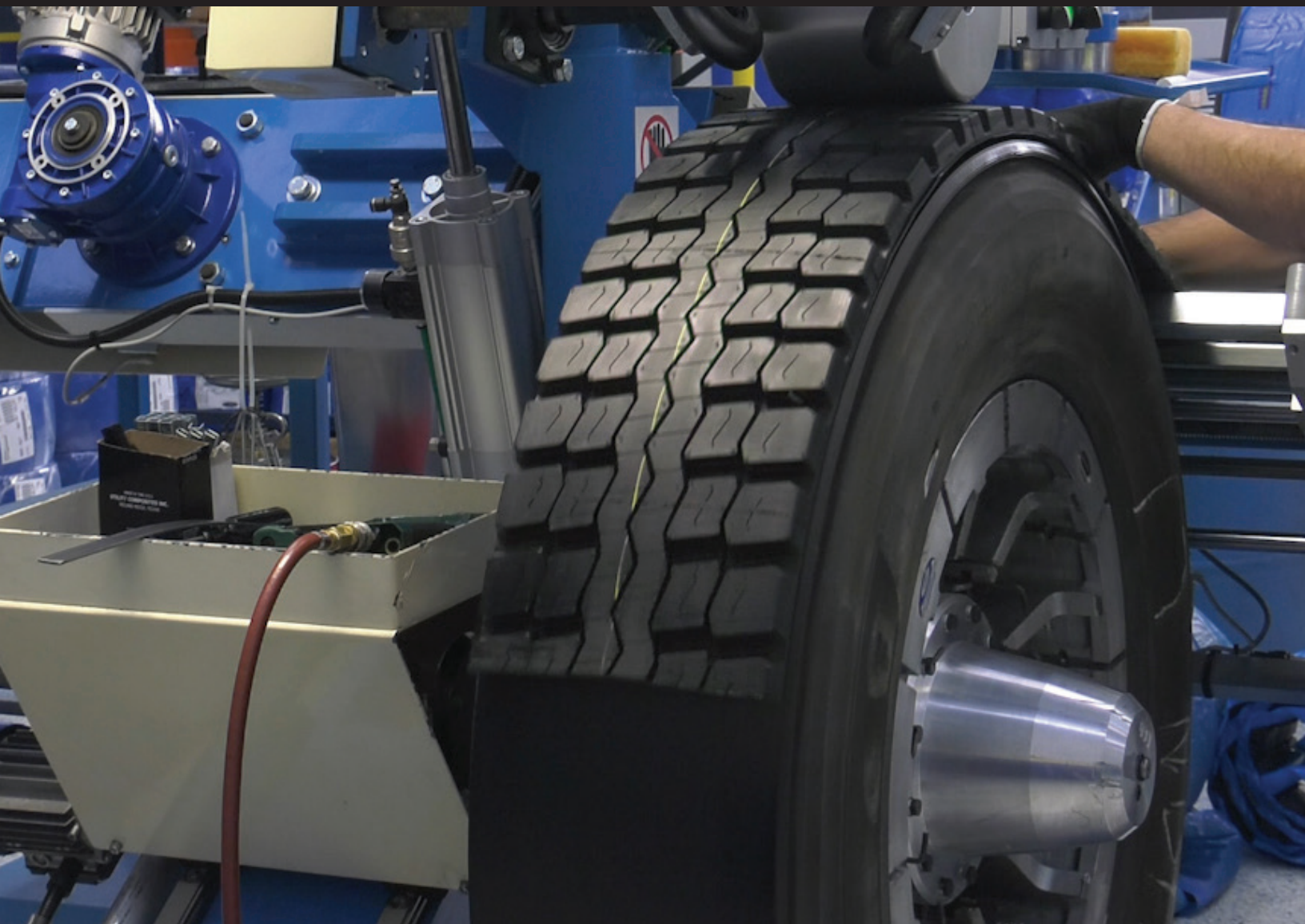




INDUSTRY RECOMMENDED PRACTICES FOR TIRE RETREADING AND TIRE REPAIRING



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Revised May 27, 2020



Mission Statement

The Tread Rubber and Tire Repair Materials Manufacturers' Group (TRMG), with voluntary participation from member supplier companies, works to produce educational materials, such as Industry Recommended Practices, designed to promote quality practices and processes in the tire retread and tire repair industry.

