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# Summer toboggan runs

## Part 1: Safety requirements and test methods (ISO 19202-1:2017 (ED.1.0) MOD)

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# Preface

This Standard was prepared by the Standards Australia Committee CS-101, Sports and recreational facilities and equipment.

The objective of this document is to specify the safety requirements for planning of track, design and calculation, manufacturing, erection, testing and commissioning of summer toboggan runs and their components according to Clause 3. Those are sports facilities with an inclined guided downhill track, on which the user passes a difference in height by the user's dependent speed control, to a limited velocity and descending by gravity. The basic approach is the consciousness that the sledding usually implies for the users a remaining risk, which is comparable with sports activities, e.g. bicycle riding, alpine skiing, rope courses, because:

(a) active independent actions without supervision are necessary on tracks in order to control descents (distance control and braking); and

(b) posture and balance to ensure the balance between centrifugal and gravitational force are required.

This document is applicable to summer toboggan runs and major modification to summer toboggan runs and toboggans manufactured after the effective date of publication.

This document is an adoption with national modifications, and has been reproduced from, ISO 19202-1:2017, *Summer toboggan runs — Part 1: Safety requirements and test methods*. The modifications are additional requirements and are set out in Appendix ZZ, which has been added at the end of the source text.

Appendix ZZ lists the variations to ISO 19202-1:2017 (ED.1) for the application of this document in Australia.

As this document has been reproduced from an International Standard, a full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms "normative" and "informative" are used in Standards to define the application of the appendices or annexes to which they apply. A "normative" appendix or annex is an integral part of a Standard, whereas an "informative" appendix or annex is only for information and guidance.

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 83, *Sports and other recreational facilities and equipment*.

A list of all the parts in the ISO 19202 series can be found on the ISO website.

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# Australian Standard®

## Summer toboggan runs

## Part 1: Safety requirements and test methods (ISO 19202-1:2017 (ED.1.0) MOD)

## 1 Scope

This document specifies the safety requirements for planning of track, design and calculation, manufacturing, erection, testing and commissioning of summer toboggan runs and their components according to Clause 3. Those are sports facilities with an inclined guided downhill track, on which the user passes a difference in height by user's dependent speed control, to a limited velocity and descending by gravity. Its basic approach is the consciousness that the sledding usually implies for the users a remaining risk, which is comparable with sports activities, e.g. bicycle riding, alpine skiing, rope courses, because

a) active independent actions without supervision are necessary on tracks in order to control descents (distance control and braking), and

b) posture and balance to ensure the balance between centrifugal and gravitational force are required.

This document is applicable to summer toboggan runs and major modification to summer toboggan runs and toboggans manufactured after the effective date of publication.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 9606 (all parts), *Qualification testing of welders — Fusion welding*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 19202-2, *Summer toboggan runs — Part 2: Safety requirements for operation*

ISO/IEC 17020, *Conformity assessment — Requirements for the operation of various types of bodies performing inspection*

IEC 60364-5-54, *Low-voltage electrical installations — Part 5-54: Selection and erection of electrical equipment — Earthing arrangements and protective conductors*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

EN 349, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 1090 (all parts), *Execution of steel structures and aluminium structures*

EN 1991 (all parts), *Eurocode 1: Actions on structures*

EN 1993 (all parts), *Eurocode 3: Design of steel structures*

EN 1999-1-1, *Eurocode 9: Design of aluminium structures — Part 1-1: General structural rules*

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EN 12927-3, *Safety requirements for cableway installations designed to carry persons — Ropes — Part 3: Long splicing of 6 strand hauling, carrying hauling and towing ropes*

EN 12930, *Safety requirements for cableway installations designed to carry persons — Calculations*

EN 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

EN 60529, *Degrees of protection provided by enclosures (IP code)*

## 3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

**3.1**
**summer toboggan run**
sports facility with an inclined guided downhill track, on which the user passes a difference in height by user's dependent speed control, to a limited velocity and descending by gravity on the toboggan run

**3.2**
**tub-guided summer toboggan run**
track with an open tub system which guide the direction of the *toboggan* (3.4) without force guidance and the position in curves results from the balance between gravitation and centrifugal force

**3.3**
**rail-guided summer toboggan run**
track with a rail system which guide the direction of the toboggan run and is force-guided

Note 1 to entry: The direction of travel and position in curves are defined.

