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ISO 3984

Third edition
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Road vehicles — Rear moving barrier impact test procedure

Véhicules routiers — Mode opératoire d'essai de choc arrière sur barrière mobile

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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 3984 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 10, *Impact test procedures*.

This third edition cancels and replaces the second edition (ISO 3984:1982), which has been technically revised.

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Road vehicles — Rear moving barrier impact test procedure

1 Scope

This International Standard specifies a rear moving barrier, rear-impact test procedure for road vehicles, with the purpose of ensuring that such tests are conducted under the same conditions as for high-speed tests.

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 1176:1990, *Road vehicles — Masses — Vocabulary and codes*

ISO 3784, *Road vehicles — Measurement of impact velocity in collision tests*

ISO 6487, *Road vehicles — Measurement techniques in impact tests — Instrumentation*

ISO 10997:1996, *Passenger vehicles — Side impact with deformable moving barrier — Full scale test*

SAE J211/1, *Instrumentation for Impact Test — Part 1: Electronic Instrumentation*

SAE J211/2, *Instrumentation for Impact Test — Part 2: Photographic Instrumentation*

3 Test facility and equipment

3.1 Test site

The test area shall be large enough to accommodate the run-up track, barrier and technical installations necessary for the test.

The impact test site surface shall be horizontal, smooth and hard.

3.2 Moving barrier test equipment

The moving barrier shall be of rigid or deformable construction, symmetrical about a longitudinal vertical plane, with fixed non-steerable front and rear axles attached directly to the frame rails with no spring or other type of suspension system apart from the tyres on each wheel.

3.3 Barrier faces

The specific moving barrier face to be used shall be selected from the following configurations.

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a) Flat face, Type 1

The moving barrier shall have a flat impact surface. An example of a typical construction is shown in Figure 1 and has the following characteristics.

1) Barrier total mass: 1 100 kg ± 20 kg or 1 800 kg ± 30 kg
2) Height: 800 mm minimum
3) Width: 2 500 mm minimum
4) Mass distribution by axle
   - front: 60 % ± 10 %
   - rear: 40 % ± 10 %
5) Height of centre of gravity: 400 mm ± 40 mm
6) Track: 1 500 mm ± 30 mm
7) Wheelbase: 3 050 mm ± 60 mm

The edges of the surface shall be rounded with a radius of curvature of 45 mm ± 10 mm.

The impact surface shall be covered with plywood 20 mm ± 2 mm thick.

Ground clearance to the lower edge of the impact surface shall be 175 mm ± 25 mm.

b) Flat face, Type 2

The moving barrier shall have a flat impact surface. An example of a typical construction has the following characteristics. See Figure 2.

1) Barrier total mass: 1 814 kg ± 23 kg
2) Height: 1 524 mm
3) Width: 1 981 mm
4) Mass distribution by axle
   - front: 55 % ± 10 %
   - rear: 45 % ± 10 %
5) Height of centre of gravity: 400 mm ± 40 mm
6) Track: 1 524 mm ± 30 mm
7) Wheelbase: 3 048 mm ± 50 mm

The impact surface shall be 19 mm thick cold rolled steel plate.

Ground clearance to the lower edge of the impact surface shall be 127 mm ± 12,7 mm.

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c) Deformable barrier face, Type 3

The moving deformable barrier (MDB) face shall be vertical and either flat or with a bumper simulation. It shall have sufficient height, depth and width to allow the desired test to be performed.

The MDB shall have an energy-absorbing face to represent the crush characteristics of the front of an average passenger car.

The dimensions of the energy-absorbing impactor face shall be

— width: 1 500 mm ± 20 mm

— height: 500 mm ± 10 mm

— depth: 440 mm minimum

and its surface shall consist of two, flat, parallel faces, offset by 60 mm ± 5 mm.

Horizontally adjacent block faces shall lie in the same vertical plane within ± 5 mm.

The ground clearance at the lower edge of the MDB face shall be 300 mm ± 10 mm.

