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## **Narrow and wide base off-road tyres and rims —**

### **Part 2: Loads and inflation pressures**

*Pneumatiques et jantes à base étroite et à base large pour engins de génie civil —*

*Partie 2: Charges et pressions de gonflage*

## 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 4250-2 was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves*.

This first edition and the first editions of ISO 4250-1 and ISO 4250-3 cancel and replace ISO/TR 4250 : 1980, the three parts together constituting a technical revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

# Narrow and wide base off-road tyres and rims —

## Part 2: Loads and inflation pressures

### 0 Introduction

ISO 4250 provides technical details on the designation and dimensions of off-road tyres and rims, as well as load ratings for these types of tyres.

This International Standard consists of three parts:

Part 1: Tyre designations and dimensions.

Part 2: Loads and inflation pressures.

Part 3: Rims.

### 1 Scope

This part of ISO 4250 gives working definitions of masses and load cycles, and sets out tyre loads and reference inflation pressures for narrow and wide base off-road tyres.

### 2 Field of application

This part of ISO 4250 applies to tyres primarily intended for off-road machines.

### 3 Definitions

#### 3.1 Definitions of masses

**3.1.1 maximum load:** Maximum loads of individual tyres determined by manufacturer's rated gross machine mass (GMM) distribution assigned to each axle, divided by the number of tyres for that axle.

NOTE — The maximum GMM includes masses calculated in 3.1.1.1 to 3.1.1.6 inclusive.

**3.1.1.1 operating mass (net weight):** Actual mass of the base machine with equipment specified by the manufacturer, operator (75 kg), full fuel tank, and full lubricating, hydraulic and cooling systems.

**3.1.1.2 optional equipment mass:** Difference in operating mass between the optional item and standard item replaced (such as engine, brakes, tyres, etc.). This includes the

operating mass of additional items offered by the manufacturer which are not replacements for standard items (such as cabs, body-liners, side-boards, air conditioners, etc.).

**3.1.1.3 mass of special modifications:** Difference in the operating mass of the machine due to modifications not previously covered in optional equipment mass (such as additional reinforcements, etc.).

**3.1.1.4 payload:** Total mass of the material being carried.

**3.1.1.5 tyre ballast:** (If used, shall also be included in determination of GMM.)

**3.1.1.6 field modifications:** Operating mass change due to machine alterations made other than by the original manufacturer (such as modifications for additional capacity, reinforcements, etc.).

#### 3.2 Definitions of operating conditions

**3.2.1 maximum speed:** Peak velocity attained by the machine.

**3.2.2 earth-moving haulage cycle:** Cycle where machine self-loads or receives a load from loading equipment, transports it elsewhere and returns unloaded. Transportation usually occurs over unimproved surfaces at medium speeds, up to 65 km/h, and short distances, up to 4 km away.

NOTE — Machines in this category are mainly haulage trucks (dumpers) and tractor-scrappers.

**3.2.3 loader cycle:** Cycle where the machine is used to pick up material and move it a short distance away. Tyre loads fluctuate depending on the conditions involved when the equipment picks up the load. Transportation speeds are low, up to 10 km/h, and distances are short, usually less than 75 m away.

**3.2.4 load carry cycle:** Cycle where the machine, primarily intended for loader service, picks up a load, transports it elsewhere and returns unloaded. Transportation usually occurs over unimproved surfaces at low speeds, up to 25 km/h, and rather short distances, up to 600 m.

NOTE — Machines in this category consist mainly of loaders, log stackers and material handling equipment. Tyre manufacturers should be consulted for specific conditions.

**3.2.5 dozer (tractor) cycle:** Condition where a machine is used to move materials (usually earth) by pushing, dragging or grading. Tyre loads are relatively constant and speeds are low, up to 10 km/h. Travel distances vary depending on work situations.

**3.2.6 grader cycle:** Condition where a machine is used in construction and road maintenance. Tyre loads are relatively constant during the work cycles. Grader speeds are slower during working periods with typical transportation speeds reaching about 40 km/h. Travel distances vary depending on work situations.

**3.2.7 creep:** Movement of equipment at a very low speed (commonly not over 120 m in 60 min). During creep motion, loads on the tyres are usually very high and consideration must be given to the type of surface over which the equipment is travelling. Tyre manufacturers should be consulted for specific conditions.

**3.2.8 drive-away:** Movement of a machine from one location to another under non-working conditions. This movement occurs during transportation of a machine from site to site. Tyre manufacturers should be consulted for specific conditions.

