International Standard 3324/1

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Aircraft tyres and rims — Part 1 : Specifications

Pneumatiques et jantes pour aéronefs — Partie 1 : Spécifications

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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.

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 3324/1 was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves.*

ISO 3324/1 was first published in 1976. This second edition cancels and replaces the first edition, of which it constitutes a technical revision.

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Contents

Aircraft tyres and rims — Part 1: Specifications

0 Introduction

This part of ISO 3324, which deals with specifications for aircraft tyres and rims, is divided into three sections, as follows:

— section one, which concerns new tyres;

— section two on retread tyres;

— section three on rims.

ISO 3324/2 deals with test procedures for aircraft tyres.

Section one: New tyres

1 Scope and field of application

This section of ISO 3324/1 sets out, for new civil aircraft tyres,

a) definitions;

b) tyre size designation;

c) tyre markings;

d) tyre dimensional tolerances;

e) a method for determining growth allowances;

f) a method for determining clearance allowances.

2 Definitions

For definitions relating to aircraft tyres, ISO 4223/1, *Definitions of some terms used in the tyre industry — Part 1: Tyres*, should be consulted.

For the purposes of this section of ISO 3324/1, the following definitions apply.

2.1 new tyre: A tyre which has been neither used nor subjected to a retreading operation.

2.2 grown tyre: A tyre which has undergone expansion due to use in service.

2.3 ply rating: A 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.

2.4 balance mark: An identifying red dot, located on the side wall at the light spot of the tyre.

2.5 chine: An annular protruberance located around the shoulder area (S) of the tyre, designed to deflect water.

2.6 skid depth (mould): The depth of the deepest tread grooves in the mould.

2.7 venting mark: An identification dot, other than red, located at the vents of tyres.

2.8 rated load: The load as given in tables 1 to 8 of the annex, in the "Maximum load" column.

2.9 aspect ratio (AR): The ratio of mean section height to mean width.

3 Tyre size designation and dimensions

3.1 Tyre size designation

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

Overall diameter × Overall section width — Rim diameter

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.

C — Indicates tyres for 15° bead seat rims with 50 % to 60 % rim width to section width ratio.

H — Indicates tyres for 5° bead seat rims width 60 % to 70 % rim width to section width ratio.

3.2 Tyre dimensions

3.2.1 The overall diameter and overall section width are the maximum permitted new inflated tyre dimensions when the tyre is 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.

3.2.2 Dimensions shall be expressed in millimetres or inches as follows:

a) tyre, overall diameter and overall width in millimetres (mm),

or

b) tyre, overall diameter and overall section width in inches (in);

c) rim diameter: inches (in) or millimetres (mm).

4 Tyre markings

The marking of new tyres shall include the following:

a) tyre size designation;

b) ply rating;

c) maximum speed rating expressed in knots or "mph" (miles per hour) on tyres for 140 knots (161 mph) and over;

d) skid depth (mould) expressed in millimetres or inches, on tyres for 140 knots (161 mph) and over;

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 Julian calendar (for example 12 March 1985 becomes 5071, the 5 representing 1985 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, 1985 becomes 03-85);

NOTE — 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;

j) venting mark;

k) rated load (kg or lb);

m) part number.

5 Tyre dimensional tolerances

New inflated tyre dimensional tolerances shall be calculated using the factors shown in figure 3 or 4. Where used, the three-part size designation, as defined in 3.1, determines the maximum permitted new inflated tyre outside diameter and width of section, and therefore tolerances shall be calculated as a minus from the permitted maximum dimensions.

6 Determination of growth allowances

6.1 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.

6.2 Dimensions and symbols

	Inflated new tyre	Inflated grown 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**	—
Rim ledge diameter	D	
Minimum lateral distance required from wheel centre line to adjacent structure	W_X	
Minimum radial distance required from axle centre line to adjacent structure	R_X	
Minimum lateral clearance[3]	C_W	
Minimum radial clearance[3]	C_R	
Minimum shoulder clearance[3]	S_X (radial distance)	

