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Aircraft tyres and rims —

Part 1: Specifications

Pneumatiques et jantes pour aéronefs —

Part 1: Specifications
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ISO 3324-1:1997(E)

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Internet iso@iso.ch

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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.

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.

International Standard ISO 3324-1 was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves*, Subcommittee SC 8, *Aircraft tyres and rims*.

This fourth edition cancels and replaces the third edition (ISO 3324-1:1993), of which it constitutes a technical revision.

ISO 3324 consists of the following parts, under the general title *Aircraft tyres and rims*:

- *Part 1: Specifications*
- *Part 2: Test methods for tyres*

Annex A of this part of ISO 3324 is for information only.

Aircraft tyres and rims —

Part 1: Specifications

1 Scope

This part of ISO 3324 gives specifications for new and retread aircraft tyres and for aircraft rims.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 3324. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 3324 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4223-1:1989, *Definitions of some terms used in the tyre industry — Part 1: Pneumatic tyres.*
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3 Definitions

For the purposes of this part of ISO 3324, the definitions in ISO 4223-1 and the following definitions apply.

- 3.1 aspect ratio (AR):** Ratio of section height to section width.
- 3.2 balance mark:** Identifying red dot, located on the sidewall at the light spot of the tyre.
- 3.3 chine:** Annular protuberance located around the shoulder area of the tyre, designed to deflect water.
- 3.4 ply rating:** Term used to identify a given tyre with its maximum load when used in a specific type of service. It is an index of relative tyre strength.
- 3.5 skid depth (mould):** Depth of the deepest tread grooves in the mould.
- 3.6 venting mark:** Identification dot, other than red, located at the vents of tyres.
- 3.7 retread tyre:** Tyre which has been subjected to a retreading operation.

4 New tyres

4.1 Tyre size designation

The tyre size designation for new design tyres in accordance with this part of ISO 3324 shall include a three-part size marking as follows:

Overall diameter × Overall section width - Nominal rim diameter

- tyre overall diameter and overall section width, both expressed in millimetres (mm) or both expressed in inches (in);
- nominal rim diameter, expressed as a code (see table 1).

For radial-ply tyres, the letter “R” shall be inserted between the overall section width and nominal rim diameter in the tyre size designation replacing the hyphen (“-”).

The size designation may also include one of the following letter prefixes:

- B indicates tyres for 15° bead seat rims with 60 % to 70 % rim width to tyre section width ratio;
- H indicates tyres for 5° bead seat rims with 60 % to 70 % rim width to tyre section width ratio.

4.2 Tyre markings

The marking of new tyres shall include the following:

- a) tyre size designation;
- b) ply rating (optional);
- c) maximum speed rating expressed in knots (kn) or miles per hour (mile/h);

NOTE 1 Mile/h is also sometimes written mph.

- d) skid depth (mould) expressed in millimetres or inches;
- e) original serial number and date of manufacture: the date of manufacture shall be expressed numerically and may use a system of marking based on the Gregorian calendar (for example 12 March 1989 becomes 9071, the 9 representing 1989 and 071 representing 12 March which is the 71st day of the year) or specify month and year of manufacture with a dash (“-”) separating them (for example March 1989 becomes 03–89);

NOTE 2 The numerical date of manufacture may form the first four digits of the manufacturer's unique serial number.

- f) the word “tubeless” if applicable;
- g) manufacturer's (brand) name, and country of manufacture;
- h) balance mark;
- i) venting mark if applicable;
- j) rated load (kg or lb);
- k) part number.

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4.3 Bias tyre dimensions and growth allowances

4.3.1 Tyre dimensions

New inflated tyre dimensional tolerances shall be calculated using the factors shown in figure 3 or 4. When used, the size designation as defined in 4.1 determines the maximum overall diameter and maximum section width of the new inflated tyre. Therefore tolerances shall be specified as a minus from the permitted maximum dimensions.

Tyre dimensions shall be measured after the new tyre has been mounted on the specified rim, inflated to its rated inflation pressure, and allowed to stand for a minimum of 12 h at normal room temperature and the inflation pressure readjusted to the original value. The maximum section width includes elevations due to labelling (marking, decorations, and all protective bands or ribs except chines).

