prevent accidental physical contact and to retain debris and parts possibly ejected.

Guards shall comply with Clauses 6 and 7 of EN 953:1997.

Guards and flaps shall remain permanently attached, even when they are opened.

5.9.2.2 Rear guards

With regard to hazards present in the lower limb area, EN 811 shall be observed. For the foot area, the following table in Figure 1 shall be observed.



h mm	s mm
≤ 100	≥ 250
≤ 120	≥ 280

Figure 1 — Milling equipment

The dimension h may be exceeded during the intended use for a short period of time if necessary, as an example, e.g. to complete material discharge or the lowering of the milling drum adjacent to an obstacle. The risk of contact with hazardous areas at the rotor shall be reduced as far as possible by protection devices (e.g. protection device according to EN 953, rear side monitoring system). The warning sign according to Figure 2 shall be permanently installed and clearly visible in the hazardous area.

5.9.2.3 Side guards

Power-operated side panels of the drum guards, intended to be controlled during operation of the machine, shall comply with the following design criteria:

— the controls shall not lock in any position except in neutral (hold-to-run control),

— the controls shall be fitted out of danger areas,

— a yellow flashing light shall be fitted within the danger areas and shall be activated whenever the controls are operated

and

— the power-operated side panels shall automatically return to their normal (pre-set) position when the controls are released except when the milling drum is stopped.

5.9.3 Lowering the milling equipment

The machines shall be prevented from any unintentional movement (e.g. jumping backwards) when lowering the milling equipment to the cutting mode.

5.9.4 Height adjustable devices

Elevating devices on the machines shall be provided with a locking device. Hydraulic load holding devices shall prevent any unintended lowering of the elevating devices.

Mechanical locking devices can be integrated with the elevating devices or can be a permanently attached separate unit. The operation manual shall include instruction on the use of the mechanical locking device.

5.10 Pressurised systems

5.11 of EN 500-1:2006 applies.

5.11 Fire protection

5.12 of EN 500-1:2006 applies.

5.12 Hot surfaces

5.13 of EN 500-1:2006 applies.

5.13 Signal devices and warning signs

5.14 of EN 500-1:2006 applies with the following addition:

— a legible and indelible warning sign „Warning! Rotating milling drum“ (black print on yellow background) shall be applied on both sides of the movable guards or on the protective devices, located around the cutter drum. The marking shall have the form of a warning triangle in accordance with Figure 2. The size of the triangle shall comply with Table 7 of EN 61310-1:1995.

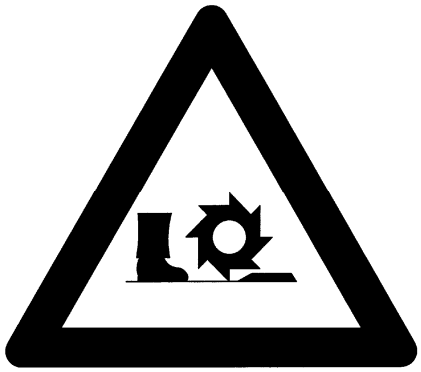


Figure 2 — Warning sign

5.14 Liquid gas units

5.15 of EN 500-1:2006 applies.

5.15 Electrical and electronic systems

5.16 of EN 500-1:2006 applies.

5.16 Electro-magnetic compatibility (EMC)

5.17 of EN 500-1:2006 applies with the following addition:

— the antenna shall be located successively on the left- and right-hand sides of the road-milling machine, with the antenna parallel to the plane of the longitudinal symmetry of the road-milling machine and in line with the SIP.

5.17 Noise and vibration

5.18.2 and 5.18.3 of EN 500-1:2006 apply with the following addition:

— for the determination of the [A1] noise emission values ⟨A1⟩, Annex A applies.

5.18 Conveyors

5.19 of EN 500-1:2006 applies.

6 Verification of safety requirements and/or protective measures

Clause 6 of EN 500-1:2006 applies.

7 Information for the user

Clause 7 of EN 500-1:2006 applies.

Annex A
(normative)

Noise test code for road-milling machines

A.1 Scope

This noise test code specifies all the information necessary to carry out efficiently and under standardized conditions the determination, declaration and verification of the noise emission characteristics of road-milling machines.

Noise emission characteristics include emission sound pressure levels at workstations and the sound power level. The determination of these quantities is necessary for:

— manufacturers to declare the noise emitted;

— comparing the noise emitted by machines in the family concerned;

— purposes of noise control at the source at the design stage.

The use of this noise test code ensures reproducibility of the determination of the noise emission characteristics within specified limits determined by the grade of accuracy of the basic noise-measurement method used. Noise-measurement methods allowed by this standard are engineering methods (grade 2).

A.2 Determination of A-weighted sound power level

A.2.1 General

This annex specifies additional requirements for the determination of A-weighted sound power level according to EN ISO 3744.

