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मानक

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IS 15780 (2007): Automotive tyres - Repair of tyres and tubes used on motor vehicles [TED 7: Automotive Tyres, Tubes and Rims]



“ज्ञान से एक नये भारत का निर्माण”

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“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
स्वचल वाहन — मोटर वाहनों में प्रयुक्त टायर
और ट्यूबों की मरम्मत

Indian Standard

**AUTOMOTIVE TYRES — REPAIR OF TYRES AND
TUBES USED ON MOTOR VEHICLES**

ICS 43.040.50; 43.180

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Tyres, Tubes and Rims Sectional Committee had been approved by the Transport Engineering Division Council.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant placed retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AUTOMOTIVE TYRES — REPAIR OF TYRES AND TUBES USED ON MOTOR VEHICLES

1 SCOPE

This standard specifies the minimum requirements for performance, inspection, marking and material strength of permanent repairs to pneumatic tyres and tubes used for road vehicles. Repairs to steel cord diagonal (cross) ply-commercial vehicle tyres are not included in the standard as this type of tyre is considered obsolete. The recommendations for repairs should be obtained from the manufacturer.

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
9081 : 2001	Automotive vehicles — Valves and valve accessories for pneumatic tyres — Specification (<i>third revision</i>)
15627 : 2005	Automotive vehicles — Pneumatic tyres for two- and three-wheeled motor vehicles — Specification
15633 : 2005	Automotive vehicles — Pneumatic tyres for passenger car vehicles — Diagonal and radial ply — Specification
15636 : 2005	Automotive vehicles — Pneumatic tyres for commercial vehicles — Diagonal and radial ply — Specification

3 TERMS AND DEFINITIONS

For the purpose of this standard, the following definitions shall apply.

3.1 Diagonal (Cross) Ply Tyre — Pneumatic tyre in which the ply cords extend to the beads and are laid at alternate angles substantially less than 90° to the center line of the tread (*see* Fig. 1 and 2).

3.1.1 Ply Rating — Index of tyre strength used to identify a given tyre with its recommended maximum permitted load when used for a given service as specified. It does not necessarily represent the actual number of plies in a tyre.

3.1.2 Radial Ply Tyre — Pneumatic tyre in which the ply cords extend to the beads and are laid substantially at 90° to the centre line of the tread, the carcass being stabilized by an essentially inextensible circumferential belt (*see* Fig. 3 and 4).

3.2 Bead — Part of the tyre that is shaped to fit the rim. It has a core made up of one or several essentially inextensible strands with the end of the plies wrapped around the core.

3.2.1 Bead Heel — Part of the bead that fills the angle formed by the junction of the rim flange and bead seat.

3.2.2 Bead Toe — Innermost part of the bead opposite the heel.

3.3 Belt — Layer of material underneath the tread, laid substantially in the direction of the tread center line that restricts the carcass, in a circumferential direction.

3.4 Breaker (Diagonal Cross Ply Tyre) — Intermediate ply between carcass and tread (*see* Fig. 1 and 3).

3.5 Buffing — Preparation of the original tyre surface prior to the application of the unvulcanized material.

3.6 Carcass (Casing) — Rubber-bonded cord structure of a tyre to contain the inflation pressure.

3.7 Chafer — Material in the bead area to protect the carcass against the rim chafing.

3.8 Cord — Textile or non-textile strands (threads) used in various components of the tyre carcass, plies, belts, breakers etc.

3.9 Crown — Road contacting area lying between the shoulders of a tyre.

3.10 Inner Lining — Layer of rubber, from bead toe to bead toe, on the inside of the carcass. In tubeless tyres it has to have air-retaining properties.

3.11 Limited Run-Flat Tyre — Tyre or tyre/wheel assembly (suitably identified) which is fit for use in a deflated or semi-inflated condition following cuts or breaks in its structure.

3.12 Ply — Layer of rubber-coated parallel cords.

3.13 Protective Breaker (Radial Ply Tyre) — Additional stock of ply material embodied

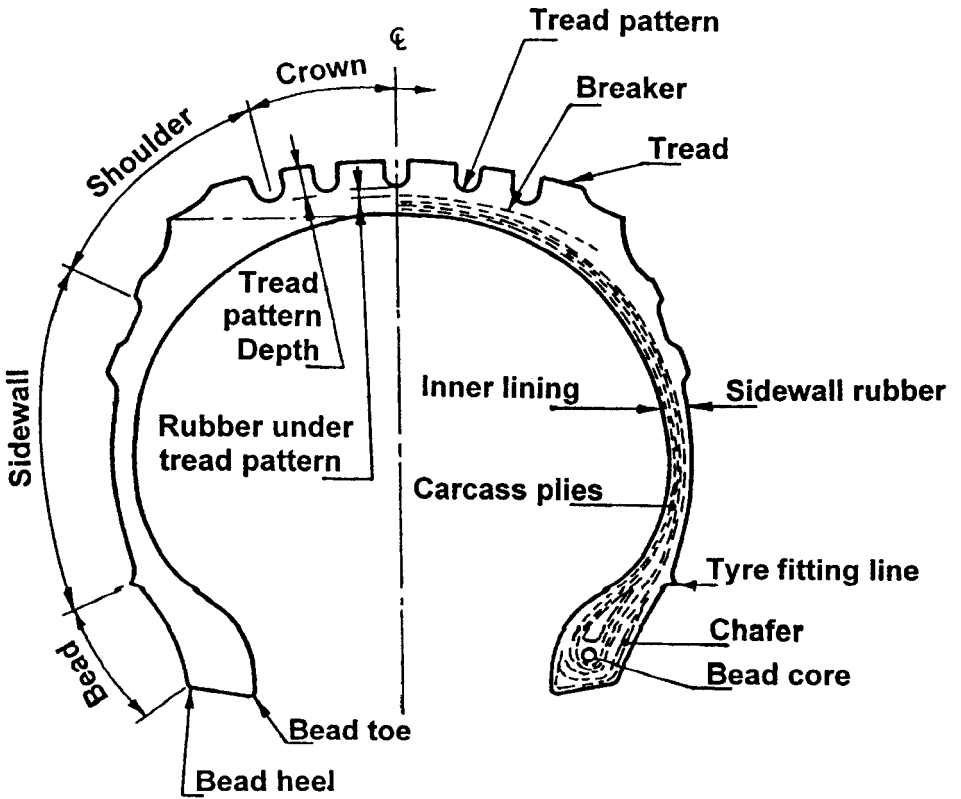


FIG. 1 TYPICAL SECTION OF DIAGONAL (CROSS) PLY CAR TYRE
(DIAGRAMMATIC REPRESENTATION ONLY)

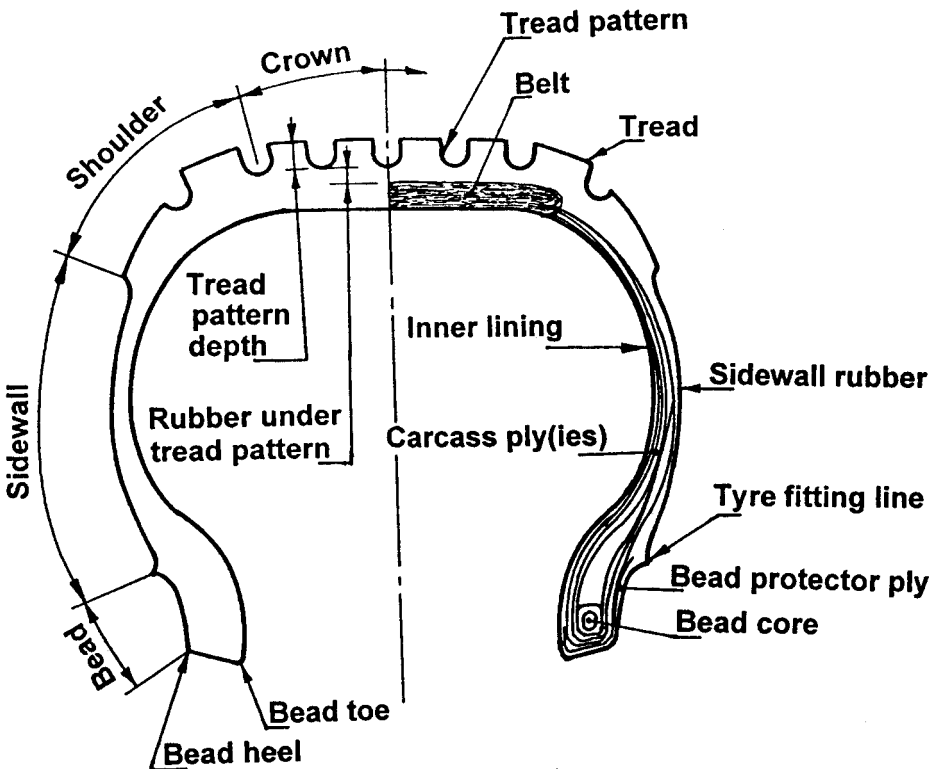


FIG. 2 TYPICAL SECTION OF DIAGONAL (CROSS) PLY COMMERCIAL VEHICLE TYRE
(DIAGRAMMATIC REPRESENTATION ONLY)

