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Motorcycle tyres and rims (metric series) —

Part 1: Design guides

*Pneumatiques et jantes pour motocycles (séries millimétriques) —
Partie 1: Guide de conception*



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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.

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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 5751-1 was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves*, Subcommittee SC 10, *Cycle, moped, motorcycle tyres and rims*.

This sixth edition cancels and replaces the fifth edition (ISO 5751-1:2001), which has been technically revised.

ISO 5751 consists of the following parts, under the general title *Motorcycle tyres and rims (metric series)*:

- *Part 1: Design guides*
- *Part 2: Tyre dimensions and load-carrying capacities*
- *Part 3: Range of approved rim contours*

This corrected version of ISO 5751-1:2004 incorporates the following correction:

- the addition of an introductory sentence, table numbering and table titles in Annex A.

Motorcycle tyres and rims (metric series) —

Part 1: Design guides

1 Scope

This part of ISO 5751 gives guidelines for the design of, and specifies the designation and calculation of the dimensions for, metric-series motorcycle tyres. It is applicable to motorcycle tyres with a reduced height/width ratio (100 and lower) that can be fitted on cylindrical bead-seat or 5° tapered bead-seat rims. It is also applicable to other concepts of tyre and rim, provided the appropriate rim/section ratios and coefficients are established for them.

NOTE See ISO 4249 for motorcycle tyres and rims (code-designated series) of rim diameter codes 13 and above, and ISO 6054 for those of codes 12 and below.

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 4223-1:2002, *Definitions of some terms used in the tyre industry — Part 1: Pneumatic tyres*

ISO 4249-3, *Motorcycle tyres and rims (code-designated series) — Part 3: Rims*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4223-1 apply.

4 Tyre designation

4.1 General

The designation of the tyre shall be shown on its sidewall and shall include the following markings, placed close to each other:

- size and construction (see 4.2);
- service description (see 4.3).

4.2 Size and construction

4.2.1 Characteristics

The size and construction characteristics shall be indicated as follows:

Nominal section width	/	Nominal aspect ratio	Tyre construction code	Nominal rim diameter code
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4.2.2 Nominal section width

The nominal section width shall be expressed in millimetres.

4.2.3 Nominal aspect ratio

The nominal aspect ratio shall be expressed as a percentage. It shall be a multiple of 10 for aspect ratios 70 and higher, and a multiple of 5 for aspect ratios lower than 70.

4.2.4 Tyre construction code

The tyre construction code shall be

- “B” for bias belted-type constructions,
- “-” for diagonal ply tyres, and
- “R” for radial ply tyres.

NOTE 1 See also 4.4.3 for codes adopted for tyres suitable for speeds in excess of 240 km/h. Other codes will be established for new concepts (constructions) of tyres.

NOTE 2 The term *bias belted construction* describes a pneumatic tyre structure of diagonal (bias ply) type in which the carcass is restricted by a substantially inextensible circumferential belt.

NOTE 3 With reference to the definition of radial ply tyre given in ISO 4223-1, for the purposes of this part of ISO 5751, “substantially at 90°” means angles between 65° and 90° as measured from the centreline of the tread.

4.2.5 Nominal rim diameter

The nominal rim diameter shall normally be expressed by a code (see Table 1). However, it shall be expressed in millimetres for new and future concepts where the application either of existing tyres on new-concept rims or of new-concept tyres on existing rims would be incompatible.

4.3 Service description

The characteristics shall be indicated as follows:

Load index	Speed symbol
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For load indices and speed symbols and their corresponding loads and speeds, see ISO 4223-1:2002, Tables A.1 and A.2.

Table 1 — Nominal rim diameter codes

Dimensions in millimetres

Nominal rim diameter code	
Code	Nominal rim diameter D_r
8	203
10	254
12	305
13 M/C	330
14 M/C	356
15 M/C	381
16 M/C	406
17 M/C	432
18 M/C	457
19 M/C	483
20 M/C	508
21 M/C	533
23 M/C	584

4.4 Other service characteristics

4.4.1 In the case of tubeless tyres, the marking "TUBELESS" shall be shown on the tyre.

4.4.2 In the case of a preferred direction of rotation of the tyre, an arrow shall be used to indicate that direction.

4.4.3 Tyres designed for vehicles having a maximum speed capacity in excess of 240 km/h shall be identified by means of the following speed categories, and not by the tyre construction code:

- "VB" or "ZB" for bias belted construction;
- "VR" or "ZR" for radial construction.

"ZB" and "ZR" should be used for the equipment of newly designed motorcycles with a maximum speed over 240 km/h.