NOTE — Load/speed/distance tables in this part of ISO 4250 are not applicable to drive-away conditions.

## 4 Special conditions

For longer hauls and/or speeds in excess of those indicated in the tables, the tyre manufacturers should be consulted for instructions regarding permissible loads and the required inflation pressures.

## 5 Selection for new machine design

Selection of size and strength index of the tyre used on each axle shall be based on the highest individual wheel load (determined by GMM distribution, including load transfer) and the machine application.

Maximum load per tyre shall not be greater than specified in the applicable tables.

The performance of machines fitted with off-road tyres depends on the operating conditions, and more particularly on the specific ground pressure which is governed by the inflation pressure. It is therefore advisable to select tyre size on the basis of low inflation pressure.

## 6 Inflation pressures — General

**6.1** Rim and wheel manufacturers should be consulted to determine if the rim and wheel are of sufficient strength for the intended service conditions (inflation pressure and load).

**6.2** Inflation pressures shown in the load inflation tables are reference pressures and do not include any pressure build-up due to vehicle operation.

**6.3** In agreement with tyre manufacturers, inflation pressures may be varied to compensate for extremes of atmospheric temperatures or special operating conditions.

**6.4** For all tables the inflation pressures are given for guidance only; in actual practice they may vary according to the operating conditions, in agreement with the tyre manufacturers.

## 7 Load/inflation tables

Load/inflation relations for diagonal ply rating tyres are given in tables 1 to 4: those for symbol-marked radial tyres are given in tables 5 and 6.

## 8 Bibliography

ISO 3877-1, *Tyres, valves and tubes — List of equivalent terms — Part 1: Tyres.*

**Table 1 – Diagonal ply rating marked narrow base tyres for earth-moving slow speed service, reference speed 10 km/h (loaded conditions)**

Tyre size designation	Ply rating	Load <sup>1)</sup> kg	Inflation kPa	Tyre size designation	Ply rating	Load <sup>1)</sup> kg	Inflation kPa
12.00 – 20/21	14	5 000	600	21.00 – 35	28	19 500	575
	16	5 450	700		32	21 200	650
12.00 – 24/25	8	4 000	325		36	23 000	750
	14	5 600	575		40	24 300	825
	16	6 150	675	44	25 000	900	
	18	6 500	750	21.00 – 49	28	23 600	575
20	6 900	825	32		25 000	650	
13.00 – 24/25	8	4 375	300		36	27 250	750
	12	5 600	450		40	29 000	825
	18	7 100	675	44	30 750	900	
	20	7 500	750	24.00 – 25	24	18 000	425
22	8 000	825	30		20 000	525	
14.00 – 24/25	8	4 875	275	24.00 – 29	24	19 000	425
	10	5 600	350		30	21 800	525
	12	6 300	425	24.00 – 35	36	26 500	650
	16	7 300	550		42	29 000	750
	20	8 500	700		48	31 500	850
	24	9 500	850		54	34 500	975
16.00 – 24/25	28	10 000	925	24.00 – 43	36	30 000	650
	12	7 100	325		42	32 500	750
	16	8 250	425		48	34 500	850
	20	9 750	550	24.00 – 49	36	32 500	650
	24	10 600	650		42	34 500	750
	28	11 500	750		48	37 500	850
18.00 – 24/25	32	12 500	875	27.00 – 33	24	22 400	350
	36	13 600	975		30	25 750	450
	40	14 700	1 075		36	29 000	550
	12	8 250	275	27.00 – 49	36	36 500	575
	16	10 000	375		42	40 000	675
	20	11 500	475		48	43 750	775
	24	12 500	550	30.00 – 51	40	45 000	575
	28	13 600	650		46	48 750	650
32	15 000	750	52		53 000	750	
36	16 000	850	33.00 – 51	42	51 500	550	
40	17 000	950		50	56 000	650	
12	8 250	275		58	61 500	750	
18.00 – 33	16	10 000	375	36.00 – 51	42	58 000	500
	20	11 500	475		50	65 000	600
	24	12 500	550		58	71 000	675
18.00 – 49	28	13 600	650	40.00 – 57	52	80 000	550
	32	15 000	750		60	87 500	650
	36	16 000	850		68	92 500	725
21.00 – 24/25	40	17 000	950				
	28	16 000	850				
	32	17 500	950				
	36	18 500	1 050				

1) For stationary service conditions, the loads in this table may be increased up to 60 % with no increase in inflation pressure.

For special equipment with a high centre of gravity, consult the tyre manufacturer.

