INTERNATIONAL STANDARD

ISO 11154-4

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Road vehicles — Roof load carriers —

Part 4: Magnetic fixing devices

Véhicules routiers — Dispositifs porte-charges de toit —

Partie 4: Dispositifs à fixation magnétique

Reference number
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Contents

Page

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 11154-4 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 14, *Exterior fittings*.

ISO 11154 consists of the following parts, under the general title *Road vehicles — Roof load carriers*:

— *Part 1: Roof bars*

— *Part 4: Magnetic fixing devices*

Road vehicles — Roof load carriers —

Part 4: Magnetic fixing devices

1 Scope

This part of ISO 11154 establishes technical specifications for the magnetic fixing devices of roof load carriers and specifies the minimum safety requirements, and test methods, for such devices, thus offering the occupants of those vehicles on which the carriers are mounted, as well as other road users and pedestrians, a minimum level of safety when the devices are used in accordance with the manufacturer's instructions.

This part of ISO 11154 is applicable to magnetic fixing devices suitable for carrying a defined load and intended for mounting on or above the roofs of passenger cars and light commercial vehicles having a maximum authorized total mass (Code ISO-M08), as defined in ISO 1176, of up to 3,5 t. It is not applicable to vacuum-fixed devices — experience with and testing of those devices not being able to guarantee a minimum safety level for carrying goods on either vehicle roof or rear.

The requirements of this part of ISO 11154 complete the provisions of Directives 79/488/EEC and 72/245/EEC concerning magnetic fixing devices.

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 612:1978, *Road vehicles — Dimensions of motor vehicles and towed vehicles — Terms and definitions*

ISO 1176, *Road vehicles — Masses — Vocabulary and codes*

ISO 4130, *Road vehicles — Three-dimensional reference system and fiducial marks — Definitions*

ISO 4892 (all parts), *Plastics — Methods of exposure to laboratory light sources*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

European Commission Directive 79/488/EEC of 18 April 1979 adapting to technical progress Council Directive 74/483/EEC on the approximation of the laws of the Member States relating to the external projections of motor vehicles

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4130 and the following apply.

3.1
magnetic roof rack
magnetic fixing device set designed to carry a load on the roof of a vehicle

NOTE In general they are not compatible with the use of additional accessories.

3.2
magnetic ski/snowboard holder
magnetic fixing device designed to carry one or more pairs of skis or one or more snowboards on the roof of a vehicle

NOTE In general they are not compatible with the use of additional accessories.

3.3
maximum vehicle roof load
m_d
maximum load capacity, expressed in kilograms, permissible on the vehicle's upper structure as defined by the vehicle manufacturer

3.4
maximum magnetic fixing set load
$m_{b,mdev}$
maximum load capacity, or number of units, expressed in either kilograms or as a quantity, permissible on a magnetic fixing device set as defined by the magnetic fixing set manufacturer

3.5
mass of the specific roof set
$m_{e,mdev}$
sum, expressed in kilograms, of the component masses of the magnetic fixing devices

3.6
theoretical maximum load
m_n
maximum vehicle roof load, m_d, less the mass of the specific roof set, $m_{e,mdev}$, expressed in kilograms

3.7
deflection
d
sum, expressed in millimetres, of permanent deformations and sliding displacement of a magnetic fixing when fixed to the vehicle roof and under test conditions

3.8
test devices
load simulation devices used during testing

EXAMPLE Test reference ski, test reference ladder.

3.9
lifting force
F_a
force, expressed in newtons, applied during testing to simulate the vertical components of the aerodynamic or vertical effect of the load or both

3.10
forward longitudinal force
F_l
force, expressed in newtons, applied during testing to simulate the horizontal forward component of the force caused by the load in the X plane

NOTE The X plane is defined in ISO 4130.

3.11
20° horizontal force
F_{lq}
force, expressed in newtons, applied during testing to simulate the effect caused by the load during braking when cornering

3.12
lateral force
F_{lat}
force, expressed in newtons, applied during testing to simulate the horizontal component of the force caused by the load parallel to the Y plane

NOTE The Y plane is defined in ISO 4130.

3.13
angular position of the device
α
angle between the carrier device and the vertical plane

See Figure D.1 a).

4 Requirements

4.1 Resistance to lifting force, F_a

4.1.1 When tested in accordance with 5.2.2, on completion of the test the magnetic ski/snowboard holder or ladder holder shall meet the following requirements:

a) the load shall remain fixed on the magnetic fixing device;

b) the magnetic fixing device shall remain fixed on the roof;

c) no breakage of any part shall occur.

4.1.2 When tested in accordance with 5.3.2, on completion of the test the magnetic roof rack shall remain fixed on the roof.

4.2 Slide resistance under quasi-static forward longitudinal force, F_l

When tested in accordance with 5.2.3 and 5.3.3, respectively, on completion of the test the magnetic ski/snowboard holder and magnetic roof rack shall meet the following requirements:

a) the load shall remain fixed on the magnetic fixing device;

b) no breakage of any part shall occur;

c) the maximum deflection shall not exceed 50 mm.

4.3 Slide resistance under quasi-static 20° horizontal force, F_{lq}

When tested in accordance with 5.2.4 and 5.3.4, respectively, on completion of the test the magnetic ski/snowboard holder and magnetic roof rack shall meet the following requirements:

a) the load shall remain fixed on the magnetic fixing device;

b) no breakage of any part shall occur;

c) the maximum deflection shall not exceed 50 mm.

4.4 Slide resistance test under quasi-static lateral force, F_{lat}

4.4.1 When tested in accordance with 5.2.5, on completion of the test the magnetic ski/snowboard holder shall meet the following requirements:

a) the load shall remain fixed on the magnetic fixing device;

b) the magnetic fixing device shall remain fixed on the roof;

c) no breakage of any part shall occur.

4.4.2 The slide resistance test under the quasi-static lateral force, F_{lat}, is not required for the magnetic roof rack.

4.5 Resistance to corrosion

When tested in accordance with 5.4, no active corrosion which affects the basic function of each part (i.e. sliding, screwing, articulation) shall appear.

4.6 Resistance of materials

The materials used shall enable the magnetic fixing device to fulfil the requirements of 4.1 to 4.4 in a range of exterior temperatures between − 20 °C and +60 °C, taking into consideration ultraviolet stability and ozone ageing.

This shall be shown by one of the following methods:

a) material certification and report showing that the design is suitable for the intended purposes (for these documents, refer to ISO 9001 or equivalent standards);

b) direct testing under the above-mentioned extreme conditions, in accordance with Clause 5;

c) reference to applicable material standards.

4.7 Overhang and external shape

The width of the magnetic fixing device should be limited to the width of the vehicle roof panel and shall not exceed the maximum width of the vehicle according to ISO 612:1978, 6.2.

The external radius of all connectable components shall be in accordance with Directive 79/488/EEC, paragraphs 6.16.2 and 6.16.3.

4.8 Additional securing means

An additional means of securing the magnetic fixing device to the road vehicle, consisting of a strap or cable permanently attached through the vehicle doors, shall be used to guard against failure.

5 Test method

5.1 General

5.1.1 All tests shall be carried out on the vehicle roof in the following sequence:

a) test under F_a;

b) test under F_l;

c) test under F_{lq};

d) other tests.

5.1.2 Each test shall be run using, as appropriate, the following configurations:

a) on a wet roof;

b) after applying a film (e.g. protective plastic layer) 0,025 mm thick on the roof if the testing tool specified in 6.4 b) is provided by the device manufacturer;

c) after applying a film (e.g. protective plastic layer) 0,25 mm thick on the roof if the testing tool specified in 6.4 b) is *not* provided by the device manufacturer.

5.1.3 Three magnetic fixing devices, manufactured using current production tools, shall be made available as test specimens.

5.1.4 Prior to each test, the magnetic fixing devices shall be fitted, released and retightened in accordance with the manufacturer's instructions. The torque or force used shall be in accordance either with the manufacturer's instructions or, in the absence of such instructions, with Annex A.

5.1.5 Test forces shall be applied to achieve the maximum value within 5 s to 10 s, with a tolerance of $^{+5}_{0}$ %.

5.1.6 The approval/rejection procedure shall be as illustrated in the examples given in Annex B.

5.1.7 The test devices used to load the magnetic fixing devices during the tests are defined in each test procedure.

5.1.8 The deflection, d, shall be measured in accordance with Figure C.1.

5.2 Magnetic ski/snowboard holder test procedure

5.2.1 Test device

Use for the test

— pairs of skis each (pair) having a total mass equal to 6 kg, or

— snowboards each of 6 kg mass.

5.2.2 Test of resistance to lifting force, F_a

5.2.2.1 Nominal value of the force

5.2.2.1.1 For the transport of skis, the nominal value of the lifting force, F_a, shall be calculated, in newtons, by (see Figure D.1):

$$F_a = 240 \times m_{b,mdev}$$

EXAMPLE In Figure D.1 b), $F_a = 240 \times 2 = 480$ N
In Figure D.1 c), $F_a = 240 \times 4 = 960$ N

5.2.2.1.2 For the transport of snowboards, the nominal value of the lifting force, F_a, shall be calculated, in newtons, by (see Figure D.1):

$$F_a = (300 + 420\sin\alpha) \times m_{b,mdev}$$

EXAMPLE In Figure D.1 d), $F_a = (300 + 420\sin\alpha) \times 1 = 720$ N (α = 90°)
In Figure D.1 e), $F_a = (300 + 420\sin\alpha) \times 1 = 720$ N (α = 90°)
In Figure D.1 f), $F_a = (300 + 420\sin\alpha) \times 2 = 720 \times 2 = 1\,440$ N (α = 90°)

5.2.2.1.3 Where it is possible to mount either skis or snowboards, or both together, or if the angle α can be adjusted, the worst case shall be considered.