The vertical plane of symmetry of the MDB face shall be coincident with the longitudinal vertical plane of the carriage with a tolerance of ± 10 mm.

The total mass of the MDB face, carriage and ballast, as necessary, shall be 950 kg ± 10 kg (see Figure 3).

The supplier of the MDB face shall provide a certificate of calibration. The supplier shall also provide an analysis of his product's conformance to the calibration requirements. The calibration procedure shall be in accordance with ISO 10997:1996, Annex A.

The performance characteristics of the MDB face (see Figure 4) are acceptable if each block and the entire face fall within the force-deflection corridors shown in Figure 5. Alternatively, the performance characteristics are acceptable if each block and the entire face fall within the energy-deflection corridors shown in Figure 6.

3.4 Propulsion of the moving barrier

The trolley shall be towed to a point no closer than 0,5 m from contact with the test vehicle, at which point it shall be released to travel freely. The trolley shall not be braked until after 200 ms from time of contact. At the moment of impact, the trolley shall be moving at the prescribed velocity.

3.5 Alignment of the moving barrier

The median longitudinal vertical planes of the moving barrier and vehicle shall be so aligned that, at the moment of impact, there is no more than ± 25 mm lateral distance between those vertical planes.

The measurement shall be made perpendicular to the path of the moving barrier.

4 Preparation of test vehicle

4.1 The test vehicle shall include all the equipment normally fitted and shall be in normal running order. Some components may be replaced by equivalent masses where this substitution clearly has no foreseeable effect on the measured results.

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4.2 Unless otherwise specified, the vehicle test mass, m_t, shall be calculated as follows:

$$m_t = m_k + m_l + m_d$$

where

m_k is the complete vehicle kerb mass (ISO-M06) in accordance with ISO 1176:1990, 4.6, in kilograms;

m_l is the rated cargo and luggage mass, in kilograms;

$$m_l = m_p - (68 \times \text{DSC})$$

where

m_p is the maximum design pay mass (ISO-M09) in accordance with ISO 1176:1990, 4.9, in kilograms, and

DSC is the designated seating capacity of the test vehicle;

m_d is the test dummy mass.

The vehicle shall be ballasted to achieve the test mass to within ± 10 kg. The ballast shall be located and secured to the vehicle so that it does not alter the structural characteristics of the parts of the vehicle expected to deform during the test.

At the time of impact, the vehicle shall be at the normal height and attitude specified by the manufacturer.

The instrumentation and cameras required for testing should not change the mass distribution between the axles by more than 20 kg.

It is permissible to substitute for the fuel in the fuel tank a non-flammable liquid having a density of from 0,7 kg/dm^3 to 1 kg/dm^3.

4.3 The test vehicle shall be stationary, its parking brake shall be off and its transmission shall be in neutral.

The doors shall be closed but not locked. If an opening or a removable roof is fitted, it shall be in place and in the closed position. For test measurement purposes, and in agreement with manufacturers, it may be open.

5 Velocity

5.1 The velocity of the moving barrier shall be measured within 0,5 m prior to impact and in accordance with ISO 3784.

5.2 The velocity at the time of impact shall be that specified in the applicable test requirements. The impact velocity tolerance shall be ± 2 % of the desired velocity.

6 Instrumentation and photographic (or equivalent) documentation

The instrumentation used for the test shall be as specified in ISO 6487 and SAE J 211/1 and SAE J 211/2.

On test vehicle sills, a package of three-axis accelerometers located under A or B pillars can be used.

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7 Dummy

Where a dummy or dummies are used, it or they shall be HYBRID III 50th percentile.

If dummy responses are being recorded, the stabilized dummy test temperature should range from 20,6 °C to 22,2 °C.

