INTERNATIONAL STANDARD

ISO 22881

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Castors and wheels — Requirements for use on manually propelled equipment for institutional applications

Roues et roulettes — Exigences pour l'utilisation en déplacement manuel pour équipements de collectivité

Reference number
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Foreword

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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 22881 was prepared by Technical Committee ISO/TC 110, *Industrial trucks*, Subcommittee SC 3, *Castors and wheels*.

Castors and wheels — Requirements for use on manually propelled equipment for institutional applications

1 Scope

This International Standard specifies the technical requirements, the appropriate dimensions and the requirements for testing of castors and wheels that may include braking and/or locking devices, specifically for manually propelled use in an institutional environment. This includes, for example, shops, restaurants, hotels, educational buildings and hospitals.

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 22877, *Castors and wheels — Vocabulary, symbols and multilingual terminology*

ISO 22878:2004, *Castors and wheels — Test methods and apparatus*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22877 apply. Symbols are given in ISO 22878:2004, Annex A.

4 Dimensions and classification

4.1 Characteristics

The characteristics of a castor are

— fixing system,

— offset,

— wheel, and

— load capacity.

4.2 Fixing system

4.2.1 General

The fixing system includes the top plate, solid stem and single bolt hole.

4.2.2 Top plates

4.2.2.1 General

Top plates are identified by classification and include rectangular and square plates with four fixing holes.

The design of the outer profile of the top plates is left to the manufacturer, provided that it is inscribed in a rectangle, as defined in Tables 1 and 2, by sizes l and b of Figure 1 and d and d' of Figure 2 which are the maximum acceptable sizes.

The holes may be oblong and form slots, provided the width of the slots is suitable for bolts of diameter (D_{G1}) as in Tables 1 and 2.

4.2.2.2 Types of top plates

4.2.2.2.1 Rectangular top plates

Dimensions and classification of rectangular top plates are detailed in Table 1 and illustrated in Figure 1.

4.2.2.2.2 Square top plates

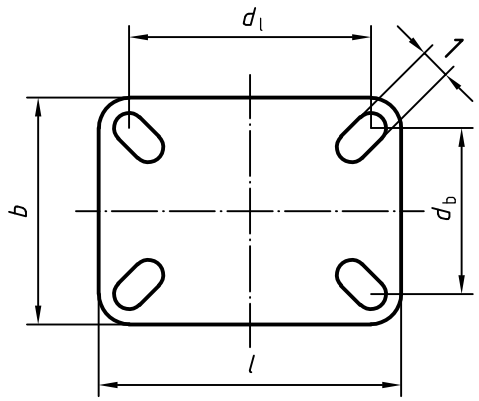
Dimensions and classification of square top plates are detailed in Table 2 and illustrated in Figure 2.

4.2.3 Solid stem

Solid stem fittings are required to suit various tube sizes which have not been defined. The length of the solid stem shall be equal or greater than 1,5 times its diameter. In those cases where the solid stem is supplied with a cross hole for fixing to a tubular structure, the axis of such hole shall be at $(19 \pm 0{,}25)$ mm from the collar of the stem and threaded M8 as illustrated in Figure 3.

4.2.4 Single bolt fixing

Table 3 specifies the single bolt fixing diameters (D_{G2}) corresponding to the wheel diameter (D).



Key

1 adapted to D_{G1}

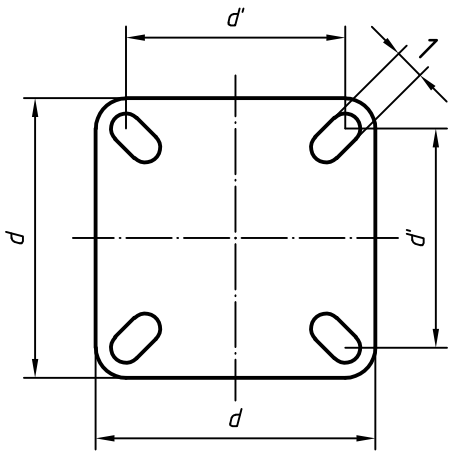
NOTE The symbols $A \times B$ (top plate outer dimensions) and $a \times b$ (bolt hole spacing) may be used in place of the recommended symbols stated above as these are of common use within the trade.