5.2.2.2 Test procedure

The test shall be carried out as follows.

a) Mount the magnetic fixing device set.

b) Install the test device or devices and clamp in accordance with the instructions for fitting and use.

c) Progressively and continuously apply a lifting force, F_a, as shown in Figure D.2 a), up to the required nominal value.

d) Maintain application of the force for 10 min.

e) Release the force.

Where the front and rear attachments are different, repeat the procedure on the rear attachment with a nominal value of the force, $F_a/2$.

5.2.3 Test of slide resistance under quasi-static forward longitudinal force, F_l

5.2.3.1 Nominal value of the force

For the transport of skis and snowboards, the nominal value of the forward longitudinal force, F_l, shall be calculated, in newtons, by (see Figure D.1):

$$F_l = 240 \times m_{b,mdev}$$

5.2.3.2 Test procedure

The test shall be carried out as follows.

a) Mount the magnetic fixing device.

b) Install the test device or devices and clamp in accordance with the instructions for fitting and use.

c) Install the measuring equipment in accordance with Annex C.

d) Progressively and continuously apply the longitudinal force, F_l, as shown in Figure D.2 b), up to the required nominal value, then immediately release the force.

e) Measure the deflection, d_1.

5.2.4 Test of slide resistance under quasi-static 20° horizontal force, F_{lq}

5.2.4.1 Nominal value of the force

For the transport of skis and snowboards, the nominal value of the 20° horizontal force, F_{lq}, shall be calculated, in newtons, by (see Figure D.1):

$$F_{lq} = 240 \times m_{b,mdev}$$

5.2.4.2 Test procedure

The test shall be carried out as follows.

a) Mount the magnetic fixing device.

b) Install the test device or devices and clamp in accordance with the instructions for fitting and use.

c) Install the measuring equipment in accordance with Annex C.

d) Progressively and continuously apply the 20°, horizontal force, F_{lq}, as shown in Figure D.2 c), up to the required nominal value, so that the force can be equally distributed over the number of units.

e) Release the force.

f) Measure the deflection, d_2.

5.2.5 Test of slide resistance under quasi-static lateral force, F_{lat}

5.2.5.1 Nominal value of the force

5.2.5.1.1 For the transport of skis, the nominal value of the lateral force, F_{lat}, shall be calculated, in newtons, by (see Figure D.1):

$$F_{lat} = 120 \times m_{b,mdev}$$

EXAMPLE In Figure D.1 b), $F_{lat} = 120 \times 2 = 240$ N
In Figure D.1 c), $F_{lat} = 120 \times 4 = 480$ N

5.2.5.1.2 For the transport of snowboards, the nominal value of the lateral force, F_{lat}, shall be calculated, in newtons, by (see Figure D.1):

$$F_{lat} = (120 + 600\cos\alpha) \times m_{b,mdev}$$

EXAMPLE In Figure D.1 d), $F_{lat} = (120 + 600\cos\alpha) \times 1 = 120$ N (α = 90°)
In Figure D.1 e), $F_{lat} = (120 + 600\cos\alpha) \times 1 = 120$ N (α = 90°)
In Figure D.1 f), $F_{lat} = (120 + 600\cos\alpha) \times 2 = 120 \times 2 = 240$ N (α = 90°)

5.2.5.1.3 Where it is possible to mount either skis or snowboards, or both together, or if the angle α can be adjusted, the worst case shall be considered.

5.2.5.2 Test procedure

The test shall be carried out as follows:

a) Mount the magnetic fixing device.

b) Install the test device or devices and clamp as described in the instructions for fitting and use.

c) Progressively and continuously apply the lateral force, F_{lat}, as shown in Figure D.2 d), up to the required nominal value, so that the force is equally distributed over the number of units.

d) Maintain application of the force for 10 min.

e) Release the force, and measure and record the total deflection, d_3.

f) Repeat the procedure, applying a lateral force in the opposite direction.

Where the front and rear attachments are different, repeat the procedure on both attachments.

5.3 Magnetic roof rack test procedure

5.3.1 Test device

Use as the test device a parallelepiped with the dimensions (length, L, width, l, and height, h — see Figure D.3) in accordance with the manufacturer's specifications.

The test device shall not be deformed by the load.

The following test conditions apply:

— the ballast used to adjust the mass shall be uniformly distributed over the test device;

— the test mass shall be adjusted to an accuracy of ± 1 kg;

— the test device shall be installed on the roof rack in accordance with Figure D.4, and the tightening of the test device on the magnetic roof rack shall give good cohesion between the roof rack and the test device;

— the mass is defined for each test.

5.3.2 Test of resistance to lifting force, F_a

5.3.2.1 Nominal value of the force

The nominal value of the lifting force, F_a, shall be calculated, in newtons, by:

$$F_a = 2\,500 + 0{,}5 m_x \times g$$

where

m_x is the actual maximum load (m_n or $m_{b,mdev}$, whichever is the lower).

g = 9,81 m/s^2

5.3.2.2 Test procedure

The test shall be carried out as follows.

a) Mount the roof rack in accordance with the magnetic fixing device manufacturer's instructions.

b) Install the test device adjusted at m_x and clamp as shown in Figures D.4 and D.6.

c) Progressively and continuously apply the vertical lifting force, F_a, as shown in Figure D.5, up to the required nominal value.

d) Maintain application of the force for 10 min;

e) Release the force.

5.3.3 Test of slide resistance under quasi-static forward longitudinal force, F_l

5.3.3.1 Nominal value of the force

The nominal value of the forward longitudinal force, F_l, shall be calculated, in newtons, by:

$$F_l = 40 m_x$$

where

m_x is the actual maximum load (m_n or $m_{b,mdev}$, whichever is the lower).

5.3.3.2 Test procedure

The test shall be carried out as follows:

a) Mount the magnetic roof rack in accordance with the manufacturer's instructions.

b) Install the test device adjusted at m_x and clamp as shown in Figures D.4 and D.6.

c) Install the measuring equipment in accordance with Annex C.

d) Progressively and continuously apply the longitudinal force, F_l, as shown in Figure D.5, up to the required nominal value.

e) Immediately release the force, and measure and record the total deflection, d_4.

5.3.4 Test of slide resistance under quasi-static 20° horizontal force, F_{lq}

5.3.4.1 Nominal value of the force

The nominal value of the 20° horizontal force, F_{lq}, shall be calculated, in newtons, by:

$$F_{lq} = 40 m_x$$

where

m_x is the actual maximum load (m_n or $m_{b,mdev}$, whichever is the lower).

5.3.4.2 Test procedure

The test shall be carried out as follows.

a) Mount the magnetic roof rack in accordance with the manufacturer's instructions.

b) Install the test device adjusted at m_x and clamp as shown in Figures D.4 and D.6.

c) Install the measuring equipment in accordance with Annex C.

d) Progressively and continuously apply the 20° horizontal force, F_{lq}, as shown in Figure D.5, up to the required nominal value.

e) Immediately release the force, and measure and record the total deflection, d_5.

5.4 Resistance to corrosion test

Expose the complete magnetic fixing device assembly to the neutral salt spray test (NSS) with 5 % sodium chloride for 192 h. Expose the functional parts (i.e. those parts not cosmetic parts) for 400 h to this salt spray. See ISO 9227. The functional parts shall be assembled when tested.

6 Instructions for fitting, use and the consumer

6.1 Language of instructions

All instructions shall be written in the official language or languages of the country of sale.

6.2 Fitting instructions

The manufacturer of the magnetic fixing device shall include the following in the assembly instructions:

a) detailed fitting instructions, together with figures or illustrations;

b) the value of the torque or force, wherever it is necessary to apply a specific torque or force to a fastening device in order to fasten the magnetic fixing device to a vehicle;

c) mounting points.

An application list shall be available and reference to that list shall be included in the outer packaging.

There should be

— a spacing of either approx. 700 mm between the fixing points of the magnetic fixing device (see Figure D.6) or the spacing specified by the vehicle or device manufacturer,

— mounting points corresponding to the type or types of vehicle for which the magnetic fixing devices are intended, and

— a warning that the magnetic fixing device is not to be used on vehicles other than those specified by the manufacturer.

6.3 Instructions for use

The manufacturer of the magnetic fixing device shall provide instructions for use containing at least the following.

a) The value of the maximum load capacity or specific quantity of units, or both, which can be mounted on the magnetic fixing device for the vehicle for which it is made, and a warning regarding the relevant mass regulation.

b) Requirements and recommendations

1) The load shall be evenly distributed over the area of the carrier system, and the centre of gravity of the load kept as low as possible. Loads which overhang the ends of the carrier system shall conform to any relevant laws or by-laws in force, and shall be adequately secured.

2) Loads shall be adequately secured using suitable straps or similar tightening and locking devices. The security of the load and magnetic fixing device shall be checked after loading and regularly throughout the journey. Elastic straps with securing hooks shall not be used.

