BRITISH STANDARD AEROSPACE SERIES

BS 2M 47:1990

(Superseding BS M 47)

Specification for

Retreading of cross ply tyres for aircraft

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Aerospace Standards Policy Committee (ACE/-) to Technical Committee ACE/59, upon which the following bodies were represented:

British Airways
British Rubber Manufacturers' Association
Civil Aviation Authority (Airworthiness Division)
Ministry of Defence
Retread Manufacturers' Association
Society of British Aerospace Companies Ltd.

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Contents

Foreword

This British Standard has been prepared under the direction of the Aerospace Standards Policy Committee and is a revision of BS M 47:1975, which is withdrawn.

In this revision account has been taken of modern tyre testing criteria and retread progression requirements have been included. Also included are more specific details on casing repair, acceptance limits and the provision of an alternative retread date marking code. This British Standard is based on the minimum qualification, acceptance and marking requirements for retreaded cross ply tyres for use on aircraft operated under the jurisdiction of the UK Civil Aviation Authority. This British Standard is generally aligned with European and USA practice.

The approving authority referred to in this British Standard is the Airworthiness Division of the Civil Aviation Authority.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies requirements for the retreading of cross ply aircraft tyres, including carcass rejection criteria and repair limits before processing. It also specifies type approval tests, quality assurance requirements and interchangeability limits to be met by the retreaded tyre after processing. Except where otherwise stated, these requirements apply to both tubed and tubeless tyres.

NOTE 1 The titles of the publications referred to in this standard are listed on the inside back cover.
NOTE 2 The latest revision of an Aerospace Series standard is indicated by a prefix number. The latest edition of the standard should be used.

2 Definitions

NOTE See Figure 1.

For the purposes of this British Standard, the definitions given in BS 3558 apply together with the following.

2.1
batch

a group of tyres of identical size, type and original manufacture that are retreaded in one production run

2.2
buffing

the preparation of the tyre surface before the application of new material

2.3
chine (deflector)

a specially profiled circumferential water-deflecting rib located on one or both side walls of the tyre at a predetermined distance below the tread edge

2.4
mould tread pattern depth

the nominal depth of the groove nearest the centreline of the mould

2.5
R level

the number of times that a carcass has been subjected to a retreading operation (e.g. third retread = R3)

2.6
retreading

a process of reconditioning a worn tyre by one of the following methods

a) **bead-to-bead remoulding**. A process in which material is removed as necessary and new material, extending from bead area to bead area, is applied.

b) **recapping**. A process in which material is removed from the worn tread and over the shoulders and new material is applied.

c) **top-capping**. A process in which the worn tread material only is renewed.

2.7
speed ratings

the maximum ground speed at which a tyre is designed to operate, as follows

a) **low speed tyre**. A tyre designed to operate at maximum ground speeds up to 120 miles/h (104 kn).

b) **high speed tyre**. A tyre designed to operate at maximum ground speeds above 120 miles/h (104 kn).

2.8
tread reinforcement

one or more layers of material fitted within or below the wearable part of the tread

2.9
tyre fitting lines

the circular moulded lines on the outside of the upper bead area to indicate concentricity of the tyre and wheel when fitting

2.10
vent holes

holes made in the tyre above the wheel rim area for relieving permeating and entrapped air within the carcass and/or between the tube and carcass of a tubed tyre

3 Retreading

3.1 Rejection criteria before processing

3.1.1 A tyre shall not be used for retreading if it displays any of the following features:

a) injuries to the bead or bead area;

NOTE Repairs may be made if the chafe-resistant material only is damaged or loose, or if damage does not extend into the plies of the tyre and if there is no sign of separation in the bead area.

b) bead injuries that affect the seal of the bead on tubeless tyres;

c) evidence of separation exceeding process specification limits between plies or around the bead wire;

d) injuries requiring reinforcement and all injuries requiring sectional repair;

e) kinked or broken bead wires;

f) weather cracking (ozone cracking) or radial cracks that penetrate body plies;

g) evidence of flex breaks;

h) loose, internally damaged or broken cords;

i) broken or cut cords in the outside sidewall or shoulder area;

j) evidence of blisters or heat damage to the bead seat where reversion, scorching or rubber flaking has occurred;

k) cracked, deteriorated or damaged inner liners that exceed the repair limits;

NOTE 1 Liner splice damage defects may be repaired if less than 250 mm in length.
NOTE 2 Other liner defects if less than 50 mm in length may be repaired provided that there are no more than 10 of them per tyre and no more than three in any quadrant.

l) flat spots and skid burns that have penetrated more than one carcass ply;

m) saturation with fuel, grease or oil to the point where tread adhesion or tyre integrity is adversely affected;

n) sidewalls that have been buffed and veneered more than three times;

o) punctures that penetrate through the cord body.