Figure 1 — Rectangular top plate

Table 1

Dimensions in millimetres

Class	Maximum top-plate dimensions $l \times b$	Bolt hole spacing $d_l \times d_b$	Fixing bolt diameter D_{G1}	Corresponding wheel diameter D
R21	75 × 60	55 × 40	6	50 63 75/80 100
R22	90 × 70	60 × 50	8	75/80 100 125 150/160 200
R23	115 × 85	80 × 60	8	100 125 150/160 200



Key

1 adapted to D_{G1}

NOTE The symbols $A \times A$ (top plate outer dimensions) and $a \times a$ (bolt hole spacing) may be used in place of the recommended symbols stated above as these are of common use within the trade.

Figure 2 — Square top plate

Table 2

Dimensions in millimetres

Class	Maximum top-plate dimensions $d \times d$	Bolt hole spacing $d' \times d'$	Fixing bolt diameter D_{G1}	Corresponding wheel diameter D
S21	50 × 50	35 × 35	6	50 63 75/80
S22	65 × 65	45 × 45	6	50 63 75/80 100 125
S23	80 × 80	60 × 60	8	63 75/80 100 125 150/160 200
S24	100 × 100	80 × 80	8	75/80 100 125 150/160 200

Dimensions in millimetres

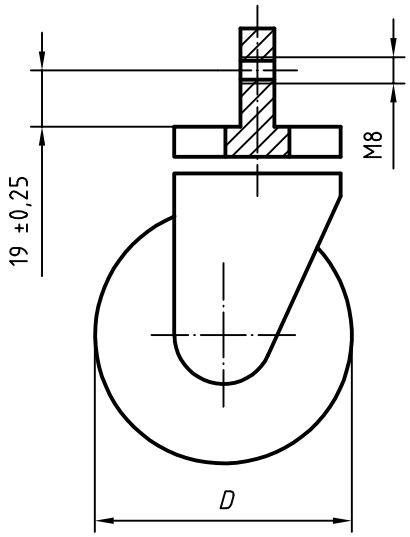


Figure 3 — Solid stem castor with threaded fixing hole

Table 3

Dimensions in millimetres

Wheel diameter D	**Single bolt fixing diameter** D_{G2}
50	8
	10
63	8
	10
75/80	8
	10
	12
100	8
	10
	12
125	8
	10
	12
	16
150/160	12
	16
200	12
	16

4.3 Offset

Table 4 specifies the minimum and maximum offset values (d_F) for the swivel castors, corresponding to the wheel diameter (D), as in Figure 4.

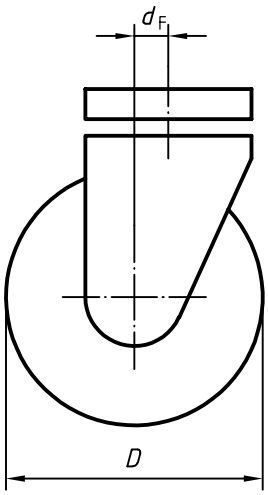


Figure 4 — Offset

Table 4

Dimensions in millimetres

Wheel diameter D	**Offset** d_F	
	Maximum	Minimum
50	30	20 % of the wheel diameter
63	40	
75	50	
80	50	
100	60	
125	70	
150	80	
160	85	
200	100	

4.4 Wheels

4.4.1 Characteristics

The characteristics of a wheel are

— diameter,

— hub width,

— bore diameter, and

— load capacity.

The characteristics of the wheel are illustrated in Figure 5, and the hub width (b_{T1}) and bore diameter (D_d) corresponding to each wheel diameter (D) are listed in Table 5. Wheels are not restricted to these hub widths and bores when used in castors.