Table 2 — Diagonal ply rating marked narrow base tyres for earth-moving service for relatively short hauls, reference speed 50 km/h

Tyre size designation	Ply rating	Load <sup>1)</sup> kg	Inflation kPa	Tyre size designation	Ply rating	Load <sup>1)</sup> kg	Inflation kPa	
12.00 — 20/21	14	2 800	425	21.00 — 35	28	11 200	425	
	16	3 000	475		32	12 150	500	
12.00 — 24/25	8	2 180	225		36	12 850	550	
	14	3 000	375		40	14 000	625	
	16	3 250	450		44	14 500	675	
	18	3 550	500	21.00 — 49	28	13 600	425	
20	3 750	550	32		15 000	500		
13.00 — 24/25	8	2 360	200		36	15 500	550	
	12	3 000	300		40	17 000	625	
	18	3 875	450	44	17 500	675		
	20	4 000	500	24.00 — 25	24	10 300	325	
22	4 250	550	30		11 800	400		
14.00 — 24/25	8	2 575	175	24.00 — 29	24	11 200	325	
	10	3 000	225		30	12 500	400	
	12	3 350	275	24.00 — 35	36	15 500	475	
	16	4 000	375		42	16 500	550	
	20	4 625	475		48	18 500	650	
	24	5 150	575		54	19 500	725	
16.00 — 24/25	28	5 600	650	24.00 — 43	36	17 000	475	
	12	3 875	225		42	19 000	575	
	16	4 875	325		48	20 600	650	
	20	5 450	400	24.00 — 49	36	18 500	475	
	24	6 000	475		42	20 000	550	
	28	6 700	575		48	21 800	650	
18.00 — 24/25	32	7 300	650	27.00 — 33	24	13 200	275	
	36	7 750	725		30	15 500	350	
	40	9 750	700		36	16 500	400	
	18.00 — 33	12	4 750	200	27.00 — 49	36	21 200	425
		16	5 600	275		42	23 000	500
		20	6 500	350		48	25 000	575
		24	7 300	425	30.00 — 33	28	16 000	275
		28	8 000	500		34	18 500	350
32		8 750	575	40		21 200	425	
18.00 — 49	36	9 250	500	30.00 — 51	40	25 750	425	
	32	10 000	575		46	29 000	500	
	36	10 600	625		52	30 000	550	
21.00 — 24/25	24	10 600	425	33.00 — 51	42	30 000	425	
	28	11 800	500		50	33 500	500	
	32	12 850	575		58	35 500	575	
21.00 — 24/25	16	6 900	250	36.00 — 51	42	34 500	375	
	20	7 750	300		50	37 500	450	
	24	8 750	375		58	41 250	525	
	28	9 500	425	40.00 — 57	52	46 250	425	
			60		50 000	475		
			68		54 500	550		

1) Load adjustment for maximum speed 65 km/h : load × 0,85  
 Load adjustment for maximum speed 15 km/h : load × 1,12

Values so calculated to be rounded off to the nearest :

- 25 kg for loads up to 4 999 kg;
- 50 kg for loads from 5 000 and 9 999 kg;
- 100 kg for loads equal to or above 10 000 kg.

**Table 3 — Diagonal ply rating marked wide base tyres for earth-moving slow speed service, reference speed 10 km/h (loaded conditions)**

Tyre size designation	Ply rating	Load <sup>1)</sup> kg	Inflation kPa	Tyre size designation	Ply rating	Load <sup>1)</sup> kg	Inflation kPa
15.5 — 25	8	4 250	250	29.5 — 35	22	17 500	325
	10	4 875	325		28	20 600	425
	12	5 600	400		34	23 000	525
17.5 — 25	8	4 750	225	33.25 — 29	26	20 600	350
	12	6 150	350		32	23 600	450
	16	7 300	475		38	25 750	525
	20	8 250	575	33.25 — 35	26	22 400	350
20.5 — 25	12	6 700	250		32	25 750	450
	16	8 250	350		38	28 000	550
	20	9 500	450	33.5 — 33	26	22 400	350
	24	10 300	525		32	25 750	425
28	11 500	625	38		29 000	525	
23.5 — 25	12	8 000	225	33.5 — 39	26	24 300	350
	16	9 500	300		32	27 250	425
	20	10 900	375		38	30 750	525
	24	12 500	475	37.25 — 35	30	28 000	375
	28	13 600	550		36	30 750	450
26.5 — 25	16	11 500	275		42	33 500	525
	20	13 200	350	37.5 — 33	30	28 000	375
	24	14 000	400		36	31 500	450
	28	15 500	475		42	34 500	525
26.5 — 29	32	17 000	550	37.5 — 39	28	29 000	350
	18	12 850	300		36	33 500	450
	22	14 500	375		44	37 500	550
	26	16 000	450	37.5 — 51	28	33 500	350
30	17 500	525	36		38 750	450	
29.5 — 25	16	12 850	250		44	42 500	525
	22	15 000	325	40.5/75 — 39	30	31 500	325
	28	17 500	425		38	37 500	425
29.5 — 29	16	14 000	250		46	42 500	525
	22	16 000	325				
	28	19 000	425				
	34	21 200	525				
	40	23 600	625				