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Dimensions in millimetres

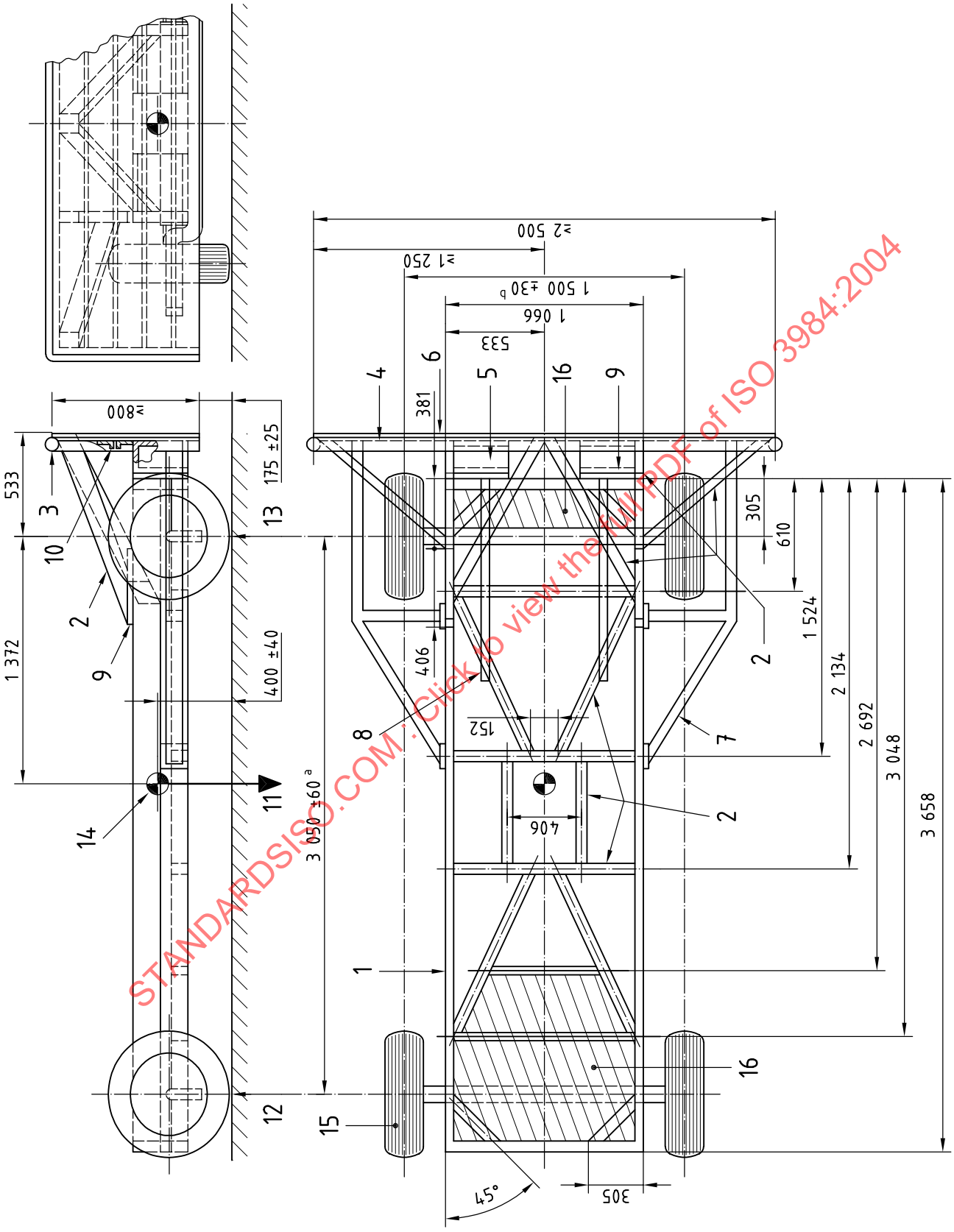

Figure 1 — Typical barrier construction — Type 1

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Key

1 152 × 51 × 5
2 102 × 1 × 5
3 ∅ int. 76 × 5 wall
4 10 thick
5 175 thick, box section 25 walls
6 plywood face covering face plate 20 thick
7 102 × 51 × 5
8 ballast tie-downs
9 reinforced areas for bolting on face plate
10 127 × 38 × 6,5 U-channel [five required for the 1 800 kg barrier (Type 2), three for 1 100 kg barrier (Type 1)]
11 total weight
12 mass distribution (40 ± 10) %, rear axle
13 mass distribution (60 ± 10) %, front axle
14 centre of gravity
15 pneumatics [all pneumatic tyres are P205-75 R15 (inflated to 207 kPa) or equivalent]
16 ballast

[a] Wheelbase.
[b] Track.