3.1.2 Defective balance patches shall be removed from all tyres accepted for retreading under **3.1.1** and each area of the carcass shall be inspected by non-destructive methods to ensure that it is suitable for retreading.

3.1.3 A tyre that has been run deflated (see note 1) or overloaded (see note 2) shall only be used for retreading at the discretion of the retreader after extensive non-destructive testing has shown the carcass to be acceptable.

NOTE 1 A tyre is considered to have been run deflated if it has been used at less than 90 % of minimum operating pressure.
NOTE 2 A tyre is considered to have been run overloaded if it is the companion to a deflated tyre on a common axle.

3.2 Preparation for processing

3.2.1 *Buffing*. The entire surface to be rerubbered shall be buffed, care being taken to avoid gouging or burning or loose rubber ends. The contour of the buffed area shall suit the tread profile and the tread mould to be used.

3.2.2 *Examination of carcass*. The carcass shall be examined after buffing to ensure that any injuries do not exceed the limits given in **3.3** or **3.4** as appropriate.

3.2.3 *Repair*. Before applying the tread rubber and/or reinforcing plies, any buffing damage and/or carcass injuries shall be repaired within the limits given in **3.3** or **3.4** as appropriate.

3.3 Repair limits for tyres operated above 120 miles/h

3.3.1 *Tread area*. Cuts, cracks or other tread area injuries that are 38 mm in length and 6 mm in width or less on the first cord body ply and that do not penetrate more than 40 % of the actual tyre cord body plies shall be repaired. Any tread injury repaired by skiving or rasping shall not have the final repair greater than 50 mm in length.

3.3.2 *Tread injuries*. Tread injuries shall be repaired if they penetrate a distance equal to 40 % of actual tyre cord body and if they are 38 mm in length or less on the first cord body, limited to six per tyre and not less than 60° apart along the tyre circumference. Maximum repairs shall be identified on the tyre.

3.3.3 *Sidewall rubber*. Surface defects of any degree, weather cracking (ozone cracking), radial and circumferential cracks, cuts and snags shall be repaired provided the injuries do not penetrate the cord body fabric plies.

3.3.4 *Bead area*. Minor injuries to the bead area shall be repaired provided the plies are not damaged.

3.3.5 *Bead seal*. The bead seal shall not be affected or intersected by impressions or depressions.

3.3.6 *Bead face and bead heel*. The bead face and bead heel areas shall be smooth.

3.3.7 *Bead toe*. The bead toe shall be trimmed so that no edges are exposed above the bead face and so that any bead toe flash remaining does not protrude more than 3 mm from the face contour of the bead. If trimming of the bead toe is necessary, the trimming shall not cut or expose the tyre cord material or more than one layer of chafer material.

3.3.8 *Chafer strip*. Minor injuries in the chafer strip and slight tyre tool injuries in the general bead area shall be repaired if they do not extend into the plies of the tyre and if there is no sign of separation in the bead area. Loose or blistered chafer strips shall be repaired or replaced.

3.3.9 *Inner liner*. Inner liner surface damage and defects other than liner splices that are less than 50 mm in length shall be repaired. A maximum of 10 of these repairs shall be acceptable with no more than three repairs in any quadrant. Liner splice damage defects shall be repaired if less than 250 mm in length.

3.3.10 *Exposed cord*. Exposed cord, either in the breaker or carcass ply, shall not exceed 1 % of the buffed total tread area on one spot or more than 2 % for the entire tyre. Exposed cord shall not exceed one carcass ply in depth.