A.2.2 Measurement surface

A hemispherical test area shall be used for measurement.

A.2.3 Size of the measurement surface

The radius shall be calculated from the basic length *L* of the machine (see Figure A.1):

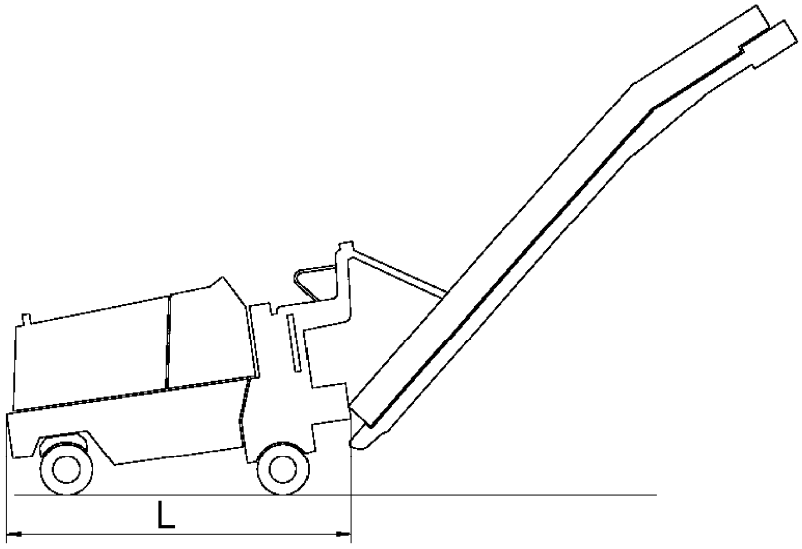


Figure A.1 — Basic length *L*

The radius shall be:

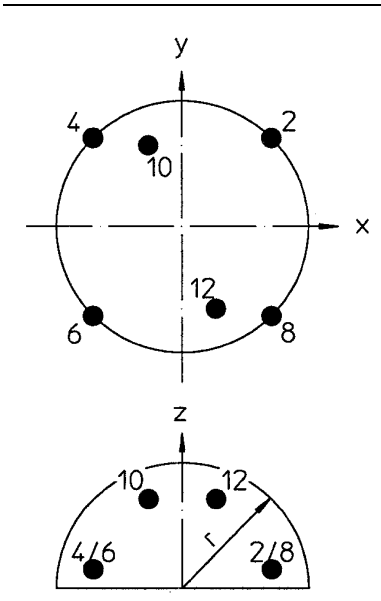
— 4 m when the basic length *L* of the machine to be tested is less than or equal to 1,5 m;

— 10 m when the basic length *L* of the machine to be tested is greater than 1,5 m but less than or equal to 4 m;

— 16 m when the basic length *L* of the machine to be tested is greater than 4 m.

A.2.4 Microphone positions on the hemispherical measurement surface

Six microphone positions (i.e. positions 2, 4, 6, 8, 10 and 12) shall be arranged according to Figure A.2.



Microphone positions	x/r	y/r	z
2	0,7	0,7	1,5 m
4	- 0,7	0,7	1,5 m
6	- 0,7	- 0,7	1,5 m
8	0,7	- 0,7	1,5 m
10	- 0,27	0,65	0,71 r
12	0,27	- 0,65	0,71 r

Figure A.2 — Microphone positions

A.2.5 Positioning of the machine

The centre of the machine shall coincide with the centre of the hemisphere which is the intersecting point of the x-axis and y-axis (see Figure A.2). The front (direction of travelling) of the machine shall point towards the microphone positions 2 and 8. For positioning the machine, the middle of the basic length *L* shall be regarded as the central point.

A.2.6 Repetition of the test

The A-weighted sound power level shall be determined at least three times. If at least two of the determined values do not differ by more than 1 dB, further measurements will not be necessary. Otherwise the measurements shall be continued until 2 values differing by no more than 1 dB are obtained. The A-weighted sound power level to be used for calculating the sound power level to be declared is the arithmetic mean of both highest values that do not differ by more than 1 dB.

The total duration of each measurement at each microphone position shall be at least 15 s.

A.3 Determination of A-weighted emission sound pressure level at the operator's position

A.3.1 General

This annex specifies additional requirements for the determination of the A-weighted emission sound pressure level at operator's position of road-milling machines according to EN ISO 11201 for a seating and/or standing operator. The operator shall be present during the test.

A.3.2 Enclosed operator's positions

When equipped with a cabin, all doors and windows shall be closed during measurement. Air conditioning shall be set to mid-position.

A.3.3 Quantities to be determined

If more than one operator's position is provided, the emission sound pressure level at the operator's station is the highest emission value determined at the operator's positions.