NOTE — For stationary service conditions, the loads in this table may be increased up to 60 % with no increase in inflation pressure.  
For special equipment with a high centre of gravity, consult the tyre manufacturer.

Table 4 — Diagonal ply rating marked wide base tyres for earth-moving service for relatively short hauls, reference speed 50 km/h

Tyre size designation	Ply rating	Load <sup>1)</sup> kg	Inflation kPa	Tyre size designation	Ply rating	Load <sup>1)</sup> kg	Inflation kPa
15.5 — 25	8	2 575	175	29.5 — 35	22	11 500	250
	10	3 000	225		28	13 600	325
	12	3 250	250		34	15 000	400
17.5 — 25	8	2 800	150	33.25 — 29	26	13 600	275
	12	3 650	225		32	15 000	325
	16	4 250	300		38	17 000	400
	20	5 000	400	33.25 — 35	26	14 500	275
20.5 — 25	12	4 500	200		32	16 000	325
	16	5 450	275		38	18 000	400
	20	6 000	325	33.5 — 33	26	15 000	275
	24	6 700	400		32	16 500	325
28	7 500	475	38		18 500	400	
23.5 — 25	12	5 300	175	33.5 — 39	26	16 000	275
	16	6 150	225		32	18 000	325
	20	7 300	300		38	20 000	400
	24	8 000	350	37.25 — 35	30	17 500	275
	28	8 750	400		36	19 500	325
26.5 — 25	16	7 300	200		42	21 800	400
	20	8 250	250	37.5 — 33	30	18 000	275
	24	9 250	300		36	20 000	325
	28	10 000	350		42	22 400	400
	32	11 200	425	37.5 — 39	28	18 500	250
26.5 — 29	18	8 250	225		36	21 200	325
	22	9 250	275		44	24 300	400
	26	10 300	325		52	26 500	475
	30	11 200	375	37.5 — 51	28	20 600	250
29.5 — 25	16	8 000	175		36	24 300	325
	22	10 000	250		44	27 250	400
	28	11 500	325	40.5/75 — 39	30	20 600	250
	29.5 — 29	16	8 500		175	38	24 300
22		10 600	250		46	27 250	400
28		12 150	325				
34		14 000	400				
40		15 000	475				

1) Load adjustment for maximum speed 65 km/h: load × 0,83  
 Load adjustment for maximum speed 15 km/h: load × 1,12

Values so calculated to be rounded off to the nearest :

- 25 kg for loads up to 4 999 kg;
- 50 kg for loads from 5 000 and 9 999 kg;
- 100 kg for loads equal to or above 10 000 kg.



Table 5 — Symbol-marked narrow base and wide base radial tyres, reference speed 10 km/h (loaded conditions)

## a) Narrow base tyres

Tyre size designation	Symbol	Load kg	Inflation kPa tol. $\pm 15\%$ 1)
12.00 R 24/25	★	5 150	550
	★★	6 900	800
	★★★	7 300	950
13.00 R 24/25	★★	8 000	800
	★★★	8 500	950
14.00 R 24/25	★★	9 500	800
	★★★	10 000	950
16.00 R 24/25	★	9 000	550
	★★	12 150	800
18.00 R 24/25	★	11 800	550
	★★	16 000	800
18.00 R 33	★★	18 500	800
18.00 R 49	★★	23 000	800
21.00 R 24/25	★★	20 600	800
21.00 R 35	★★	24 300	800
21.00 R 49	★★	29 000	800
24.00 R 35	★★	30 750	800
24.00 R 43	★★	34 500	800
24.00 R 49	★★	37 500	800
27.00 R 33	★★	37 500	800
27.00 R 49	★★	45 000	800
30.00 R 51	★★	56 000	800
33.00 R 51	★★	65 000	800
36.00 R 51	★★	80 000	800
40.00 R 57	★★	100 000	800