4.3.2 Determination of growth allowances

4.3.2.1 General

Growth allowances provide for the increase in tyre dimensions over the maximum new inflated tyre dimensions to allow for growth or stretch of the tyre during service.

4.3.2.2 Dimensions and symbols

The following dimensions and symbols are used (also see figure 2):

	Inflated new tyre	Inflated growth tyre
Maximum section width ¹⁾	W	W_G
Maximum shoulder width ²⁾	W_S	W_{SG}
Maximum overall diameter	D_o	D_G
Maximum shoulder diameter	D_S	D_{SG}
Maximum section height	H	—
Maximum shoulder height	H_S	—
Aspect ratio		AR
Ply rating		PR
Specified rim diameter		D
Nominal rim diameter code		D_r
Section height growth factor		G_H
Section width growth factor		G_W
Minimum lateral distance required from wheel centreline to adjacent structure		W_X
Minimum radial distance required from axle centreline to adjacent structure		R_X
Minimum lateral clearance ³⁾		C_W
Minimum radial clearance ³⁾		C_R
Minimum shoulder clearance ³⁾		S_X

1) Maximum section width includes protective side ribs, lettering bars and decorations, but does not include chines (water deflectors) present on certain types of nose wheel (or auxiliary gear) tyres.

2) Maximum shoulder width does not include chines (water deflectors) present on certain types of nose wheel (or auxiliary gear) tyres.

3) These are minimum clearance allowances between the maximum grown tyre and the adjacent structure.

4.3.2.3 Calculations

4.3.2.3.1 Determine grown dimensions as follows, using the appropriate growth factor given in 4.3.2.3.2:

$$W_G = G_W W$$

$$W_{SG} = G_W W_S$$

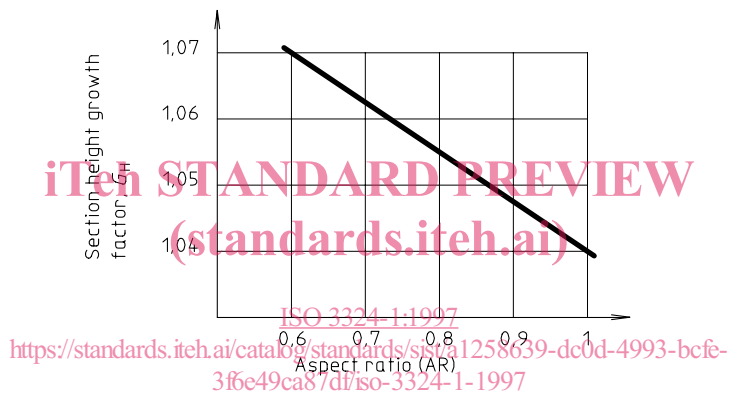
$$D_G = D_r + 2G_H H$$

$$D_{SG} = D_r + 2G_H H_S$$

$$H = \frac{D_o - D_r}{2}$$

$$H_s = \frac{D_s - D_r}{2}$$

4.3.2.3.2 Growth factors are expressed in figure 1.



Section width growth factor, $G_W = 1,04$
 Section height growth factor, $G_H = 1,115 - (0,075 \times AR)$

Figure 1 — Growth factors

4.3.2.3.3 Obtain the new tyre dimensions D_o , D_s , W and W_s , as shown in the tyre tables (see annex A); such dimensions should be considered maxima.

4.3.2.3.4 The maximum shoulder width, W_s , and the maximum shoulder height, H_s , are determined by the formulae:

$$W_s = 0,9 W$$

$$H_s = 0,9 H$$

4.3.2.3.5 Nominal rim diameters are shown in table 1.

Table 1 — Nominal rim diameter code

Code	Nominal rim diameter, D_r	
	inch	mm
4	4	102
5	5	127
6	6	152
7	7	178
8	8	203
9	9	229
10	10	254
11	11	279
12	12	305
13	13	330
14	14	356
15	15	381
16	16	406
17	17	432
18	18	457
19	19	483
20	20	508
21	21	533
22	22	559
23	23	584
24	24	610

4.4 Radial tyre dimensions and dimensional tolerances

The dimensions to be specified for radial tyres are the grown tyre dimensions. They include:

- a) the maximum overall diameter, D_G ;
- b) the maximum section width, W_G ;
- c) the maximum shoulder diameter, D_{SG} ;
- d) the maximum shoulder width, $W_{SG}^{1)}$;

1) For some tyre sizes, the maximum shoulder width should be calculated using the formula:

$$W_{SG} = 0,88 W_G$$

Consult the tyre manufacturer for application recommendation.