3) It is recommended that items which may produce significant lifting forces are carried in such a way that the lifting force is minimized, securing them independently using straps or other methods capable of withstanding lifting forces. Elastic straps shall not be used.

4) Where specialized accessories are available for carrying or securing loads — for example, cycle carriers — these should be used.

5) The handling characteristics of a vehicle (in particular, crosswind sensitivity, handling on bends and braking) change when a carrier system is fitted, especially if that system is loaded. Driving techniques should be altered to allow for these changes, speed reduced — especially on bends — and braking distances made greater.

6) To reduce fuel consumption, the magnetic fixing device should be removed after use.

c) Warnings

1) the importance of correctly following the instructions for fitting and use;

2) the need for the fixing devices to be tightened correctly and checked regularly during travel;

3) the necessity of carrying loads within the limitations of 6.3 a) and 6.3 b);

4) the necessity of securing loads correctly and safely;

5) the importance of maintaining equipment in good working order, and

6) the need to check the full contact of the whole magnetic surface in accordance with the device manufacturer‘s instructions.

6.4 Other instructions for the consumer

In addition, the consumer shall be instructed to

a) check that the magnetic properties of the roof material are given;

b) check the magnetic characteristics of the contact surface by means of a testing tool provided by the magnetic device manufacturer;

c) store magnetic fixing devices away from electric or electronic appliances;

d) not store the magnetic fixing devices in direct contact with each other;

e) check that the surface of the magnet and of the car roof is clean, dry and undamaged;

f) not place the magnetic fixing device set completely or partially on any part of the roof other than steel parts;

g) when a magnetic device is placed on a steel sun roof, keep the sun roof in the closed position and not operate it;

h) not employ magnetic devices on vehicles whose roofs have been repaired by means of tin, plaster layers or through varnishing of the same;

i) be aware that, following accidental damage (e.g. from the device falling to the floor), the magnetic properties of the device could be affected;

j) ensure, for safety reasons, that the skis are placed with their turned ends towards the back of the car, and

k) not interpose any object of any type between the magnetic fixing device and the roof of the car.

7 Marking

Magnetic fixing devices shall be marked with the following information:

a) name or trademark of the manufacturer, importer or distributor;

b) type of magnetic fixing device;

c) maximum load for one set and kind of load defined according to this part of ISO 11154;

d) reference ensuring traceability;

e) if necessary, the attachment position on the vehicle.

Annex A
(normative)

Tightening torques for fastening magnetic roof racks and magnetic ski/snowboard holders

Table A.1 gives the tightening torque corresponding to each of the different types of fastener used with these magnetic fixing devices.

Table A.1 — Tightening torques corresponding to the different types of fastener

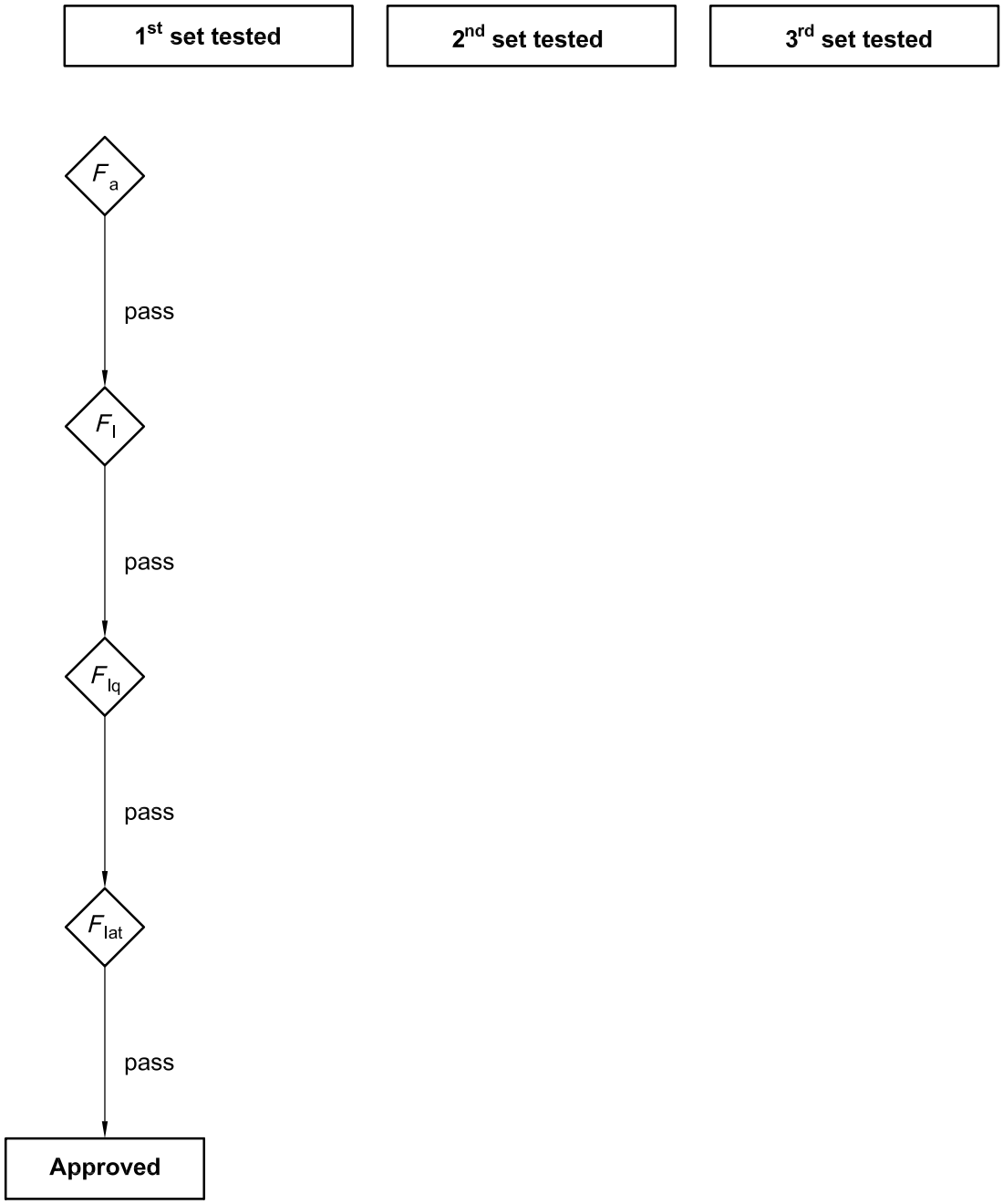
Type of fastener	Torque N · m
Hand nut/screw, ∅ less than 35 mm	2
Hand nut/screw, ∅ 35 mm to 45 mm	3
Hand nut/screw, ∅ 45 mm to 55 mm	4
Hand nut/screw, ∅ 55 mm to 65 mm	5
Slotted-head screw M6	3
Slotted-head screw M8	4
CHC, VH, TORX[a] M6 screw	5
CHC, VH, TORX M8 screw	6
Hexagon nut M6	5
Hexagon nut M8	6
Butterfly nut M6	2
Butterfly nut M8	3

[a] TORX is a trade name. This information is given for the convenience of users of this part of ISO 11154 and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

Annex B
(normative)