## b) Wide base tyres

Tyre size designation	Symbol	Load kg	Inflation kPa tol. $\pm 15\%$ 1)
15.5 R 25	★	5 800	475
	★★	7 100	600
17.5 R 25	★	7 100	475
	★★	8 500	600
20.5 R 25	★	9 500	475
	★★	11 500	600
23.5 R 25	★	12 150	475
	★★	14 500	600
26.5 R 25	★	15 000	475
	★★	18 500	600
26.5 R 29	★	16 000	475
	★★	19 500	600
29.5 R 25	★	18 000	475
	★★	22 400	600
29.5 R 29	★	19 500	475
	★★	23 600	600
29.5 R 35	★	21 200	475
	★★	25 750	650
33.25 R 29	★	23 600	475
	★★	29 000	650
33.25 R 35	★	25 750	475
	★★	31 500	650
33.5 R 33	★	25 750	475
	★★	31 500	650
33.5 R 39	★	28 000	475
	★★	34 500	650
37.25 R 35	★	31 500	475
	★★	37 500	650
37.5 R 33	★	31 500	475
	★★	37 500	650
37.5 R 39	★	33 500	475
	★★	41 250	650
37.5 R 51	★	37 500	475
	★★	46 250	650
40.5/75 R 39	★	37 500	475
	★★	46 250	650

1) The tolerance on inflation pressure is in recognition of a wide variety of service conditions encountered.

Table 6 — Symbol-marked narrow base and wide base radial tyres, reference speed 50 km/h

a) Narrow base tyres

b) Wide base tyres

Tyre size designation	Symbol	Load <sup>1)</sup> kg	Inflation kPa tol. ± 15 % <sup>2)</sup>
12.00 R 24/25	★★	4 000	650
	★★★	4 250	700
13.00 R 24/25	★★	4 750	650
	★★★	4 875	700
14.00 R 20/21	★	3 750	450
	★★	5 000	650
14.00 R 24/25	★★	5 600	650
	★★★	5 800	700
16.00 R 20/21	★	5 150	450
	★★	6 900	650
16.00 R 24/25	★	5 450	450
	★★	7 300	650
18.00 R 24/25	★	7 100	450
	★★	9 250	650
18.00 R 33	★★	10 900	650
18.00 R 49	★★	13 600	650
21.00 R 24/25	★★	12 150	650
21.00 R 35	★★	14 500	650
21.00 R 49	★★	17 500	650
24.00 R 35	★★	18 500	650
24.00 R 43	★★	20 600	650
24.00 R 49	★★	21 800	650
27.00 R 33	★★	21 800	650
27.00 R 49	★★	27 250	650
30.00 R 51	★★	33 500	650
30.00 R 51	★★	38 750	650
36.00 R 51	★★	46 250	650
40.00 R 57	★★	60 000	650

Tyre size designation	Symbol	Load <sup>1)</sup> kg	Inflation kPa tol. ± 15 % <sup>2)</sup>
15.5 R 25	★	3 550	350
	★★	4 500	475
17.5 R 25	★	4 125	350
	★★	5 450	475
20.5 R 25	★	5 600	350
	★★	7 300	475
23.5 R 25	★	7 100	350
	★★	9 250	475
26.5 R 25	★	9 000	350
	★★	11 500	475
26.5 R 29	★	9 500	350
	★★	12 500	475
29.5 R 25	★	10 900	350
	★★	14 000	475
29.5 R 29	★	11 500	350
	★★	15 000	475
29.5 R 35	★	12 500	350
	★★	16 000	500
33.25 R 29	★	14 000	350
	★★	18 500	500
33.25 R 35	★	15 500	350
	★★	20 000	500
33.5 R 33	★	15 500	350
	★★	20 000	500
33.5 R 39	★	16 500	350
	★★	21 800	500
37.25 R 35	★	18 500	350
	★★	23 600	500
37.5 R 33	★	18 500	350
	★★	24 300	500
37.5 R 39	★	20 000	350
	★★	25 750	500
37.5 R 51	★	22 400	350
	★★	29 000	500
40.5/75 R 39	★	22 400	350
	★★	29 000	500

1) Load adjustment for maximum speed 65 km/h: load × 0,88  
 Load adjustment for maximum speed 15 km/h: load × 1,12

Values so calculated to be rounded off to the nearest:

- 25 kg for loads up to 4 999 kg;
- 50 kg for loads from 5 000 and 9 999 kg;
- 100 kg for loads equal to or above 10 000 kg.

2) Tolerance on inflation pressure in recognition of a wide variety of service conditions encountered.