This identification shall be placed inside the tyre designation (see 4.2.1), instead of in the tyre construction code, as follows.

- a) For speed category "V", "VB" or "VR" tyres suitable for speeds of over 240 km/h, a service description shall be marked with the speed symbol "V" between parentheses, e.g. "120/60 VR 17 (55 V)".
- b) For speed category "ZB" or "ZR" tyres suitable for speeds up to 270 km/h, a service description shall be marked with the speed symbol "W", e.g. "120/60 ZR 17 55 W".
- c) For speed category "ZB" or "ZR" tyres suitable for speeds of over 270 km/h, the service description shall be marked with the speed symbol "W" between parentheses, e.g. "120/60 ZR 17 (55 W)".

The maximum speed approved by the tyre manufacturer may also be marked on the tyre, e.g. "V250" to identify a maximum speed of 250 km/h.

4.4.4 The symbol “MST” may be used to identify special service tyres.

4.4.5 The symbol “DP” may be used to identify tread type C tyres.

4.5 Designation examples

4.5.1 A motorcycle tyre having

a) a size and construction of

- nominal section width, 120 mm,
- nominal aspect ratio, 80,
- diagonal construction, and
- nominal rim diameter code 18, with

b) a service description consisting of

- a load-carrying capacity of 290 kg, corresponding to load index “65”, and
- a maximum speed of 180 km/h, corresponding to speed symbol “S”

shall be marked:

120/80 – 18 M/C

65 S

4.5.2 A motorcycle tyre having

a) a size and construction of

- nominal section width, 140 mm,
- nominal aspect ratio, 70,
- radial construction, and
- nominal rim diameter code 17, with

b) a service description consisting of

- a reference speed in excess of 240 km/h
- a reference load-carrying capacity of 300 kg, corresponding to load index “66”, and
- a maximum speed of 270 km/h, corresponding to speed symbol “W”,

shall be marked:

140/70 ZR 17 M/C

66 W

The same tyre approved for speeds in excess of 270 km/h shall be marked:

140/70 ZR 17 M/C

(66 W)

5 Tyre dimensions

5.1 Calculation of design tyre dimensions

5.1.1 Theoretical rim width, R_{th}

The theoretical rim width, R_{th} , shall be calculated as follows:

$$R_{th} = K_1 \times S_N$$

where

K_1 is the rim/section ratio;

S_N is the nominal section width.

For tyres of existing concepts, K_1 shall be equal to

- 0,6 for aspect ratios 100, 90, 80,
- 0,7 for aspect ratios 70, 65, 60,
- 0,8 for aspect ratios 55, 50 and
- 0,9 for aspect ratios 45, 40.

NOTE K_1 will be defined later for aspect ratios below 40.

5.1.2 Measuring rim width, R_m

The measuring rim width, R_m , is width A of the existing rim width nearest to R_{th} . See ISO 4249-3 for widths of existing rims.

5.1.3 Design tyre section width, S

The design tyre section width, S , shall be the nominal section width, S_N , transferred from R_{th} to R_m , calculated as follows:

$$S = S_N + K_2 (R_m - R_{th})$$

rounded to the nearest whole number.

For tyres of existing concepts, $K_2 = 0,4$.

5.1.4 Design tyre section height, H

The design tyre section height, H , shall be calculated as follows:

$$H = S_N \frac{H/S}{100}$$

rounded to the nearest whole number,

where

S_N is the nominal section width;

H/S is the nominal aspect ratio.

5.1.5 Design tyre overall diameter, D_o

The design tyre overall diameter, D_o , shall be calculated as follows:

$$D_o = D_r + 2H$$

where

D_r is the nominal rim diameter;

H is the design tyre section height.

NOTE For those tyres using a nominal rim diameter code, see Table 1 for the value of D_r to be used.

5.1.6 Values

Guideline values for the design tyre dimensions for metric-series motorcycles tyres are given in Annex A.

5.2 Calculation of maximum overall tyre dimensions in service

5.2.1 General

The calculations of 5.2.2 and 5.2.3, as well as Clause 9, are for use by vehicle manufacturers in designing for tyre clearances.

5.2.2 Maximum overall width in service, $W_{\max}$

The maximum overall width in service, $W_{\max}$, shall be calculated as follows:

$$W_{\max} = S \times a$$

where

S is the design tyre section width;

a is the appropriate coefficient (see Table 2).

It includes protective ribs, lettering, embellishments, tread overhang, manufacturing tolerances and growth due to service.