Figure 1 — Typical barrier construction — Type 1 *(continued)*

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Dimensions in millimetres

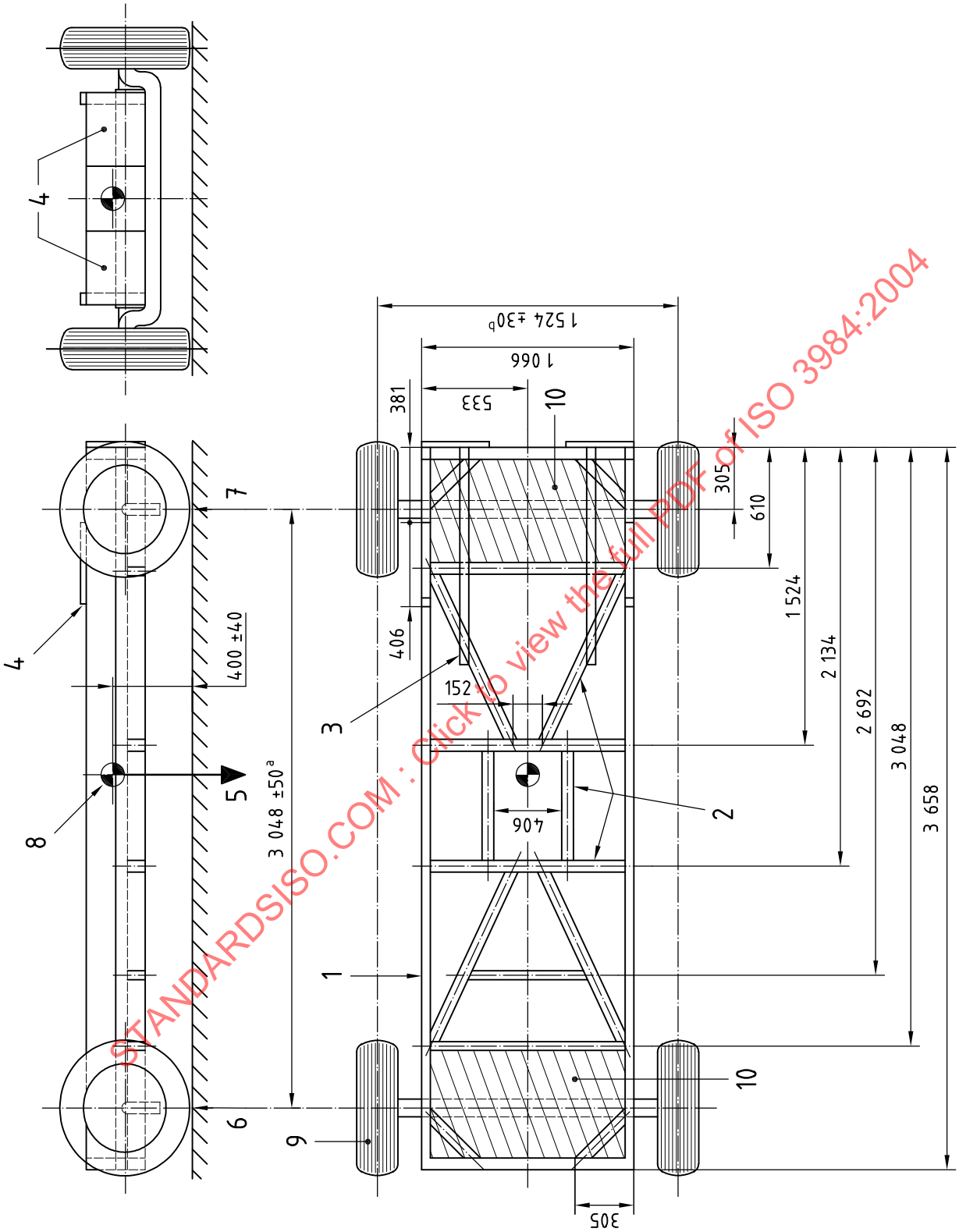

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Figure 2 — Example MDB carriage — Type 2

