
Wheelchairs —

Part 22:

Set-up procedures

Fauteuils roulants —

Partie 22: Modes opératoires de réglage



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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 3.

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 part of ISO 7176 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 7176-22 was prepared by Technical Committee ISO/TC 173, *Technical systems and aids for disabled or handicapped persons*, Subcommittee SC 1, *Wheelchairs*.

ISO 7176 consists of the following parts, under the general title *Wheelchairs*:

- *Part 1: Determination of static stability*
- *Part 2: Determination of dynamic stability of electric wheelchairs*
- *Part 3: Determination of efficiency of brakes*
- *Part 4: Energy consumption of electric wheelchairs and scooters for determination of theoretical distance range*
- *Part 5: Determination of overall dimensions, mass and turning space*
- *Part 6: Determination of maximum speed, acceleration and deceleration of electric wheelchairs*
- *Part 7: Measurement of seating and wheel dimensions*
- *Part 8: Requirements and test methods for static, impact and fatigue strengths*
- *Part 9: Climatic tests for electric wheelchairs*
- *Part 10: Determination of obstacle-climbing ability of electric wheelchairs*
- *Part 11: Test dummies*
- *Part 13: Determination of coefficient of friction of test surfaces*
- *Part 14: Power and control systems for electric wheelchairs — Requirements and test methods*
- *Part 15: Requirements for information disclosure, documentation and labelling*
- *Part 16: Resistance to ignition of upholstered parts — Requirements and test methods*
- *Part 22: Set-up procedures*

The following parts are also on the programme of work:

- *Part 19: Wheeled mobility devices for use in motor vehicles*
- *Part 20: Determination of the performance of stand-up wheelchairs*
- *Part 21: Electromagnetic compatibility of electrically powered wheelchairs and motorized scooters — Requirements and test methods*
- *Part 23: Attendant-operated stair-climbing devices — Requirements and test methods*
- *Part 24: User-operated stair-climbing devices — Requirements and test methods*

A technical report will also be made available giving a simplified explanation of these parts of ISO 7176.

Annex A forms a normative part of this part of ISO 7176. Annex B is for information only.

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Introduction

Many wheelchairs have adjustable or optional features which, depending upon their setting, can have significant effects on the results from test methods specified in other parts of the ISO 7176 series.

When used in combination with other parts of ISO 7176, this procedure will produce test results which permit comparison between different wheelchairs and give reproducibility results between different test laboratories.

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Wheelchairs —

Part 22: Set-up procedures

1 Scope

This part of ISO 7176 specifies a set-up procedure to be used in the preparation of adjustable wheelchairs for testing in accordance with the ISO 7176 series. This procedure gives methods to be used where there are no manufacturers' instructions for setting the wheelchair adjustments.

This part of ISO 7176 is applicable to manual wheelchairs and electric wheelchairs (including scooters) intended to provide indoor and/or outdoor mobility.

Other parts of ISO 7176 may give specific requirements for the adjustment of the wheelchair. In such cases, that individual part of ISO 7176 takes precedence over this part of ISO 7176.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 7176. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 7176 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 6440, *Wheelchairs — Nomenclature, terms and definitions*.

ISO 7176-7, *Wheelchairs — Part 7: Measurement of seating and wheel dimensions*.

ISO 7176-8, *Wheelchairs — Part 8: Requirements and test methods for static, impact and fatigue strengths*.

ISO 7176-11, *Wheelchairs — Part 11: Test dummies*.

ISO 7176-15, *Wheelchairs — Part 15: Requirements for information disclosure, documentation and labelling*.

3 Terms and definitions

For the purposes of this part of ISO 7176, the terms and definitions given in ISO 6440, ISO 7176-7, ISO 7176-8, ISO 7176-11 and ISO 7176-15 and the following apply.

3.1

negative camber

inclination of a wheel towards the opposite wheel so that its top is closer to the other wheel than its bottom

See Figure 1.

3.2

castor stem angle

angle between the castor stem and vertical

NOTE Positive castor stem angles are shown in Figure 2.