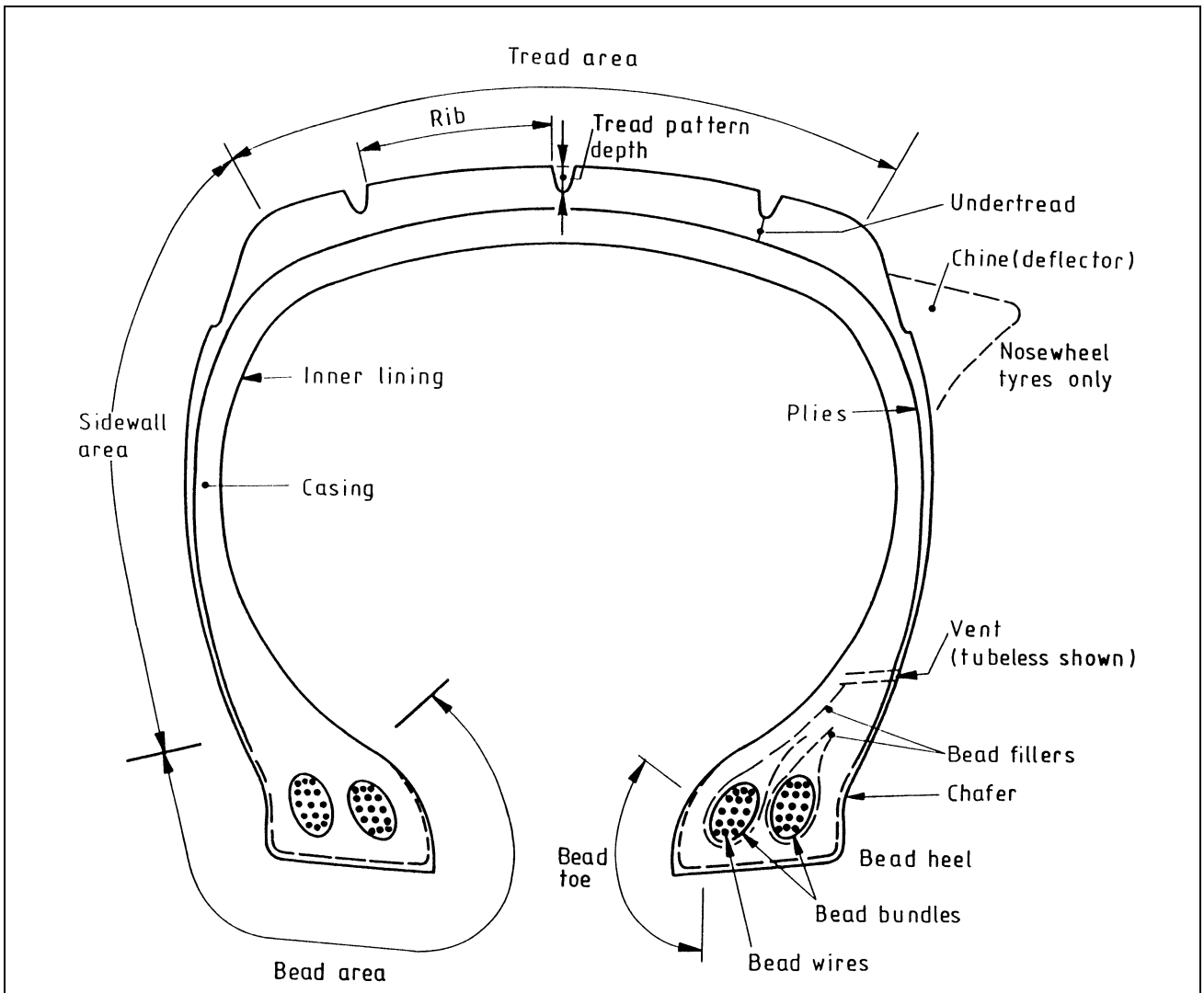

Figure 1 — Typical tyre section

3.4 Repair limits for tyres operated below 120 miles/h

3.4.1 *Bead injuries*. Repairs shall be made where only the chafe-resistant material is damaged or loose or where minor injuries do not penetrate more than 25 % of the tyre plies, up to a maximum of three damaged plies.

3.4.2 *Tread or sidewalls*. Injuries shall be repaired by the spot method. This shall include cuts in the tread area that are smaller than 12 mm in length and do not penetrate more than the number of plies given in Table 1 into the cord body.