A.3.4 Repetition of the test

The sound pressure level shall be measured at least three times at each microphone position. If at least two of the measured values do not differ by more than 1 dB, further measurements will not be necessary. Otherwise the measurements shall be continued until two values differing by no more than 1 dB are obtained. The A-weighted emission sound pressure level to be used is the arithmetic mean of the two highest values that do not differ by more than 1 dB.

The duration of each measurement at each microphone position shall be at least 15 s.

A.3.5 Microphone position(s)

Should more than one operator’s position be provided, measurement shall be carried out for all positions.

A.4 Operating conditions

The machine shall be equipped as determined by the manufacturer, i.e. all working units shall be fitted.

The engine of the machine shall operate at the nominal speed indicated by the manufacturer. All working units shall be activated and operate at their respective rated speeds.

A.5 Uncertainty

The measurement uncertainty and, in the case of series machines, the uncertainty due to production variations shall be considered when determining the value of the A-weighted sound power level and that of the A-weighted emission sound pressure level at the operator's position.

Current experience shows that the total uncertainty (measurement plus production) of road-milling machines is less than K_{WA} = 1,0 dB for the A-weighted sound power levels and less than K_{pA} = 2,0 dB for the A-weighted emission sound pressure level.

A.6 Information to be recorded

EN ISO 3744 and EN ISO 11201 shall apply with the following additions:

— type and output of engine;

— engine speed;

— fan speed;

— measurement duration t_M for each measurement;

— description of the test environment;

— A-weighted sound power level from each of the three measurements and the resulting sound power level as emission value;

— A-weighted sound pressure levels from each of the three measurements at the operator's position and the resulting emission sound pressure level;

— place, date of measurement, test laboratory and person responsible.

A.7 Information to be reported

EN ISO 3744 and EN ISO 11201 shall apply with the following additions:

— type and output of engine;

— engine speed;

— fan speed;

— measurement duration t_M for each measurement;

— description of the test environment;

— A-weighted sound power level from each of the three measurements and the resulting sound power level as emission value;

— A-weighted sound pressure levels from each of the three measurements at the operator's position and the resulting emission sound pressure level;

— place, date of measurement, test laboratory and person responsible.

The test report shall include the statement that the sound power level and the emission sound pressure level at the operator's position have been determined entirely in accordance with the specifications of this annex. The A-weighted sound power level of the machine under test and A-weighted emission sound pressure level at the operator's position shall be rounded down or up to the nearest integral value in dB (< 0,5 round down, ≥ 0,5 round up).

A.8 Declaration and verification of noise emission values

The declared A-weighted sound power level shall be the sum of the measured value and the associated uncertainty K_{WA} (see A.5).

NOTE The declared value of the A-weighted sound power level is identical to the guaranteed sound power level according to 2000/14/EC.

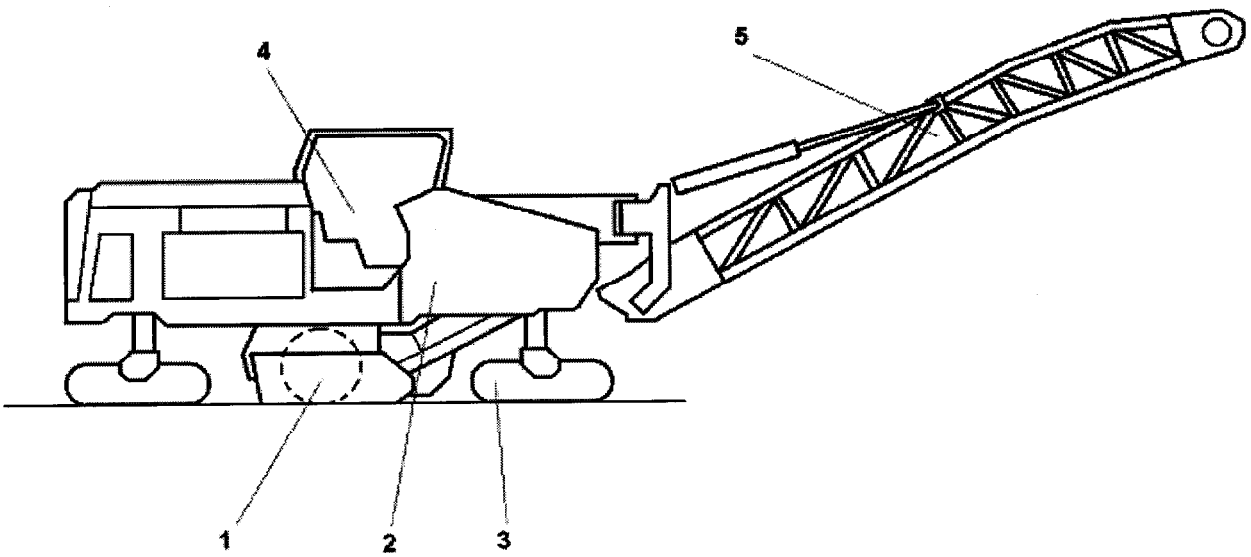
The declared A-weighted emission sound pressure level shall be the sum of the measured value and the associated uncertainty K_{pA} (see A.5).