3.3

castor support

support member to which the castor wheel is connected

See Figure 2.

3.4

castor stem housing

device in which the castor support device is pivoted

See Figure 2.

3.5

forward trailing position

orientation of the castor wheels when the wheelchair is driven in the forward direction

3.6

control device

means by which the user directs an electric wheelchair to move at the desired speed and/or in the desired direction of travel

3.7

suspension

shock-absorbent device that gives the user the desired seat angle when the wheelchair is used on a flat horizontal surface

4 Apparatus

4.1 **Reference loader gauge** (RLG), as specified in ISO 7176-7.

4.2 **Test dummy**, as specified in ISO 7176-11.

4.3 **Footpieces**, to replace the lower-leg portion of the standard test dummies as specified in ISO 7176-8.

4.4 **Means for measuring linear dimensions** up to 2000 mm, to an accuracy of ± 1 mm.

4.5 **Means for measuring the angles** of surfaces with respect to each other and/or to the vertical or horizontal, to an accuracy of $\pm 0,2^\circ$.

4.6 **Means of measuring force** between 25 N and 250 N, to an accuracy of ± 5 %.

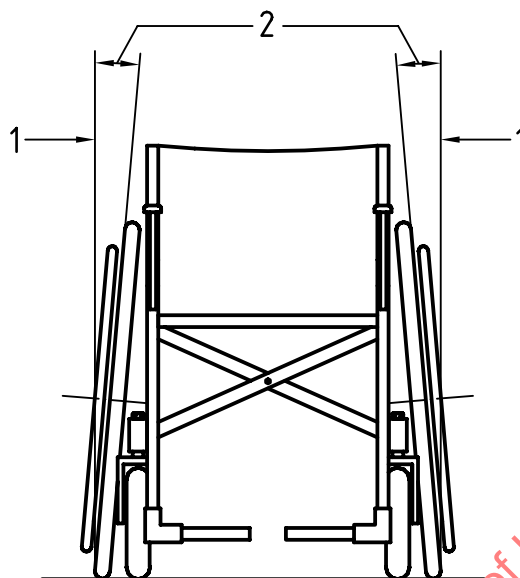
4.7 **Means of measuring torque** between 2 N·m and 100 N·m, to an accuracy of ± 10 %.

4.8 **Means to inflate** pneumatic wheelchair tyres up to a pressure of 10 bar, with an accuracy of $\pm 0,2$ bar.

4.9 **Hard horizontal test plane**, of sufficient size to support the wheelchair during testing, such that the whole surface is contained between two imaginary parallel planes 5 mm apart.

NOTE The imaginary planes are intended to provide a measure of control on the flatness of the test plane.

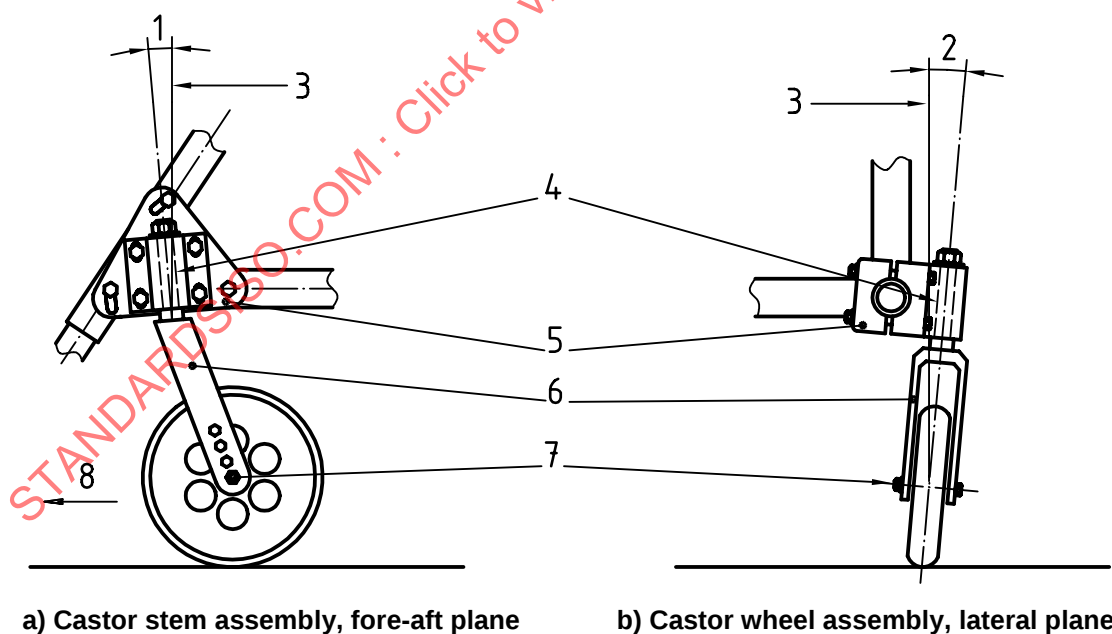
4.10 Means to prevent the wheelchair from moving during positioning of the RLG-dummy as specified in ISO 7176-7.