Table 1 — Ply penetration repair limit

Number of plies	Maximum cut depth
< 8	0
8 to 16	2 plies
> 16	4 plies

3.5 Process

3.5.1 *Materials*. The materials used in the retreading process shall be chemically compatible with the materials used in the original manufacture of the tyre and shall enable the retreaded tyre to comply with clause **4**.

3.5.2 *Reventing*. The tyre shall be revented if the original vent holes are determined to be no longer operative or if the tyre has been subjected to bead-to-bead remoulding. The depth of venting shall be sufficient to penetrate at least the two outermost plies.

3.5.3 *Retreader's specification*. The retreading processes (recapping, top-capping or bead-to-bead remoulding) and curing shall be carried out in accordance with the individual retreader's specification.

4 Retreaded tyre

NOTE All dimensional and functional requirements of aircraft tyres are given in BS 2M 45-1.

4.1 Interchangeability

A retreaded tyre shall be interchangeable with the equivalent new tyre and shall comply with the following requirements:

a) the inflated dimensions, before or after dynamic testing (see **5.2.2**), shall not exceed the grown dimensions of a new tyre specified in BS M 45-1;

b) the mass shall not exceed the mass specified by the airline commissioning the retreading;

c) the maximum moment of static imbalance shall be as specified in **4.2.1**;

d) the speed and load rating shall not exceed that marked on the tyre sidewall;

e) the chine shall not be altered from the original profile.

4.2 Balancing

4.2.1 The tyre shall be balanced. The maximum moment of static imbalance of a tyre M shall be less than the value calculated from the empirical equation:

$$M = (3.87 \times 10^{-5})\, D^2$$

where

D is the maximum outside diameter (in mm).

NOTE Certain aircraft applications may require a lower M value, and if they do this should be stated in the contract or order.

4.2.2 Residual out of balance shall be corrected by applying a balance patch to the inside of the tyre in the crown area, or by another approved method. The balance patch shall be such that it will not chafe the inner tube, if fitted.

4.2.3 Any balance patch or other materials added to the inside of the tyre shall be securely attached to withstand service operation but shall be fixed such that removal before reprocessing shall not damage the inside surface of the tyre.

5 Type test

5.1 Test requirements

5.1.1 The type tests given in **5.2** shall be conducted at each manufacturing plant on the following occasions:

a) whenever the manufacture of a new size of retread is undertaken;

b) before initial fit of a retread to a different aircraft application of equal load rating to that marked on the retread.

5.1.2 Type testing shall be conducted on first life (R1) retreaded tyres manufactured from carcasses that have been previously approved by the approving authority (see foreword) for each aircraft type to which it is intended to fit the retread.

5.1.3 Carcasses used to manufacture R1 retreads for type testing shall have been worn to a minimum of 80 % in service, and shall have representative maximum damage repairs (see **3.3** or **3.4**) naturally or artificially induced.

NOTE 1 Initially, the retreader should successfully type test a retread carried out on a worn first life carcass approved by the approving authority and produced by a specific new tyre manufacturing plant. Approval may then be given for retreads of the same designation and for the same aircraft type produced from approved carcasses from other new tyre manufacturing plants provided that it can be demonstrated that the type test result is equally applicable to such retreads.

NOTE 2 When retreading a tyre of the same size designation for a lesser performance or load rating, an additional type test is not required.

5.2 Performance

5.2.1 *Static tests*

NOTE For these tests two tyres should be used, one tyre for the tests in **5.2.1.1** and **5.2.1.2**, and the other for the tests in **5.2.1.3** and **5.2.1.4**. It is however permissible to use one tyre for all tests, in which case the order of testing should be **5.2.1.1**, **5.2.1.3**, **5.2.1.2** and **5.2.1.4**.

5.2.1.1 *Dimensional test*. When tested in accordance with BS M 45-2 the tyre dimensions shall comply with BS M 45-1.

5.2.1.2 *Adhesion test*. When tested in accordance with BS 903-A12 the bond strength between the old rubber and the new rubber shall be not less than the minimum value specified in the retread manufacturer's specification.