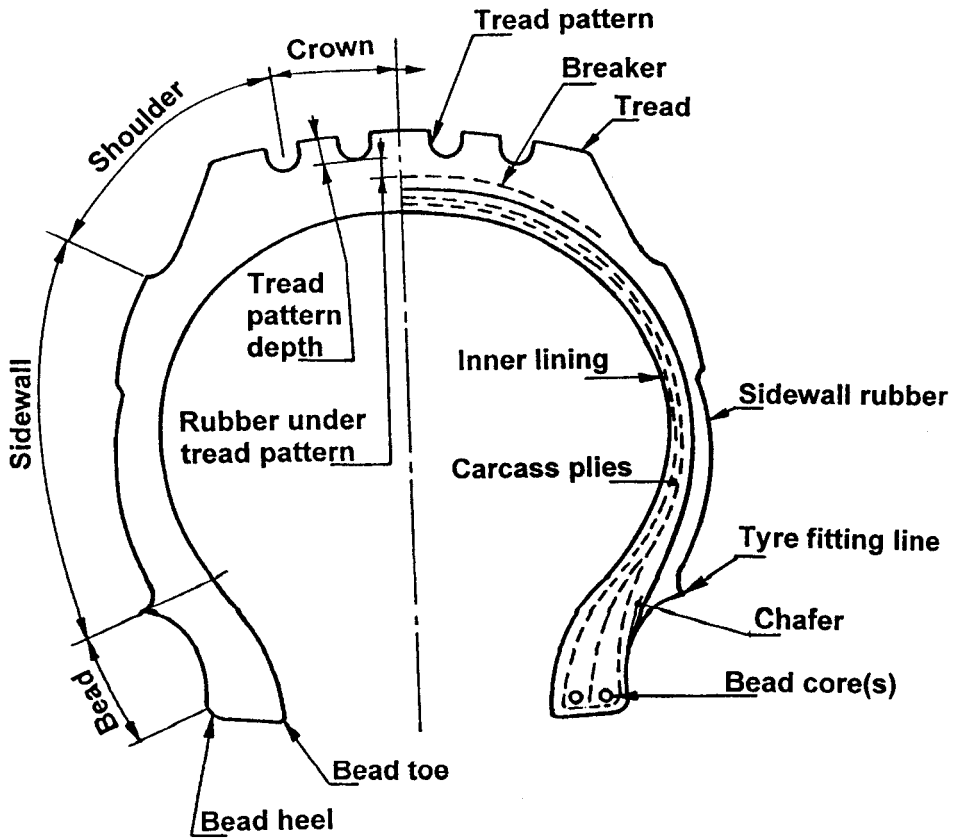


FIG. 3 TYPICAL SECTION OF RADIAL PLY CAR TYRE
(DIAGRAMMATIC REPRESENTATION ONLY)

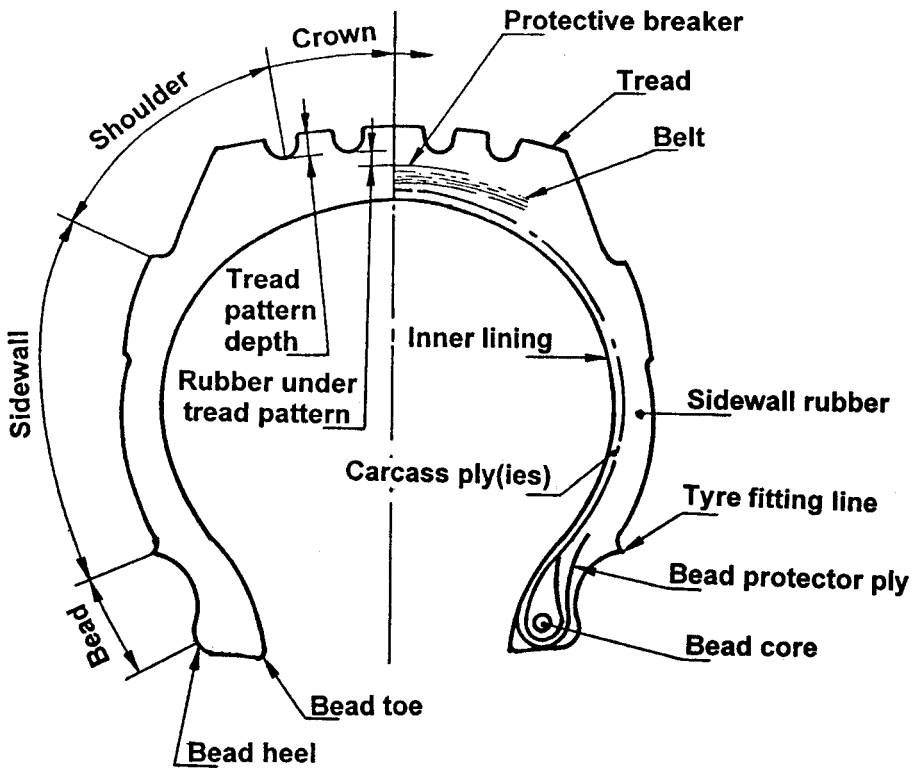


FIG. 4 TYPICAL SECTION OF RADIAL PLY COMMERCIAL VEHICLE TYRE
(DIAGRAMMATIC REPRESENTATION ONLY)

circumferentially within the pneumatic tyre between the tread and the belt to minimize damage to the belt.

3.14 Reinforced Patch — Patch that contains, in addition to rubber, other material, often in the form of cord to have extra strength.

3.15 Rubber — Macromolecular material that has, or can be given, properties of:

- a) returning rapidly at room temperature to the approximate shape from which it has been substantially distorted by a weak stress, and
- b) not being easily changed to any other permanent shape by the application of heat and moderate pressure.

3.16 Shoulder — Transitional area between the sidewall and the tread.

3.17 Sidewall — Part of a pneumatic tyre between the shoulder and the bead.

3.18 Sidewall Rubber — Rubber layer on the sidewall of the tyre and over the carcass which may include ornamental or protective ribs and fitting lines.

3.19 Tread — Part of a pneumatic tyre that normally comes in contact with the ground.

3.20 Tubeless Tyre — Pneumatic tyre designed for use without an inner tube.

3.21 Vulcanization (Cure) — The transformation of rubber from its plastic to elastic state by:

- a) application of heat and physical pressure for a given period of time, or
- b) room temperature minimum 15°C over an extended period of time (preferably with pressure).

4 INSPECTION BEFORE REPAIRING

4.1 The tyre (and tube if applicable) shall be removed from its associated wheel and thoroughly inspected for damage.

NOTE — There is no substitute for this operation. Guidance for rejection is given in Annex A.

4.2 The tyre construction shall be identified with reference to the definition given in 3.8 and with reference to ply materials (textile and/or steel).

4.3 Any existing repair shall be closely inspected. If its condition is found to be unsatisfactory, the repair shall be removed and the damage re-assessed to repair.

5 REPAIRING

5.1 All damage, within the repair limits recommended in Annexes A to J, that is assessed as detrimental to performance shall be repaired.

5.2 All repairs to penetrations through the tyre carcass shall include a suitable patch on the inside of the tyre.

5.3 During the application of a reinforced patch, the tyre carcass shall be in its 'relaxed' (not distorted) shape.

5.4 During the curing period, the tyre carcass shall be in its 'relaxed' (not distorted) shape.

5.5 After curing, rubber used to repair areas of tread should be repatterned to reproduce the basic grooves.

6 PERFORMANCE

Tyres, tubes and valves repaired in accordance with the requirements of this standard shall be capable of operation of the following speeds with the loads and inflation pressures:

- a) Car tyres shall be repaired such that they retain their original speed capabilities, for example 'S', 'H' or 'V' speed category rating (*see* IS 15633);
- b) Commercial vehicle tyres diagonal (cross and radial ply) shall be repaired such that they retain their original speed capabilities (*see* IS 15636);
- c) Motorcycle and scooter tyres shall be repaired such that they retain their original speed capabilities, for example 'S', 'H' or 'V' speed category rating (*see* IS 15627); and
- d) Tubes and valves shall be repaired such that they retain their original performance capabilities (*see* IS 9081).

NOTE — The limits of repairable damage such that repaired car tyres, commercial vehicle tyres, motor cycle tyres, scooter tyres, tubes and valves retain their original speed capabilities are given in Annexes C to H.

7 INSPECTION

On completion of repairs, the tyre or tube shall be thoroughly inspected to ensure that it is fully serviceable and complies with the requirements given in 6 (*see* Annex K).

8 MARKING

8.1 Reinforced repairs made in accordance with the requirements of this standard shall have a patch legibly and indelibly marked with the number of this standard and the repairer's name or identification mark.

8.2 In the case of a tubeless tyre that can only be repaired so as to be serviceable as a tubed tyre the repairer shall remove the word 'Tubeless' from the sidewalls of the tyre and shall tie a label to the tyre or tyre/wheel assembly bearing the following words:

'THE DAMAGE TO THIS TYRE DID NOT PERMIT US TO REPAIR IT TO THE TUBELESS SPECIFICATION. IT IS NOW SERVICEABLE AS A TUBED TYRE ONLY. A TUBE MUST BE FITTED.'