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Key

1 outer frame 132 × 31 × 3 steel tubing, two pieces welded together for 305 mm height
2 inner reinforcements and frame gussets (all of 102 × 51 × 5 steel tubing)
3 ballast tie-downs
4 reinforced areas for bolting on face plates
5 total weight
6 mass distribution (45 ± 10) %, rear axle
7 mass distribution (55 ± 10) %, front axle
8 centre of gravity
9 pneumatics [all pneumatic tyres are P205-75 R15 (inflated to 207 kPa) or equivalent]
10 ballast

[a] Wheelbase.
[b] Track.

Figure 2 — Example MDB carriage — Type 2 *(continued)*

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Dimensions in millimetres

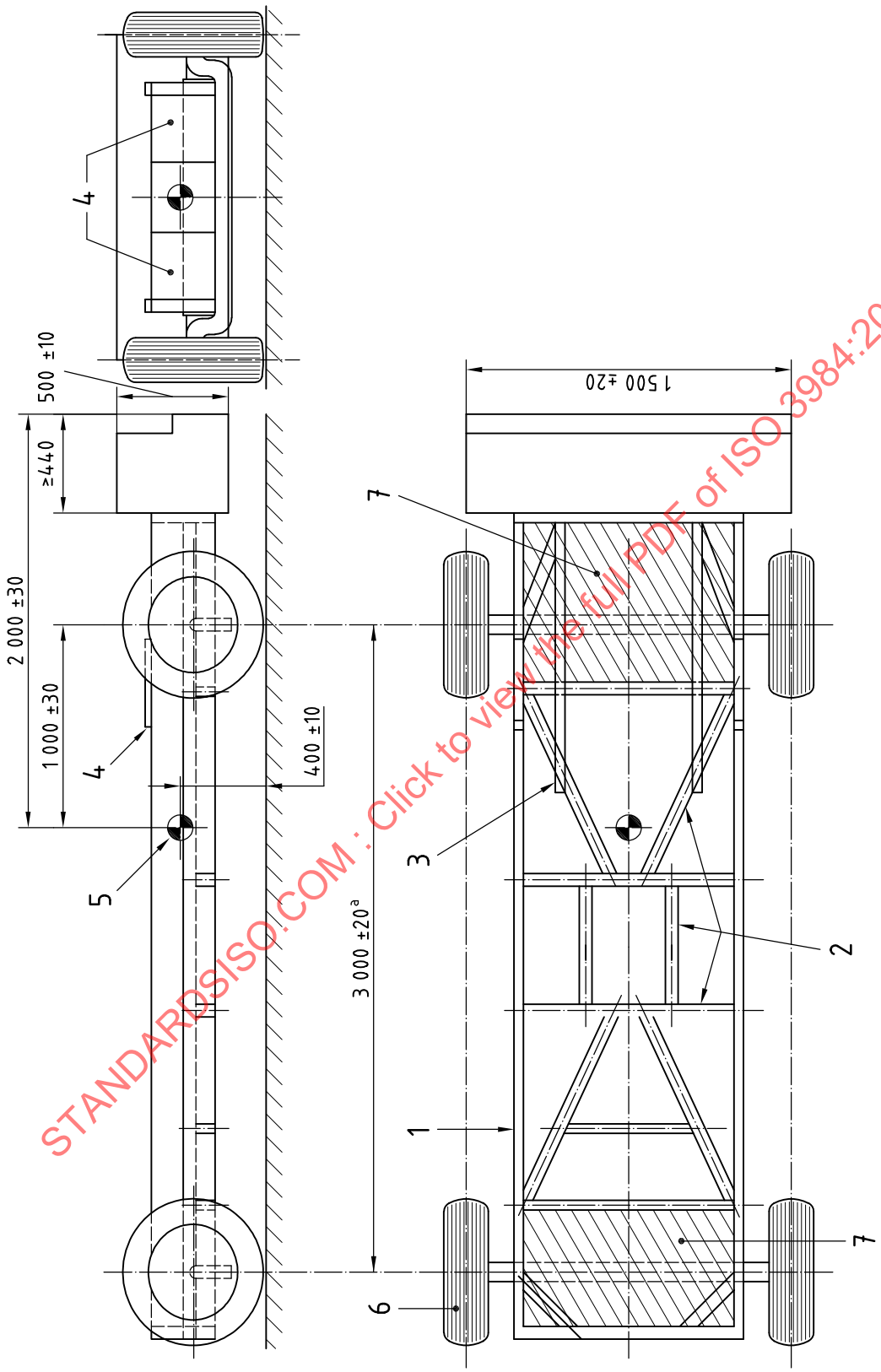

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Figure 3 — Typical barrier construction — Type 3

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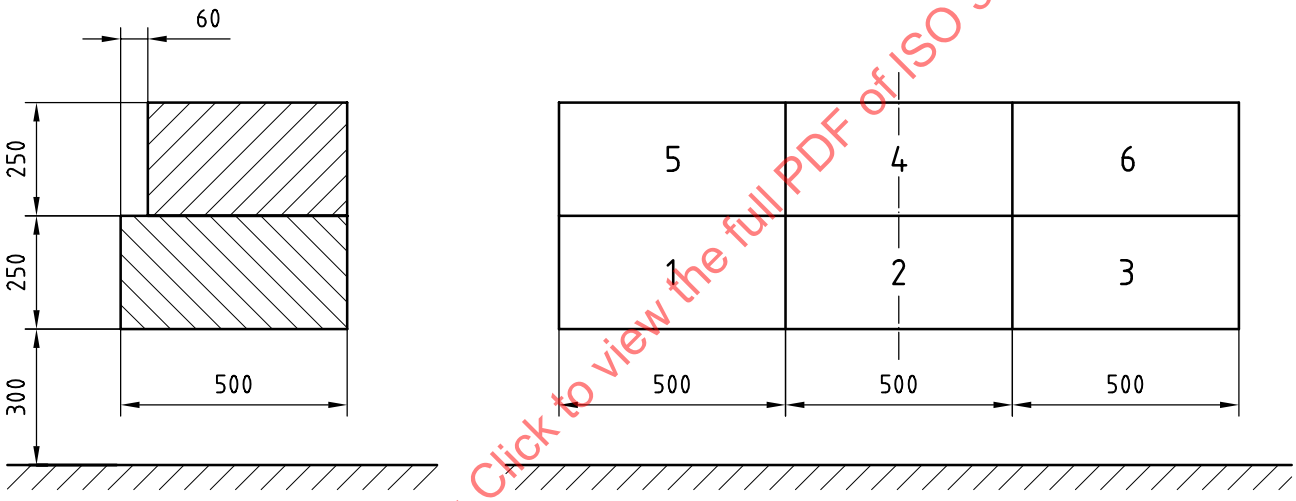
Key

1 outer frame
2 inner reinforcements and frame gussets
3 ballast tie-downs
4 reinforced areas for bolting on energy-absorbing face
5 centre of gravity
6 pneumatics [all pneumatic tyres are P205-75 R15 (inflated to 207 kPa) or equivalent]
7 ballast

[a] Wheelbase.