* $W_S = 0{,}88\ W$

** $H_S = 0{,}82\ H$

6.3 Calculations

6.3.1 Determine grown dimensions as follows, using the appropriate growth factor given in 6.3.2:

$$W_G = G_W\ W$$

$$D_G = D + 2G_H\ H$$

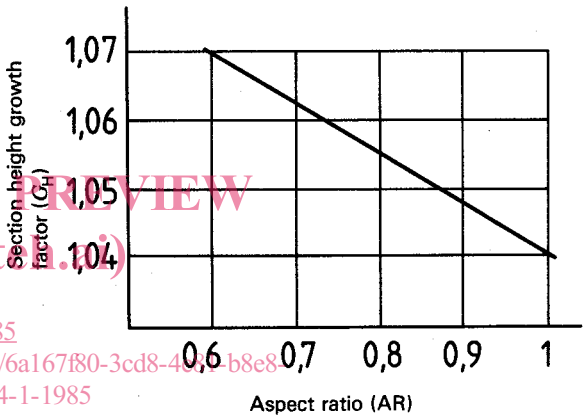
$$W_{SG} = G_W\ W_S$$

$$D_{SG} = D + 2G_H\ H_S$$

$$H = \frac{D_O - D}{2}$$

$$H_S = \frac{D_S - D}{2}$$

6.3.2 Growth factors are expressed in figure 1.



Section width growth factor, $G_W = 1{,}04$

$G_H = 1{,}115\ (0{,}075 \times AR)$

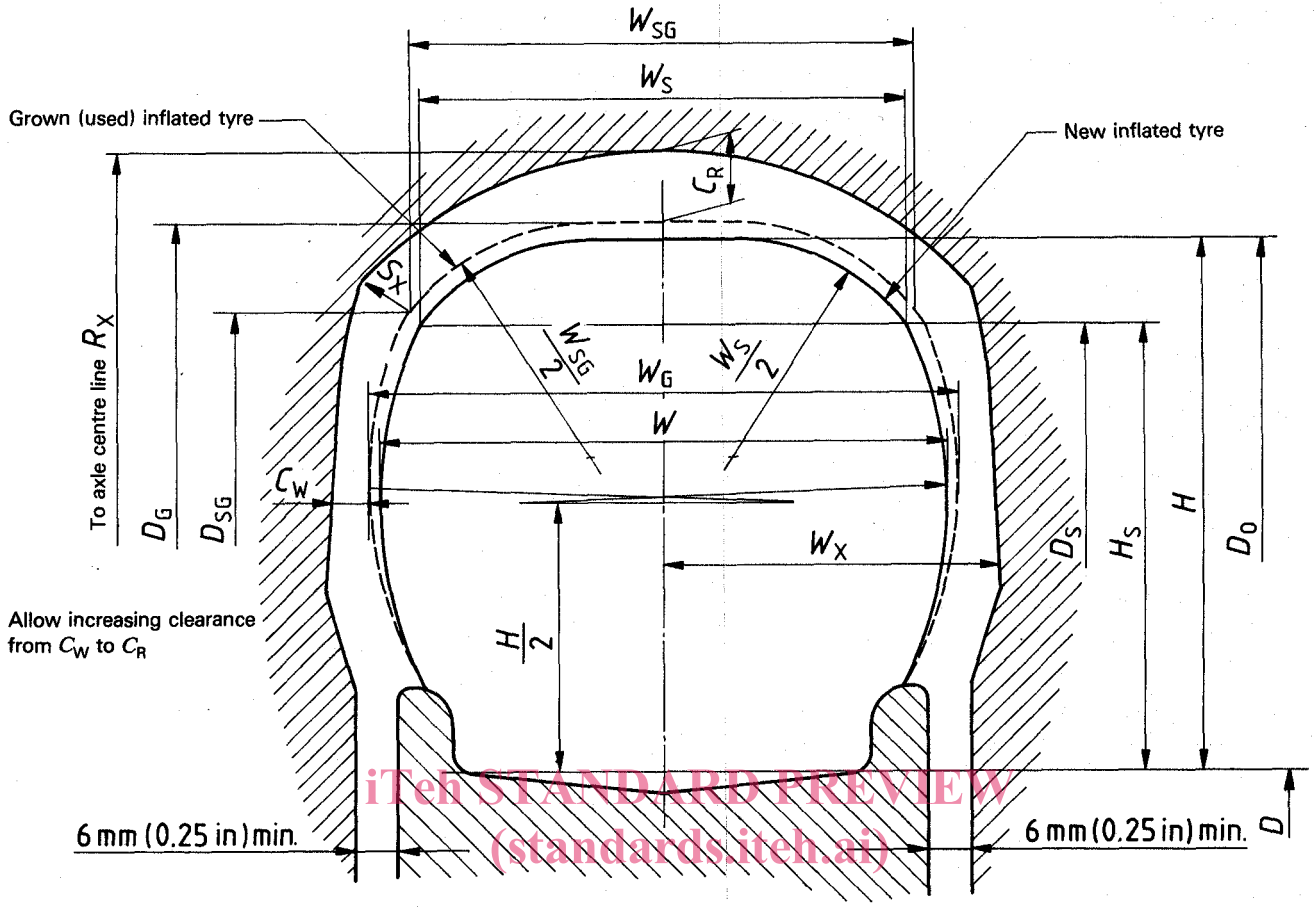
Figure 1 — Growth factors (section height)