5.2.3 Maximum overall diameter in service, $D_{o,\max}$

The maximum overall diameter in service, $D_{o,\max}$, shall be calculated as follows:

$$D_{o,\max} = D_r + 2Hb$$

where

D_r is the nominal rim diameter;

H is the design tyre section height;

b is the appropriate coefficient (see Table 2).

It includes manufacturing tolerances and growth due to service (for deformation due to centrifugal force, see Clause 9).

5.3 Calculation of minimum dimensions — Section width, $S_{\min}$

The minimum section width, $S_{\min}$, shall be equal to the product of the design tyre section width, S , and the appropriate coefficient:

$$S_{\min} = 0,96S$$

$S - S_{\min}$ shall be at least 4 mm.

NOTE In the case of type B tread tyres, minimum section width refers to overall tread width.

5.4 Measuring tyre dimensions — Procedure

Before measuring, mount the tyre on the measuring rim ready for tyre fitment, inflate to the recommended pressure, and allow to stand for a minimum of 24 h at normal room temperature, after which readjust the inflation pressure to the original value.

6 Tread configurations

These attributions of tread type configurations to the type of service are to be considered as examples only. The choice of a given tread type configuration for a given tyre is at the discretion of the tyre manufacturer alone.

Figure 1 shows various tread configurations:

- tread type A corresponds to highway service tyres manufactured for speed symbols up to “S”;
- tread type B corresponds to highway service tyres (for high performance vehicles) manufactured for speed symbols “S” and higher;
- tread type C corresponds to tyres for on-and-off-road service manufactured for speed symbols up to and including “H”;
- tread type D corresponds to tyres for exclusive off-road service manufactured for speed symbol “M”.

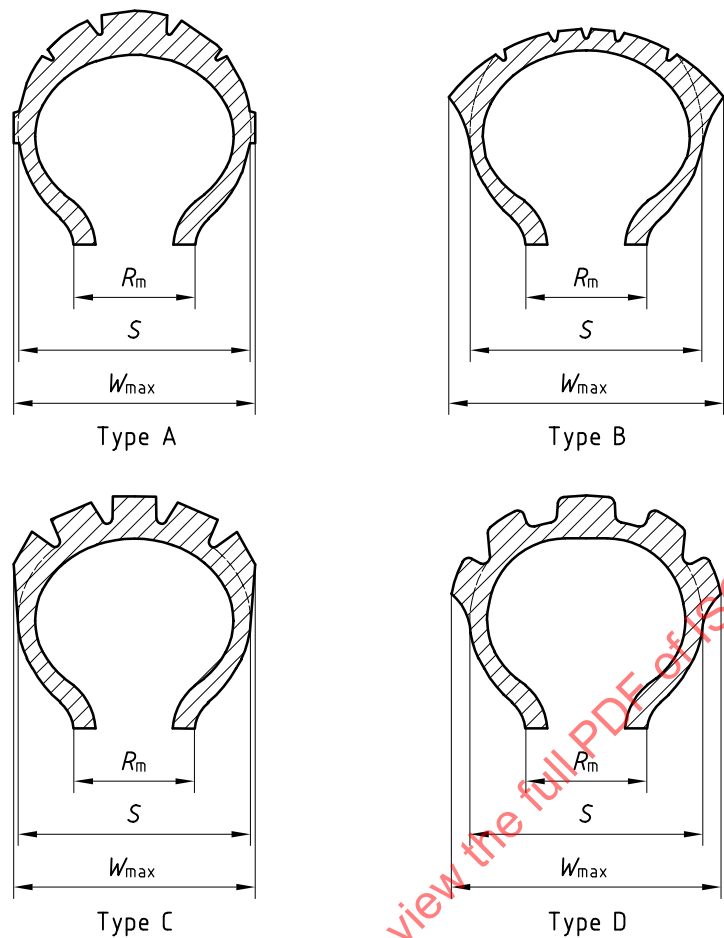


Figure 1 — Tread configurations

Table 2 — Coefficients for calculation of maximum overall tyre dimensions in service

Tread configuration	Coefficient	
	<i>a</i>	<i>b</i>
Type A	1,1 ^a	1,07 ^b
Type B	1,1 ^a	1,07 ^b
Type C	1,1 ^a	1,12 ^c
Type D	1,25	1,12 ^c
NOTE Coefficients for diagonal tyres are also applicable to tyres of bias belted construction.		
^a 1,08 for tyres on rim diameter code 12 and below and 1,07 for radial tyres.		
^b Subject to the condition that $D_{o,max} - D_o$ is at least 6 mm.		
^c Subject to the condition that $D_{o,max} - D_o$ is at least 8 mm.		