Figure 3 — Typical barrier construction — Type 3 *(continued)*

Dimensions in millimetres



Key

1 to 6 blocks 1 to 6

Figure 4 — Design of energy-absorbing MDB face

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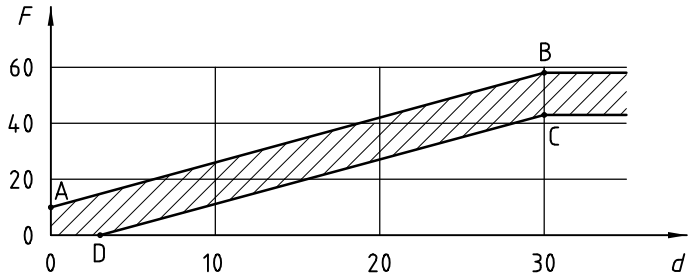
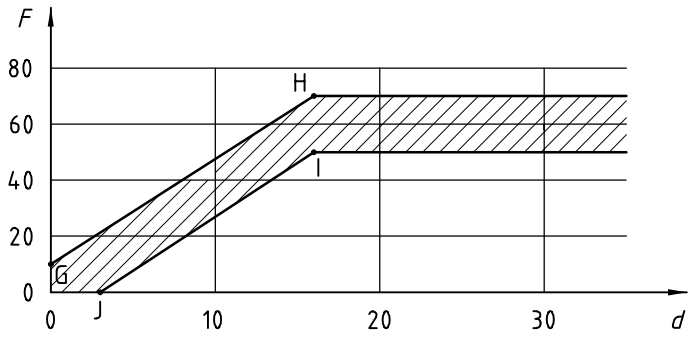


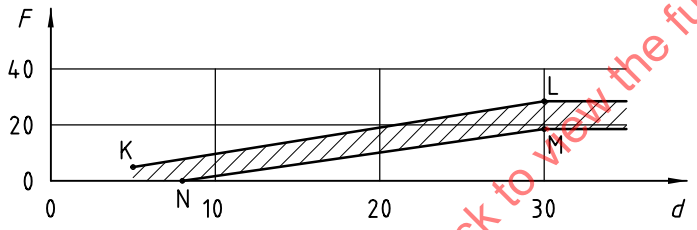
	d	F
A	0	10
B	30	58
C	30	43
D	3	0

a) Blocks 1 and 3



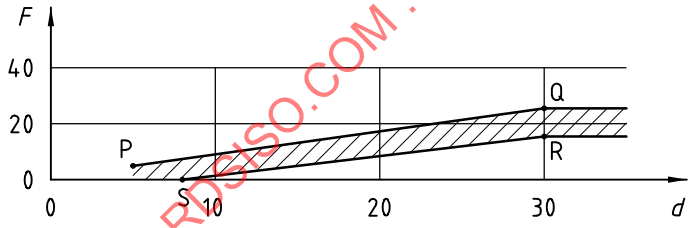
	d	F
G	0	10
H	16	70
I	16	50
J	3	0

b) Block 2



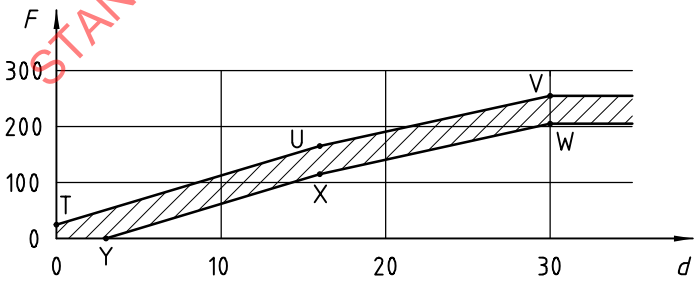
	d	F
K	5	5
L	30	28,5
M	30	18,5
N	8	0

c) Block 4



	d	F
P	5	5
Q	30	25,5
R	30	15,5
S	8	0

d) Blocks 5 and 6



	d	F
T	0	25
U	16	165
V	30	255
W	30	205
X	16	115
Y	3	0

e) Total

Key

F force, in kilonewtons (kN)

d deflection, in centimetres (cm)

Figure 5 — Force/deflection

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