Adopted 11/4/2019



INTRODUCTION

The tire retread and repair industry serves a vital purpose in the recycling of worn tires. Through recycling, valuable natural resources are conserved and the economic function of tires is prolonged. To enhance public and industry safety and efficiency in the retreading and repairing of radial passenger car, light truck radial fabric body ply, light truck radial steel body ply, medium truck, heavy radial truck, bus, and bias tires, the Tread Rubber and Tire Repair Materials Manufacturers' Group (TRMG), taking into account the views of interested members of affected industries and the public, has drafted and periodically updates this set of Industry Recommended Practices for Tire Retreading and Tire Repairing (IRPs).

The IRPs are completely voluntary. Neither the TRMG, or other associations or companies, have agreed to use the IRPs, or to make adoption of or adherence to the IRPs, a condition of membership. Nor does the TRMG or other associations seek to inspect and/or accredit the operations of industry members or enforce compliance with the IRPs.

No member of the industry or other person is authorized to use these IRPs to advertise, promote, induce or disparage the sale of retreaded and/or repaired tires or of tire retreading or repairing services.

Much as the TRMG would like to do so, there is no way to come up with warnings and cautions in these IRPs that will cover every eventuality. The IRPs do not, for example, eliminate the need for in-depth, hands-on training of industry personnel in such areas as mounting/demounting, tire balancing, and retreading/repairing. Personnel performing these services should be professionally trained by persons qualified to conduct that training.

Questions pertaining to a specific product or piece of service equipment should be addressed to the manufacturer of that product.

The Federal Government publications listed in the Table of Contents under "Reference Documents" are listed only for ease of reference in conjunction with these IRPs. They may be obtained from the appropriate government agency and/or the U.S. Government Printing Office.

While the Tire Retread and Repair Information Bureau (TRIB) and the Tire Industry Association (TIA) did not participate in the technical discussions leading to the preparation of this document, TRIB and TIA have been designated as the primary agents for distribution and general dissemination of the IRPs. Any comments or suggestions may be submitted to TRIB or TIA, and additional digital copies of the IRPs may be obtained from TRIB or TIA at:

Tire Retread and Repair Information Bureau
703-533-7677
www.retread.org
Email: info@retread.org

Tire Industry Association
800-876-8372
www.tireindustry.org

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NAVIGATING THROUGH THE IRPs

The following charts show the size guidelines for light truck, medium truck, and heavy truck tires. Retreaders are encouraged to use this chart as a guide for determining which section of the IRPs to refer to when retreading or repairing a tire. In addition to providing size guidelines, the chart is color coded to correspond to the various sections of the IRPs.

RADIAL LIGHT TRUCK TIRE SIZE CHART

RETREADING	REPAIRING	RETREADING	REPAIRING
Fabric Light Truck (Up to Load Range E) 6.50 – 12.50 215/85 – 255/85 215/75 – 265/75	Fabric Light Truck (Up to Load Range E) 6.50 – 12.50 215/85 – 255/85 215/75 – 265/75	Steel* Body Ply Light Truck <small>*or similar material</small> (Load Range E and above) 225/75R16 – 245/75R17	Steel* Body Ply Light Truck <small>*or similar material</small> (Load Range E and above) 225/75R16 – 245/75R17

MEDIUM AND HEAVY RADIAL TRUCK TIRE SIZE CHART

RETREADING		REPAIRING	
Medium Truck 7.50 – 10.00 8 – 11 215/75 – 285/75	Heavy Radial Truck 11.00- 16.00 12 – 18 295/80 – 445/65 435/50 - 495/50	Medium Truck 7.50 – 10.00 8 – 11 215/75 – 285/75	Heavy Radial Truck 11.00- 16.00 12 – 18 295/80 – 445/65 435/50 - 495/50

NOTE: Dimensions shown are for general guidance. Repair material manufacturers' and new tire manufacturers' recommendations may differ. Specific limits should be based on recommendations of the tire manufacturer, repair material manufacturer, and type of tire service. Consult tire manufacturer and repair material manufacturer for tire sizes not covered.