5.2.1.3 *Air retention test (tubeless tyres)*. When tested in accordance with BS M 45-2 the pressure drop in tubeless tyres shall not exceed 5 % of the rated inflation pressure in a period of 24 h.

5.2.1.4 *Burst test (carcass strength)*. When tested in accordance with BS M 45-2 the tyre shall be capable of withstanding without failure a pressure of at least three times the maximum rated inflation pressure for at least 3 s.

NOTE Burst pressure testing of tubeless tyres may be conducted with an inner tube fitted.

5.2.2 *Dynamic tests*. When tested in accordance with BS M 45-2 the tyre shall remain in sound condition except for normal expected tread wear.

NOTE After overload testing in accordance with **8.5** of BS 2M 45-2 the tyre tread does not need to be in good condition.

5.2.3 *Growth allowance.* On completion of dynamic testing (see **5.2.2**) allow the tyre to cool to ambient temperature. Adjust the pressure to the rated inflation pressure and remeasure the dimensions stated in **5.2.1.1**. Calculate the tyre growth, which shall not exceed the allowances given in BS M 45-1 for new tyres.

5.3 Type test report

On completion of each type test the report given in Appendix A shall be forwarded to the approving authority (see foreword).

5.4 Type approval

After type approval has been granted, the individual retreader's specification shall not be changed without the agreement of the approving authority.

6 R level proof (establishment)

6.1 General

To establish the airworthiness of carcasses used in the manufacture of retreaded tyres, each retread manufacturer shall proceed in accordance with **6.2** to **6.4** and, if applicable, **6.5**. This procedure shall be followed for each proposed increase in R level.

6.2 Sample

Select 20 in-service tyres at the highest retread level in use distributed among tyre brands, sizes and operators. If the distribution is biased, it shall be in favour of higher load, high speed tyres.

6.3 Assessment of R level (establishment)

Assess the tyre sample in accordance with Table 2 to determine the R level.

6.4 R level proof test

6.4.1 *Retreading.* Retread the tyre sample in accordance with clause **3**.

6.4.2 *Proof test.* Subject the retreaded sample to the proof test given in Appendix B.

6.5 Retesting

If any tyre fails to comply with the appropriate requirements when tested in accordance with Appendix B, a second sample of 20 tyres, selected and assessed in accordance with **6.2** and **6.3**, shall be retested in accordance with **6.4**. If any second sample tyre fails to comply with the appropriate requirements, the tyres are below the minimum standards of airworthiness and shall be rejected.

NOTE 1 A retreader who before publication of this British Standard was retreading aircraft tyres of many sizes to, for example, R7 or higher, may meet the requirements for retreading all tyres up to R7 by testing 5 R4 tyres, 10 R6 tyres and 5 R7 tyres. This 20 tyre sample would be distributed among tyre brands, sizes and operators. If later the retreader wanted to qualify for retreading at R9, he would need to test 5 additional R7 tyres and 5 R9 tyres.

NOTE 2 Subsequent to the publication of this British Standard, retreaders may qualify tyres of new design or new size by carrying out the type test described in clause **5** and the R level proof test described in clause **6** on one tyre for level R1. For subsequent increases in R levels it would be necessary to carry out R level proof tests, as tyres of increasing R level become available, on the following basis:

a) for R2, two tyres;

b) for R3, three tyres;

c) for R4 and above, one tyre at each R level.

Tyres retreaded at each R level may be put into service without test, but a tyre may not progress to the next R level until the adhesion tests on the number of tyres of the previous R level have been carried out and the requirements have been complied with. Any tyre with defects that do not affect adhesion may be used for the adhesion proof test.

7 Quality assurance

7.1 Quality control

Each retread manufacturer shall operate a system of quality control for each material and process used that is acceptable to the approving authority (see foreword).

7.2 Individual tyre quality checks

7.2.1 Each tyre shall comply with the following requirements:

a) the residual imbalance shall not exceed the limits given in **4.1** c);

b) the mass shall not exceed the limits given in **4.1** b);

c) marking shall be in accordance with clause **8**.

7.2.2 Failure to comply with **7.2.1** shall result in the rejection of the tyre.

7.3 Tyre batch quality checks

7.3.1 One sample tyre from each production batch shall comply with the following requirements:

a) the dimensions shall not exceed the limits given in **4.1** a);

b) the air retention (tubeless tyres) shall be not less than the limits given in **5.2.1.3**.