7 Tyre load-carrying capacity

7.1 Tyre load-carrying capacity (TLCC), corresponding to the load index (see ISO 4223-1:2002, Table A.1), is applicable for speeds up to and including 210 km/h.

7.2 For speed symbol “V” tyres, between 210 km/h and 240 km/h the applicable load-carrying capacity shall be reduced with respect to the value corresponding to the load index, and shall be obtained by applying the following percentages.

Up to 210 km/h: 100 % of TLCC

220 km/h max.: 95 % of TLCC

230 km/h max.: 90 % of TLCC

240 km/h max.: 85 % of TLCC

Between these speeds, linear interpolation is permitted.

7.3 For “VB” and “VR” tyres, the load-carrying capacity above 240 km/h shall be further reduced by 5 % for each 10 km/h increase in speed.

7.4 For speed symbol “W” tyres, the load-carrying capacity is applicable for speeds up to and including 240 km/h. The applicable load-carrying capacity above 240 km/h shall be reduced with respect to the value corresponding to the load index, and shall be obtained by applying the following percentages.

250 km/h: 95 % of TLCC

260 km/h: 85 % of TLCC

270 km/h: 75 % of TLCC

7.5 For “ZR” and “ZB” tyres at speeds over 270 km/h, consult the tyre manufacturer.

8 Speed symbols

Speed symbols up to “H” (corresponding to speed category 210 km/h) shall be in accordance with ISO 4223-1:2002, Table A.2.

9 Centrifugal radius

The maximum centrifugal radius, R_{dyn} , caused by centrifugal force, is related to the maximum speed of the vehicle, and shall be calculated as follows:

$$R_{\text{dyn}} = 0,5D_r + Hc$$

where

D_r is the nominal rim diameter;

H is the design tyre section height;

c is the appropriate coefficient (see Table 3).

For vehicles having maximum speeds in excess of 240 km/h, consult the tyre manufacturer.

Table 3 — Coefficients for calculation of maximum centrifugal radius at various maximum driving speeds

Tread configuration	Coefficient c			
	Up to 150 km/h	Up to 180 km/h	Up to 210 km/h	Up to 240 km/h
Types A and B	1,07 ^a	1,10	1,13	1,16
Types C and D	1,12 ^b	1,15	1,18	—
^a Subject to the condition that $H_c - H$ is at least 3 mm. ^b Subject to the condition that $H_c - H$ is at least 4 mm.				

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Annex A (informative)

Guideline values for metric series

Guideline values for tyre dimensions are given in Tables A.1 and A.2.

Table A.1 — Guideline values of R_{th} , R_m and S for different values of S_N

Dimensions in millimetres

Nominal section width S_N	Aspect ratios 100, 90, 80: Rim/section ratio $K_1 = 0,6$			Aspect ratios 70, 65, 60: Rim/section ratio $K_1 = 0,7$		
	Theoretical rim width R_{th}	Measuring rim width code R_m	Design section width S	Theoretical rim width R_{th}	Measuring rim width code R_m	Design section width S
60	36	1.5	61	42	1.6	59
70	42	1.6	69	49	1.85	69
80	48	1.85	80	56	2.15	80
90	54	2.15	90	63	2.50	90
100	60	2.50	101	70	2.75	100
110	66	2.50	109	77	3.00	110
120	72	2.75	119	84	3.50	122
130	78	3.00	129	91	3.50	129
140	84	3.50	142	98	4.00	141
150	90	3.50	150	105	4.00	149
160	96	4.00	162	112	4.50	161
170	102	4.00	170	119	4.50	168
180	108	4.50	183	126	5.00	180
190	—	—	—	133	5.00	188
200	—	—	—	140	5.50	200

Table A.1 (continued)

Dimensions in millimetres

Nominal section width S_N	Aspect ratios 55, 50: Rim/section ratio $K_1 = 0,8$			Aspect ratios 40, 45: Rim/section ratio $K_1 = 0,9$		
	Theoretical rim width R_{th}	Measuring rim width code R_m	Design section width S	Theoretical rim width R_{th}	Measuring rim width code R_m	Design section width S
130	104	4.00	129	—	—	—
140	112	4.50	141	—	—	—
150	120	4.50	148	—	—	—
160	128	5.00	160	—	—	—
170	136	5.50	171	—	—	—
180	144	5.50	178	—	—	—
190	152	6.00	190	—	—	—
200	160	6.25	200	180	7.00	199
210	168	6.50	209	189	7.50	211
220	176	7.00	221	198	8.00	222
230	184	7.00	228	207	8.00	228
240	192	7.50	239	216	8.50	240
250	200	8.00	251	225	9.00	251