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REFERENCE DOCUMENTS

1. National Highway Traffic Safety Administration, Federal Motor Vehicle Safety Standard No. 117, Retreaded Pneumatic Tires 49 C F R § 571 117 as amended (FMVSS 117)
2. National Highway Traffic Safety Administration, Tire Identification and Record Keeping, 49 C.F.R. Part 574, as amended

Industry Recommended Practices for Tire Retreading

Retreading Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

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I. PURPOSE

The purpose of this section is to offer Industry Recommended Practices (IRPs) to members of the industry, for the manufacturing of retreaded radial passenger car and light truck radial fabric body ply tires, for highway service. These IRPs are not intended to be, and should not be, used as a substitute for the judgment that each industry member should make in establishing and implementing procedures, training, and supervisory practices for the proper inspection, selection, and retreading of worn tires.



CAUTION

Before beginning, retreaders should contact tire manufacturers regarding proper procedures and guidelines for retreading radial passenger car and light truck radial fabric body ply tires.

II. SCOPE

This section addresses industry terminology, initial casing inspection and selection for retreading, processing, and final inspection guidelines used in the tire retreading industry.

III. INDUSTRY TERMINOLOGY

See Appendix 1 - Common Retread and Repair Terminology - A Compendium of Industry Terms.

IV. INITIAL CASING INSPECTION AND SELECTION FOR RETREADING

A. General Statement

Thorough inspection should be made by a skilled operator and should include placing the tire casing on a tire inspection machine, or other machine capable of spreading the beads under adequate lighting (i.e., 200 footcandles (fc) / 2153 lux (lx) minimum, 300 fc / 3229 lx recommended) at the work surface, so that the interior and exterior of the casing is adequately exposed for visual and manual examination.



Tire Casing on Inspection Machine

All casings should be dry and free of all loose contaminants (e.g., dirt, water, debris, sealants, visual materials, balancing materials, etc.) and/or other foreign materials, prior to inspection. All repair units should be replaced

Retreading Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

unless they can be determined to be sound and have been properly installed. Inspection criteria should be posted in retread plants.

Retreaders should consult new tire manufacturers or material manufacturers regarding the alteration (i.e., retreading or repairing) of speed rated tires.

In addition to visual inspection, it is also recommended that some type of nondestructive inspection equipment (e.g., holography, shearography, X-ray, ultrasonics, electrostatic, high pressure tester, etc.) be utilized for casing inspection.

B. Radial Passenger Car Tire Casings

Radial passenger car tire casings must meet the requirements of Federal Motor Vehicle Safety Standard 117, Retreaded Pneumatic Tires, 49 C.F.R. § 571.117, as amended (FMVSS 117).

C. Inspection Criteria for Radial Passenger Car Tire Casings Used on the Highway

No radial passenger car tire casings should be accepted for retreading having any of the following conditions or injuries which require repairs beyond the limits of the IRPs, or repairs in the area described in Table I (see Tables section at the end of this document).

1. External

- a. Exposed fabric in the tread area in excess of FMVSS 117
- b. Ply separation
- c. Broken belts
- d. Excessive oxidation (i.e., weather checking) extending to the body plies or deeper than 2/32" (1.5 mm)
- e. Surface cuts which exceed the size of a repairable injury and penetrate the cord body
- f. Radial ply cracking

- g. Circumferential cracking
- h. Broken, damaged, kinked or exposed bead wire bundle
- i. Damaged beads exposing bead wire or cord fabric
- j. Improper labeling
- k. Tire belt separation or lifting
- l. Tread separations which are not removed during buffing
- m. Radial tires with rust or corrosion beyond repairable limits
- n. Any signs of weakness or non-repairable injury (e.g., softness due to contamination from chemical/petroleum products, ripples, bulges, porosity, etc.) in the sidewall, particularly in the upper sidewall

2. Internal

- a. Flex breaks, X-breaks or impact breaks
- b. Porous, contaminated from chemical degradation, or loose inner liners
- c. Open inner liner splices which expose cord
- d. Loose cords on the inside ply or evidence of having been run underinflated or overloaded
- e. Injury to the ply cord fabric in the bead area and sidewall
- f. Previously installed repairs found to be defective and/or unrepairable
- g. Casings having or requiring any section repairs
- h. Damage larger than allowable repair limits

Retreading Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

D. Inspection Criteria for Light Truck Radial Fabric Body Ply Tire Casings Used on the Highway

No light truck radial fabric body ply tire casings should be accepted for retreading having any of the following conditions or injuries which require repairs beyond the limits of the IRPs or beyond the limits outlined in Tables I and II (see Tables section at the end of this document).