**3.4**
**toboggan**
sports device with runners and/or rollers without an internal or external drive

**3.5**
**uphill transport system**
rail or tub-guided system of a *summer toboggan run* (3.1) without intermediate stops intended for other activities, which returns the occupied or unoccupied toboggan from the valley to the top station

Note 1 to entry: Otherwise, the coupling or decoupling station serves as the interface to other technical systems that are subject to other standards or directives such as the Lifts Directive, Cableways Directive, Machinery Directive.

**3.6**
**restraint system**
equipment for securing the user on the *toboggan* (3.4)

Note 1 to entry: An example of a restraint system is a safety belt.

**3.7**
**means of conveyance**
means to transport the *toboggans* (3.4) uphill

Note 1 to entry: Ropes, chains, belts, etc., can be used as a means of conveyance.

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**3.8**
**supporting structure**
connection of the rail/tub and the support

Note 1 to entry: Bridges, crossovers, columns, booms, hangers and structure can serve as supporting structures.

**3.9**
**service brake**
user-dependent manual braking system for individual toboggan speed control

**3.10**
**speed limitation**
user-independent toboggan braking system to limit the toboggan speed

Note 1 to entry: Eddy current brakes, centrifugal brakes and limiting inclines can serve as speed limitation.

**3.11**
**storage brake**
toboggan braking system which brakes down or holds up the *toboggan* (3.4) without the user actuating the control elements at the toboggan

EXAMPLE Spring-loaded brake.

**3.12**
**holding or reducing brake**
user-independent toboggan braking system for reduction of the toboggan speed

Note 1 to entry: Examples of holding or reducing brakes are brake bands, magnetic brakes and eddy-current brakes.

**3.13**
**dead-weight anchor**
ballast body set up on the ground or anchored in the ground

**3.14**
**rod anchor**
steel rods with eye or butted/welded head

**3.15**
**commissioning**
taking the toboggan run into public operation the first time

## 4 List of significant hazards

Table 1 contains the significant hazards, risk situations and hazardous incidents dealt with in this document, which have been established as being significant by way of risk assessment, as well as the technical measures for prevention or reduction of risks.

**Table 1 — List of significant hazards**

| | Hazard related to | Risk, hazard area | Requirements from subclause |
|---|---|---|---|
| **1** | **Mechanical hazards** | | |
| | Faulty production and assembly | Failure of welded or bolted joints, functional failure | 5.1.1, 5.1.2, 5.1.3 |