6.3.3 Obtain the new tyre dimensions D_O, D_S, W and W_S, as shown in the tyre tables; such dimensions should be considered maxima.

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.



NOTE — Radii $\frac{W_S}{2}$ and $\frac{W_{SG}}{2}$ are drawn through their respective shoulder points tangent to D_O 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.

Figure 2 — Grown and clearance allowances

7 Determination of clearance allowances

7.1 Clearance around individual tyres

Clearance allowances between the tyre and the adjacent parts of the aircraft should be based on the maximum overall tyre dimensions plus growth allowance due to service, plus the increase in diameter due to centrifugal force. Minimum distances to adjacent parts of the aircraft are determined as follows:

a) Determine the maximum grown tyre envelope as instructed. (This is the dotted line labelled "grown (used) inflated tyre" on the figure above.)

b) Obtain the radial clearance C_R from figure 5 or 6 (mm or in).

c) Determine the distance to adjacent parts as follows:

$R_{X\,min}$ (Radial distance from axle centre line to adjacent part) $= \frac{D_G}{2} + C_R$

$W_{X\,min}$ (Lateral distance from the wheel centre line to adjacent part) $= \frac{W_G}{2} + C_W$

$S_{X\,min}$ Radius (Clearance allowed between tyre shoulder area and adjacent part) $= \frac{C_W + C_R}{2}$

NOTE — The above radial clearance includes allowances for increase in tyre diameter due to centrifugal force at speeds up to 220 knots (250 mph).

7.2 Spacing between twin tyres

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

7.3 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.