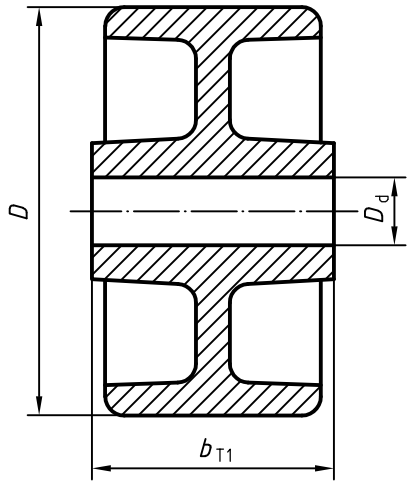


Figure 5 — Wheel dimensions

Table 5

Dimensions in millimetres

Wheel diameter D	**Hub width**[a] b_{T1}	**Bore diameter** D_d
50	**20**/25	6 8
63	**20**/25	6 8
	25	8 10
75/80	**30**/35	8 10 12
	40/45	10 12
100	**30**/35	8 10 12
	40/45	10 12
125	**30**/35	8 10 12
	40/45	10 12
150/160	**40**/45	12
200	**40**/45	12

[a] Preferred dimensions are 20 mm, 30 mm and 40 mm.

4.4.2 Wheel diameter tolerance

The tolerance on the wheel diameter (D) is $\pm$ 1 % with a minimum value of $\pm$ 1 mm.

4.4.3 Hub width tolerance

The tolerance on hub width (b_{T1}) is $^{0}_{-2}$ % with a minimum of 1 mm.

4.5 Load capacity

This is the maximum load, in newtons, which can be carried by a wheel or a castor so as to fully comply with the required acceptance criteria.

5 Requirements for testing

5.1 General

Test methods and apparatus shall be as specified in ISO 22878.

5.2 Standard conditions

5.2.1 Environmental conditions

Tests shall be carried out at a temperature between 15 °C and 28 °C. During the 24 h prior to the test, the samples shall remain at the specified temperature, in an environment with a relative humidity between 40 % and 70 %.

Samples shall not be artificially cooled during testing.

5.2.2 Test sequence

Tests, where relevant, shall be carried out in the sequence shown in Table 6.

5.3 Initial wheel play

5.3.1 Test objectives, apparatus and procedures

These shall be as specified in ISO 22878:2004, 4.2.

Table 6

Reference in this International Standard	Test sequence	Castors and wheel types	Test procedures given in ISO 22878:2004, subclause
5.3	Initial wheel play	All	**4.2**
5.4	Initial swivel play	Swivel castors with or without accessories	**4.3**
5.5	Electrical resistance	Castors and wheels antistatic or electrically conductive	**4.4**
5.6	Fatigue test for braking and/or locking devices	Castors with — wheel locking/braking device — directional locking device — total locking/braking device — central locking/braking device	**4.5**
5.7	Efficiency check of wheel braking and/or locking devices	Castors with — wheel locking/braking device — total locking/braking device — central locking/braking device	**4.6**
5.8	Efficiency check of swivel braking and/or locking devices	Castors with — directional locking/braking device — total locking/braking device — central locking/braking device	**4.7**
5.9	Static test	All	**4.9**
5.10	Dynamic test	All	**4.8**
5.11	Efficiency check of wheel braking and/or locking devices	Castors with — wheel locking/braking device — total locking/braking device — central locking/braking device	**4.6**
5.12	Efficiency check of swivel braking and/or locking devices	Castors with — directional locking/braking device — total locking/braking device — central locking/braking device	**4.7**
5.13	Final wheel play	All	**4.2**
5.14	Final swivel play	Swivel castors with or without accessories	**4.3**

5.3.2 Acceptance criteria

The measured initial wheel play shall not exceed the value (d_{W1}) shown in Table 7.

Table 7

Dimensions in millimetres

Wheel diameter D	Maximum initial wheel play d_{W1}
50	0,70
63	0,70
75/80	0,80
100	1,00
125	1,25
150/160	1,60
200	2,00

5.4 Initial swivel play

5.4.1 Test objectives, apparatus and procedures

These shall be as specified in ISO 22878:2004, 4.3.

5.4.2 Acceptance criteria

The measured initial swivel play shall not exceed the value (d_{S1}) given Table 8.

