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ISO 5751-1

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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

Reference number
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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.

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 part of ISO 5751 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 fifth edition cancels and replaces the fourth edition (ISO 5751-1:1994), 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*

Annex A of this part of ISO 5751 is for information only.

Motorcycle tyres and rims (metric series) —

Part 1:
Design guides

1 Scope

This part of ISO 5751 gives guidelines for the design and specifies the designation, the calculation of dimensions and the load-carrying capacity of metric-series motorcycle tyres.

This part of ISO 5751 is applicable to motorcycle tyres with a reduced height/width ratio (100 and lower) that can be fitted on cylindrical bead seat rims or 5° tapered bead seat rims. It is also applicable to other concepts of tyre and rim, in which case, however, the appropriate rim/section ratios and coefficients will have to be established.

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

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 5751. 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 5751 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 4000-2, *Passenger car tyres and rims — Part 2: Rims*

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

ISO 4251-3, *Tyres (ply rating marked series) and rims for agricultural tractors and machines — Part 3: Rims*

3 Terms and definitions

For the purposes of this part of ISO 5751, 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**

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. 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 70° 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**

The load index is a numerical code associated with the maximum load a tyre can carry at the speed indicated by its speed symbol under the conditions specified in clause 7 (see Table 3).

The speed symbol indicates the speed category in which the tyre can carry the load corresponding to its load index under the service conditions specified in clause 7 (see Table 4).

Table 1 — Nominal rim diameter and rim width codes

Dimensions in millimetres

Nominal rim diameter code		Rim width code	
Code	Nominal rim diameter D_r	Code	Measuring rim width R_m
8	203	1.50	38
10	254	1.60	40,5
12	305	1.85	47
13 M/C	330	2.15	55
14 M/C	356	2.50	63,5
15 M/C	381	2.75	70
16 M/C	406	3.00	76
17 M/C	432	3.50	89
18 M/C	457	3.75	95
19 M/C	483	4.00	101,5
20 M/C	508	4.50	114,5
21 M/C	533	5.00	127
23 M/C	584	5.50	139,5
		6.00	152,5
		6.25	159
		6.50	165
		7.00	178

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 code letters

— “VB” or “ZB” for bias-belted construction,

— “VR” or “ZR” for radial construction,

where “ZB” and “ZR” should be used for newly designed motorcycles with a maximum speed over 240 km/h.

This identification shall be placed inside the tyre designation (see 4.2) instead of in the tyre construction code.

For speed category “V”, “VB” or “VR” tyres suitable for speeds of over 240 km/h, a service description with the speed symbol “V” shall be marked in parentheses.

EXAMPLE 1 120/60 VR 17 (55 V)

For speed category “ZB” or “ZR” tyres suitable for speeds up to 270 km/h, a service description with the speed symbol “W” shall be marked.

EXAMPLE 2 120/60 ZR 17 55 W

If the same tyres are suitable for speeds of over 270 km/h, the service description shall be marked in parentheses.

EXAMPLE 3 120/60 ZR 17 (55 W)

4.4.4 For nominal rim diameter codes 13 and above, the suffix “M/C” shall be added to the size and construction marking, to prevent confusion and misfitting of motorcycle tyres on rims having the same nominal diameters but designed primarily for passenger car tyres in accordance with ISO 4000-2 or agricultural tyres in accordance with ISO 4251-3.

4.4.5 The maximum speed approved by the tyre manufacturer may be marked on the tyre.

EXAMPLE “V250” to identify a maximum speed of 250 km/h.

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

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

4.5 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 (code letter “ZR”),
- 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

In the case of “VR” and “VB” tyres approved for speeds in excess of 240 km/h or “ZR” and “ZB” tyres approved for speeds in excess of 270 km/h, the service description shall be marked in parentheses.

EXAMPLE 1 140/70 ZR 17 M/C (66 W)

The actual maximum speed certified by the tyre manufacturer may be marked on the tyre.

EXAMPLE 2 “V280” to identify a maximum speed of 280 km/h.

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:

$$R_{th} = K_1 S_N$$

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, and

— 0,8 for aspect ratios 55, 50.

NOTE K_1 will be defined later for aspect ratios below 50.

5.1.2 Measuring rim width, R_m

The measuring rim width, R_m, is the width of the existing rim nearest to R_{th}. See Table 1 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.

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 are given in annex A.

5.2 Maximum overall tyre dimensions in service

5.2.1 General

The calculations of 5.2.2 and 5.2.3 are for use by vehicle manufacturers in designing for tyre clearances.

5.2.2 Max. overall width in service, W_{max}

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

$$W_{max} = Sa$$

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 Max. 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, growth due to service, and deformation due to centrifugal force.

5.3 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.

5.4 Measuring tyre dimensions — Procedure

Before measuring, mount the tyre on the measuring rim ready for tyre fitting, 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 service are to be considered as examples only. The choice of a given tread type configuration for a given tyre depends on the tyre manufacturer alone.

Figure 1 shows various tread configurations:

— tread type A corresponds to highway service tyres manufactured for speed symbols P, S and higher;

— 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.