Key

- 1 Vertical
- 2 Negative camber angle

Figure 1 — Negative camber angle



a) Castor stem assembly, fore-aft plane

b) Castor wheel assembly, lateral plane

Key

- | | |
|--|-----------------------|
| 1 Positive castor stem angle, fore-aft | 5 Castor stem housing |
| 2 Positive castor stem angle, lateral | 6 Castor support |
| 3 Vertical | 7 Castor wheel axle |
| 4 Castor stem | 8 Forward direction |

Figure 2 — Castor assembly

5 Equipping the wheelchair

5.1 Fit any appropriate armrests, headrest, leg support and/or footrests specified by those commissioning the tests. Remove any loose cushions, straps, etc. which are not fastened to and are not an integral part of the wheelchair necessary for normal use.

5.2 If the wheelchair is electrically powered, fit batteries of the size and type recommended by the manufacturer. Charge the batteries to at least 75 % of their rated nominal capacity.

CAUTION — If the wheelchair is equipped with liquid-electrolyte-type batteries, some tests can be hazardous and there is a risk of spillage. In such a case, the batteries may be replaced by the nearest equivalent gel or sealed batteries, with supplementary weights to give equivalent mass distribution.

6 Adjusting the wheelchair

6.1 General

6.1.1 Pneumatic tyres

If parts of ISO 7176 have specific set-up requirements, use the method of adjustment specified in that particular part. Adjust all other settings as follows.

If the wheelchair has pneumatic tyres, inflate them to the pressure recommended by the wheelchair manufacturer. If a pressure range is given, inflate to the highest pressure in the range. If there is no recommendation for inflation pressure from the wheelchair manufacturer, inflate the tyres to the maximum pressure recommended by the tyre manufacturer.

6.1.2 Positioning

Place the wheelchair on the test plane. Place the castors in their forward trailing position.

6.1.3 Parking brakes

If parts of ISO 7176 have specific set-up requirements, use the method of adjustment specified in that particular part. Adjust all other settings as follows.

Some of the adjustments may have influences on the function of the brakes, e.g. if the brake blocks do not keep up with their contact surfaces when adjusting the main wheels. If the brakes are adjustable and there are no manufacturers' instructions for adjustments, measure the distance between the brake blocks and their contact surfaces when the brakes are in their released position. Record this distance.

NOTE This distance is used when resetting the brakes in the final adjustment (see clause 7).

6.2 Positioning

Position any adjustable parts as specified by the manufacturer for driving.

6.3 Adjustment

6.3.1 General

For any adjustable parts where there are no manufacturers' recommendations for settings, set adjustable parts in the following order. Where there are no manufacturers' specification for settings, set adjustable parts as follows without changing any adjustments made in 6.2. Do not make any adjustment that prevents normal operation of the wheelchair as described by the manufacturer.