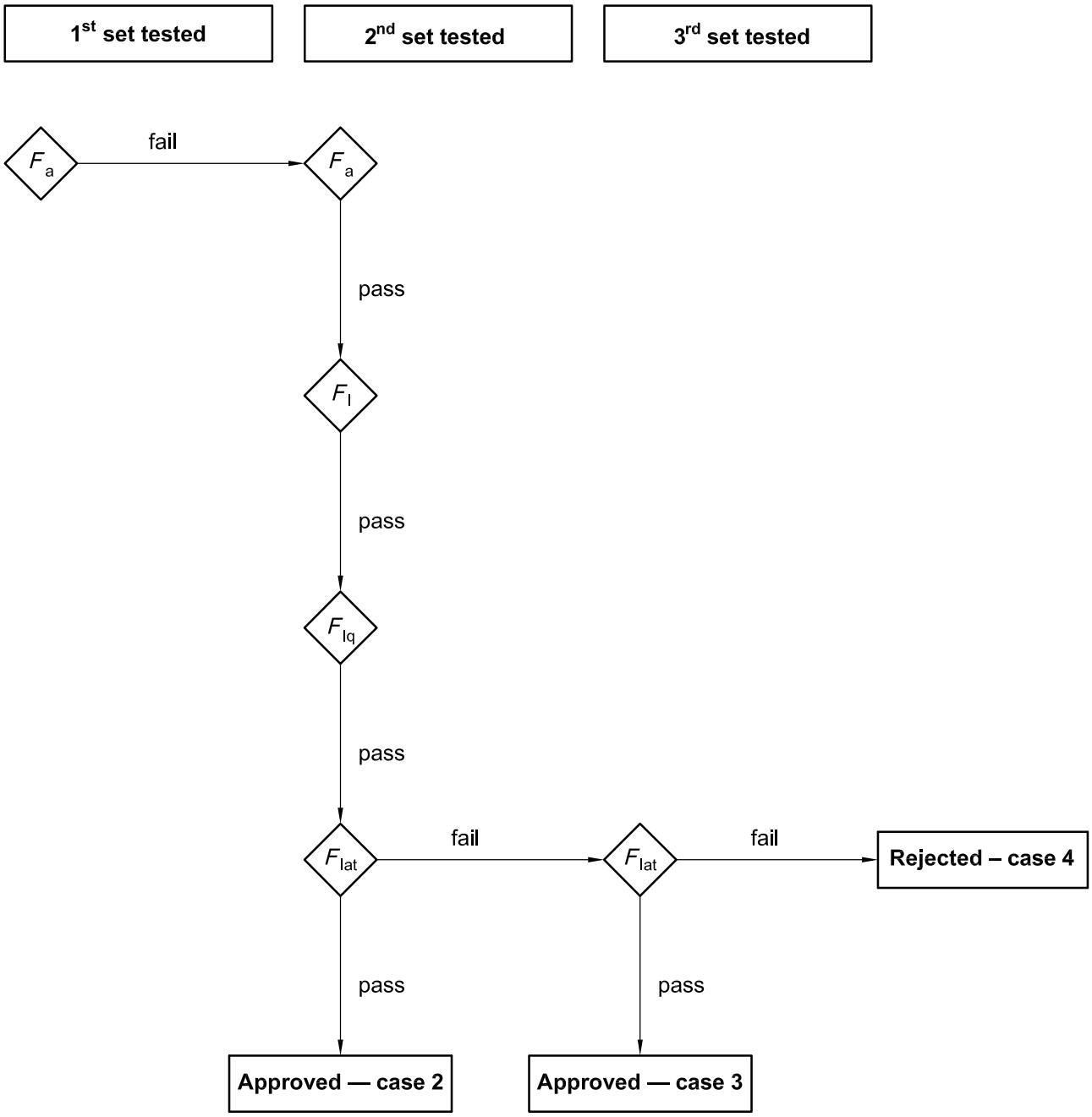
Approval/rejection procedure

Figure B.1 illustrates the approval/rejection procedure for 16 possible cases.



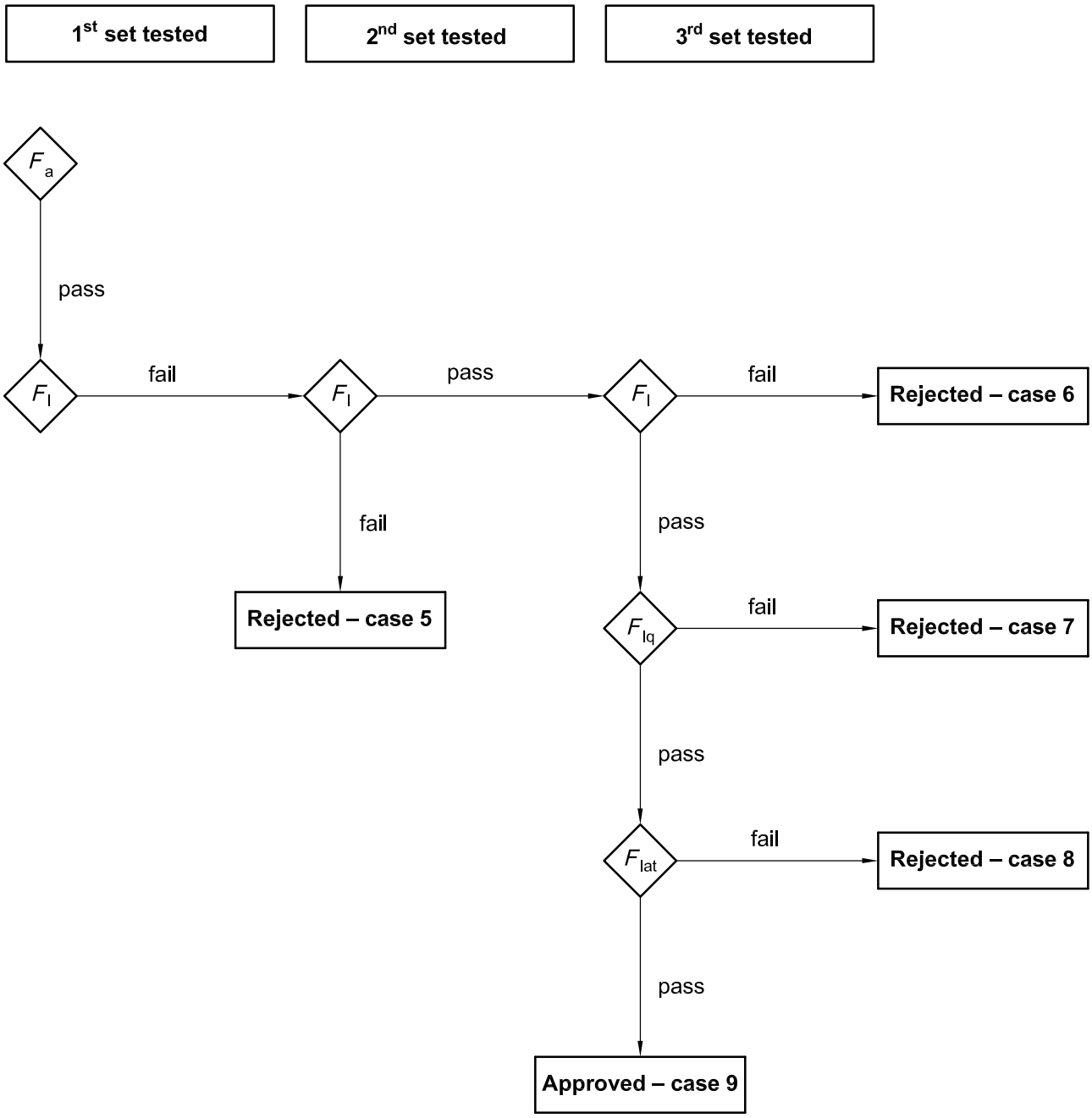
a) Case 1

Figure B.1 — Approval/rejection procedure



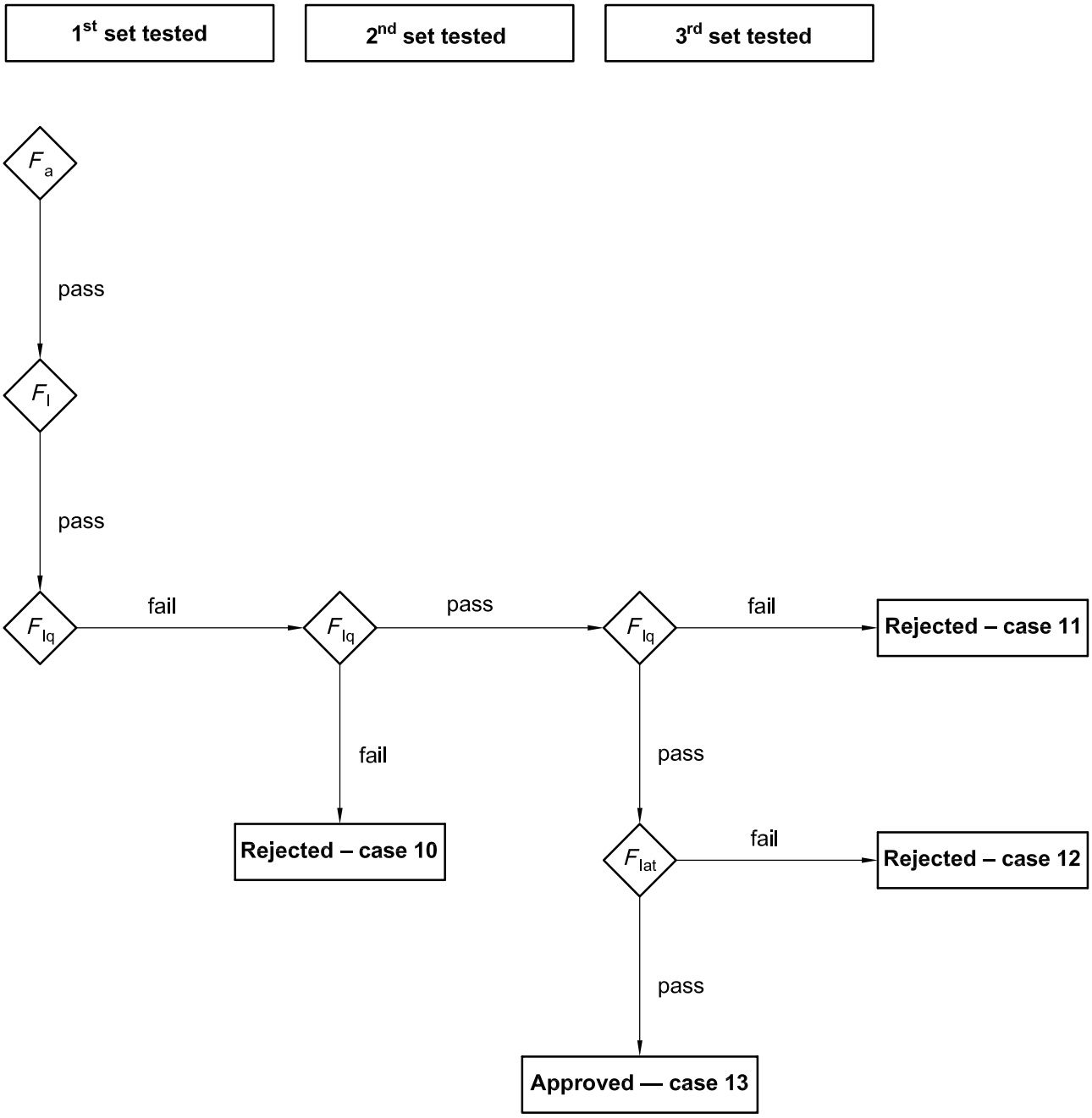
b) Cases 2 to 4

Figure B.1 — Approval/rejection procedure (*continued*)