9 REPAIR MATERIALS

9.1 Repair materials showing externally shall be self-coloured black.

9.2 The manufacturer or the supplier of repair materials (including patches) shall be responsible for the following:

- a) Defining method(s) of application;
- b) Defining limits of damage for which the material are designed;
- c) Ensuring that reinforced patches for tyres, if correctly applied in completed carcass repairs, are capable of withstanding a pressure not less than the following:
 - 1) *Car tyres*: five times the highest inflation pressure, appropriate to the tyre size.
 - 2) *Commercial vehicle tyres*: three times the highest inflation pressure, appropriate to the tyre size.
 - 3) *Motor cycle and scooter tyres*: three times the highest inflation pressure, appropriate to the tyre size.

NOTE — The capability outlined in 9.2(c) necessitates special test facilities for the patch manufacturer or supplier. The tyre repairer should not attempt to carry out the test unless he is also a patch manufacturer.

- d) Ensuring that the repair material, if correctly applied in a completed tube repair essentially restores the strength of the tube.
- e) Ensuring that any repair material(s) are capable of flexing compatibly with the carcass or tube when these are used in normal service.
- f) Ensuring in the case of a patch designed for use in tubed tyres, that when correctly fitted it does not damage the tube.
- g) Ensuring the suitability of any other repair materials for the service intended.

9.3 The repairer shall be responsible for the correct application of the repair material using a compatible bonding system, which ensures that the repair material retains its position and the repair retains its strength when the tyre or tube is used in normal service.

NOTE — Attention is drawn to the process in which an extended curing time is recommended for vulcanization at room temperature.

10 SEALANTS

A liquid sealant introduced into tube or tubeless tyres to remake the air retention property shall in no way be considered to be a repair for the purposes of this standard.

ANNEX A

(Clauses 4.1, 5.1, and E-2.1)

GUIDANCE FOR REJECTION OF TYRES AND TUBES

A-1 GENERAL

Tyres, both tubed and tubeless, and tubes exhibiting any of the damage listed in this annex should be discarded as unsuitable for repair, except in those cases where the repairer is able to show that damage in excess of these limits can be repaired in a satisfactory manner and that the required minimum performance (*see* 6) can be achieved. Such exception would normally only apply to tyre manufacturers repairing their own tyres, because they have unique knowledge of their own product.

A-2 TYRES

Tyres with any of the following types of damage should be rejected as unsuitable for repair:

- a) Extensive rubber cracking extending through to the carcass;
- b) Penetrations or cuts, that after preparation, would be outside the recommended limits shown in Annexes C to G;
- c) Unsatisfactory previous repairs, outside the recommended limits shown in Annexes C to G;
- d) Carcass break-up;
- e) Damage caused by severe under inflation in service;
- f) Appreciable oil or chemical attack or aged (perished) rubber;
- g) Ply separation(s) exceptional looseness associated with the injury;

- h) Tyres where the tread wear is beyond the legal limit (these may be submitted for retreading);
- j) Tyres needing reinforced patches that would overlap;
- k) Damage to carcass cords due to excessive tread wear or sidewall scuffing, outside the limits recommended in Annexes C to G;
- m) Bead damage other than rubber or textile chafer damage as follows:
 - 1) *For passenger car, motorcycle and scooter tyres*: no damage is permitted;
 - 2) *For commercial vehicle diagonal (cross) ply tyres*: damage to more than three local areas, or to any are more than 25 mm long, or to any two areas less than 300 mm apart, or any damage penetrating more than 25 percent of the carcass plies in the area from the bead heel to the rim fitting line; and
 - 3) *Commercial vehicle radial ply tyres*: damage to the bead protector ply in more than five local areas, or to any area more than 60 mm long (circumferentially) or 30 mm long (radially), or to any two areas less than 100 mm apart, or to any areas where more than one carcass cord is damaged in the area from the bead heel to the rim fitting line.

NOTES

1 When the tyre is fitted and inflated to the pressure specified in IS 15627, IS 15633 and IS 15636, it is normal for such radial ply tyres to be repaired using reinforced patches having physical properties that restrict the height of the bulge to less than 4 mm.

2 Commercial vehicle radial ply tyres that contain damage to the belt plies outside the recommended limits shown in Annex F may be considered for a revised process that incorporates belt replacement.

A-3 TUBES

Tubes with any of the following types of damage should be rejected as unsuitable for repair:

- a) Pinched or worn thin;
- b) Dimpled at base;
- c) Damage by oil, chemical or solvent attack;
- d) Aged (perished) rubber;
- e) Splitting or leaking at the joint;
- f) Local stretching or creasing in service;
- g) Damage by heat, flap (tube base protector) or spoke heads;
- h) Damage outside the limits recommended in Annex H;
- j) Previous unsatisfactory repairs outside the limits recommended in Annex H;
- k) Where size markings are indeterminable by inspection, unless tyre/tube relationship is known; and
- m) Tubes requiring patches that would overlap.

NOTE — Damage to valve or valve base does not necessarily imply rejection of the tube for repair. Valves may be replaced.

ANNEX B

(Clauses 5.1)

REPAIR OF TYRES AND TUBES

B-1 PREPARATION OF TYRES FOR INTERNAL PATCHING

When repairing tyres for internal patching the following practices should be adopted:

- a) With the selected patch held in position internally, its outline should be marked on the inner lining.
- b) The inner lining around the damage should be buffed approximately 5 to 6 mm larger than

the marked area (to remove all dirt and 'aged' surface rubber and to allow for patch/cushion rubber flow during curing) producing a flat, fine matt finish. The following recommendations should also be observed:

- i) Care should be exercised to avoid 'burning' (oxidation) of the prepared face, which can be caused by the heat produced when excessive pressure is applied to rotating buffing tools.

- ii) Impervious air retention materials are often used for inner linings (particularly in tubeless tyres). If problems occur with patch adhesion, the impervious material in the defined area to be patched should be removed (taking care not to expose the carcass cords) in order to maximize patch adhesion.
- iii) Buffer liquids (solvents) may be used to clean the patch area. The area cleaned with solvents is not considered to be 'buffed'.
- c) Any raised ribbed patterns in the inner lining should be buffed flat over the patch seating area.

B-2 PREPARATION OF DAMAGE TO TYRES AND TUBES FOR REPAIR

B-2.1 Tyres

When preparing tyres for repair of damage following practices should be adopted:

- a) Surrounding all the damaged area of the injury should be removed by cutting (skiving) and buffing to produce a cavity as shown in Fig. 5, 6 and 7, taking care not to enlarge the damaged area more than necessary. With penetration damage between 3 mm and 6 mm diameter, only minimal straight through preparation (with a 'rat tail') need be carried out.
- b) The cavity and its periphery should be buffed

to a fine matt finish. This ensures the best adhesion of the surrounding rubber.

B-2.2 Tubes

When preparing tubes for repair the following practices should be adopted:

- a) Major tears should have the ends of the damage rounded to relieve localized stress points and thus avoid further extension (see Fig. 8)
- b) All repairs should have the surface area surrounding the damage prepared by light buffing to remove the oxidized surface film, care being taken to avoid further oxidation by 'burning' and extending the damage through heavy application of the buffing tool.

NOTE — See also B-1(b)(iii) concerning the use of 'buffer' liquids, which is equally applicable to the preparation of tubes for repair.

B-3 REPAIR BUILDING OF TYRES AND TUBES

To ensure complete repair consolidation and to obtain maximum patch adhesion properties, the following practices should be adopted:

- a) All repair preparation should be carried out with the carcass or tube dried to remove moisture from the damaged area and its surroundings.
- b) Care should be taken to maintain complete cleanliness of operations, such that all loose and extraneous materials, for example buffing