Table 8

Symbol	Value	Description
d_{S1}	4 mm	maximum initial swivel play

5.5 Electrical resistance test

5.5.1 Test objectives, apparatus and procedures

These shall be as specified in ISO 22878:2004, 4.4.

5.5.2 Test values

The test values shall be as listed in Table 9.

Table 9

Symbol	Value	Description
F_{max}	variable	load capacity
F_{17}	10 % of F_{max}	test load
R	variable	electrical resistance

5.5.3 Tolerances

The tolerance shall be as shown in Table 10.

Table 10

Symbol	Unit	Tolerance	
		Acceptable	Unit
F_{17}	N	$^{+2\ \%}_{0}$	N

5.5.4 Acceptance criteria

The resistance R of the sample tested shall be

— $R \leqslant 10^5\ \Omega$ for conductive castors or wheels, and

— $10^5\ \Omega < R \leqslant 10^7\ \Omega$ for antistatic castors or wheels.

5.6 Fatigue test for braking and/or locking devices

5.6.1 Test objectives, apparatus and procedures

These shall be as specified in ISO 22878:2004, 4.5.

5.6.2 Test values

The test values shall be as listed in Table 11.

Table 11

Symbol	Value	Description
n_E	5 000	number of locking actions
f_E	10 cycles/min	frequency of locking actions
F_{max}	variable	load capacity
F_3	equal to F_{max}	test load

5.6.3 Tolerances

The tolerances shall be as shown in Table 12.

Table 12

Symbol	Unit	Tolerance	
		Acceptable	Unit
n_E	—	$^{+1\ \%}_{0}$	—
f_E	cycles/min	$^{0}_{-2}$	cycles/min
F_3	N	$^{+2\ \%}_{0}$	N

5.6.4 Acceptance criteria

The sample shall not show any wear and/or permanent deformation that adversely affects its performance.

5.7 Efficiency check of wheel braking and/or locking devices

5.7.1 Test objectives, apparatus and procedures

These shall be as specified in ISO 22878:2004, 4.6.

5.7.2 Test values

The test values shall be as listed in Table 13.

Table 13

Symbol	Value	Description
F_{max}	variable	load capacity
F_{11}	equal to F_{max}	test load
F_{K1}	20 % of F_{max}	horizontal tractive force

5.7.3 Tolerances

The tolerances shall be as shown in Table 14.

Table 14

Symbol	Unit	Tolerance	
		Acceptable	Unit
F_{11}	N	$^{+2\ \%}_{0}$	N
F_{K1}	N	$^{+4\ \%}_{0}$	N

5.7.4 Acceptance criteria

The wheel shall have no revolving movement around its axis during the second application of the force F_{K1}.

5.8 Efficiency check of swivel braking and/or locking devices

5.8.1 Test objectives, apparatus and procedures

These shall be as specified in ISO 22878:2004, 4.7.

5.8.2 Test values

The test values shall be as listed in Table 15.

Table 15

Symbol	Value	Description
F_{max}	variable	load capacity
F_{11}	equal to F_{max}	test load
F_{K2}	20 % of F_{max}	horizontal tractive force

5.8.3 Tolerances

The tolerances shall be as shown in Table 16.

Table 16

Symbol	Unit	Tolerance	
		Acceptable	Unit
F_{11}	N	$^{+2\ \%}_{0}$	N
F_{K2}	N	$^{+4\ \%}_{0}$	N

5.8.4 Acceptance criteria

No swivelling movement shall be detected during the second application of the force F_{K2}.

5.9 Static test

5.9.1 Test objectives, apparatus and procedures

These shall be as specified in ISO 22878:2004, 4.9.

5.9.2 Test values

The test values shall be as listed in Table 17.

Table 17

Symbol	Value	Description
F_{max}	variable	load capacity
y_1	1,5	load factor
F_6	$F_{max} \times y_1$	test load
t_{y1}	1 h	time of application of the load
t_{y2}	24 h	elapsed time prior to inspection

5.9.3 Tolerances

The tolerances shall be as shown in Table 18.