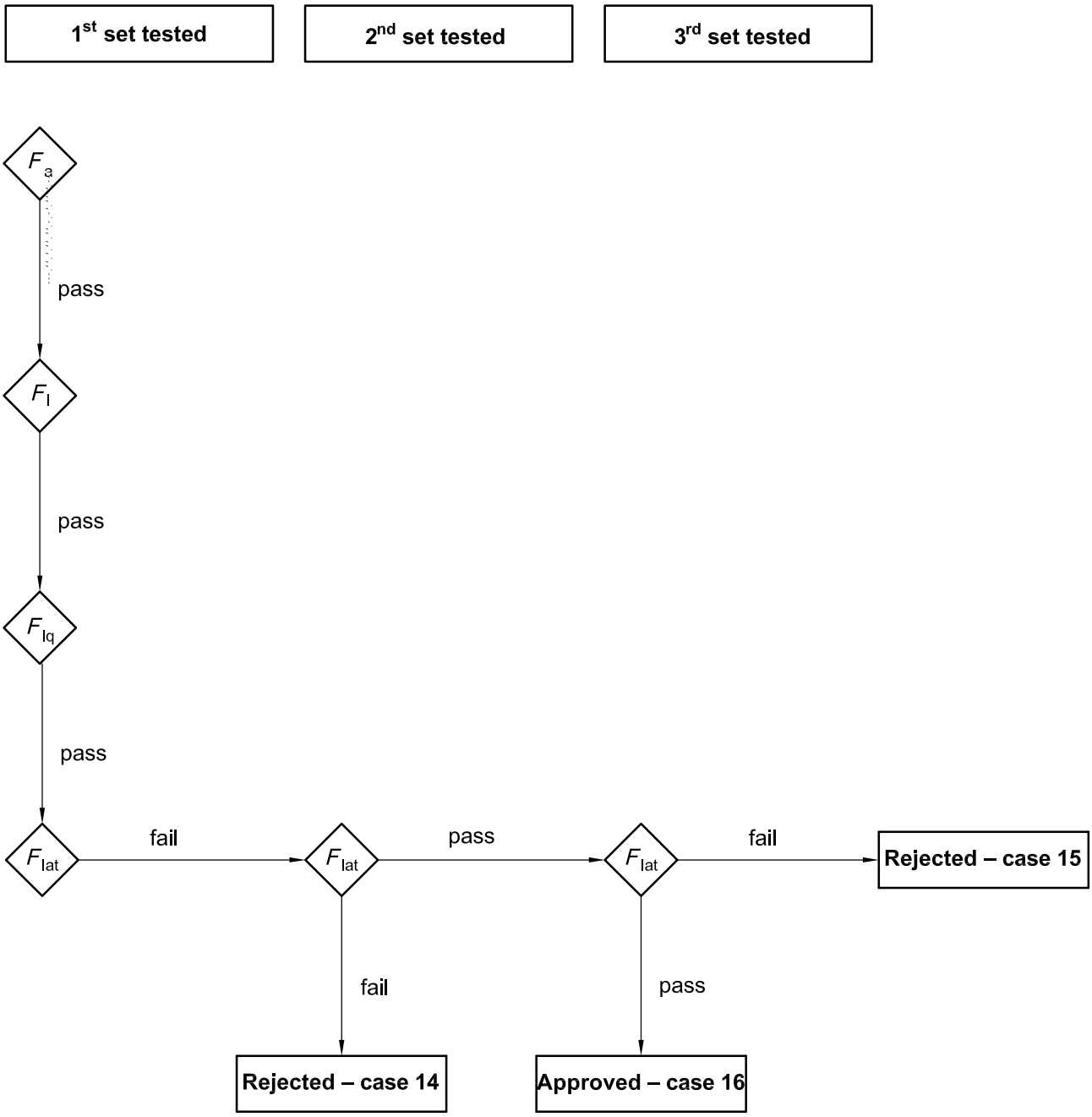
c) Cases 5 to 9

Figure B.1 — Approval/rejection procedure (*continued*)



d) Cases 10 to 13

Figure B.1 — Approval/rejection procedure (*continued*)

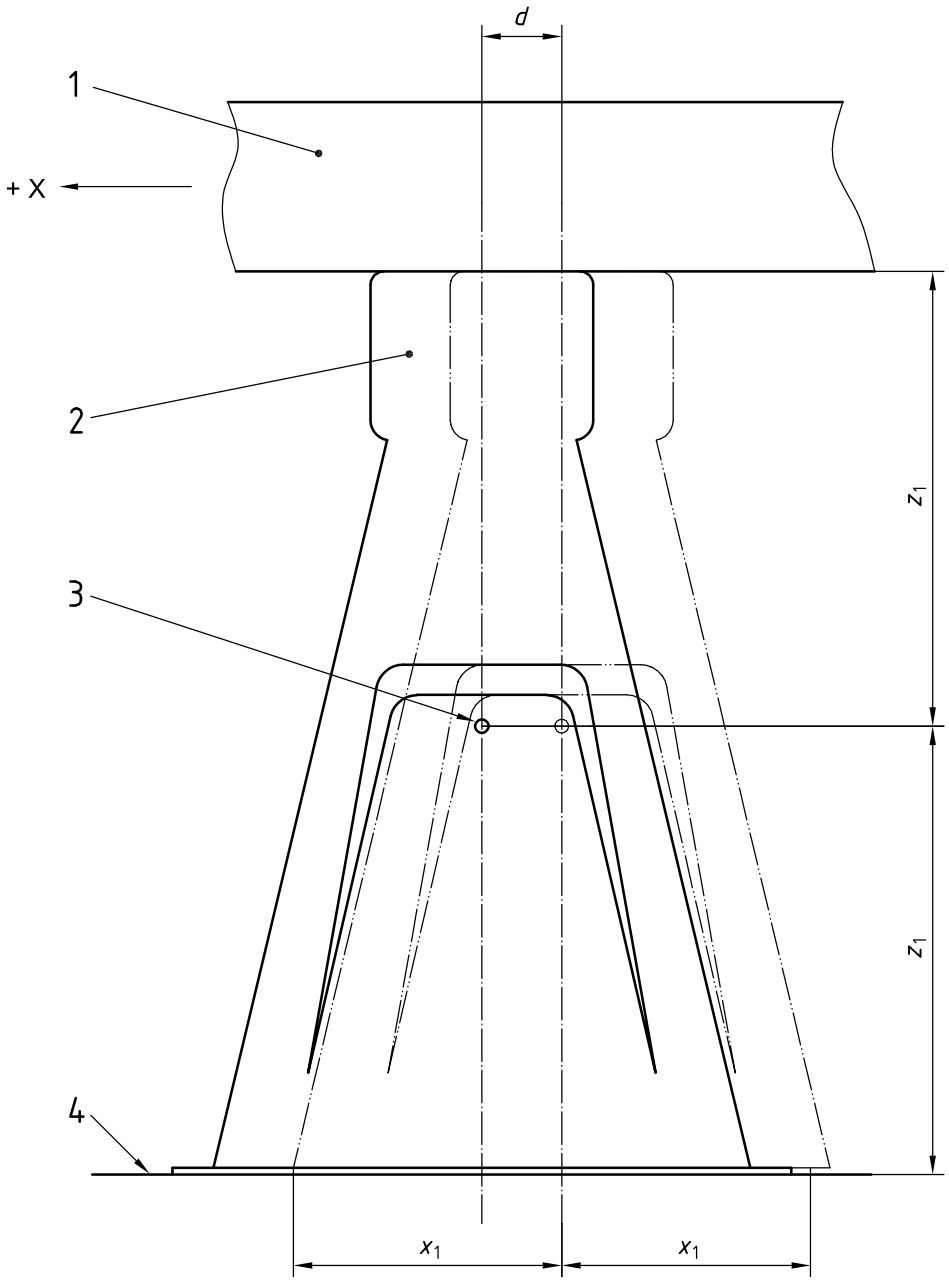


e) Cases 14 to 16

Figure B.1 — Approval/rejection procedure (*continued*)

Annex C
(normative)

Measuring deflection, d



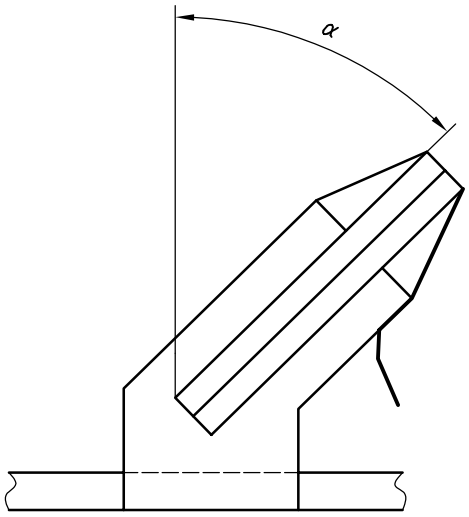
Key
1 load-fixing device
2 magnetic device
3 measuring point
4 vehicle roof

Figure C.1 — Measuring deflection, d

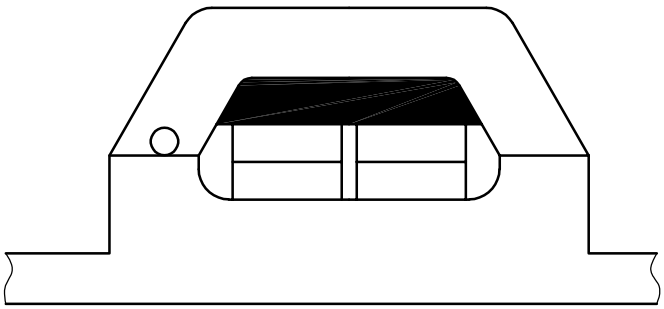
Annex D
(normative)

Force application

D.1 Figure D.1 shows angular position of the device, α, and the maximum load, $m_{b,mdev}$, for different types of magnetic ski/snowboard holders.