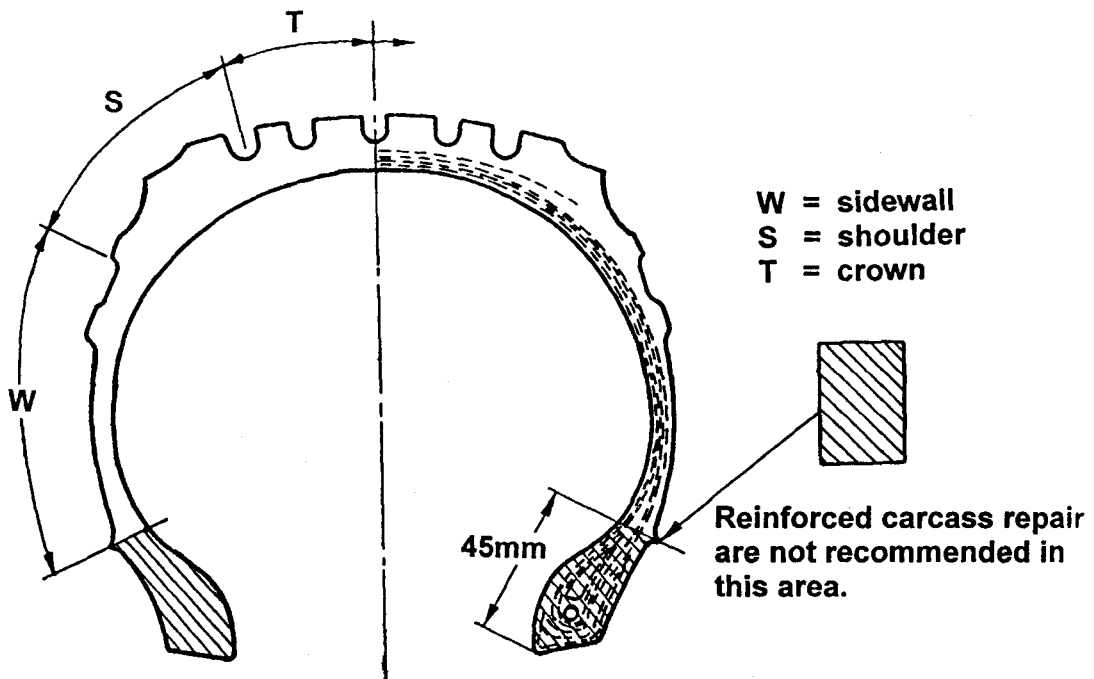
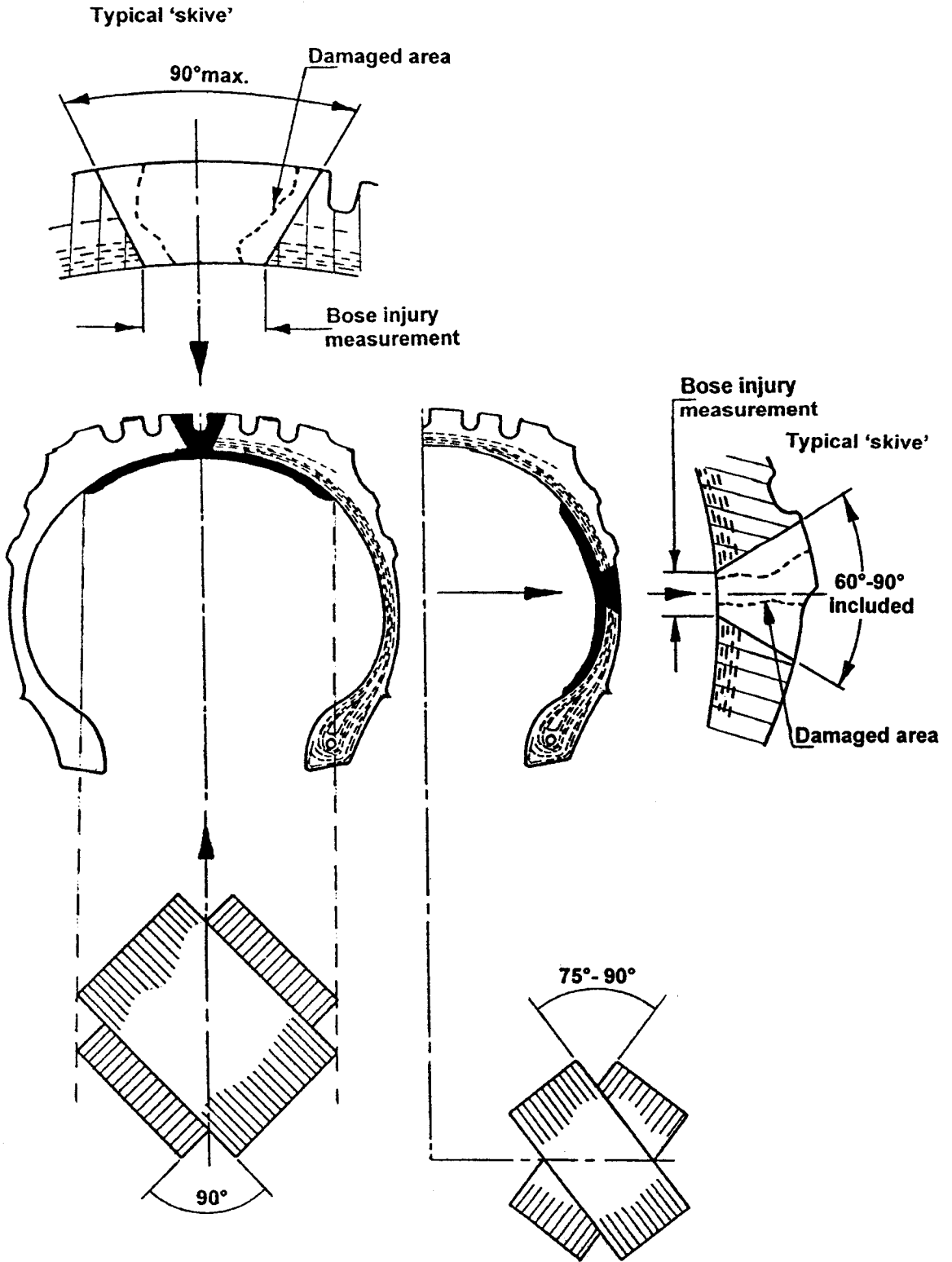


FIG. 5 TYPICAL PATCH APPLICATION FOR DIAGONAL (CROSS) PLY CAR TYRE



NOTE — The figures are digrammatic only. They are examples of ply construction and do not indicate the number of plies required for repair patch.

FIG. 6 TYPICAL PATCH APPLICATION FOR DIAGONAL (CROSS) PLY COMMERCIAL TEXTILE CORD TYRES

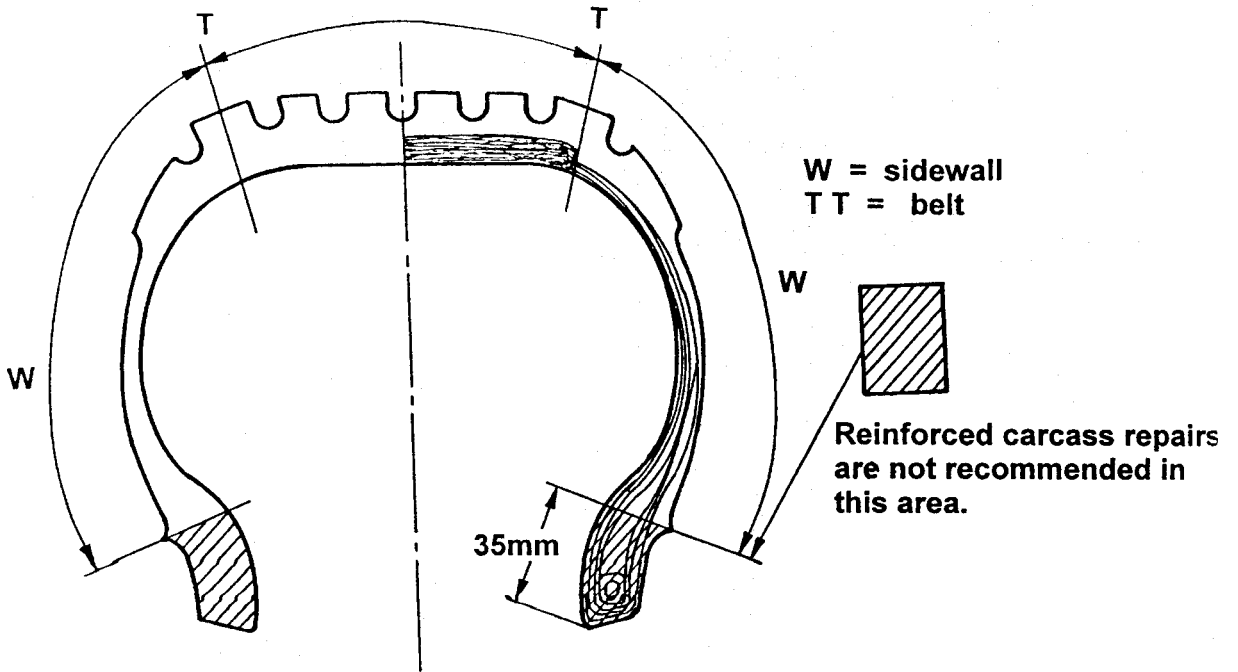


FIG. 7 TYPICAL PATCH APPLICATION FOR RADIAL PLY COMMERCIAL VEHICLE TYRES

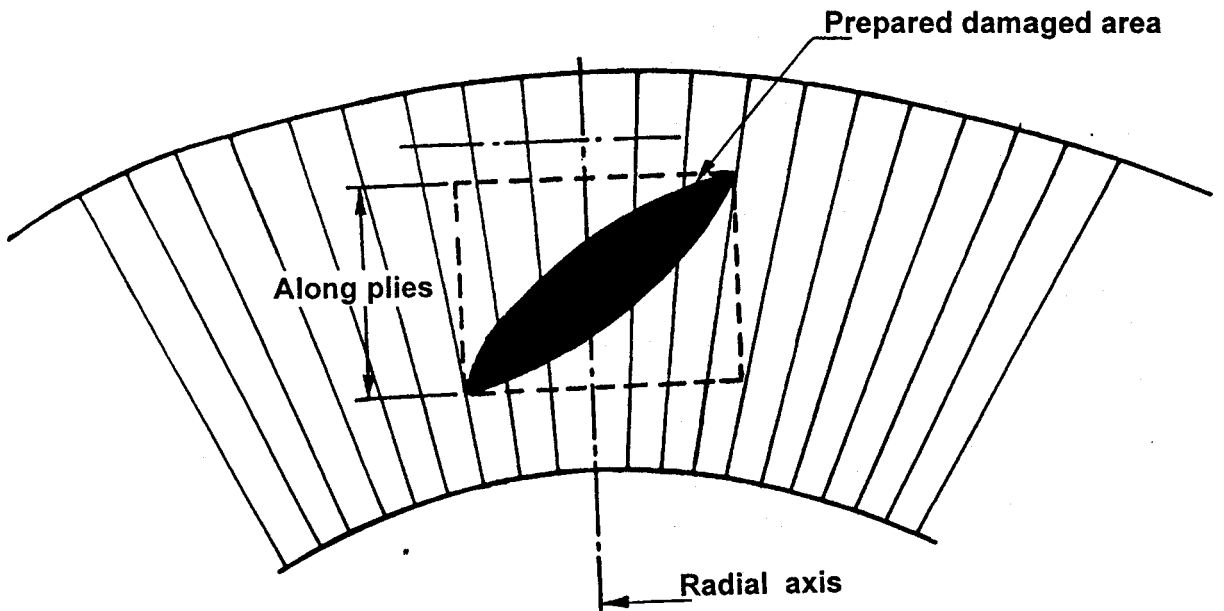


FIG. 8 TYPICAL SPLIT DAMAGE OF TUBES

dust, wire particles and fluffed cords are completely removed from prepared surfaces prior to solution and patch applications. The use of suction cleaner is recommended. Fibrous cloth dusters and contaminated air lines should be avoided.