1. External

- a. Ply separation beyond repairable limits
- b. Tread separations which cannot be removed during buffing
- c. Broken, damaged, kinked or exposed bead wire bundle
- d. Excessive oxidation (i.e., weather checking) extending to the body plies or deeper than 2/32" (1.5 mm)
- e. Circumferential cracking
- f. Any signs of weakness or non-repairable injury (e.g., softness due to contamination from chemical/petroleum products, ripples, bulges, porosity, etc.) in the sidewall, particularly in the upper sidewall
- g. Crunching or popping sounds when flexed
- h. Surface cuts which exceed the size of a repairable injury and penetrate the cord body
- i. Radial cracking
- j. Improper labeling

2. Internal

- a. Injuries to the body plies in the non-repairable bead area
- b. Open inner liner splices which expose cord

- c. Flex breaks, X-breaks or impact breaks
- d. Loose cords on the inside ply or evidence of having been run underinflated or overloaded
- e. Non-repairable damage to the inner liner or bead area on tires identified as tubeless
- f. Porous, contaminated from chemical degradation, or loose inner liners
- g. Previously installed repairs found to be defective and unrepairable
- h. Suspected of potential zipper damage
 - Cuts, snags or chips exposing body cords
 - Distortions or undulations (i.e., ripples and/or bulges) visible when using an indirect light source which will produce shadows left by any sidewall irregularities
 - Creasing, wrinkling, cracking or discoloration of the inner liner
 - Soft spot(s) in the sidewall flex area
 - Protruding filaments indicating broken cords
 - Any popping sound when feeling for soft spots or when rolling the tire

E. Selection Criteria for Light Truck Radial Fabric Body Ply Tire Casings to be Retreaded for Use in Steer Axle Applications

Light truck radial fabric body ply tire casings retreaded for steer axle applications, should be appropriately marked on the sidewall adjacent to the federal retread identification

code (see Appendix 5 for federally-required labeling). Note that certain state and/or other government agencies may have specific requirements.

V. PROCESSING

A. General Statement

The processes listed below are essential to proper manufacturing of the retread and should be posted in retread plants. Adequate lighting (i.e., 200 fc / 2153 lx minimum, 300 fc / 3229 lx recommended) at the work surface should be provided in the processing area.

B. Buffing

1. Buffed tire dimensions should be appropriate to the tire brand, size, and type, as well as to the retread system used. After buffing, wait time to build should be minimized in order to avoid contamination or oxidation. If wait time exceeds two hours, the surface should be brushed to remove possible contamination or oxidation before applying cement or cushion.
2. The tread surface, which is to receive the new rubber, should be prepared to a symmetrical profile and proper texture. The buffed surface should be free from contamination and have a TRMG BT3 or BT4 texture (see RP 01/02-23 "BTS6 - Standard Buffing Textures for Tire Retreading and Repairing"). Buffed radial passenger car tire casings must comply with the exposed cord limitations of FMVSS 117 (see Reference Documents list following the Table of Contents).
3. Damage to the #2 or #3 belt greater than 3/8" (10.0 mm) may require a section repair. Consult the new tire manufacturer and/or the tire repair materials manufacturer for further information.



WARNING

DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

C. Cementing (if required)

1. Tires to be cemented should be free of loose cords or foreign material such as rubber buffings, dirt, oil, etc.
2. Cementing should be accomplished as soon as possible. Consult the retread materials supplier for additional information.
3. Exposed steel should be cemented as soon as possible - recommendation is within 15 minutes after exposure.
4. Cemented tires should be kept free from dust and other contaminants.
5. Cemented tires stored for extended periods should be covered, and may need to be cleaned and/or recemented.
6. Cement, if required, should be handled according to the manufacturer's recommendations. Follow all OSHA requirements and safety precautions. Contact the individual materials manufacturer for a copy of any Material Safety Data Sheets (MSDS) needed. Also refer to federal, state, and local regulations, especially as related to Volatile Organic Compound (VOC) emissions.

D. Building/Tread Application

1. If tire cord is exposed on any portion of the buffed area, it should be coated with a suitable vulcanizing material before applying the tread rubber.

2. Skives should be filled with a repair material that is thoroughly stitched or extruded into place to eliminate all trapped air, and reinforced if necessary (see Recommended Practices for Tire Repairing).

3. Mold Cure (Uncured Rubber) Retreading

- a. Apply cushion gum according to the material supplier's guidelines. Tread rubber should be of crown, base, and gauge dimensions as required for matrix (i.e., mold) design and size, and should provide a minimum of 2/32" (1.5 mm) replacement undertread.