Table 18

Symbol	Unit	Tolerance	
		Acceptable	Unit
F_6	N	$^{+2\ \%}_{0}$	N
t_{y1}	h	$^{+15}_{0}$	min
t_{y2}	h	$\pm$ 1	h

5.9.4 Acceptance criteria

There shall be no permanent deformation of the sample that adversely affects its performance.

5.10 Dynamic test

5.10.1 Test objectives, apparatus and procedures

These shall be as specified in ISO 22878:2004, 4.8.

5.10.2 Test values

The test values shall be as listed in Table 19.

Table 19

Symbol	Value	Description
F_{max}	variable	load capacity
v_1	0,83 m/s (3 km/h)	average speed of running period
v_2	0,83 m/s (3 km/h)	speed at impact with obstacles
h_1	3 % of D	height of obstacles
d_c	1 m to 3 m	distance between obstacles
n	10 times D, in mm	number of obstacles to be passed by the wheel
n_{r1}	not required in this test	number of wheel revolutions
t_{z1}	3 min	running period
t_{z2}	3 min	pause
D	variable	wheel diameter

The actual wheel diameter shall be measured prior to commencement and on completion of the test to establish wear.

5.10.3 Tolerances

The tolerances shall be as shown in Table 20.

Table 20

Symbol	Unit	Tolerance	
		Acceptable	Unit
v_1	m/s	$^{+5\ \%}_{0}$	m/s
v_2	m/s	$^{+5\ \%}_{0}$	m/s
h_1	mm	$^{0}_{-5\ \%}$	mm
n	—	$^{+1\ \%}_{0}$	—
n_{r1}	—	$^{+1\ \%}_{0}$	—
t_{z1}	min	$\pm$ 10	s

5.10.4 Acceptance criteria

There shall be no permanent deformation of the sample which adversely affects its performance. The reduction of the wheel diameter shall not exceed 2 % of the measured diameter.

5.11 Efficiency check of wheel braking and/or locking devices

Repeat test 5.7.

5.12 Efficiency check of swivel braking and/or locking devices

Repeat test 5.8.

5.13 Final wheel play

5.13.1 Test objectives, apparatus and procedures

These shall be as specified in ISO 22878:2004, 4.2.

5.13.2 Acceptance criteria

The wheel wear play shall not exceed the value d_{W2} detailed in Table 21.

Table 21

Dimensions in millimetres

Wheel diameter D	Maximum wheel wear play d_{W2}
50	0,40
63	0,50
75/80	0,64
100	0,80
125	1,00
150/160	1,28
200	1,60

5.14 Final swivel play

5.14.1 Test objectives, apparatus and procedures

These shall be as specified in ISO 22878:2004, 4.3.

5.14.2 Acceptance criteria

The swivel wear play calculated from the difference between the measured initial and final swivel play shall not exceed the value d_{S2}.

Table 22

Symbol	Value	Description
d_{S2}	4 mm	maximum swivel wear play

6 Conformity

On request, the manufacturer shall declare by a certificate of conformity that the castors or wheels are in accordance with the requirements as stated in this International Standard.

The type of testing machine shall be stated in the conformity document.

7 Marking of the product

7.1 Product marking

All the products shall be permanently and visibly marked with a name and/or trademark of the manufacturer.

7.2 Marking of electrically conductive or antistatic castors or wheels

All products shall bear, on their outer surface, a clearly visible mark as follows:

— antistatic: a white mark and, where appropriate and possible, the word “antistatic”;

— conductive: a yellow mark and, where appropriate and possible, the word “conductive”.

Bibliography

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[2] ISO 22880, *Castors and wheels — Requirements for castors for swivel chairs*

[3] ISO 22882, *Castors and wheels — Requirements for castors for hospital beds*

[4] ISO 22883, *Castors and wheels — Requirements for applications up to 1,1 m/s (4 km/h)*

[5] ISO 22884, *Castors and wheels — Requirements for applications over 1,1 m/s (4 km/h) and up to 4,4 m/s (16 km/h)*

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