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**Table 1** *(continued)*

| | Hazard related to | Risk, hazard area | Requirements from subclause |
|---|---|---|---|
| | Failure of rail, tub, toboggan and support components and loss of stability, undercutting of the supports | Toboggan derailment, crushing, shearing, colliding with components; falling from the toboggan | 6.2, 6.3, 6.4, 6.5 |
| | Collision with objects on the track | Injuries of all kinds | 5.3.1, 5.3.4, 5.7, 10.6 |
| | Unauthorized access to the system, third parties climb over the equipment | Injuries of all kinds | 5.3.1, 5.4, 10.6 |
| | No observance of the clearance zone | Hitting obstacles (e.g. roads, bridges, tunnels) | 5.7 |
| | Rupture of transport rope or guy rope, failure of the tensioning device, failure of the toboggan clamping device | Toboggan roll-back, injury induced by rope ends; slack ropes and loss of pretensioning | 5.5.2 |
| | Unrestricted access to movable drive components, reaching into pulleys and rope sheaves | Injuries of all kinds | 5.5, 5.6 |
| | Unintended actuation of operating components | Injuries of all kinds | 5.6, 5.8 |
| | Failure of safety equipment (e.g. light barriers, ripping wires, emergency shutdown systems, anti-roll-back systems) | Collision of toboggans, failure of drive unit to shut down | 5.6, 5.8 |
| | Lack of a cover to protect movable toboggan parts (e.g. wheels, clamping couplings) | Injuries of all kinds (e.g. strangulation) | 5.2 |
| | Unergonomically shaped seat, backrest, footrests or handles | Uncomfortable sitting posture on the toboggan | 5.2 |
| | No means of communication with the operating company (intercom, video surveillance, etc.) | No detection of inappropriate user behaviour | 5.6, 10.6 |
| | Inadequate rescue possibilities | Assistance after accident is delayed | 5.6, 10.6 |
| **2** | **Hazards caused by the electrical system** | | |
| | Faulty production and assembly | Functional failure, electric impact | 5.8 |
| | Danger caused by unintended/unauthorized start-up of the drive | Injury of persons during maintenance tasks | 5.8 |
| | Defective fault indicators | Downtimes and waiting periods on the uphill track | 5.8 |
| | Power failure | Drive failures, toboggans are standing on the uphill track, braking system failure | 5.8.1 |
| | Unprotected live components, inadequate earthing, stroke of lighting | Injury through electric impact | 5.8 |
| | Malfunctions of the emergency switch and the fault current circuit breaker system | Disturbances of operational procedures | 5.8.2 |
| **3** | **Chemical hazards** | | |
| | Use of substances which pose a health hazard (e.g. PAH, coatings) made of plastic, fibreboards, leather, etc. | Increased risk of cancer through dermal absorption of substances hazardous to the health | 5.1.1 |

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**Table 1** *(continued)*

| | Hazard related to | Risk, hazard area | Requirements from subclause |
|---|---|---|---|
| **4** | **Danger through inappropriate user behaviour** | **Falling out, impact, fall, shearing and crushing, collision, etc.** | **5.2, 5.3, 5.7 10.6** |
| | Collision with other toboggans | Impact loads on the body, crushing caused by restraint system | 5.2, 5.3.4, 5.4.3 |
| | Standing up, leaning out | Falling out of the toboggan | 5.2 |
| | Sticking out arms or legs | Injuries caused by fixed objects, structures | 5.7 |
| | No observance of the signs at the end of the track | Impact load on braking systems due to bumping | 5.2.4, 5.4.3 |
| | Inadmissible number of persons in the toboggan | Ineffective restraint system, toboggan overload | 5.2 |

# 5 Safety requirements

## 5.1 Manufacturing

### 5.1.1 Materials

Safety-relevant components require the use of materials for which design values are specified in standards.

For other materials, proof of suitability shall be provided.

Materials shall be ageing-resistant. For safety-relevant components, the manufacturer shall indicate the time limits for ageing resistance.

Materials which come into contact with the skin of the user shall not be hazardous to health.

### 5.1.2 Safety measures against loosening of connections

Bolts, nuts, tapered washers and other fasteners, which might loosen as a result of fluctuating stresses, shall be secured by well-recognized methods, e.g. prestressing, cotter pin, retaining compound, counter nut, self-lock nut, spring washers, toothed lock washers, fan type (serrated) lock washers, etc.

### 5.1.3 Welded joints

The manufacturer of welding construction shall have an appropriate welding qualification according to suitable international or national accepted standards, e.g. EN 1090 (all parts).

The welder shall have an appropriate welding qualification according to ISO 9606.

### 5.1.4 Corrosion and surface protection, protection against rot

All parts shall be protected by means of adequate measures to prevent corrosion or rotting, e.g. EN 1090 (all parts). The type of protection and inspection intervals shall be specified.

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## 5.2 Toboggan

### 5.2.1 General

The passenger compartment shall be designed in such a way that the user is properly seated and kept on the toboggan (e.g. backrests, armrests). Handles, seat with lateral reinforcement and footrests shall also be provided on the toboggan.

It shall be ensured that the users can safely operate the toboggan as it is intended.

The toboggan shall be designed in such a way that users cannot reach hazardous parts when conducting themselves as intended.

The toboggan shall be designed in such a way that no unexpected forces occur as a result of changes in transverse gradients, curves, crests or depressions and as a result of wear.