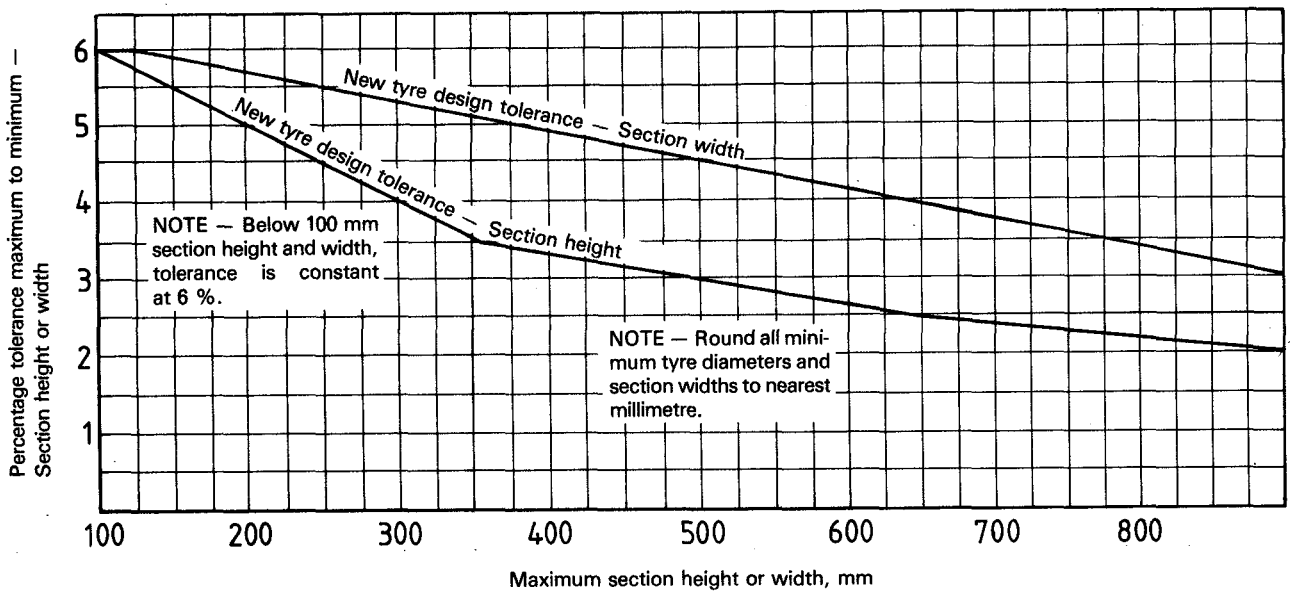


Figure 3 — New aircraft tyre section height and width — Dimensional tolerances (millimetres) [1)]

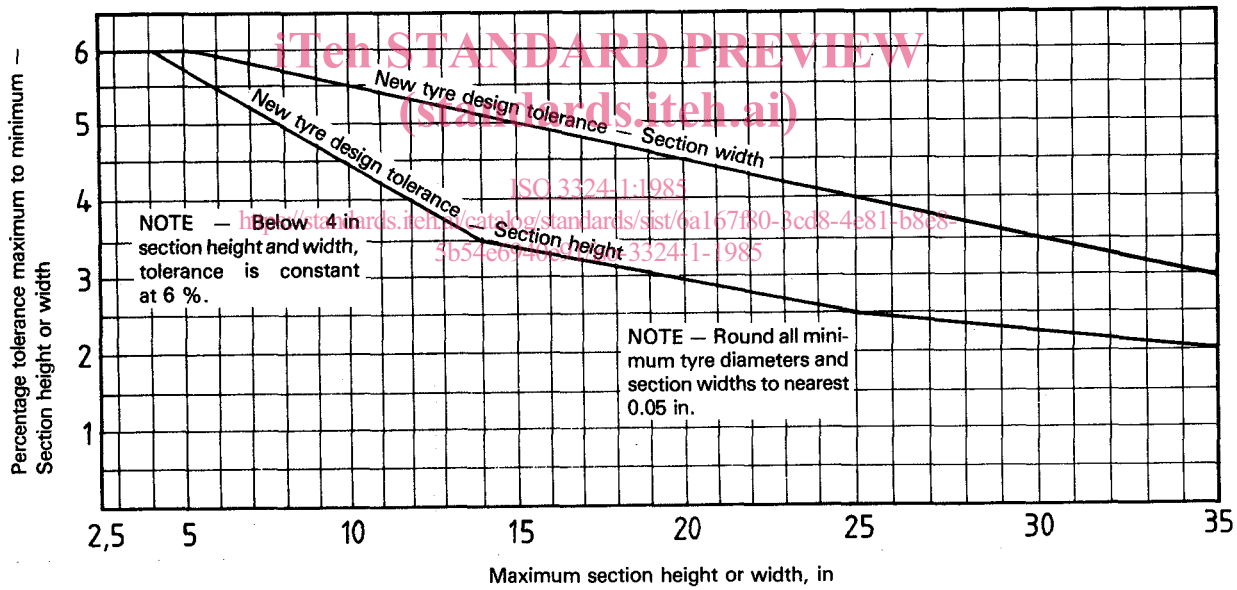


Figure 4 — New aircraft tyre section height and width — Dimensional tolerances (inches) [2)]

1) Tolerances ares shown in the following table.

Percent of tolerance	
Section width (maximum width)	Formula (%)
0 < < 127	6,0
127 < < 890	6,5 – 0,1 (maximum width)
Section height (maximum height)	
0 < < 100	6,0
100 < < 355	7,0 – 0,25 (maximum height)
355 < < 635	(52,5 – maximum height)/11,0
635 < < 890	3,75 – 0,05 (maximum height)

2) Tolerances are shown in the following table.