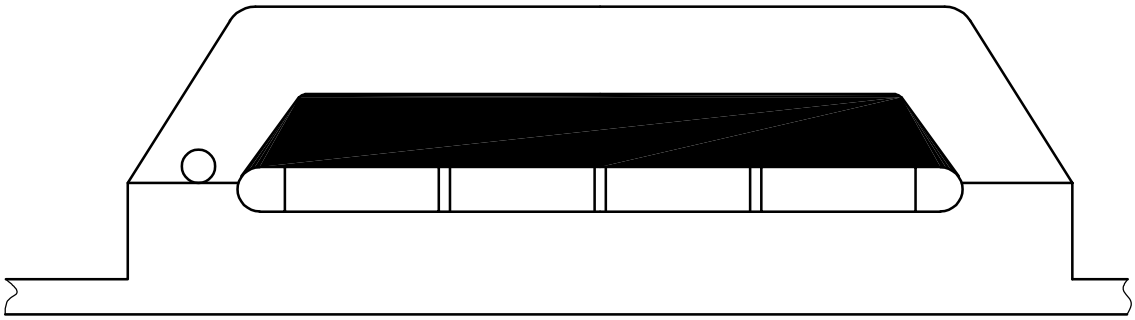


a) Angular position of the device, α

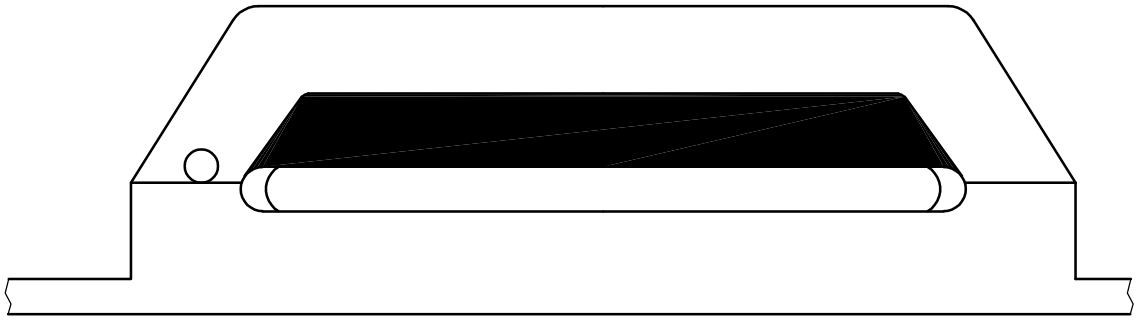


b) Magnetic ski holder, $m_{b,mdev} = 2$

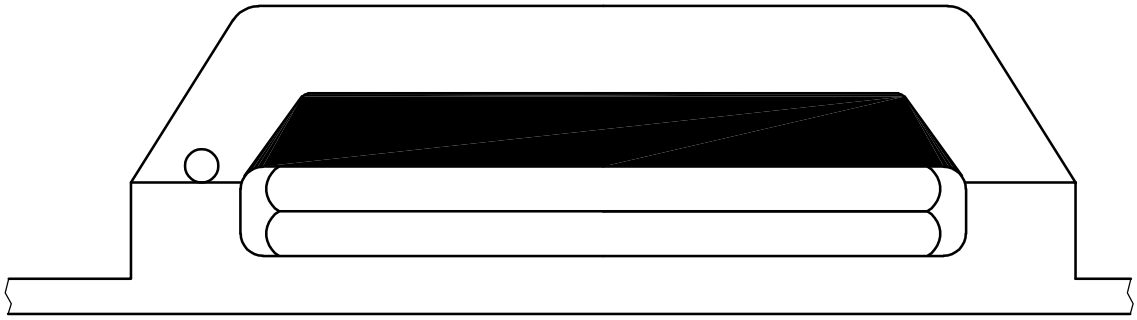
Figure D.1 — Angular position, α, and maximum load, $m_{b,mdev}$ — Examples



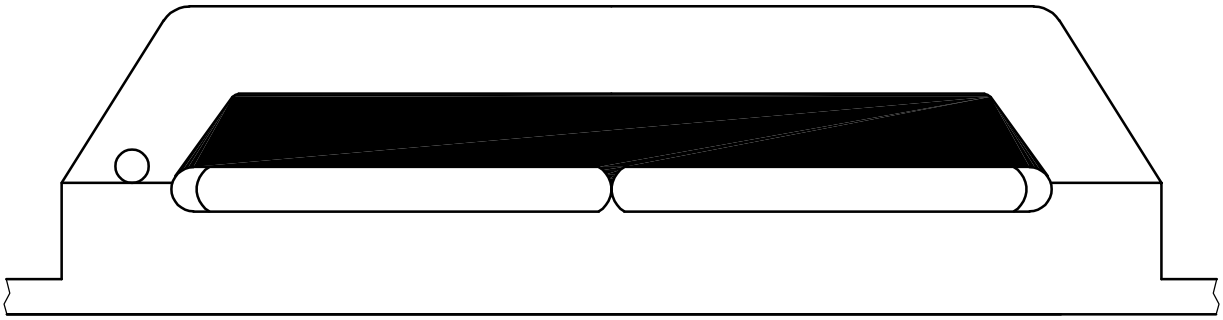
c) Magnetic ski holder, $m_{b,mdev} = 4$



d) Magnetic snowboard holder, $m_{b,mdev} = 1$



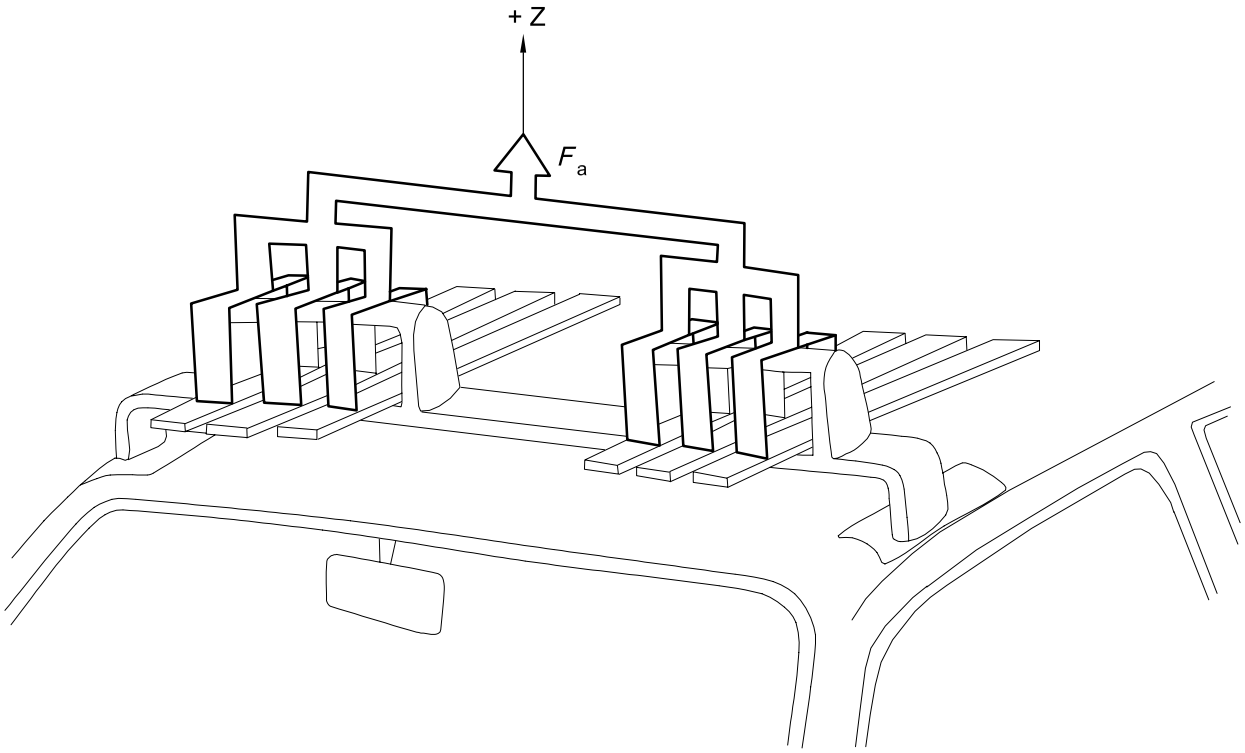
e) Magnetic snowboard holder, $m_{b,mdev} = 1$