It shall be ensured that the toboggan is decelerated if the user is not using the toboggan control elements. If this cannot be realized for all operating conditions, at least one user-independent brake shall be provided in the entrance and/or exit zone.

A backrest shall be provided for uphill passengers facing in driving direction if inclines exceed 35 %.

### 5.2.2 Toboggan for rail-guided summer toboggan runs

The system shall be designed to prevent derailment of the toboggans.

An emergency running device shall ensure a safe-guided toboggan all the time.

Restraint systems are mandatory for each user and shall be verified (e.g. by calculation, tests and certificates).

Restraint systems shall be designed in such a way that the devices cannot open at purely or unintentionally.

The restraint system shall be designed in such a way that crushing or trapping of body parts is not possible.

The toboggan shall be provided with a shock-absorbing device, which shall be effective at any part of the downhill track. The design basis for shock-absorbing devices and restraint system shall be the maximum speed. An analysis of the loads expected to act on the users is mandatory.

The restraint system shall be able to withstand such loads.

Passing over or under the shock-absorbing devices in a collision shall be prevented by the system's design devices.

### 5.2.3 Toboggan for tub-guided summer toboggan runs

Tub-guided toboggans may be used without restraint system because the toboggans are not force-guided and the user can overturn with the toboggan.

The toboggan shall be provided with a shock-absorbing device, which shall be effective at any part of the downhill track. Shock absorbing may also be ensured by the toboggan design and/or selecting appropriate material for the toboggan. The shock-absorbing device shall be designed for maximum speed. An analysis of the loads expected to act on the users is mandatory.

Running over of toboggans shall be prevented.

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### 5.2.4 Braking

The braking systems of the summer toboggan run fall into the following categories: limitation of speed, service brake (manual brake), storage brake and holding or reducing brake.

a) Limitation of speed (e.g. eddy-current brake, centrifugal brake): It shall be ensured that a speed of 40 km/h can only be exceeded for 3 s and by 4 km/h and this is only permitted at 5 % of the downhill track length. This applies for downhill travel without using the manual braking system. If the speed of 40 km/h is not limited by the gradient, it shall be ensured that malfunction of one component does not result in failure of the whole braking system.

b) Service brake (manual brake): It shall be ensured that the user can control the toboggan speed anytime by using the manual braking system. The service brake shall be calculated according to 6.3.6 with verification of the brake's fail safety.

c) The storage brake shall ensure that a toboggan does not move or stop to move on the downhill track if the control element is released.

d) Deceleration of the holding or reducing brake shall be limited to ensure that the user remain seated all the time.

## 5.3 Track

### 5.3.1 Structural design of the system on the site

The suitability of the site (composition of the ground, vegetation, rock, etc.) for the erection and operation of a summer toboggan run shall be determined.

The substructure (e.g. foundations, dead-weight anchors, rod anchors) shall not be impaired in its stability by ground water, rain water and snowmelt.

All foundations shall be designed to withstand the loads according to Clause 6.

The anchoring/supporting of the structure shall be effected by means of, for example, rod anchors or foundations.

For temperature compensation, expansion joints shall be provided to prevent constraints in the track.

Based on risk assessment, the manufacturer shall specify the access restrictions and other safety equipment (e.g. signage, barriers) for the summer toboggan run that are essential for safe use and operation.

On the basis of a risk assessment, the access restrictions and other safety devices (e.g. signage, barriers) that are required for safe use and operation of a summer toboggan run as given in ISO 19202-2 shall be presented.

### 5.3.2 Rail-guided summer toboggan runs

If the toboggan is rail-guided, the acceleration shall not be <0,2 $g$ acting vertically on the seat.

At points where the toboggan can be stopped during operation, the highest transverse rail gradient shall be limited to 25°.

Track calculation for rail-guided summer toboggan runs shall be carried out according to Annex B.

### 5.3.3 Tub-guided summer toboggan runs

If the toboggan is guided inside a tub, the acceleration shall not be <0,2 $g$ acting vertically on the seat.