- c) Patch application and cavity filling should be carried out whilst the tyre is in its normal 'relaxed' condition (without distortion). All cavities greater than 3 mm should be filled (with rubber).
- d) Moisture can cause unsatisfactory adhesion. Workshops should be so controlled as to avoid high humidity.

- e) Solution application should be carried out at a room temperature of 15° to 24°C (59° to 75°F) and with minimal dust in the atmosphere.

NOTE — The solution drying time recommended by the repair material manufacturer/supplier is applicable only under the conditions given in B-3(d) and B-3(e).

- f) Patch and rubber applications should be carried without trapping air.
- g) Repair filler rubber is normally built 1 mm or 2 mm proud of the surrounding tyre (this facilitates the reproduction of the original profile after cure).
- h) Where a mixture of solution(s) or compound(s) is used, compatibility should be ensured.

ANNEX C

(Clauses 5.1 and 6; and Annex A)

REPAIR OF DIAGONAL (CROSS) PLY CAR TYRES

C-1 REPAIR PATCH INFORMATION

C-1.1 Crown and Shoulder (see Fig. 5 and 9) — For penetrations up to 6 mm a rubber only repair may be used. For carcass damage over 6 mm a reinforced repair patch should be used.

C-1.2 Sidewall (see Fig. 5 and 9) — For penetrations up to 3 mm a rubber only repair may be used. For carcass damage over 3 mm a reinforced repair patch should be used.

C-2 LIMITS ON REPAIRS (see Table 1)

C-2.1 Reinforced Repairs — To avoid balance problems, only one reinforced repair is recommended in any one quarter of the tyre circumference.

C-2.2 Rubber Repairs — There is no limit to the number of rubber only repairs, provided that the rubber patches do not overlap.

Table 1 Injury Limitations — Diagonal (Cross) Ply Car Tyres

(Clause C-2)

Sl No.	Speed Category	Maximum Recommended Size of Damage Measured at Base of Injury			Maximum Recommended Number of Reinforced Repairs ¹⁾	Maximum Recommended Distance from Bead Toe to Damage Measured Internally
		Crown <i>T</i> mm	Shoulder <i>S</i> mm	Sidewall <i>W</i> mm		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Up to and including 'S' rating	15	6	6	2	45
ii)	Above 'S' rating	6	3	3	2	45

¹⁾ This includes any satisfactory existing repairs.

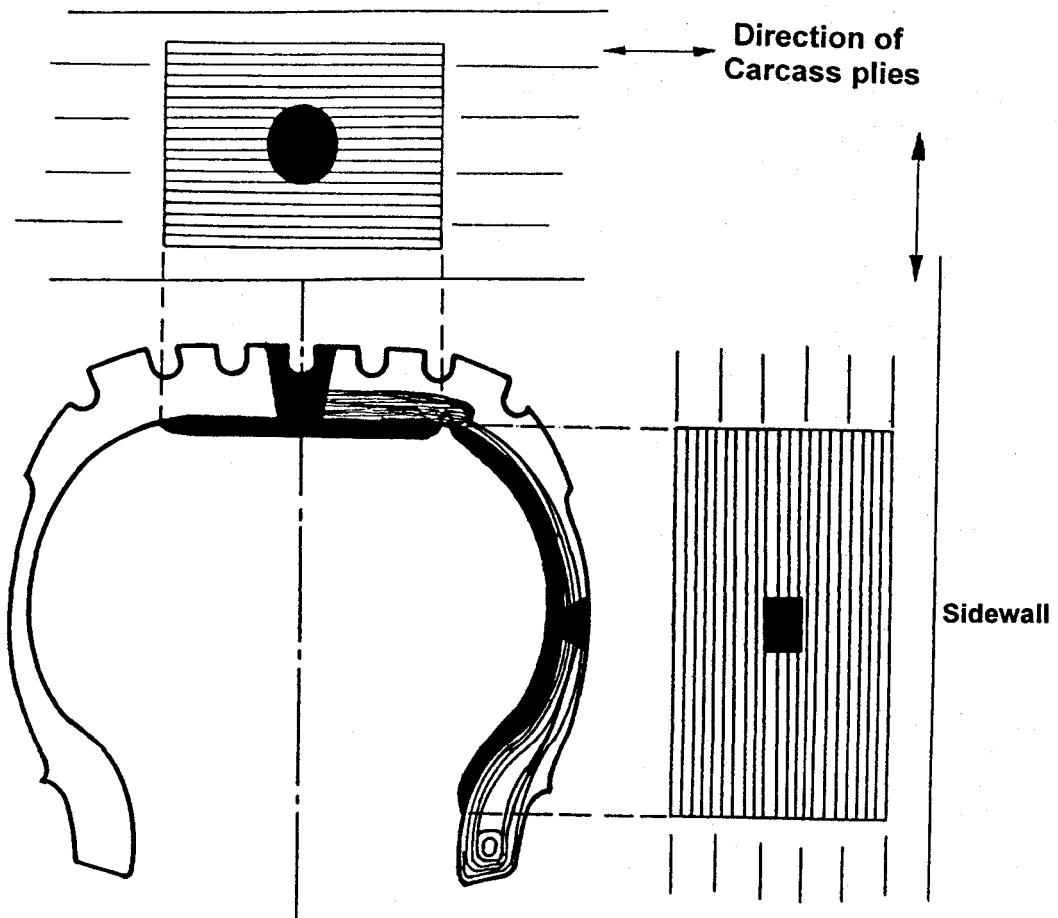


FIG. 9 RECOMMENDED REPAIRABLE AND NON-REPAIRABLE AREAS FOR DIAGONAL (CROSS) PLY CAR TYRES

ANNEX D

(Clauses 5.1 and 6; and Annex A)

REPAIR OF RADIAL PLY CAR TYRES

D-1 LIMITS ON REPAIRS (see Table 2)

D-1.1 Reinforced Repairs

To avoid balance problems, one reinforced repair is recommended in any one repair of the tyre circumference.

D-1.2 Rubber Repairs

There is no limit to the number of rubber only repairs, provided that the rubber patches not overlap, except for 'V' rating tyres.

D-2 PATCH APPLICATION (see Fig. 10)

D-2.1 Reinforced Patch

It is normal to use a patch with reinforcing cords

running in one direction only, and to apply it with the cords parallel to the carcass plies.

D-2.2 Belt (see Fig. 10 and 11)

The following types of patches should be used:

- 'V' rating tyres for penetration up to 3 mm;
- 'S' and 'H' rating tyres for penetration up to 6 mm; and
- 'S' rating tyres for carcass damage above 6 mm and up to the limits shown in Table 2.

While a diagonal (cross) ply type patch could be used in the belt area, it is not recommended because of the difficulty in locating the belt edges within which the patch should be confined and correctly aligned.

Table 2 Injury Limitations (Radial Ply Car Tyres)
(Clauses D-1 and D-2.2)

Sl No.	Speed Category	Maximum Recommended Size of Damage Measured at Base of Injury			Maximum Recommended Number of Reinforced Repairs ¹⁾	Minimum Recommended Distance from Bead Toe to Damage Measured Internally
		Belt <i>TT</i>	Sidewall, <i>W</i> (see Fig. 8)			
			Across plies mm	Along plies mm		
(1)	(2)	mm (3)	mm (4)	mm (5)	m (6)	mm (7)
i)	Up to and including 'S' rating	15	10	35	2	35
ii)	'H' rating	6	1 cord	35	2	35
iii)	'V' rating	3	Nil	Nil	Nil [see D 2.2(a)]	—

¹⁾ This includes any satisfactory existing repairs.