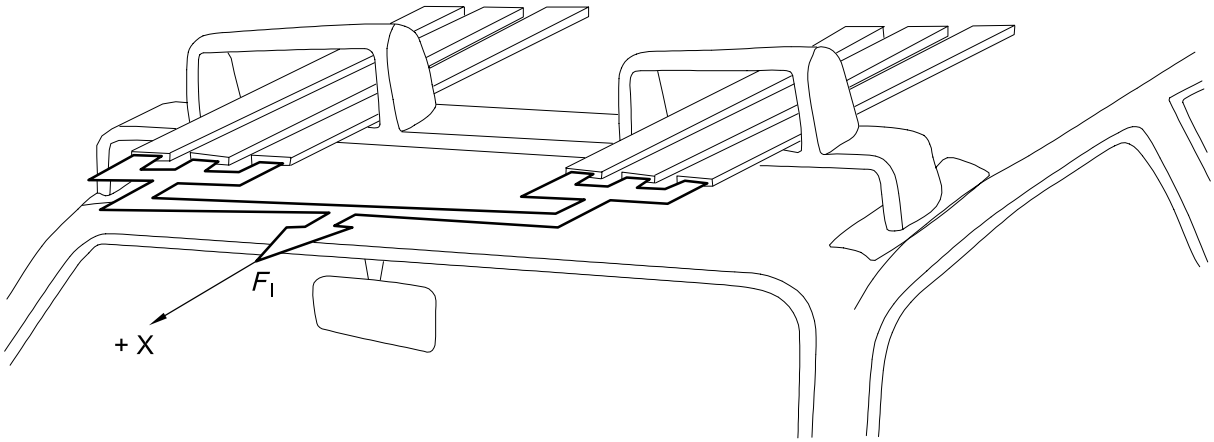
f) Magnetic snowboard holder, $m_{b,mdev} = 2$

Figure D.1 — Angular position, α, **and maximum load,** $m_{b,mdev}$ **— Examples** (*continued*)

D.2 The application of the lifting force, F_a, forward longitudinal force, F_l, 20° horizontal force, F_{lq}, and lateral force, F_{lat}, for tests of magnetic ski/snowboard holders is illustrated by Figure D.2.

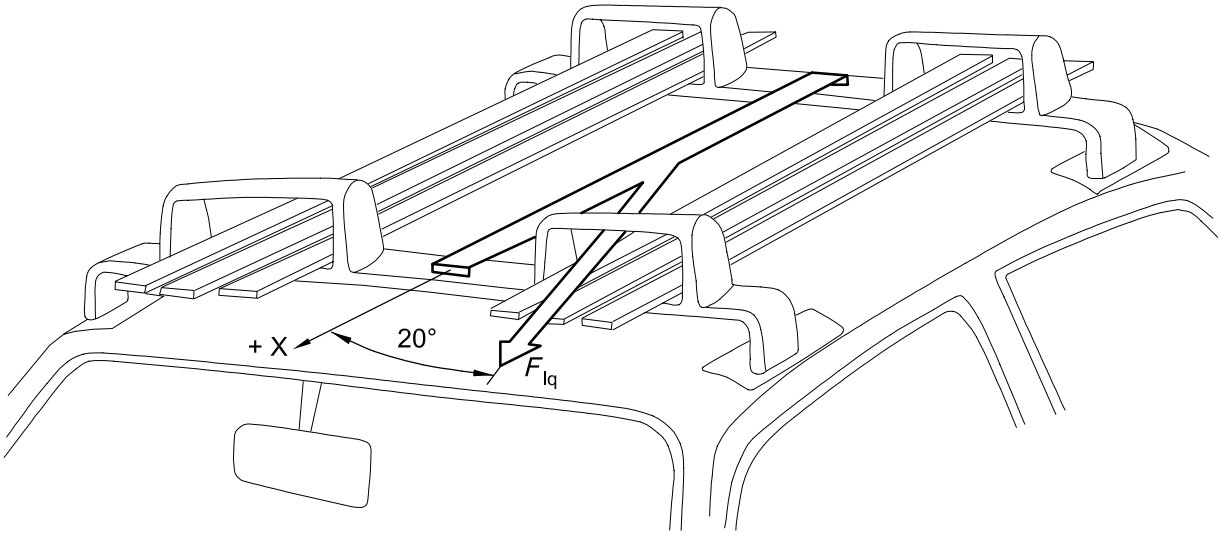


a) Lifting force, F_a

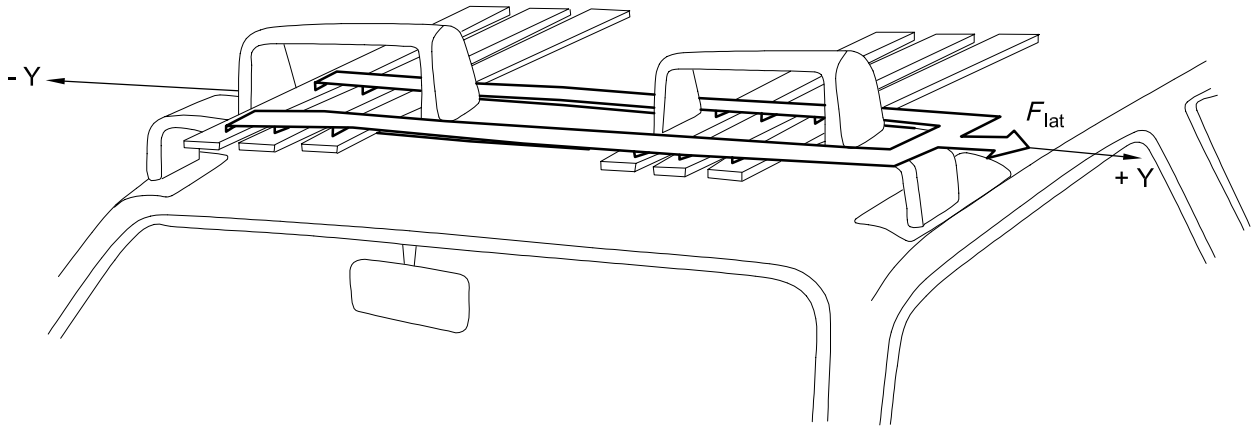


b) Forward longitudinal force, F_l

Figure D.2 — Application of lifting force, F_a, forward longitudinal force, F_l, 20° horizontal force, F_{lq}, and lateral force, F_{lat}, for testing magnetic ski/snowboard holders



c) 20° horizontal force, F_{lq}



d) Lateral force, F_{lat}

Figure D.2 — Application of lifting force, F_a, forward longitudinal force, F_l, 20° horizontal force, F_{lq}, and lateral force, F_{lat}, for testing magnetic ski/snowboard holders (*continued*)

D.3 Figures D.3 and D.4 show, respectively, the parallelepiped to be used for testing magnetic roof racks, and its installation. The application of the lifting force, F_a, forward longitudinal force, F_l, and 20° horizontal force, F_{lq}, for tests of magnetic roof racks is illustrated by Figure D.5.