NOTE 1 When adjusting parts of a wheelchair, it is often found that an adjustment to one part changes that of another, e.g. changing the wheel position may also change the seat angle. Thus it may be necessary to make several readjustments to some parts to compensate for the interaction of others.

NOTE 2 This procedure uses the ISO 7176-7 loader gauge (RLG) which has a mass of 51 kg (11 kg for child RLG). For some wheelchairs, with suspension or other compressible parts such as wheels and seats, the adjustments can be affected when the wheelchairs are intended for heavier users. In such circumstances, readjustments in accordance with item 9 c) 4) may be necessary.

6.3.2 Drive wheels

6.3.2.1 Drive-wheel axle position: horizontal

If the position of the drive wheels can be adjusted horizontally, set them in the mid-position ± 3 mm or, where there is no provision for a mid-position setting, set them to the nearest position which provides a longer wheelbase than the mid-setting.

6.3.2.2 Drive-wheel axle position: vertical

If the position of the drive wheels can be adjusted vertically, set them to the mid-position ± 3 mm or, where there is no provision for a mid-position setting, set them to the nearest position below the mid-position.

6.3.2.3 Drive-wheel camber

If the drive-wheel camber is adjustable, set it to the mid-position between vertical and maximum negative camber, or where there is no provision for a mid-setting, set it to the nearest mid-position with greater angle of camber. If there is no predetermined range of camber, set the wheels to $2^\circ \pm 1^\circ$ negative camber. If this is not possible, set them to the nearest greater angle. See Figure 1.

6.3.2.4 Drive-wheel track width

If the width between the drive wheels can be adjusted, set it to the mid-width position. Where there is no provision for a mid-setting, set it to the wheel track width nearest to, but greater than, the mid-position. If this adjustment results in the wheels contacting other parts of the wheelchair, e.g. the armrests, increase the wheel track width just enough to ensure free rotation of the wheels.

6.3.3 Castors

6.3.3.1 Castor stem housing position: horizontal

If the position of the castor stem housings can be adjusted horizontally, set them to the mid-position ± 3 mm or, where there is no provision for a mid-position setting, set them to the nearest position which provides a longer wheelbase than the mid-setting.

6.3.3.2 Castor stem housing position: vertical

If the position of the castor stem housings can be adjusted vertically, set them to the mid-position ± 3 mm or, where there is no provision for a mid-position setting, set them to the nearest position below the mid-position.

6.3.3.3 Castor wheel axle position: vertical

If the position of castor wheels is adjustable for height on their support devices, set them to the mid-position ± 3 mm or where there is no mid-position, set them to the position nearest the mid-position which gives the greater distance between the castor stem housings and the wheels. Do not use alternative vertical settings of the castor wheels if the alternative settings are intended only for castor wheels of other diameters.

6.3.3.4 Castor wheel track width

If the track width between the castors can be adjusted set it to the middle of the width range with the castors in forward trailing position. Where there is no provision for a mid-range setting, set it to the nearest greater track width.

6.3.3.5 Castor stem angle, fore-aft plane

If the castor stem angle is adjustable in the fore-aft plane, set it to vertical with a tolerance of $+1^{\circ}_0$ or, if this is not possible, set it to the position nearest to vertical in the positive direction (see Figure 2).

6.3.3.6 Castor stem angle, lateral plane

If the castor stem angle is adjustable in the lateral plane, set it to vertical with a tolerance of $+1^{\circ}_0$ or, if this is not possible, set it to the position nearest to vertical in the positive direction (see Figure 3).

6.3.4 Seat and backrest

6.3.4.1 RLG position

Position the RLG on the wheelchair according to ISO 7176-7.

6.3.4.2 Seat depth

If the effective seat depth as defined in ISO 7176-7 (dimension 2) is adjustable, set the seat depth to the mid-position. If there is no mid-position, set it to the position that gives the nearest greater seat depth.

6.3.4.3 Backrest height

If the backrest height as defined in ISO 7176-7 (dimension 7) is adjustable, set it to the mid-height position, or if there is no mid-height position set it to the position that gives the nearest higher backrest height.