NOTE:

Tires with thicker tread depth may require additional material.

- b. Tread rubber bonding surfaces are not to be contaminated in any way.
- c. Tread rubber should be centered around the tire +/- 1/8" (3.0 mm) from the centerline.
- d. Tread stitching should be performed in such a way as to avoid trapping air, pulling the tread off center, and distorting, folding or wrinkling in the shoulders.
- e. Splices, if any, should be made in such a manner as to ensure minimum distortion of the rubber. The shoulder area should be cut back at a slight angle to remove excess rubber due to crowding in the smaller tire diameters.
- f. If splices are required, a 1/8" to 1/4" (3.0 mm-6.0 mm) overlap, depending on tire size, should be used to allow for a small amount of crowding of the stock, which serves to apply pressure in holding the two surfaces together. Retreaders should use either a butt splice or a 45 degree beveled splice. If a hot

knife is used to make these cuts, the temperature of the knife must be below 250°F to prevent scorching, and all cuts should be wiped with a solvent to prevent contamination.

4. Precure Tread Retreading

- a. Tread rubber should be centered around the buffed circumference of the tire +/- 1/8" (3.0 mm) from the centerline.
- b. Tread pattern should be matched as closely as possible at the splice(s), if required, while assuring proper tread length.
- c. Tread ends should be properly prepared over the entire surface and be free of contaminants. If required, the entire tread end surface should be cemented and gum stripped per posted procedure.
- d. Tread stitching should be performed in such a way as to avoid trapping air, pulling the tread off center, and distorting, folding or wrinkling in the shoulders.

E. Curing

1. Mold Cure (Uncured Rubber) Retreading

- a. Tires should be kept free from contamination and stored in such a manner as to avoid distortion of the uncured rubber.
- b. Follow manufacturers' information and/or specifications on curing time, temperature, pressure, and proper curing equipment (i.e., tubes and rims, if used).

2. Precure Tread Retreading

- a. Envelopes or diaphragms, if used, must be leak free. Various testing methods are available, such as inflation or vacuum.

Retreading Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

- b. Wicking, if required, will be used to allow for air removal from between the envelope or diaphragm on the enclosed tire surface during cure.
- c. Follow manufacturers' information and/or specifications on curing time, temperature, pressure, and proper curing equipment (i.e., tubes and rims, if used).
- E. Approved procedures should be followed when the tire is mounted and inflated. The tire should be inspected at this time for any anomalies not previously detected. Follow the OSHA Standards for Servicing Multi-piece and Single-Piece Rim Wheels (29 C.F.R. § 1910.177, as amended).

VI. FINAL INSPECTION

- A. After curing, the retreader should make a final examination of the tire, preferably while it is still warm, and while it is mounted on a spreader under adequate lighting (i.e., 200 fc / 2153 lx minimum, 300 fc / 3229 lx recommended) at the work surface, so that the interior and exterior of the tire is adequately exposed for visual and manual examination.
- B. The inside of the tire should be checked to ensure that all repairs are properly installed and bonded, and for any internal injuries or conditions that may have been missed during the initial inspection phase.
- C. The outside of the tire should be checked to ensure that it has been properly molded, cured, trimmed, and has all the required labeling, including as federally required in 49 C.F.R. Part 574 – Tire Identification and Record Keeping (as amended) and Retreaded Pneumatic Tires FMVSS 117 (see Reference Documents list following the Table of Contents). Retreads used in certain states may require additional labeling indicating that a tire has been retreaded in accordance with this retreading standard, and whether or not it qualifies for use in steer axle applications (see Appendices at the end of this document and Reference Documents list following the Table of Contents).
- D. Retreaded tires should not be returned to service for at least 24 hours since adhesion is reduced until the tire has cooled.

Industry Recommended Practices for Tire Repairing

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

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I. PURPOSE

The purpose of this section is to offer Industry Recommended Practices (IRPs) to members of the industry, for the permanent repairing of radial passenger car and light truck radial fabric body ply tires for highway service. These IRPs are not intended to be, and should not be, used as a substitute for the judgment that each industry member should make in establishing and implementing procedures, training, and supervisory practices for the proper repair of damaged tires.

II. SCOPE

This section addresses industry terminology, initial tire inspection, acceptable repairing criteria, repair finishing, and final inspection practices used in the tire repairing industry.

