



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS T 9210 : 2020

**Safety requirements for horse riding style
electric wheelchair**

ICS 11.180

Reference number : JIS T 9210 : 2020 (E)

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Date of Establishment: 2020-09-23

Date of Public Notice in Official Gazette: 2020-09-23

Investigated by: Japanese Industrial Standards Committee

Standards Board for ISO area

Technical Committee on Assistive Technology

JIS T 9210 : 2020, First English edition published in 2021-09

Translated and published by: Japanese Standards Association
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

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Printed in Japan

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Foreword

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Safety requirements for horse riding style electric wheelchair

1 Scope

This Japanese Industrial Standard specifies requirements for the safe design and information for use of electric wheel-driven wheelchairs with convertible chair for indoor movement equipped with a seat elevating mechanism and swivel mechanism, that are designed so as to allow users to slide into the seat from the rear side of the chair (hereafter referred to as the horse riding style electric wheelchairs).

This Standard describes hazards associated with the use of horse riding style electric wheelchairs and provides information to eliminate or minimize the risks associated with these hazards.

NOTE The horse riding style electric wheelchairs are designed to allow users to operate the wheelchair themselves while keeping their posture by putting their weight on the body support system of the wheelchair, thereby enhancing and improving the quality of life of users in their movement inside care facilities, medical facilities and their own homes.

2 Normative reference

Part or all of the provisions of the following standard, through reference in this text, constitute provisions of this Standard. The most recent edition of the standard (including amendments) indicated below shall be applied.

JIS T 0102 *Glossary of terms used in assistive products for persons with disabilities*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions, and those given in **JIS T 0102** apply.

NOTE For typical structures and names of components, see Annex A.

3.1

horse riding style electric wheelchair

electric wheelchair with a seat height adjustment function that allows the user to bring the seat flush and in close contact with the start or end position of transfer (e.g. bed, toilet) and slide into/out of the wheelchair from the rear side of the seat

Note 1 to entry In this Standard, a horse riding style electric wheelchair may be referred to as the machine body.

3.2

body support system

part which directly contacts and supports the body of the user

Note 1 to entry It includes the seat, arm supports, chest support, knee supports, foot supports, and back support.

3.3

seat

part on which the user sits, and which moves up and down via vertical movement mechanism

Note 1 to entry This term is equivalent in definition to the “seat” used in **JIS T 9203**.

3.4

arm support

bar or structure provided at the front and sides of the wheelchair on which the user can rest their elbows and arms

3.5

chest support

part provided in front of the user that supports the user at the chest when they are in a forward leaning posture

3.6

knee support

front section of the machine body designed to support the knees of the user

3.7

foot support

part on which the user rests their feet when they get into the machine body

3.8

back support

part for supporting the user's back that the user can pop up, attach, etc. for use after sliding into the seat

3.9

side grips

parts the user grasps to support their body when sliding in/out of the wheelchair for transfer

3.10

vertical movement mechanism

part consisting of a motor and a structure for vertical movement, intended for moving the seat up and down

3.11

controller

part consisting of a control lever for travelling/stopping/swivelling, control switches/buttons for vertical movement of the seat and other functions, and display screen

3.12

wheel

part consisting of driving wheels, castors or steering wheels

3.13

clutch

part that conveys the power for travelling to the driving wheels

Note 1 to entry It is used for switching between manual driving and electric power driving.

3.14

highest seat position

state in which the seat is raised to its highest position by vertical movement mechanism

3.15

lowest seat position

state in which the seat is lowered to its lowest position by vertical movement mechanism

3.16

user

person who rides on a horse riding style electric wheelchair

3.17

assistant

person who helps the user with all the tasks involved in use of the wheelchair including preparation of the machine body (e.g. battery charging), moving the machine body to the place of use, transfer of user in and out of the machine body, and movement and storage of the machine body after use

3.18

prescribed maximum mass

maximum body weight of the occupant (including the weight of loaded objects) allowable on a horse riding style wheelchair prescribed by its manufacturer for each product type

3.19

clutch manual mode

mode where the clutch for power conveyance between the driving wheels and the motor has been switched off, and manual operation is possible

3.20**prescribed maximum slope**

maximum angle of slope prescribed by the manufacturer for each product type up to which wheelchair operation with sufficient hill-climbing performance and static and dynamic stability is ensured

3.21**prescribed maximum step height**

maximum height of step the wheelchair can transit over, prescribed by the manufacturer for each product type

4 Safety requirements**4.1 General**

Horse riding style electric wheelchairs shall conform to the safety requirements provided in Clause 4.