Percent of tolerance	
Section width (maximum width)	Formula (%)
0 < < 5	6,0
5 < < 35	6,5 – 0,1 (maximum width)
Section height (maximum height)	
0 < < 4	6,0
4 < < 14	7,0 – 0,25 (maximum height)
14 < < 25	(52,5 – maximum height)/11,0
25 < (< 35)	3,75 – 0,05 (maximum height)

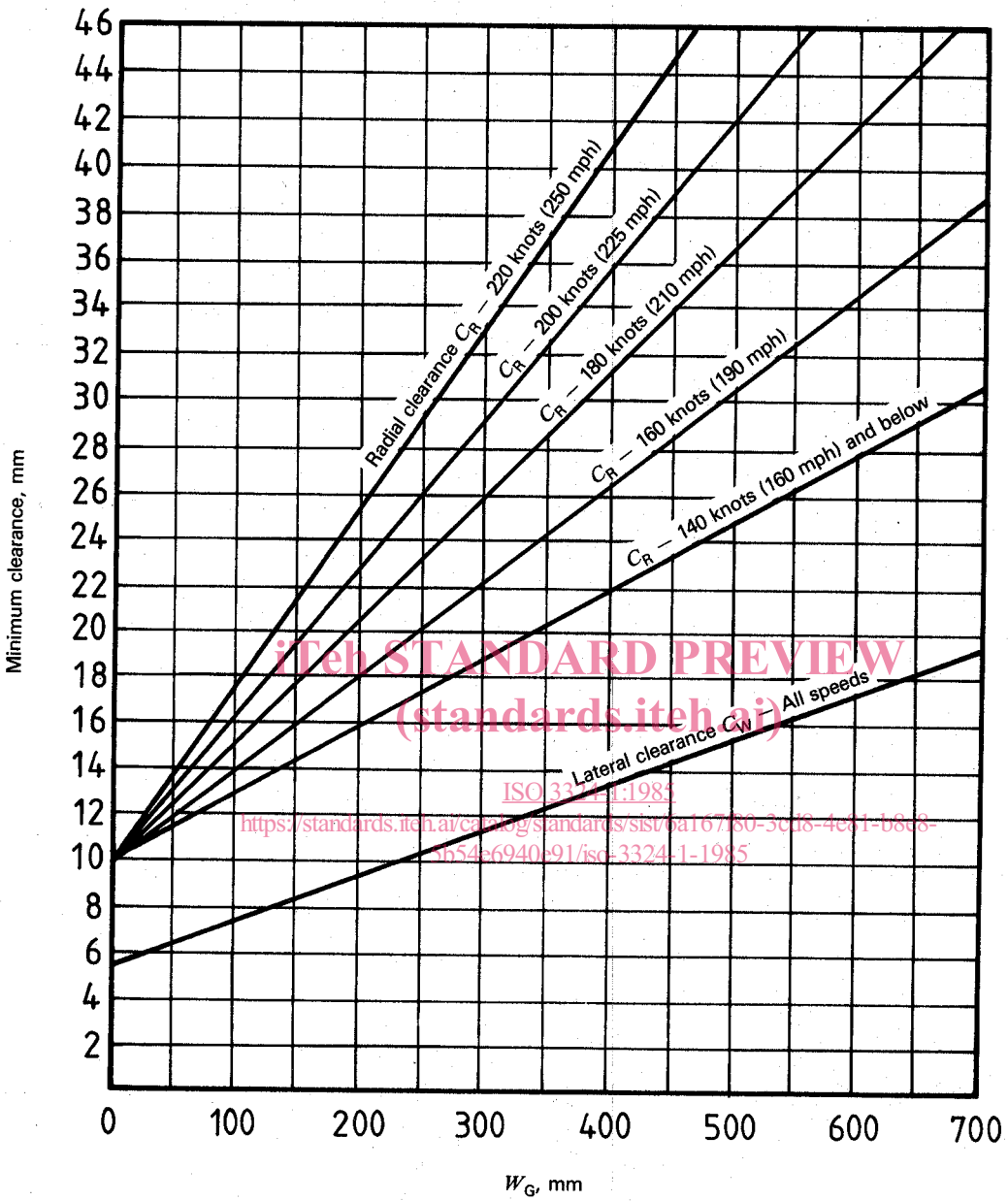


Figure 5 — Chart to be used for calculating radial C_R and lateral C_W clearances