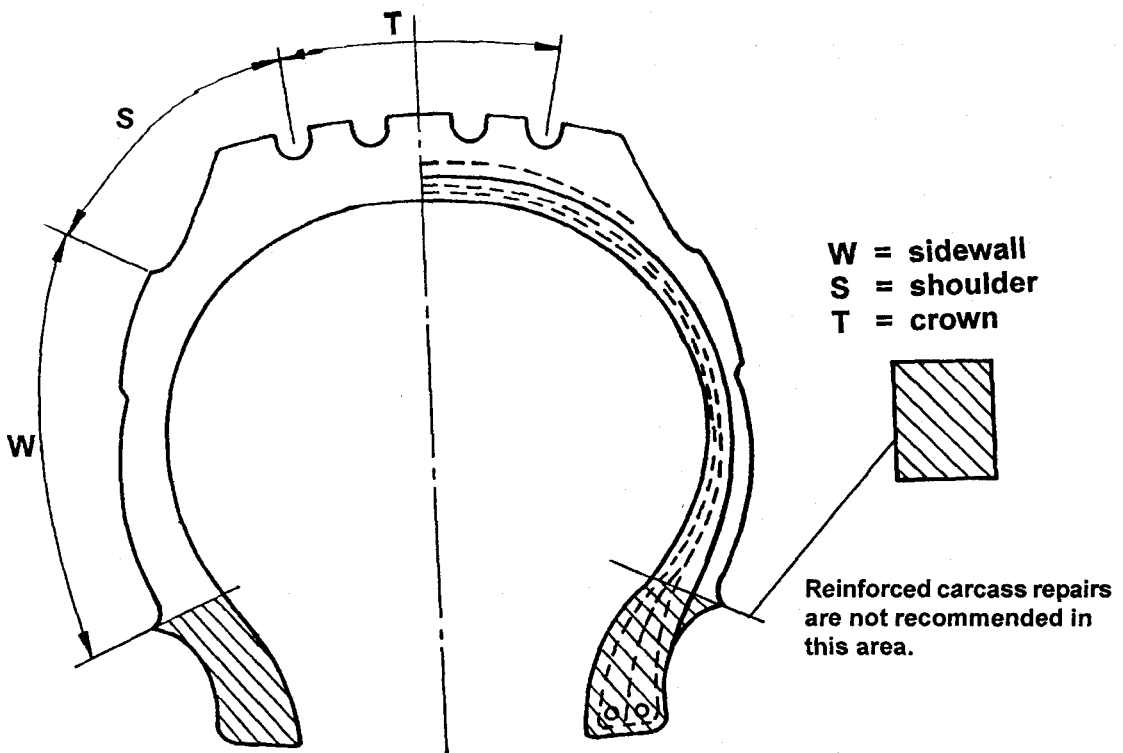


FIG. 10 TYPICAL PATCH APPLICATION FOR RADIAL PLY CAR TYRE

D-2.3 Repairs at Points 'T' (see Fig. 11)

Up to and including 'S' rating tyres, in the areas 15 mm either side of points 'T' (see Fig. 7), the recommended permissible repairable damage size should be less than 50 percent of the limits shown in Table 2.

D-2.4 Sidewall Area (see Fig. 10, 11 and 12)

For all sidewall area ply damage given in Table 2, a reinforced repair patch should be used.

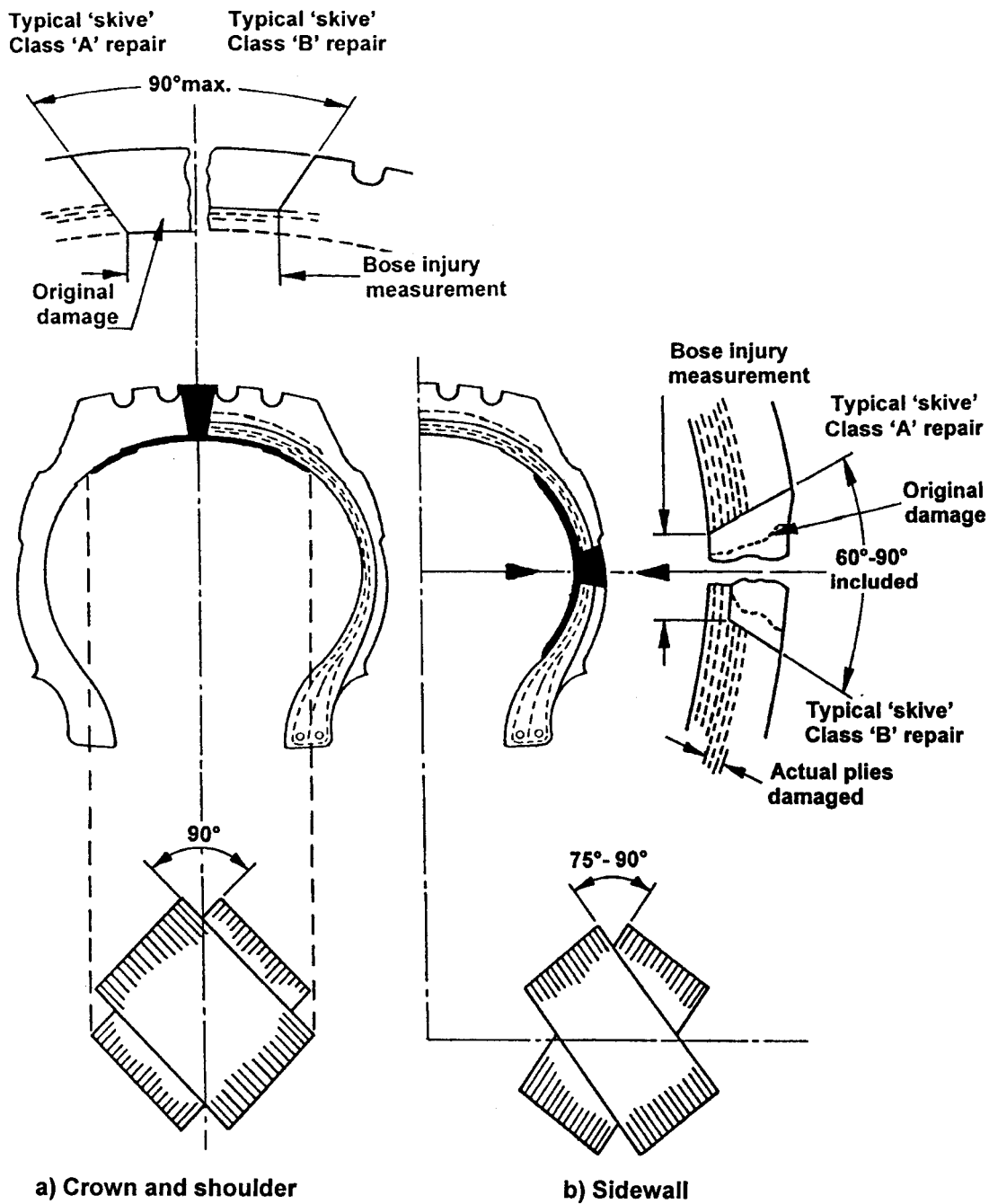


FIG. 11 RECOMMENDED REPAIRABLE AND NON-REPAIRABLE AREAS FOR RADIAL PLY CAR TYRES

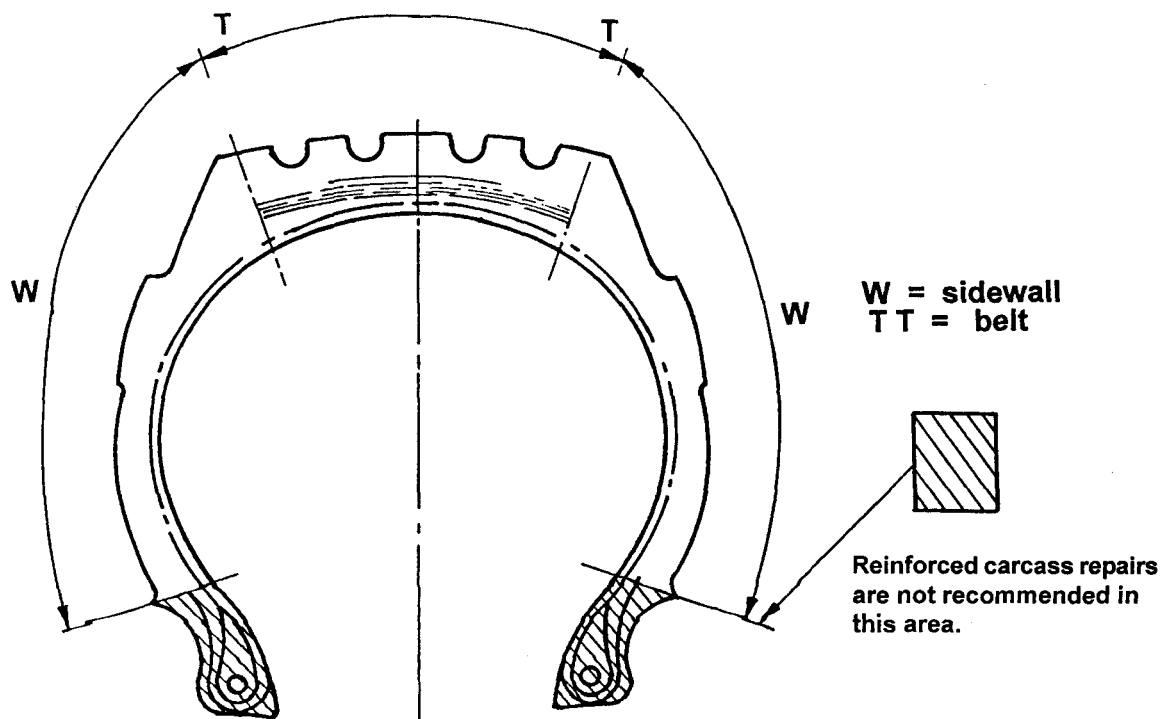


FIG. 12 TYPICAL SIDEWALL DAMAGE OF RADIAL PLY CAR TYRES

ANNEX E

(Clauses 5.1 and 6; and Annex A)

REPAIR OF DIAGONAL (CROSS) PLY COMMERCIAL VEHICLE TYRES

E-1 LIMITS ON REPAIRS (see Table 3)

E-1.1 General repair patches should not overlap.