7.3.2 Failure to comply with **7.3.1** shall result in the rejection of the sample tyre, and all remaining tyres in the batch shall be checked in accordance with **7.3.1**.

Any further failure shall result in the rejection of the batch.

7.4 Rubber adhesion and carcass strength

7.4.1 If additional tests of rubber adhesion and carcass strength are required by the purchaser, this shall be stated in the purchaser's enquiry and/or order.

7.4.2 Sample tyres that undergo the additional tests referred to in **7.4.1** shall comply with the limits given in **5.2.1.2** and **5.2.1.4**.

Table 2 — R level proof

		R level (establishment)											
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
Minimum number of tyres required at each R level	R1	20	15										
	R2		5	15									
	R3			5	15	5	5						
	R4				5	10		5					
	R5					5	10		5				
	R6						5	10	10	5			
	R7							5		10	5	5	5
	R8								5		10		
	R9									5		10	10
	R10										5		
	R11											5	
	R12												5
	Total	20	20	20	20	20	20	20	20	20	20	20	20

NOTE Read down in any column to find the number of tyres at each R level for approval. The proportion of the sample below each R level should not exceed the proportion of retreader's production at that R level.
Example. A retreader who has met all the requirements for retreading to R3 should have tested a minimum of 15 R2 tyres and 5 R3 tyres. In order to qualify for retreading at the R4 level, the retreader should test 10 additional R3 tyres and 5 R4 tyres. To go to R5, the retreader should test 5 additional R4 tyres and 5 R5 tyres.

7.4.3 Failure to comply with **7.4.2** shall result in the rejection of all tyres represented by the sample.

7.5 Certificate of conformity

The retread manufacturer shall issue a certificate of conformity for each tyre.

8 Marking

8.1 General

All markings shall be such that they shall be clearly legible throughout the tread life of the tyre. All previous retread stage markings shall be removed.

8.2 Recap and top-cap operations only

After processing, the tyre shall bear the following markings in characters not less than 8 mm high on the side bearing the carcass serial number.

a) the name of the retreader and the country in which the tyre was retreaded;

b) the R level, e.g. R1, followed by the date of retreading[1)];

c) the speed rating (miles/h or kn) in accordance with BS M 45-1 (see also **8.4**);

d) the mould tread pattern depth;

e) the tread identification code, which consists of the letter F followed by the number of reinforcing plies and a capital letter indicating the modification state of the tread, e.g. F2A.

8.3 Bead-to-bead remould

In addition to the markings specified in **8.2** the following markings shall be included on the sidewall or on the tread edge:

a) the size designation;

b) the ply rating and/or load rating;

c) the original manufacturer's part number;

d) the name of the original manufacturer;

e) the date of original manufacture[1)];

f) the original manufacturer's serial number [to immediately follow e)];

g) the word "TUBELESS" in capital letters, if applicable;

h) the certifying authority's approved markings, if applicable.

[1)] The date of manufacture and retreading should be indicated such that the first digit represents the last figure of the year, followed by a further three digits indicating the number of days into that year (commonly known as the "Julian" system). Alternative systems in which the first two digits represent the month and the second two digits represent the year, or in which the first digit represents the year and the second and third digits represent the week, are acceptable.

8.4 Speed rating

Where the speed rating of the tyre after recapping or top-capping differs from that of the tyre before processing, the original speed rating shall be buffed off the sidewall.

8.5 Additional markings

8.5.1 *Vent holes*. Vent holes shall be indicated with a painted or dyed circular mark, not less than 6 mm in diameter, of a colour other than red.

8.5.2 *Balance markings*. The light spot of the tyre shall be marked with a red triangle or dot painted or dyed on the sidewall above the bead on the same side as the serial number marking. Old balance markings shall be removed if not applicable.

Appendix A Type test report for a retreaded cross ply aircraft tyre

Retreader and plant location ..... Date .....

Retreader's specification reference number .....