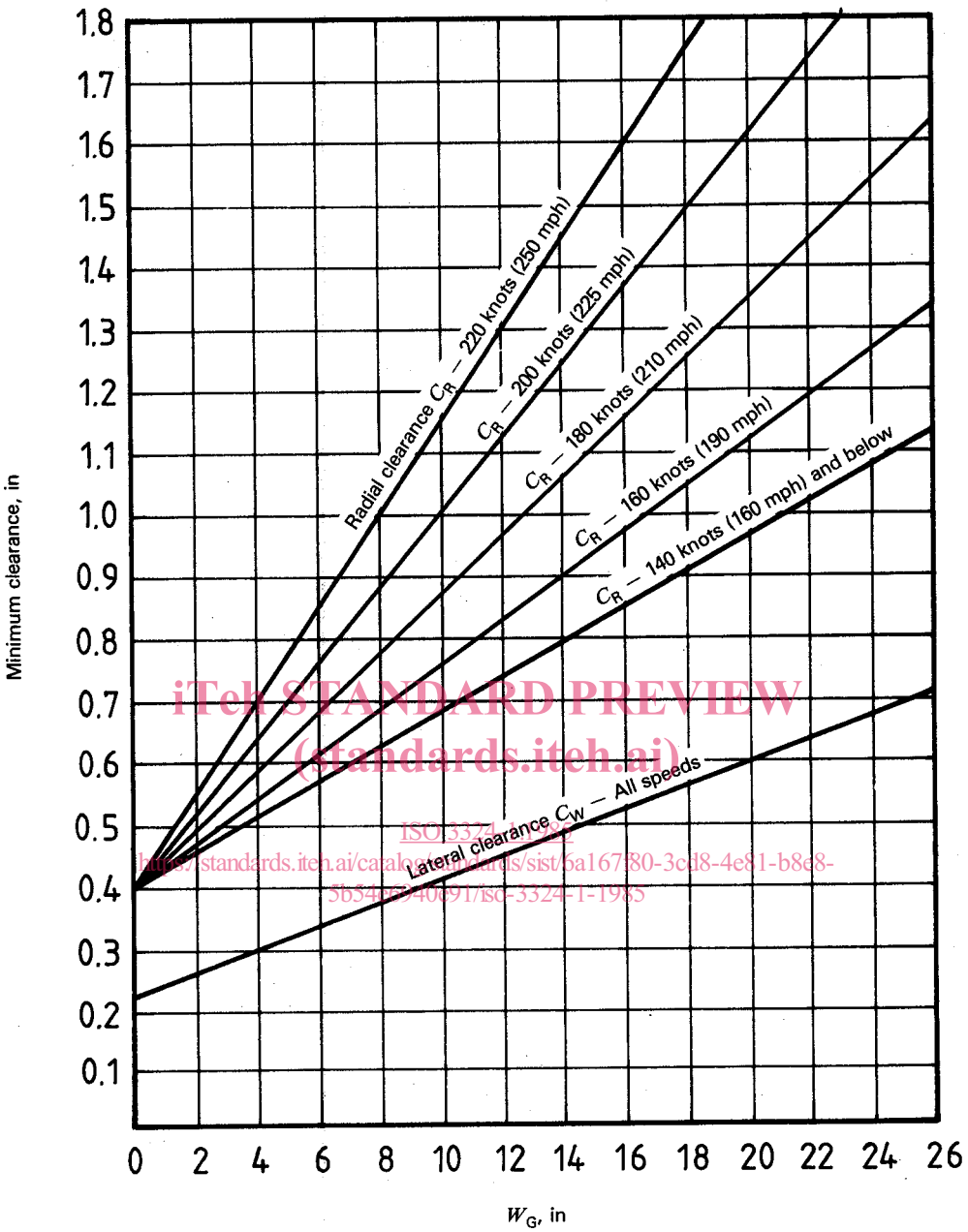


Figure 6 — Chart to be used for calculating radial C_R and lateral C_W clearances

Section two : Retread tyres

8 Scope and field of application

This section of ISO 3324/1 sets out, for retread civil aircraft tyres,

a) definitions;

b) tyre size designation;

c) tyre markings;

d) tyre dimensional tolerances.

9 Definitions

For definitions relating to aircraft tyres, ISO 4223/1, *Definitions of some terms used in the tyre industry — Part 1: Tyres* should be consulted.

For the purposes of this section of ISO 3324/1, the following definitions apply.

9.1 retread tyre: A tyre which has been subjected to a retreading operation.

9.2 balance mark: An identifying red dot, located on the side wall, at the light spot of the tyre.