This Standard provides safety requirements separately for use and for structure and mechanism of horse riding style electric wheelchairs. In each set of requirements, the horse riding style electric wheelchairs are required to be designed according to the principles comprised of the following items in order to reduce the risks arising from significant hazards that have been identified. In case any hazard not described in this Standard exists, the risk should be reduced using the inherently safe design, protective measures and information for use. If risks can be reduced by any measures not provided in this Standard, other requirements determined by risk assessment shall be applied.

- a) Inherently safe design
- b) Safeguarding and complementary protective measures
- c) Information for use

The satisfaction of the safety requirements of Clause 4 can be verified and validated by one or more methods, such as :

- A : inspection;
- B : practical tests;
- C : measurement;
- D : observation during operation;
- E : examination of circuit diagrams;
- F : examination of software;
- G : review of task-based risk assessment;

— H : examination of layout drawings and relevant documents.

4.2 Safety requirements for use

4.2.1 Safety requirements for transfer (getting in and out of wheelchair)

4.2.1.1 Significant hazards

The significant hazards associated with the transfer are as follows.

- a) Compression occurring during transfer due to the trapping of a foot between the foot support on the rear side of the machine body and the object (e.g. bed, toilet) to/from which the transfer is being made.
- b) Backward tipping of the machine body occurring as a result of sitting at the rear of the seat during transfer and putting weight on the rear side of the wheelchair.
- c) Collision and fall due to inadequate positioning and height adjustment with the destination of transfer because of the difficulty in turning back and checking behind when positioning and height adjustment are performed in backward facing position for dismount.
- d) Unnatural posture and excessive bending at the knee joint or hip joint that cause aching pains, compression of feet and lower limbs, user falling out of the wheelchair, etc. occurring when the user is in the mounting position or the seat is in vertical motion.
- e) Fall due to the unintended movement of the machine body when the user starts to transfer without turning off the clutch manual mode.
- f) User falling into a gap between the wheelchair and the object to/from which the transfer is being made, when the user or the assistant could not bring the machine body close enough to the object.
- g) Failure of transfer and tipping occurring during transfer due to inadvertent touching of the control lever by the user or assistant causing unintended movement of the machine body.
- h) User sliding into a gap between the wheelchair and the object to/from which the transfer is being made, when the height adjustment of the seat to close the gap was inadequate.
- i) User falling when attempting a transfer on a sloped surface.
- j) User falling during the transfer to/from an object that can easily move or tip (e.g. chair with castors) by moving away from the seat of the machine body due to movement/tipping of such an object.
- k) User falling backwards when the wheelchair starts to move after the user attempts a transfer to/from an object (e.g. bed, toilet) that is lower in height than usual with their legs stretched due to limited flexibility in their body, and are unable to keep the posture and lean backwards.

4.2.1.2 Inherently safe design

Inherently safe design for each of the hazards indicated in **4.2.1.1** shall consist of the following considerations.

NOTE The alphabetical subdivision in this subclause corresponds to that of **4.2.1.1**.

- a) To prevent trapping and compression of a foot between the foot support on the rear side of the machine body and the object to/from which the transfer is being made (e.g. bed, toilet) that may occur during transfer, the wheelchair shall be designed to secure sufficient space for the feet not to be trapped by the machine body when they are placed on the floor.
- b) The wheelchair shall be structured not to tip backward when the user sits at the rear of the seat and puts weight on the rear side of the wheelchair.
- c) To prevent fall and collision occurring when the user sits at the rear of the seat to perform positioning and height adjustment with the destination of transfer in backward facing position for dismount, the side grips shall be provided at an easy position for the user to grip onto to support their body.
- d) The wheelchair shall be designed to ensure that bending and compression on each part of the user's body is minimum.
- e) The switchover switch of the clutch shall be located outside the user's reach so that switching of the clutch can only be done by the assistant, and the user cannot change the clutch from electric mode to manual mode easily and inadvertently.
- f) The side grips shall be provided at an easy position for the user to grip onto to support their body during transfer.
- g) The control lever shall be designed so as not to be activated by a brief touch.
- h) The side grips shall be provided at an easy position for the user to grip onto to support their body when they sit at the rear of the seat to adjust the position and height of the wheelchair with the destination of transfer in backward facing position for dismount.
- i) The wheelchair shall be structured so that it can maintain static stability when on the prescribed maximum slope and at the highest seat position for indoors.
- j) [Since the hazard described in **4.2.1.1 j)** is an issue of the object to/from which the transfer is made, it is not part of the inherently safe design considerations of the horse riding style wheelchairs.]
- k) The control lever shall be located at an unreachable distance from the rear side of the machine body so that, in a transfer from a low position, the wheelchair will not be inadvertently started until the user has completed the transfer by elevating the seat and then sliding from the rear side of the seat into the standard position.