- e) the minimum static loaded radius, $SLR_{G,min}$;
- f) the maximum static loaded radius, $SLR_{G,max}$.

D_G , W_G , D_{SG} , W_{SG} are the maximum permitted grown inflated tyre dimensions. SLR_G is the loaded radius when the grown tyre is inflated to its rated inflation pressure, and loaded to its rated load against a flat surface.

Grown dimensions shall be measured on tyres that have completed a sufficient number of take-off cycles. Tyres shall be allowed to cool to room temperature and shall be measured at the rated inflation pressure.

The size designation defined in 4.1 determines the maximum dimensions of an equivalent new inflated bias tyre that would have the same grown dimensions as calculated in 4.3.2.

4.5 Determination of clearance allowances

4.5.1 Clearance around individual tyres

Clearance allowances between the tyre and the adjacent parts of the aircraft shall be provided by the aircraft manufacturer. These allowances are to be based on the maximum overall tyre dimensions plus growth allowances due to service, plus the increase in diameter due to centrifugal force. Minimum distances to adjacent parts of the aircraft are determined as specified in 4.5.1.1 to 4.5.1.3.

4.5.1.1 Determine the maximum grown tyre envelope as specified in 4.3.2. for bias tyres and 4.4 for radial tyres. (This is the dotted line labelled "grown (used) inflated tyre" in figure 2.)

4.5.1.2 Obtain the radial (C_R) and lateral (C_W) clearances from the formulae in a) or b) as appropriate.

For speeds which do not fall into the stated categories, clearance dimensions are to be interpolated.

a) For dimensions in millimetres:

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$C_R = 0,084 W_G + 10$ for 230 kn (265 mile/h)

= 0,07 $W_G + 10$ for 213 kn (245 mile/h)

= 0,063 $W_G + 10$ for 204 kn (235 mile/h)

= 0,06 $W_G + 10$ for 195 kn (225 mile/h)

= 0,047 $W_G + 10$ for 182 kn (210 mile/h)

= 0,037 $W_G + 10$ for 165 kn (190 mile/h)

= 0,029 $W_G + 10$ for 139 kn (160 mile/h)

= 0,023 $W_G + 10$ for 104 kn (120 mile/h)

$C_W = 0,019 W_G + 6$

b) For dimensions in inches:

$$\begin{aligned}
 C_R &= 0,084 W_G + 0,4 \text{ for 230 kn (265 mile/h)} \\
 &= 0,07 W_G + 0,4 \text{ for 213 kn (245 mile/h)} \\
 &= 0,063 W_G + 0,4 \text{ for 204 kn (235 mile/h)} \\
 &= 0,06 W_G + 0,4 \text{ for 195 kn (225 mile/h)} \\
 &= 0,047 W_G + 0,4 \text{ for 182 kn (210 mile/h)} \\
 &= 0,037 W_G + 0,4 \text{ for 165 kn (190 mile/h)} \\
 &= 0,029 W_G + 0,4 \text{ for 139 kn (160 mile/h)} \\
 &= 0,023 W_G + 0,4 \text{ for 104 kn (120 mile/h)}
 \end{aligned}$$

$$C_W = 0,019 W_G + 0,23$$

4.5.1.3 Determine the distance to adjacent parts as follows:

a) The radial distance from the axle centreline to the adjacent part, $R_{X,\min}$, is given by

$$R_{X,\min} = \frac{D_G}{2} + C_R$$

b) The lateral distance from the wheel centreline to the adjacent part, $W_{X,\min}$, is given by

$$W_{X,\min} = \frac{W_G}{2} + C_W$$

c) The radius or clearance allowed between tyre shoulder area and adjacent part, $S_{X,\min}$, is given by