6.3.4.4 Seat height

If the seat is adjustable in height relative to the frame, set the seat at the highest height for normal driving according to the manufacturer.

6.3.5 Seat plane angle

6.3.5.1 If the seat plane angle is adjustable relative to the frame of the wheelchair, set it to $+8^{\circ}$ with a tolerance of $+3^{\circ}_0$ as measured in ISO 7176-7 (dimension 1). If this angle is not possible to achieve, set it to the nearest greater angle. If this angle is also impossible to achieve, set it to the angle nearest to $+8^{\circ}$. This adjustment overrides 6.3.2.

6.3.5.2 If the seat is fixed relative to the frame of the wheelchair, or if a seat plane angle of $+8^{\circ}$ with a tolerance of $+3^{\circ}_0$ is not achieved when the seat has been adjusted in accordance with 6.3.5.1, set the drive wheels so that the seat plane angle is $+8^{\circ}$ with a tolerance of $+3^{\circ}_0$ as measured in ISO 7176-7. If this angle is not possible to achieve, set it to the nearest greater angle. If this angle also is impossible to achieve, set it to the angle nearest to $+8^{\circ}$. This adjustment overrides 6.3.2.

6.3.5.3 If a seat plane angle of $+8^{\circ}$ with a tolerance of $+3^{\circ}_0$ is not achieved when the seat has been adjusted in accordance with 6.3.5.1 and/or 6.3.5.2, adjust the castor wheels so that the seat plane angle is $+8^{\circ}$ with a tolerance of $+3^{\circ}_0$ as measured in ISO 7176-7. If this angle is not possible to achieve, set it to the nearest greater

angle, or, if this angle also is impossible to achieve, set it to the angle nearest to $+8^\circ$. This adjustment overrides 6.3.3.2 and 6.3.3.3, but do not use vertical settings of the castor wheels if these settings are intended only for castor wheels of other diameters.

6.3.6 Backrest angle

If the backrest angle is adjustable set it to $+10^\circ$ with a tolerance of $+3^\circ_0^\circ$ as measured in ISO 7176-7 (dimension 6). If this angle is not possible to achieve, set it to the nearest greater angle, or, if this angle also is impossible to achieve, set it to the angle nearest to $+10^\circ$.

6.3.7 Leg-to-seat-surface angle

If the leg-to-seat-surface angle is adjustable, set it as close as possible to, but not less than, 90° as measured in ISO 7176-7 (dimension 15).

6.3.8 Footrests

6.3.8.1 Footrest angle

If the footrest-to-leg angle is adjustable, set it as close as possible to, but not less than, 90° as measured in ISO 7176-7 (dimension 14).

6.3.8.2 Footrest clearance

If the footrest clearance is adjustable, set it as close as possible to, but not less than, 50 mm above the test plane as measured in ISO 7176-7 (dimension 12). If the foot support prevents any swivelling of the castors, readjust the leg-to-seat surface angle (6.3.7) the minimum amount to ensure free swivelling.

6.3.9 Control device

6.3.9.1 Mounting

For electrically powered wheelchairs with a control device that can be placed in different positions in space, set it to the mid-position. Where there is no provision for a mid-setting, use the position that gives the mid-setting furthest away from the armrest.

6.3.9.2 Electrical settings

Set the control device to the manufacturers' recommended setting. If there is no recommended setting, set to the maximum speed.

6.3.9.3 Other electrical control devices

Set any other electrical control devices which do not require the use of any tools and do not change previous adjustments in 6.3.4 to 6.3.8 to the manufacturers' recommended position. If there is no recommended position for any such controls, set them to the mid-position.

6.3.10 Other components

Set all other mechanically adjustable components of the wheelchair to their mid-position. If there is no mid-position, set them to the position that gives the nearest longest, highest and widest measurements.

NOTE Typical adjustable components are headrests and armrests.

7 Final adjustments

After completing the requirements in clause 6, make the following final adjustments with priority given to those last in the list, but not in conflict with the manufacturers' instructions.