4.2.1.3 Safeguarding and complementary protective measures

Safeguarding and complementary protective measures for each of the hazards indicated in **4.2.1.1** shall consist of the following considerations.

NOTE The alphabetical subdivision in this subclause corresponds to that of **4.2.1.1**.

- a) The foot support shall be covered with a soft material.
- b) A balance support material shall be provided as necessary under the rear part of the seat so as to prevent backward tipping when the users sits at the rear of the seat for transfer.
- c) A device for providing a rearward view such as a rearview mirror or a rearview monitoring camera, or a swivel mechanism that allows positional adjustment with the destination of transfer in forward facing position and swivelling on the spot shall be provided.
- d) A test ride by the user shall be performed prior to use for adequacy/inadequacy screening regarding usage.
- e) The status of the clutch, i.e. either manual or electric mode, shall be displayed.
- f) A rearview mirror and/or rearview monitoring camera shall be attached.
- g) An alarm device that gives an alert when the distance sensor detects a dangerous distance between the wheelchair and the object to/from which the transfer is being made shall be provided.
- h) A rearview mirror and/or rearview monitoring camera shall be attached.
- i) [Since the transfer on a sloped surface as stipulated in **4.2.1.1 i)** is a prohibited matter, it is not part of the safeguarding and complementary protective measure considerations of the horse riding style electric wheelchairs.]
- j) [Since the hazard described in **4.2.1.1 j)** is an issue of the object to/from which the transfer is made, it is not part of the safeguarding and complementary protective measure considerations of the horse riding style wheelchairs.]
- k) The side grips shall be provided at an easy position for the user to grip onto to support their body during transfer.

4.2.1.4 Information for use

The information for use for each of the hazards indicated in **4.2.1.1** shall be provided to the user through listing of the items given in **B.2** according to the requirements in Clause 6.

4.2.1.5 Verification and validation

Appropriate method(s) shall be chosen from **4.1**.

4.2.2 Safety requirements for movement (including starting, moving, and stopping)

4.2.2.1 Significant hazards

The significant hazards associated with movement are as follows.

- a) Backward fall from the seat during movement (including starting and stopping) caused by incorrect operation by the user.

- b) Backward tipping caused by entrapment of a long cloth, scarf or gown in the wheel during movement.
- c) Forward tipping and falling during movement with the user in a forward leaning posture at a high seat position without the chest support.
- d) Tipping and falling due to loss of balance during movement at the highest seat position and a high centre of gravity of the user.
- e) Fatigue and stress caused by maintaining a posture that is not usually taken.
- f) Entrapment of a foot under the wheel due to inadvertent operation of the control lever by the user or the assistant during movement.
- g) Collision or tipping due to difficulties arising from a certain viewing angle or range of view, such as difficulty in seeing backward while in backward movement, or difficulty in getting a clear view of the floor around the wheelchair when seeing from an elevated viewpoint.
- h) Fall occurring when the user's body is thrown off by acceleration and centrifugal force of the movement or swivelling of the wheelchair that is started before the user is in the correct riding position and posture after transferring to the back of the seat.
- i) Fall due to the loss of balance during acceleration and deceleration of movement (starting, travelling, and stopping).
- j) Backward tipping and falling occurring when the user starts the wheelchair without fully completing the transfer, under the false notion that the transfer is complete.

4.2.2.2 Inherently safe design

Inherently safe design for each of the hazards indicated in 4.2.2.1 shall consist of the following considerations.

NOTE The alphabetical subdivision in this subclause corresponds to that of 4.2.2.1.

- a) The seat shall be designed so that the user does not easily fall backwards during movement.

Example 1 A forward leaning seating angle is possible with raising of the seat height, the seat has sufficient length to prevent falling, etc.

- b) The seating position during movement shall be designed to be as forward and high as can be allowed by the user's physical condition in order to prevent entrapment of a long cloth, scarf, gown, etc. in the wheel that may cause backward tipping (a large enough distance shall be secured between the hip of the user and the rear end of the seat to prevent the said type of entrapment).
- c) The wheelchair shall be provided with a chest support to prevent forward tipping and falling when the seat position is high and the user is in forward leaning posture, and designed to achieve machine body balance.