E-1.2 Reinforced Repairs

The maximum recommended number of reinforced repairs (including any satisfactory existing repairs) is three per tyre, of which only one may be in the sidewall area (see Fig. 13).

E-1.3 Rubber Repairs

There is no limit to the number of rubber only repairs that is, Class C and minor penetration repairs.

E-2 REPAIR CLASSIFICATION (see Table 3 and Fig. 6)

The types of repair for classes of carcass ply damage and minor penetrations should be as given in E-2.1 to E-2.4.

E-2.1 Class C Repairs

Rubber only repair without size limitation, and any bead damage permitted in A-2(m).

E-2.2 Minor Penetration

Rubber only repair patch for damage up to 6 mm diameter.

E-2.3 Class B Repairs

Reinforced repair patch for carcass damage up to 50 percent greater in size than the recommended maxima shown in Table 3 for Class A repairs.

E-2.4 Class A Repairs

Reinforced repair patches should be used for carcass damage that exceeds the limitation of Class B repairs up to the maximum shown in the Table 3. For tyres of 8 ply rating and above, with an original speed capability

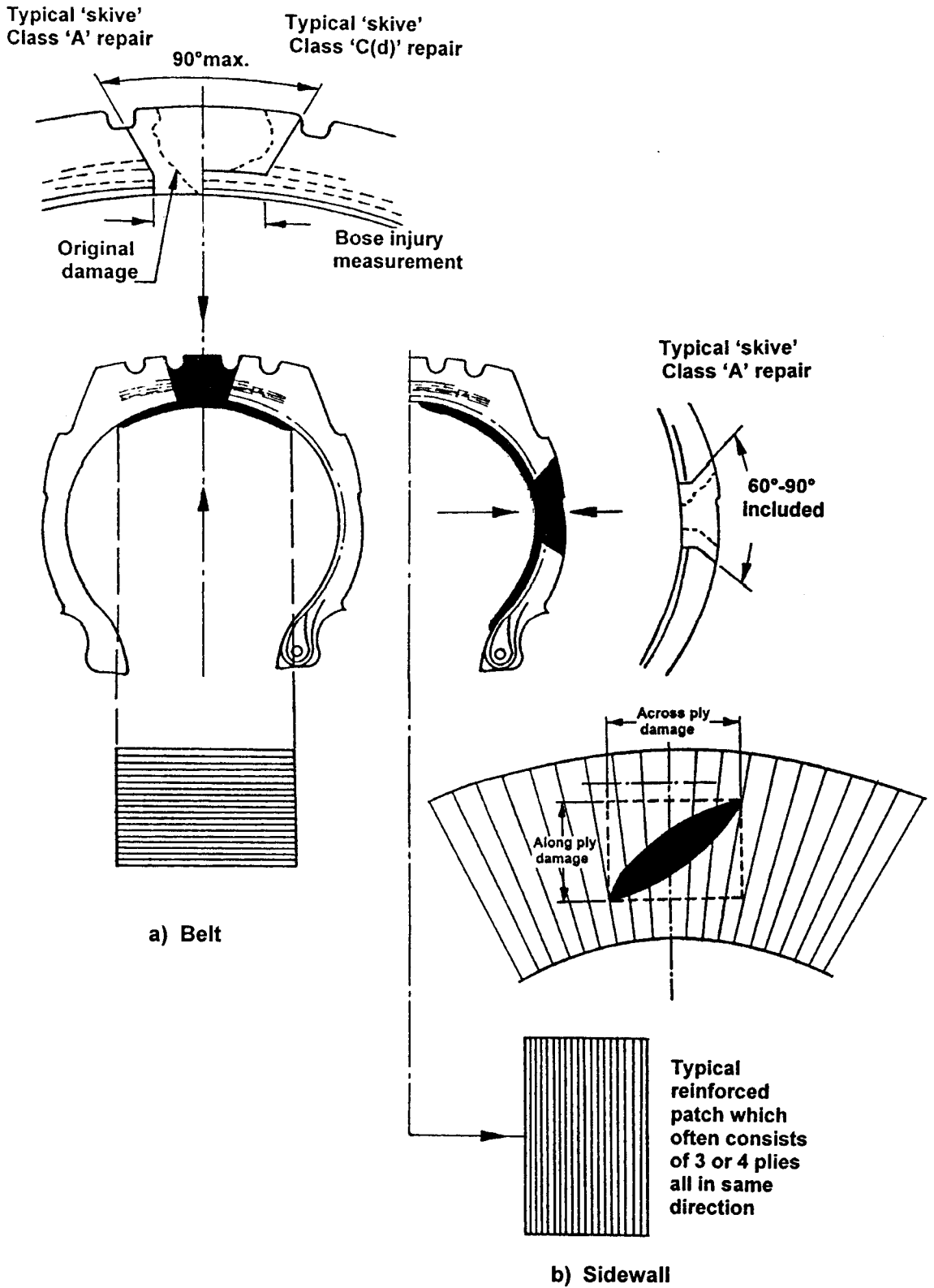


FIG.13 RECOMMENDED REPAIRABLE AND NON-REPAIRABLE AREAS FOR DIAGONAL (CROSS) PLY COMMERCIAL VEHICLE TEXTILE CORD TYRES

**Table 3 Injury Limitations Diagonal (Cross) Ply Commercial Vehicle
Textile Tyres (After Preparation)**
(Clauses E-1, E-2.3 and E-2.4)

Sl No.	Nominal Tyre Section Size/Size Code or Equivalent	Number of Carcass Plies Damaged for Repair of			Maximum Recommended Size of Damage Measured at Base of Injury (Class A Repair)		Minimum Recommended Distance from Bead Toe to Damage Measured Internally
		Class C	Class B	Class A	Crown and Shoulder, T and S	Sidewall, W	
(1)	(2)	(3)	(4)	(5)	mm (6)	mm (7)	mm (8)
i)	Up to and including 8.25 B	1	2 or 3	4 or more	35	20	90
ii)	9.00 C, 10, 10.00 D, 11	1 or 2	3 or 4	5 or more	45	25	110
iii)	11.00 E, 12 12.00 F	Up to 3	4 or 5	6 or more	55	30	130
iv)	13.00 and above	Up to 3	4 to 6	7 or more	65	35	150

greater than 100 km/h, it is recommended that no Class A repairs be carried out in the sidewalls and that the maximum permitted damage for shoulder Class A

repairs be limited to 50 percent of the maximum given in Table 3.

ANNEX F

(Clauses 5 and 6; and Annex A)

REPAIR OF RADIAL PLY COMMERCIAL VEHICLE TYRES

F-1 LIMITS ON REPAIRS

F-1.1 General

Repair patches should not overlap.

F-1.2 Reinforced Repairs

The maximum recommended number of reinforced repairs (including any satisfactory existing repairs) is shown in Table 4.

Table 4 Injury Limitations for Radial Ply Commercial Vehicle Tyres (After Preparation)
(Clause F-1.2)

Sl No.	Nominal Tyre Section Size/Size Code or Equivalent	Maximum Recommended Size of Damage Measured at Base of Injury (Class A Repair)			Maximum Recommended Number of Class A Repairs	Minimum Recommended Distance from Bead Toe to Damage Measured Internally
		Sidewall, W		Belt, TT		
		Across ply cords	Along ply cords	mm		
(1)	(2)	mm (3)	mm (4)	mm (5)	(6)	mm (7)
i)	Up to and including 7.00	20	100	25	2	60
ii)	Over 7.00, up to 10.00 (D) including 9,10,11 (tubeless)	or 10 25 or 20 or 10	120 90 120 140	40	3	65
iii)	11.00 (E), 12 (tubeless) and above	25 or 20 or 10	90 120 140	40	3	70

F-1.3 Rubber Repairs

There is no limit to the number of rubber only repairs that is, Class B, Class C and minor penetration repairs.

F-2 REPAIR CLASSIFICATION (see Table 4 and Fig. 7 and 14)

F-2.1 Class C Repairs

A surface rubber repair should be used for the following:

- Any rubber damage;
- Any bead damage as allowed in A-2(m);
- Damage up to 20 mm diameter in any belt ply except that belt ply which is adjacent to the carcass ply; and
- Damage up to 35 mm diameter when confined to the outermost belt ply only.

F-2.2 Minor Penetrations

Rubber only repair patch for damage up to 3 mm

diameter through the belt area.