Description*

Static tests	Requirements (see clause 5)	Type test result
Max. unbalance	..... N·m	..... N·m
(a) Dimensions and functions		
Outside diameter (max.)	..... mm	..... mm
Outside diameter (min.)	..... mm	
Overall width (max.)	..... mm	..... mm
Overall width (min.)	..... mm	
Shoulder diameter (max.)	..... mm	..... mm
Shoulder width (max.)	..... mm	..... mm
Mass (max.)	..... kg	..... kg
(b) Air retention (tubeless tyres)	..... %	..... %
(c) Adhesion strength	..... N/mm width	..... N/mm width
(d) Carcass strength and burst pressure	..... kPa	..... kPa

(e) Dynamic tests
(based on aircraft manufacturer's data)

Data reference .....

High speed tests Test report reference .....

No. of cycles .....

(f) Dimensional check of tyre after dynamic tests

	Requirements (see clause 5)	Type test result
Outside diameter (max.)	..... mm	..... mm
Outside diameter (min.)	..... mm	
Overall width (max.)	..... mm	..... mm
Overall width (min.)	..... mm	
Shoulder diameter (max.)	..... mm	..... mm
Shoulder width (max.)	..... mm	..... mm

(g) Report of tyre condition

*Record the information specified in **8.2** or **8.3** as appropriate.

Appendix B R level proof test

B.1 Background

B.1.1 The wide variation in tyre operating environments, which affects total carcass life and serviceability, makes it inadvisable to prescribe arbitrarily the maximum number of times that a tyre should be retreaded.

B.1.2 Studies have disclosed that due to the complexity of aircraft tyres, the separation propagation mechanism is critically influenced by the overall structural strength and structural uniformity of the carcass. Small separations in a weak carcass may propagate very quickly while the same separation in a very strong carcass may propagate very slowly and go through many R levels before it leads to a terminal failure. Accordingly, the number of times a tyre can be retreaded can only be controlled by a thorough inspection of the carcass using non-destructive inspection methods for each area of the carcass being inspected.

B.2 Procedure

B.2.1 *Visual inspection*

Inspect each tyre of the sample visually for compliance with **3.1** to **3.4**.

B.2.2 *Air needle inspection*

Subject each tyre to an air needle inspection of the casing to expose any ply separation or defects in the inner liner.

B.2.3 *Cross section examination*

Cut a cross section from each tyre in the sample and visually examine for ply or tread separation, voids or other defects that would render the tyre unsuitable for service.

B.2.4 *Tread adhesion test*

Cut or stamp three test specimens from the centre of the tread at equidistant (about 120° apart) places around each of the sample tyres. The specimens shall be tested for tread adhesion in accordance with BS 903-A12 or an equivalent test at the retread buff line. When the results from the three specimens from each tyre are averaged they shall be as follows.

a) For the tyre with the lowest adhesion value of the 20 tyres the adhesion shall be not less than 134 N.

b) For the tyre with the second lowest adhesion value of the 20 tyres the adhesion shall be not less than 148 N.

c) For the tyre with the third lowest adhesion value of the 20 tyres the adhesion shall be not less than 161 N.

d) For the tyre with the fourth lowest adhesion value of the 20 tyres the adhesion shall be not less than 175 N.

B.2.5 *Ply adhesion*

Specimens taken in accordance with **B.2.4** shall be tested for ply adhesion in accordance with BS 903-A12 or an equivalent test between the third and fourth body plies from the top. When the results from the three specimens from each tyre are averaged they shall be as follows.

a) For the tyre with the lowest adhesion value of the 20 tyres the adhesion shall be not less than 90 N.

b) For the tyre with the second lowest adhesion value of the 20 tyres the adhesion shall be not less than 103 N.

c) For the tyre with the third lowest adhesion value of the 20 tyres the adhesion shall be not less than 116 N.

d) For the tyre with the fourth lowest adhesion value of the 20 tyres the adhesion shall be not less than 130 N.

blank

Publications referred to

BS M 45, *Aircraft tyres and rims.*
BS M 45-1, *Specification for new tyres, retreads and rims.*
BS M 45-2, *Methods of test for tyres.*
BS 903, *Methods of testing vulcanized rubber.*
BS 903-A12, *Determination of the adhesion strength of vulcanized rubbers to fabrics (ply adhesion).*
BS 3558, *Glossary of rubber terms.*

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