The noise declaration shall explicitly state that the noise emission values have been obtained according to this noise test code.

Any verification shall be done using this noise test code. If the value measured during verification is less than or equal to the declared value, the declared value is confirmed.

Annex B
(informative)

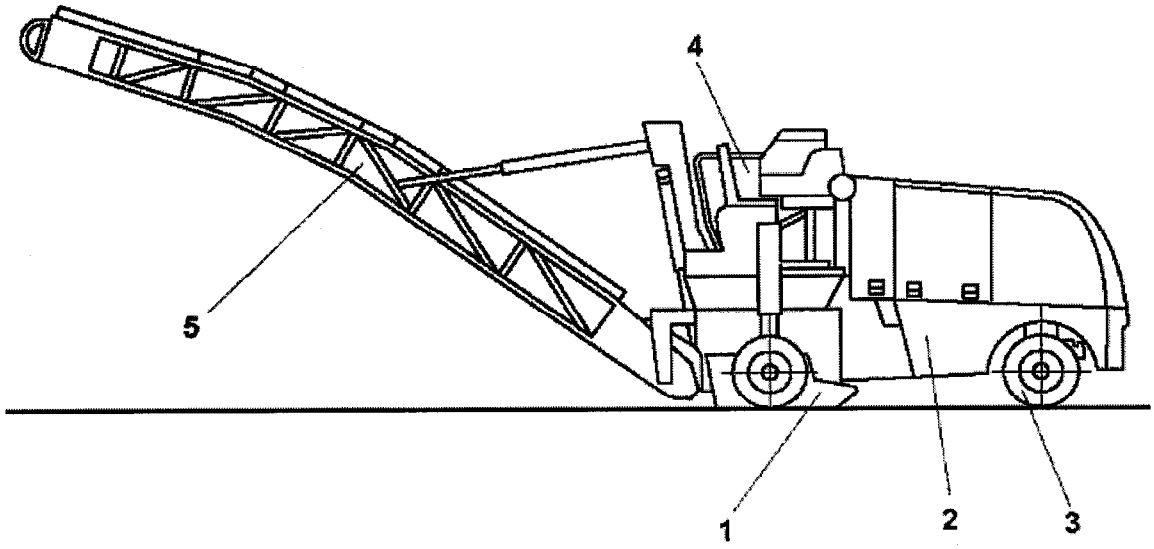
Examples of road-milling machines



Key

1	milling drum	4	operator's station
2	chassis	5	conveyor
3	crawler		

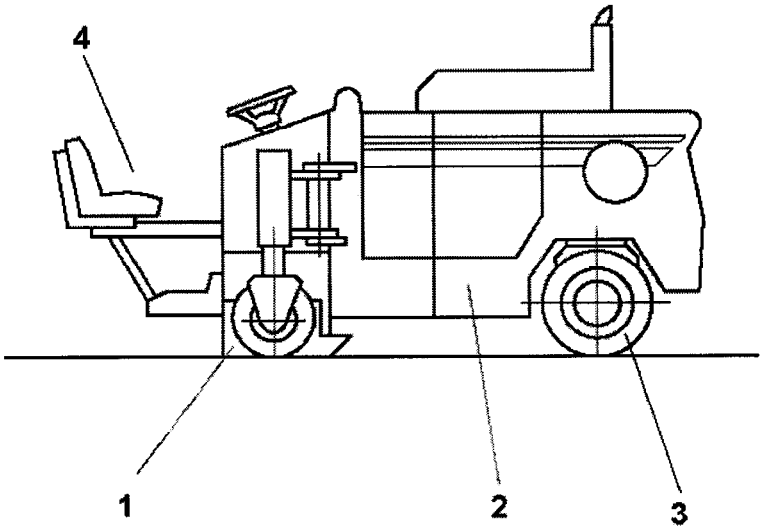
Figure B.1 — Road-milling machine with front-loading conveyor



Key

1 milling drum
2 chassis
3 wheel
4 operator's station
5 conveyor

Figure B.2 — Road-milling machine with rear-loading conveyor



Key

1 milling drum
2 chassis
3 wheel
4 operator's station

Figure B.3 — Road-milling machine without conveyor

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EC Directive 98/37/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive Machinery 98/37/EC amended by 98/79/EC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Annex ZB
(informative)

A1 Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

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WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard. A1

Bibliography

[1] EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

[2] ISO 8643:1997, *Earth-moving machinery — Hydraulic excavator and backhoe loader boom-lowering control device — Requirements and tests*

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