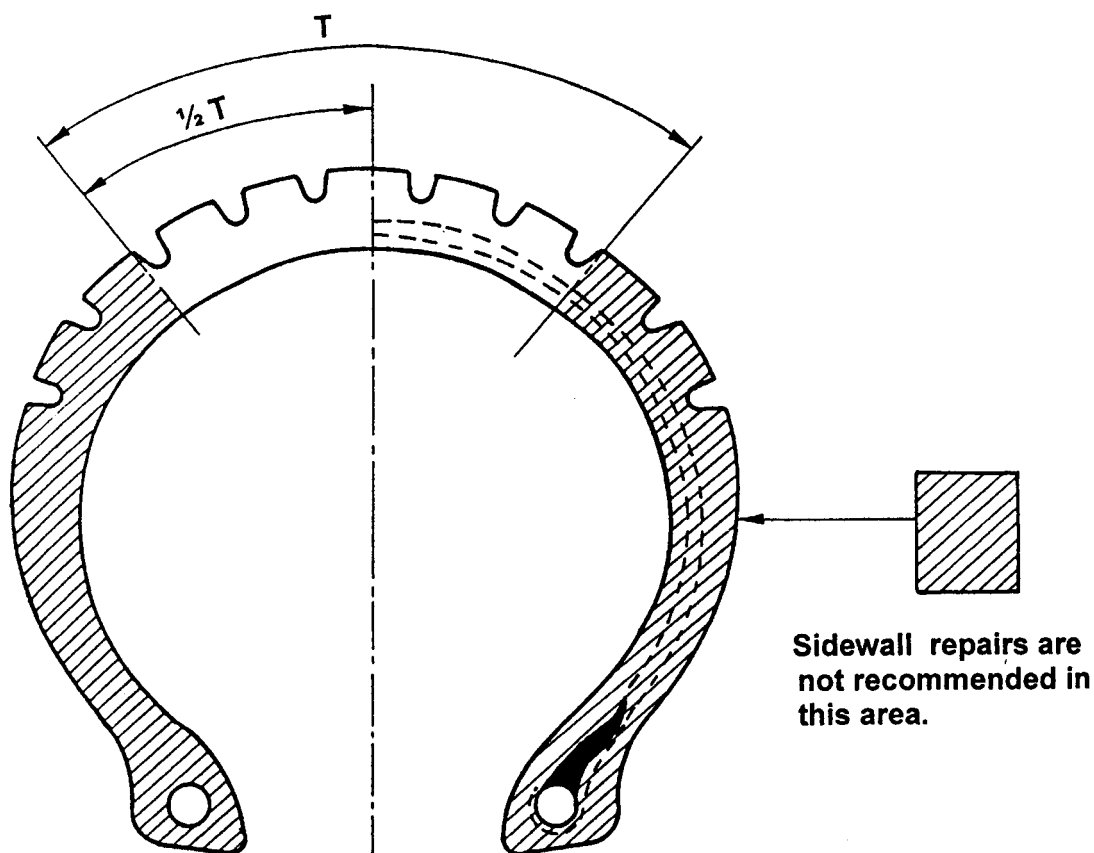
F-2.3 Class B Repairs

A surface rubber repair and internal rubber only repair patch should be used for the following:

- Any penetration damage above 3 mm and up to 6 mm through the belt area.
- Any penetration damage or tear of rubber between cords of the radial carcass, up to 10 mm in length, in the sidewall area W , without damage to the carcass cords, except that two cords may have the spiral wrapping filament broken.

F-2.4 Class A Repairs

Reinforced repair patches should be used for carcass damage that exceeds the limitations for Class B repairs up to the maxima shown in Table 4.



T is the tread, which is $\frac{1}{4}$ of nominal section width.

FIG. 14 RECOMMENDED REPAIRABLE AND NON-REPAIRABLE AREAS FOR RADIAL PLY COMMERCIAL VEHICLES TYRES

ANNEX G

(Clauses 5.1 and 6; and Annex A)

REPAIR OF DIAGONAL (CROSS) PLY MOTORCYCLE AND SCOOTER TYRES

G-1 PENETRATION DAMAGE

For all penetration damage a rubber patch or combined rubber plug/patch can be used (*see* Fig. 15 and Table 5).

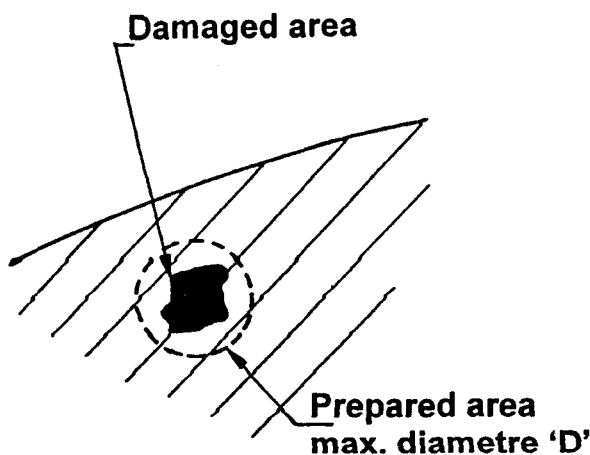


FIG. 15 RECOMMENDED REPAIRABLE AND NON-REPAIRABLE AREAS FOR DIAGONAL (CROSS) PLY MOTORCYCLE AND SCOOTER TYRES

Table 5 Injury Limitations for Diagonal (Cross) Ply Motorcycle and Scooter Tyres (After Preparation)

(Clause G-1)

Sl No.	Speed Category	Maximum Recommended Diameter of Damage Measured at Base of Injury, Tread Area, T, Only mm	Maximum Recommended Number of Repairs ¹⁾
(1)	(2)	(3)	(4)
i)	Up to and including 'S' rating	3	2
ii)	'T' rating and above	3	1

¹⁾ This includes any satisfactory existing repairs.

G-2 RUBBER ONLY DAMAGE THAT IS NO PENETRATION

Surface rubber repairs are permissible in all areas without limitation.

ANNEX H

(Clauses 5.1 and 6; and Annex A)

REPAIR OF TUBES

H-1 TUBES (*see* Table 6 and Fig. 8 and 16)

For typical damages of tubes, *see* Fig. 8 and 16.

H-1.1 Multiple splits should be contained within the maximum recommended diameter of damage given in Table 6.

H-1.2 When assessing the total damage, any thinning of the surrounding area should be included.

H-1.3 There is no limit to the number of repairs, provided that the repair patches do not overlap.

H-1.4 When a valve is replaced in a different position in the tube, the hole made during removal of the valve

Table 6 Injury Limitations for Tubes (After Preparation)

(Clauses H-1.1 and H-1.4)

Sl No.	Speed Category	Maximum Recommended Diameter, D of Damage mm	Maximum Recommended Length, L of (Single) Split Damage mm
(1)	(2)	(3)	(4)
i)	Motorcycle and scooter	10	20
ii)	Car and light truck up to 7.00 section	15	40
iii)	Commercial vehicle 7.00 section	30	60

should not be greater than the maximum recommended diameter given in Table 6.

H-2 VALVES

H-2.1 Damaged metal parts of the valve should be either repaired or replaced, according to the nature of the damage.

H-2.2 If the rubber valve base is damaged, the valve should be replaced.

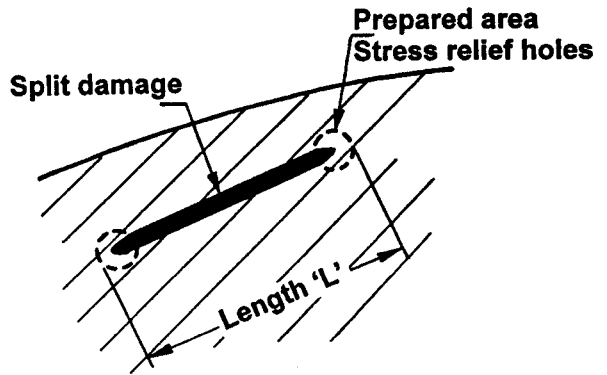


FIG. 16 TYPICAL AREA DAMAGE (TUBES)

ANNEX J

(Clause 5.1)

CURING

J-1 HOT CURE

J-1.1 For all normal repair materials, vulcanization (cure) should be carried out in the temperature range 130° to 160°C with an applied pressure of 379 kPa to 586 kPa and for a time dependent on:

- thickness of uncured repair material,
- temperature, and
- type of curing system.

The complete hot cure procedure should be in accordance with the instructions of the manufacturer or supplier of the repair material.

J-2 COLD CURE

J-2.1 When using chemical (cold) cure repair material,

except for rubber only a repair patches, vulcanization (cure) should be carried out at a minimum room temperature of 15°C for an extended period of two to five days, preferably with an applied pressure of 103 kPa. The complete procedure should be in accordance with the instructions of the manufacturer or supplier of the repair material.

J-2.2 It is possible to reduce the cure time for chemical (cold) cure material by the use of a moderately elevated temperature in the range 90° to 110°C, provided that pressure in the range 103 to 172 kPa is applied to the area undergoing repair.

NOTE — Attention is drawn to the requirements of 6.4, that is, "During the curing process the carcass shall be in its 'relaxed' (not distorted) shape".

ANNEX K

(Clause 7)

AFTER CURING INSPECTION OF TYRES AND TUBES

K-1 TYRES

All tyres should be visually examined after curing to ensure that:

- a) repairs are free from defects that may detract from the performance capabilities. For repairs, cured with heat, this inspection should be carried out within 30 min of the end of cure.
- b) all damage to the tyre that may affect the service life has been repaired.
- c) reinforced repairs have been marked in accordance with the requirements of 8.
- d) for tubeless tyres that have been repaired and

then regarded for use as tubed tyres, a label has been attached to indicate this (*see* 8) and the word 'Tubeless' has been removed from the tyre.

K-2 TUBES AND VALVES

On completion of repairs to tubes and valves, the complete tube should be checked for air leaks. If the inflation pressure method is used, care should be taken to ensure that the pressure does not cause distortion.

NOTE — Where a repair is found to be unsatisfactory it may be re-repaired provided that the damage is still within the recommendations of the relevant appendix of this standard.

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