- Adjust the backrest angle, if necessary, without changing the drive-wheel position and the seat angle, as close as possible to $+10^\circ$. If this angle is not possible to achieve, set it to the nearest greater angle or, if this angle also is impossible, to the angle nearest to $+10^\circ$.
- If the seat angle is adjustable, without changing the castor or drive wheel position, adjust the seat angle as close as possible to $+8^\circ$. If this angle is not possible to achieve, set it to the nearest greater angle or, if this angle also is impossible, to the angle nearest to $+8^\circ$.
- Adjust the castor stem angle, if necessary, to vertical with a tolerance of $+1^\circ_0$ in the fore-aft plane or, if this is not possible, to the position nearest to vertical in the positive direction. No lateral deviation of the castor stems is allowed.
- If the parking brakes are adjustable, adjust the parking brakes as specified by the manufacturer. If the parking brakes are adjustable and there are no manufacturers' instructions for adjusting the brakes, adjust the brakes in accordance with the measurement taken in 6.1.3.

8 Final check

After the procedures of clauses 5, 6 and 7 have been completed, ensure that all fasteners disturbed during adjustment are tightened in accordance with the manufacturers' recommendations. If there are no manufacturers' recommendations, guidance is given in annex B.

9 Set-up procedures for test dummies

If the test procedure requires the use of a test dummy, as specified in ISO 7176-11, use the following procedure for selecting and positioning the dummy.

- Calculate the angle between the backrest 7 a) and the seat plane 7 b).
- Select a test dummy (ISO 7176-11) of mass equal to or, if there is no dummy of equal mass, the next size greater than the maximum user mass recommended by the manufacturer as shown in Table 1.

Table 1

Maximum user mass kg	Test dummy mass kg
Up to 25	25
> 25 to 50	50
> 50 to 75	75
> 75	100

- c) Place the selected test dummy in the wheelchair as follows.
- 1) Position the dummy symmetrically with a tolerance of ± 10 mm about the wheelchair seat centreline.
 - 2) Ensure that the hinge between the body and seat portions of the dummy is free.
 - 3) Adjust the fore-aft position of the dummy to give a seat-to-back angle within $\pm 3^\circ$ of that determined in 9 a).
 - 4) Check that the seat plane angle, measured on the selected ISO 7176-11 dummy, corresponds with the angle stated in 7 b). If not, readjust the wheelchair, where applicable, in accordance with clauses 6 to 8.

NOTE If the dummy has to be removed from the wheelchair during the test procedure and then be replaced, a reference mark on the wheelchair frame, perpendicular to the dummy hinge point, can be used to aid rapid replacement.

10 Records

Record the dimensions of the settings in a table of the form given in annex A.

Annex A (normative)

Record of measurements and settings from set-up procedures in accordance with ISO 7176-22

Wheelchair identification (type, serial number, etc.):

Manufacturer:

Address:

Adjustable parameter	Type of equipment (size, article number, etc.)	Value/Position/Measure
Air pressure in pneumatic tyres, drive wheels (6.1.1)		
Air pressure in pneumatic tyres, castors (6.1.1)		
Distance between the brake blocks and their contact surfaces (6.1.3)		
Drive-wheel axle position, horizontal (6.3.2.1)		
Drive-wheel axle position, vertical (6.3.2.2)		
Drive-wheel camber (6.3.2.3)		
Drive-wheel track width (6.3.2.4)		
Castor stem housing position, horizontal (6.3.3.1)		
Castor stem housing position, vertical (6.3.3.2)		
Castor wheel axle position, vertical (6.3.3.3)		
Castor wheel track width (6.3.3.4)		
Castor stem angle, fore-aft plane (6.3.3.5)		
Castor stem angle, lateral plane (6.3.3.6)		
Seat depth (6.3.4.2)		
Backrest height (6.3.4.3)		
Seat height (6.3.4.4)		
Seat plane angle (6.3.5)		
Backrest angle (6.3.6)		
Leg-to-seat-surface angle (6.3.7)		
Footrest angle (6.3.8.1)		
Footrest clearance (6.3.8.2)		