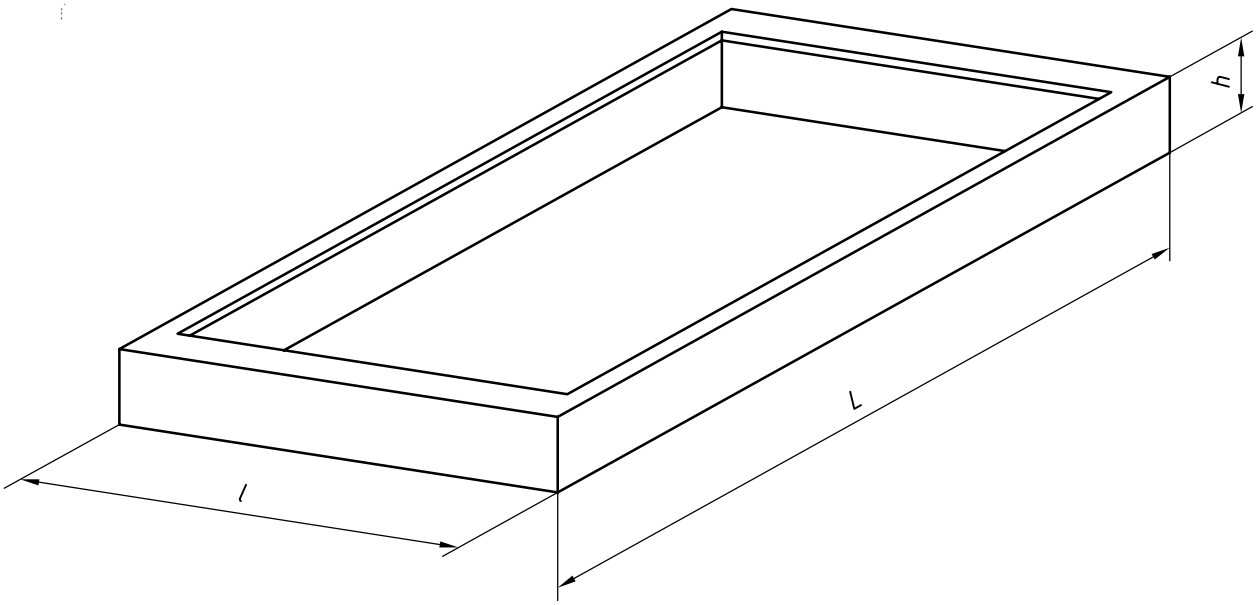


Figure D.3 — Parallelepiped for testing magnetic roof racks

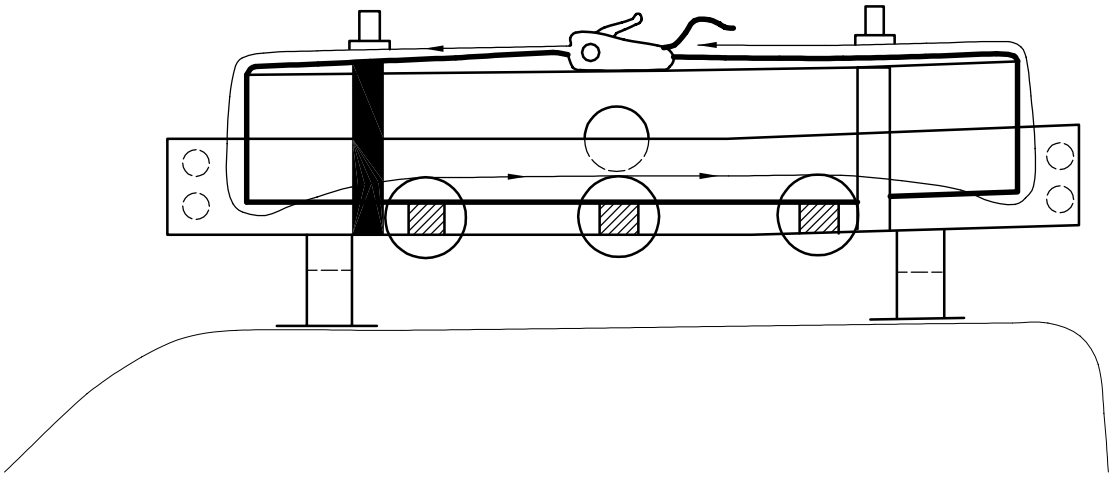


Figure D.4 — Installation of parallelepiped for testing magnetic roof racks

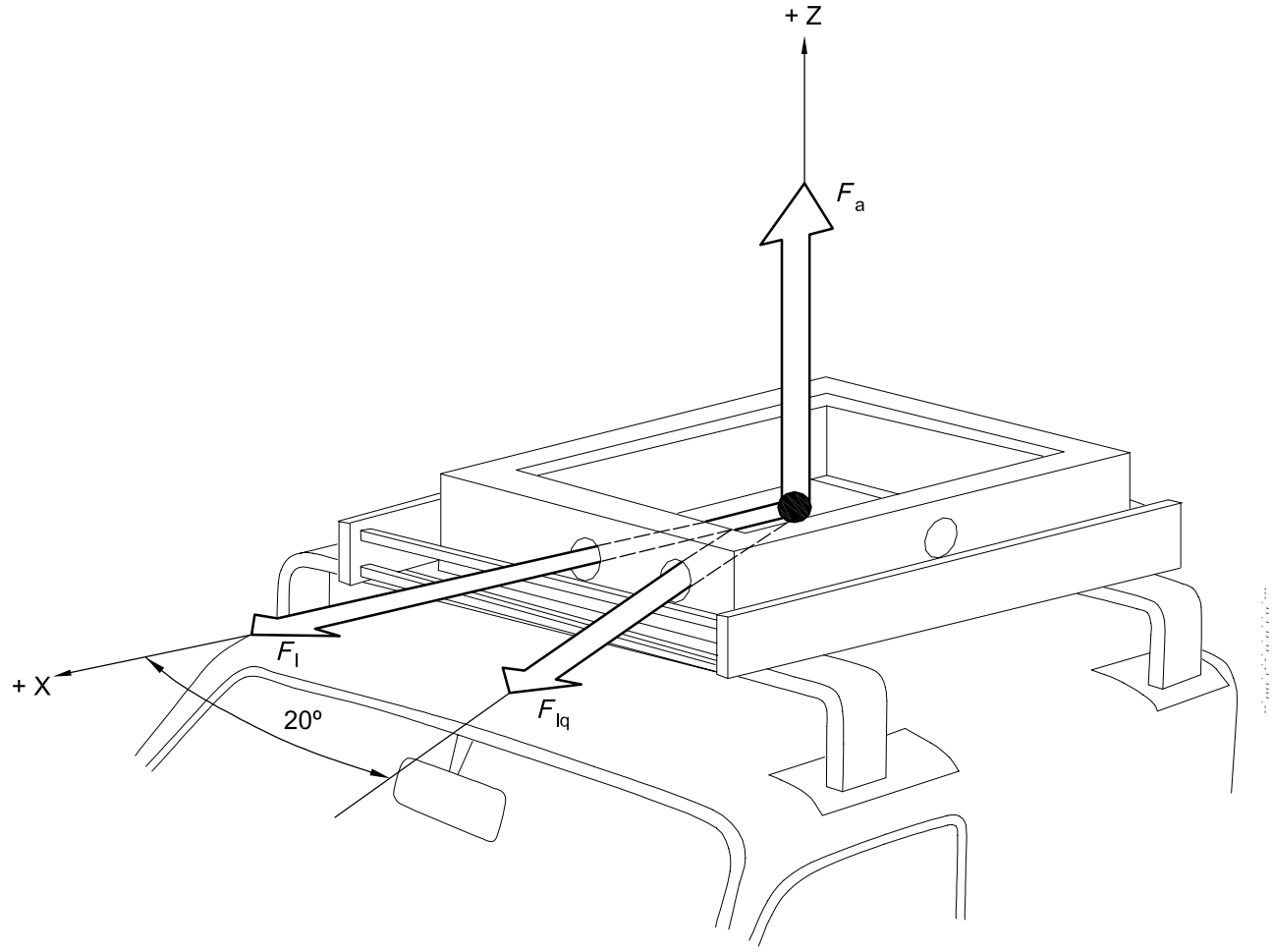


Figure D.5 — Application of lifting force, F_a, forward longitudinal force, F_l, and 20° horizontal force, F_{lq}, for testing magnetic roof racks

D.4 Figure D.6 shows the spacing between the fixing points for magnetic roof racks.

Dimensions in millimetres

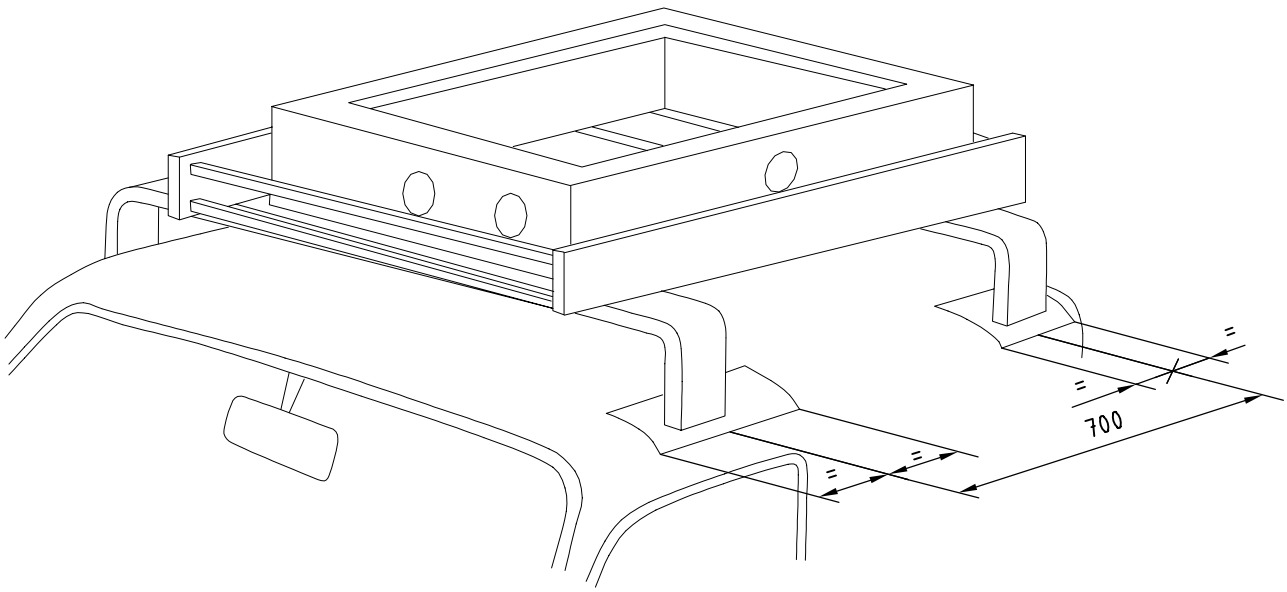


Figure D.6 — Spacing between fixing points on magnetic roof racks

Bibliography

[1] ISO 9001, *Quality management systems — Requirements*

[2] Council of Europe Directive 72/245/EEC of 20 June 1972 on the approximation of the laws of the Member States relating to the suppression of radio interference produced by spark-ignition engines fitted to motor vehicles

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