10 Tyre size designation

Designation is the same as the new tyre size designation, as detailed in clause 3.

11 Tyre markings (original carcass markings and/or retread markings)

The marking of retread tyres shall include the following :

a) original tyre size designation;

b) ply rating;

c) maximum speed rating expressed in knots or "mph" (miles per hour) on tyres for 140 knots (161 mph) and over;

d) original serial number;

e) original carcass date of manufacture unless part of original serial number;

f) the word "tubeless" if applicable;

g) original manufacturer's (brand) name;

h) original manufacturer's country;

j) retreader's name;

k) retreader's factory location;

m) date of retread : this shall be expressed numerically and may use a system based on the Julian calendar (for example 12 March 1985 becomes 5071, the 5 representing 1985 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 1985 becomes 03-85);

n) retread level : letter R followed by the total number of times tyre has been retreaded (for example, R-3);

p) balance mark — applied to retread tyres;

q) skid depth (retread mould) expressed in millimetres or inches;

r) venting mark;

s) rated load (kg or lb).

12 Retread tyre dimensions

Retread tyre dimensional tolerances shall be in accordance with the new tyre grown dimensional tolerances as detailed in clauses 5 and 6.

Section three: Rims

13 Scope and field of application

This section of ISO 3324/1 sets out, for civil aircraft,

a) fundamental rim standards;

b) inspection tolerances for aircraft rims;

c) method of dimensioning and inspection tolerances for rim diameters;

d) design guide for rim flange height;

e) design guide for width between rim flanges;

f) valve hole and fusible plug hole locations.

14 Fundamental rim standards

14.1 Symbols

A = width between flanges

B_{min} = flange width (minimum)

G_{min} = minimum ledge width

H = flange height

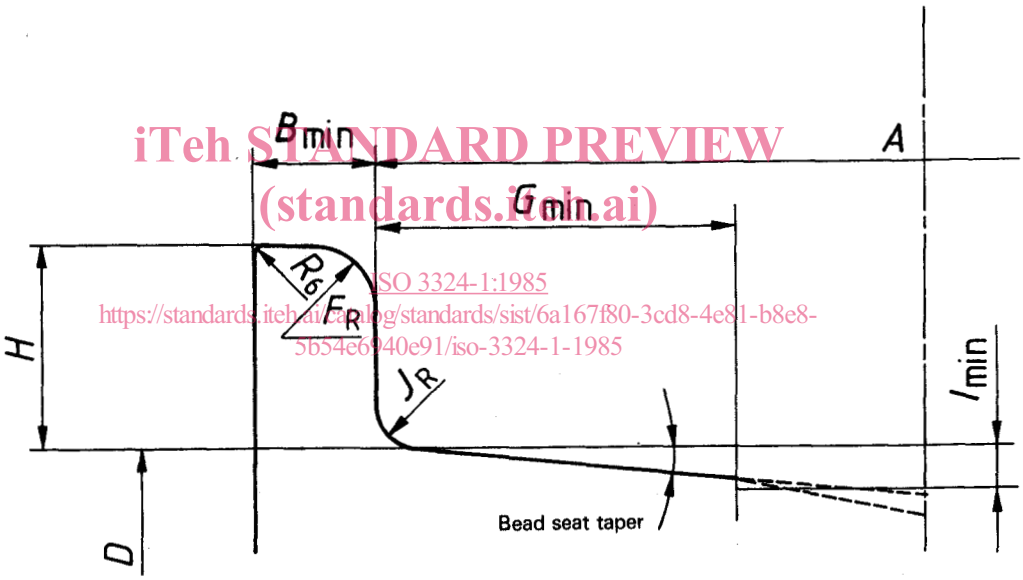
I_{min} = well depth (minimum)

F_R = flange radius

J_R = heel radius

R_6 = flange edge radius

D = specified rim diameter



I_{min} shall be included between the points where the bead seat taper surfaces intersect a horizontal line located at I_{min} below the specified bead seat diameter (D).