III. INDUSTRY TERMINOLOGY

See Appendix 1 - Common Retread and Repair Terminology - A Compendium of Industry Terms.

IV. GENERAL STATEMENT ABOUT TIRE REPAIRING

Thorough inspection should be made by a skilled technician and should include placing the tire casing on a tire inspection machine, or other machine capable of spreading the beads under adequate lighting (i.e., 200 footcandles (fc) / 2153 lux (lx) minimum, 300 fc / 3229 lx recommended) at the work surface, so that the interior and exterior of the casing is adequately exposed for visual and manual examination.



Tire Casing on Inspection Machine

All casings should be dry and free of all loose contaminants (e.g., dirt, water, debris, sealants, visual materials, balancing materials, etc.) and/or other foreign materials prior to inspection. All repair units should be replaced unless they can be determined to be sound and have been properly installed. Inspection criteria should be posted in retread plants.

Tire repair facilities should consult new tire manufacturers or material manufacturers regarding the alteration (i.e., retreading or repairing) of speed rated tires. The selection of repair materials used should be based on the suppliers' recommendations.

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.

V. INITIAL TIRE INSPECTION

Repair procedures require the following:

- Removal of damaged material
- Preparing the injured area
- Filling the injury with a suitable vulcanizing material or vulcanizing rubber stem
- Reinforcing and sealing the repair area

NEVER PERFORM A TIRE REPAIR WITHOUT REMOVING THE TIRE FROM THE RIM/WHEEL ASSEMBLY FOR INTERNAL INSPECTION.

OUTSIDE-IN OR ON-THE-WHEEL TIRE REPAIRS ARE NOT RECOMMENDED.

CONTACT TIRE MANUFACTURERS FOR SPECIFIC REPAIR PROCEDURES.

A. Inspection Criteria for Tire Repairing

No tires should be accepted for repairing if they have any of the following conditions or injuries or which require repairs beyond the limits shown in Tables I, II and IIA (see Tables section at the end of this document).

1. External

- a. Surface cuts which exceed the size of a repairable injury and penetrate the cord body
- b. Broken, damaged, kinked or exposed bead wire bundle
- c. Damage which requires the repairs to overlap

- d. Excessive oxidation (i.e., weather checking) beyond 2/32" (1.5 mm) in depth
- e. Broken belts
- f. Tires with less than 2/32" (1.5 mm) tread depth (i.e., non-skid) remaining unless retreading is planned
- g. Radial and/or circumferential cracking
- h. Improper or missing sidewall information
- i. Any signs of weakness or non-repairable injury (e.g., softness due to contamination from chemical/petroleum products, ripples, bulges, porosity, etc.) in the sidewall, particularly in the upper sidewall
- j. Crunching or popping sounds when flexed

2. Internal

- a. Open inner liner splices which expose cord
- b. Porous, contaminated from chemical degradation, or loose inner liners
- c. Loose cords on the inside ply or any evidence of having been run underinflated or overloaded
- d. Injury to the body ply cords beyond repairable limits
- e. Previously installed repairs found to be defective and unrepairable
- f. Injuries to the body plies in the non-repairable bead area
- g. Flex breaks, X-breaks or impact breaks
- h. Non-repairable damage to the inner liner or bead area on tires identified as tubeless

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

In addition to checking for non-repairable conditions, check the valve assembly and bead area for leaks using a water or leak detection solution, where practical, *prior to* demounting and deflating the tire. If a leak is found in the valve assembly or in the bead area, certain repairs may not be possible since the tire will not hold air.

Furthermore, along with visual inspection, it is also recommended that some type of nondestructive inspection equipment (e.g., holography, shearography, X-ray, ultrasonics, electrostatic, high pressure tester, etc.) be utilized for casing inspection.

and maintain its air retention capability. Consult casing manufacturer for bead area repair specifications.

D. Steps for Minor Rubber Repair

The steps listed below are essential to perform a minor rubber repair.



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.



WARNING

DO NOT use flammable **solvents** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of solvents could cause serious personal injury or death.

VI. MINOR RUBBER REPAIRS

Minor repairs are generally rubber only repairs, but should be performed in a full-service repair facility. See Appendix 1 - Common Retread and Repair Terminology – A Compendium of Industry Terms for a definition of “Full Service Repair Facility”.

A. Spot Repair

Radial tires with damage to the body cords cannot be spot repaired but should be considered for section repairing.