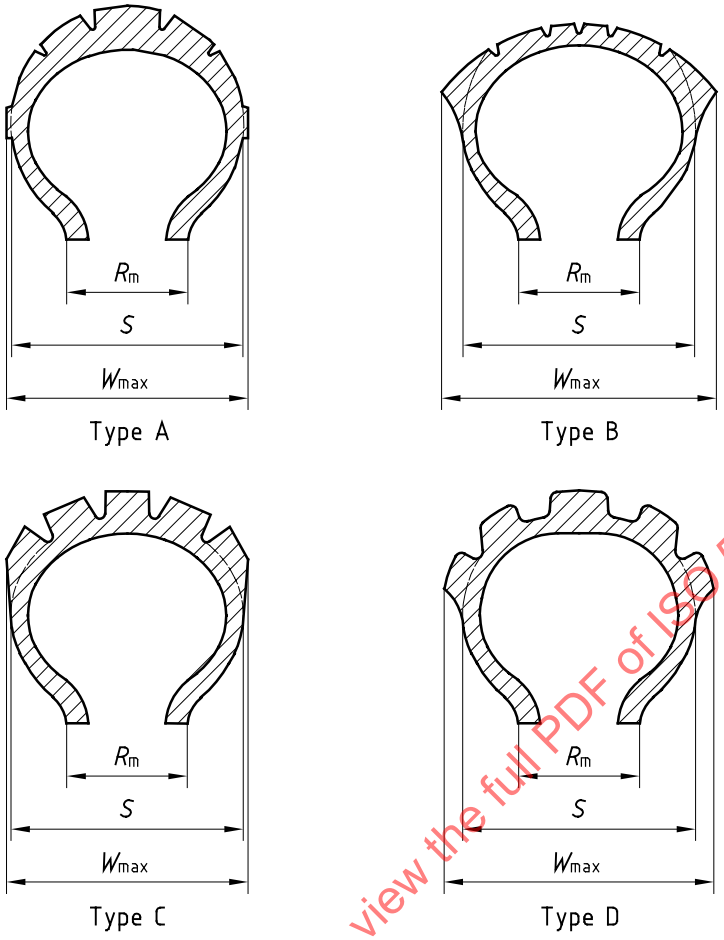

Figure 1 — Tread configurations

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

Tread configuration	Coefficient	
	a	*b*
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 in 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 Table 3), is applicable for speeds up to and including 210 km/h.

Table 3 — Correlation between load index (LI) and tyre load-carrying capacity (TLCC)

LI	TLCC kg	LI	TLCC kg	LI	TLCC kg
0	45	30	106	60	250
1	46,2	31	109	61	257
2	47,5	32	112	62	265
3	48,7	33	115	63	272
4	50	34	118	64	280
5	51,5	35	121	65	290
6	53	36	125	66	300
7	54,5	37	128	67	307
8	56	38	132	68	315
9	58	39	136	69	325
10	60	40	140	70	335
11	61,5	41	145	71	345
12	63	42	150	72	355
13	65	43	155	73	365
14	67	44	160	74	375
15	69	45	165	75	387
16	71	46	170	76	400
17	73	47	175	77	412
18	75	48	180	78	425
19	77,5	49	185	79	437
20	80	50	190	80	450
21	82,5	51	195	81	462
22	85	52	200	82	475
23	87,5	53	206	83	487
24	90	54	212	84	500
25	92,5	55	218	85	515
26	95	56	224	86	530
27	97,5	57	230	87	545
28	100	58	236	88	560
29	103	59	243	89	580

7.2 For speed symbol “V”, between 210 km/h and 240 km/h, the load-carrying capacity shall be reduced with respect to the value corresponding to the load index as follows:

— up to 210 km/h: 100 % load

— 220 km/h max.: 95 % load;

— 230 km/h max: 90 % load;

— 240 km/h max: 85 % load.

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 “ZR” tyres, the load-carrying capacity is applicable for speeds up to and including 240 km/h. The load-carrying capacity above 240 km/h shall be reduced as follows:

— 250 km/h: 95 % load;

— 260 km/h: 85 % load;

— 270 km/h: 75 % load.

For speeds over 270 km/h, consult the tyre manufacturer concerned.

8 Speed symbols

Speed symbols shall be as given in Table 4.

Table 4 — Correlation between speed symbols and speed categories

Speed symbol	Speed category km/h
J	100
K	110
L	120
M	130
N	140
P	150
Q	160
R	170
S	180
T	190
H	210
V	240[a]
W	270[b]

[a] Tyres designed for operations at speeds in excess of 240 km/h shall be identified according to 4.4.3, Example 1. For the maximum speed capability, consult the tyre manufacturer.

[b] Tyres designed for operations at speeds in excess of 270 km/h shall be identified according to 4.3.3, Example 3. For the maximum speed capability, consult the tyre manufacturer.

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:

$$R_{dyn} = 0{,}5D_r + H \times c$$

where

D_r is the nominal rim diameter;

H is the design tyre section height;

c is the appropriate coefficient (see Table 5).

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

Table 5 — 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 $Hc - H$ is at least 3 mm.

[b] Subject to the condition that $Hc - H$ is at least 4 mm.

Annex A
(informative)

Guideline values for metric series

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

Table A.1 — Guideline values

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			Aspect ratios 55, 50: Rim/section ratio K_1 = 0,8		
	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	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	104	4.00	129
140	84	3.50	142	98	4.00	141	112	4.50	141
150	90	3.50	150	105	4.00	149	120	4.50	148
160	96	4.00	162	112	4.50	161	128	5.00	160
170	102	4.00	170	119	4.50	168	136	5.50	171
180	108	4.50	183	126	5.00	180	144	5.50	178
190	—	—	—	133	5.00	188	152	6.00	190
200	—	—	—	140	5.50	200	160	6.25	200