In accordance with Formula (B.1), the theoretical transverse gradient, $\alpha$, shall be such that the forces acting transversally to the toboggan reach the value zero.

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If swinging of the vehicle is limited by contacting boundaries, the boundaries shall be calculated to withstand the contacting impact. If no detailed calculations are given, the impact shall be at least assumed using Formula (1):

$$H_A = 0{,}30 \cdot Q \quad (1)$$

where

$Q$ is the vehicle and imposed load.

The accelerations occurring from the toboggan's swinging movement shall also be calculated for toboggan, tub and substructure.

The layout of the track shall be such that a user can safely travel along the track at an adequate speed.

### 5.3.4 Visibility down the track and braking distances

#### 5.3.4.1 Rail-guided runs

a) The visibility down the track shall be chosen as a function of the braking distance plus a reaction time of about 1 s, but shall be at least 20 m.

b) At top speed, the braking distance resulting from a "dry" emergency braking situation shall be no more than 10 m.

c) At top speed, the braking distance resulting from a "wet" emergency braking situation shall be no more than 20 m.

In exceptional cases such as in tunnels and on hilltops, signs requesting the user to brake or to drive slowly shall be used to indicate a reduced range of vision.

#### 5.3.4.2 Tub-guided runs

a) The visibility down the track shall be chosen as a function of the braking distance plus a reaction time of 1 s, but shall be at least 25 m.

b) At top speed, the braking distance resulting from a "dry" emergency braking situation shall be no more than 15 m.

c) At top speed, the braking distance resulting from a "wet" emergency braking situation shall be no more than 40 m.

For runs which can also be operated in "wet" conditions, the range of vision should be at least 50 m.

In exceptional cases such as in tunnels and on hilltops, signs requesting the user to brake or to drive slowly shall be used to indicate a reduced range of vision.

## 5.4 Entrance and exit area

### 5.4.1 General

These areas shall be designed such that the operation and the entry and exit of the user can be achieved in a safe and smooth manner.

The station area prohibited for the users shall be secured against unauthorized access. Barriers, stairs, etc., shall be designed in compliance with national regulations.

Walkways shall be even and slip-resistant.

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At the entrance and exit areas, the users shall be informed by signs, according to ISO 19202-2, which the correct behaviour is.

### 5.4.2 Entrance areas

The area assigned to users and areas used by supervisors/operators shall be separated from each other for safety reasons. System control units shall be separated from users, but with free access for operators.

The station area needs to be designed to secure the direct communication between the operator and the users.

### 5.4.3 End of downhill track

The end of the downhill track shall be clearly indicated by signs.

In case of misbehaviour of the user at the end of the downhill track, the speed shall be reduced by user-independent measures. These measures (e.g. brakes, limiting gradient, deceleration zone) shall reduce a fully occupied toboggan to a speed of ≤18 km/h.

### 5.4.4 Exit areas

The exit area shall be designed to enable the user to exit comfortably. The exit area shall accommodate at least five toboggans and the floor shall have a paved surface.

The exit height as from the vehicle seat should be between 20 cm and 60 cm.

The maximum speed shall be ≤2 km/h.

## 5.5 Uphill transport system

### 5.5.1 General

The uphill transport system comprises:

a) drive systems;

b) means of conveyance (e.g. steel cables, chains, belts);

c) coupling between the means of conveyance and the toboggan;

d) structures and rail or tub system;

e) safety equipment, rescue facilities.

### 5.5.2 Technical design

If the uphill track requires the installation of an anti-roll-back system, this shall be redundant, where

a) at least one of the devices shall act on the toboggan (e.g. wheels with anti-roll-back), and

b) at least one of the devices shall be form-fitted between the toboggan and the uphill track (e.g. anti-roll-back hook, return flaps, toothed rails).

The system's effectiveness shall be calculated and the impact loads acting on the user shall be analysed.

In a coupled state, toboggans shall be guided uphill in a manner that precludes derailment. Where occupied toboggans are coupled to the uphill transport system, this should be largely jolt-free, e.g. by using a damping system or adjusting the speed.

Documents
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