$$S_{X,\min} = \frac{C_W + C_R}{2}$$

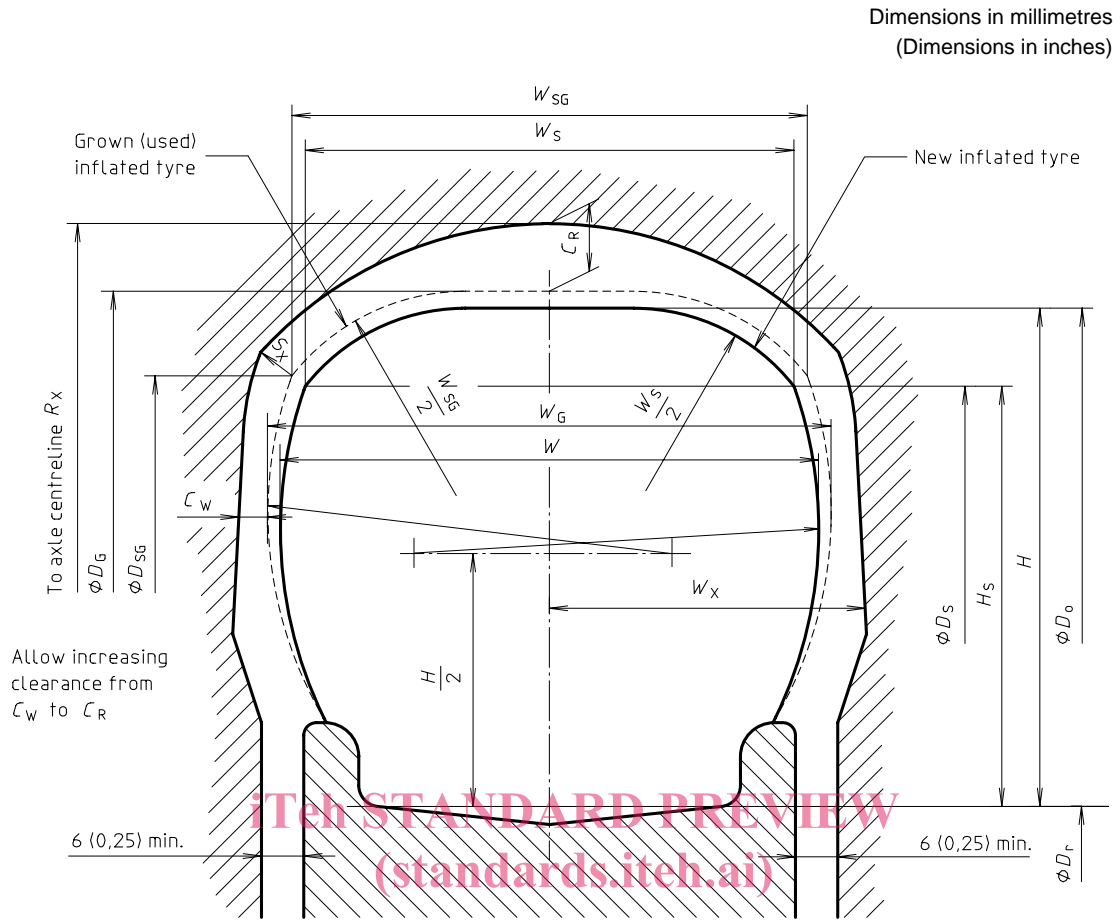
NOTE — The radial clearance, $S_{X,\min}$, includes allowances for increase in tyre diameter due to centrifugal force.

4.5.2 Spacing between twin tyres

The minimum distance between the tyre tread centrelines shall be $1,18 \times W_G$, where W_G is the maximum grown width of the tyre.

4.5.3 Spacing between tyres in tandem

The minimum distance between axle centres shall be $D_G + 2C_R$, where D_G is the maximum grown tyre diameter and C_R is the tyre radial clearance allowance for the maximum aircraft ground speed.



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NOTE — Radii $\frac{W_S}{2}$ and $\frac{W_{SG}}{2}$ are drawn through their respective shoulder points tangent to D_0 and D_G respectively. Radii below the shoulder points pass through the shoulder points and are tangent to W and W_G respectively.

Dimensions W and W_G include all protective side ribs, lettering, bars, and decorations, but do not include chines.

Figure 2 — Grown and clearance allowances