Bead seat	Well depth (minimum)
5°	$I_{min} = 0{,}087\,5\,(G_{min} - J_R) + 0{,}005\,D + 0{,}002\,5$
15°	$I_{min} = 0{,}268\,0\,(G_{min} - J_R) + 0{,}005\,D + 0{,}002\,5$

Figure 7 — Contour of bead seat area

14.2 Dimensions in millimetres

Wheel details	Rim width to section width ratio			
	50 % to 60 %	60 % to 70 %		70 % and over
Rim prefix letter	"C" prefix	"B" prefix	"H" prefix	No prefix
Bead ledge taper	15°	15°	5°	5°
Nominal rim diameter	1" increments, diameter to end in .5" (Example: 10.5; 12.5)	1" increments, diameter to end in .5" (Example: 10.5; 12.5)	1" increments, diameter to end in whole number (Example: 20; 21)	1" increments, diameter to end in whole number (Example: 15; 16)
Flange height (H)	Nominal section width < 255 : 12,7 mm > 255 : 20,3 mm	0,75 calculated flange height (see figure 5) Round to nearest 3 mm increment	0,85 calculated flange height (see figure 5) Round to nearest 1,0 mm for a flange height up to 25 mm, and to nearest 2,5 mm for a flange height 25 mm and above	See figure 5
Flange radius (F_R)	Nominal section width < 255 : 6,4 mm > 255 : 9,5 mm	0,667 flange height rounded down to nearest 3 mm increment	0,60 flange height rounded down to nearest 1,0 mm increment	0,50 of the flange height
Heel radius (J_R)	Nominal section width < 255 : 6,4 mm > 255 : 7,0 mm	0,333 flange height rounded to nearest 1 mm increment	0,30 flange height rounded up to nearest 1,0 mm increment	To be equal to 0,25 of flange height for flanges < 30 mm in height and 0,225 of flange height for flanges > 30 mm in height. In all cases, round flange height to nearest 1 mm.
Minimum flange width (B_{min})	Nominal section width < 255 : 20,6 mm > 255 : 26,2 mm	1,3 flange radius to the nearest 1 mm	1,3 flange radius rounded to nearest 1,0 mm increment	1,3 flange radius rounded to the nearest 1 mm
Rim width between flanges Increments (A)	10 mm — up to 120 mm width between flanges 15 mm — 120 to 300 m width between flanges 25 mm — 300 mm and larger			
Flange edge radius (R_6)	1,5 mm min.			

14.3 Inch dimensions

Wheel details	Rim width to section width ratio			
	50 % to 60 %	60 % to 70 %		70 % and over
Rim prefix letter	"C" prefix	"B" prefix	"H" prefix	No prefix
Bead ledge taper	15°	15°	5°	5°
Nominal rim diameter	1" increments, diameter to end in .5" (Example: 10.5; 12.5)	1" increments, diameter to end in .5" (Example: 10.5; 12.5)	1" increments, diameter to end in whole number (Example: 20; 21)	1" increments, diameter to end in whole number (Example: 15; 16)
Flange height (H)	Nominal section width $\leq$ 10 in : 0.50 in $>$ 10 in : 0.80 in	0,75 calculated flange height (see figure 6) Round to nearest 0.125 in	0,85 calculated flange height (see figure 6) Round to nearest 0.05 in for flange heights up to 1 in, and to nearest 0.10 in for flange heights of 1 in and above	See figure 6
Flange radius (F_R)	Nominal section width $\leq$ 10 in : 0.25 in $>$ 10 in : 0.375 in	0,667 flange height rounded down to nearest 0.125 in	0,60 flange height rounded down to nearest 0.05 in	0,50 flange height
Heel radius (J_R)	Nominal section width $\leq$ 10 in : 0.25 in $>$ 10 in : 0.275 in	0,333 flange height rounded to nearest 0.031 in	0,30 flange height rounded up to nearest 0.05 in	0,25 of flange height for flanges $\leq$ 1.25 in height and 0,225 of flange height for flanges $>$ 1.25 in height. In all cases round flange height to nearest 0.031 in.
Minimum flange width (B_{min})	Nominal section width $\leq$ 10 in : 0.81 in $>$ 10 in : 1.03 in	1,3 flange radius rounded to nearest 0.31 in	1,3 flange radius rounded to nearest 0.05 in	1,3 flange radius to the nearest 0.031 in
Rim width between flanges Increments (A)	0.25 in — up to 4.75 in width between flanges 0.50 in — 5 to 11.50 in width between flanges 1 in — 12 in width between flanges and over			
Flange edge radius (R_6)	0,062 in min.			