B. Inner Liner Repair

Open inner liner splices, cracks which do not expose cord, tool damage or blisters, may be repaired in tubeless tires. Consult casing manufacturer for inner liner repair specifications.

C. Bead Area Repair

Bead area repairs are limited to rubber only repairs. In no case should a kinked or broken bead be repaired. Tires with evidence of bead area separation or rusting in the body plies should be rejected.

Bead area repairs on all tires should restore the original contour of the bead. In addition, bead repairs on a tubeless tire should restore

1. Probing and Foreign Material Removal

Use a probe to inspect the damage. Remove any foreign material.

2. Inspection

Inspect the injury to determine the extent of damage. If there is ply body damage, refer to the Section Repairs portion of this document (see section IX).

In addition to visual inspection, it is also recommended that some type of nondestructive inspection equipment (e.g., holography, shearography, X-ray, ultrasonics, electrostatic, high pressure tester, etc.) be utilized for casing inspection.

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

3. Pre-Cleaning

Remove all contaminants from around the injury.

NOTE:

1.) Tires that contain any type of aftermarket puncture sealant(s) may have been damaged as a result of being run underinflated and/or overloaded, and should be inspected accordingly.

2.) Tires that are manufactured with puncture sealing capabilities require specialized repair techniques. The tire and/or sealant manufacturers should be contacted for recommendations. It may be necessary to repeat step 3, pre-cleaning, to ensure that the repair area is free of contaminants.

4. Buffing

Buff the injury to achieve a uniform TRMG BT1 or BT2 buff texture for all repairs (see RP 01/02-23 "BTS6 - Standard Buffing Textures for Tire Retreading and Repairing"). Remove all damaged or loose material. Texturize the repair area with a low-speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing tool, while keeping the repair area as small as possible.

5. Cleaning

Remove any rubber dust and contaminants from the buffed area with a fine wire brush and vacuum to provide a clean, dry surface. Do not use compressed air to clean bonding surfaces because the unfiltered air lines may contain contaminants such as oil and moisture, which can reduce adhesion.



WARNING

DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

6. Cementing

Apply the appropriate cement to the prepared surface with no puddling or streaking. Allow the cement to dry for the recommended time. In cold and/or humid climate conditions, extend the drying time as recommended by the manufacturer.

7. Filling

Fill the injury with a suitable vulcanizing material.

8. Curing

Cure the repair for the specified time, temperature, and pressure according to the equipment and materials manufacturers' recommendations. For chemically activated repairs, allow sufficient time for curing as recommended by the manufacturer.

VII. PUNCTURE REPAIR (NAIL HOLE REPAIR)

Prior to demounting and deflating the tire, check the valve and outer surface for leaks using a water or leak detection solution, where practical. If a leak is found in the valve assembly or in the bead area, a puncture repair may not be possible since the tire will not hold air. If no leak is found in the valve assembly or bead area, proceed by marking the injury, totally deflate, and demount the tire.

Repair procedures require the following:

- Removal of damaged material
- Preparing the injured area
- Filling the injury with a suitable vulcanizing material or vulcanizing rubber stem
- Reinforcing and sealing the repair area

NEVER PERFORM A TIRE REPAIR WITHOUT REMOVING THE TIRE FROM THE RIM/WHEEL ASSEMBLY FOR INTERNAL INSPECTION.

OUTSIDE-IN OR ON-THE-WHEEL TIRE REPAIRS ARE NOT RECOMMENDED.

CONTACT TIRE MANUFACTURERS FOR SPECIFIC REPAIR PROCEDURES.

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

Determine the extent and location of any injuries. Repair shops should consult the tire manufacturer and repair material manufacturer regarding the alteration (i.e., retreading or repairing) of speed rated tires.

NOTE:

Not all tires can be repaired. Specific repair limits should be based on recommendations or repair policies of the tire manufacturer and/or type of tire service (e.g., service description, run-flat technology, commercial service applications, etc.).

A. Radial Passenger Car and Light Truck Radial Fabric Body Ply Tire Puncture Repair

Radial passenger car and some light truck radial fabric body ply¹ tire puncture repairs, should be limited to the tread area only and not exceed 1/4" (6.0 mm) in diameter after preparation.

Figure 1 represents a radial passenger car/light truck radial fabric body ply tire and indicates that puncture repairs are limited to the tread area only, as generally depicted in the graphic.



FIGURE 1

¹Tire sizes for light vehicles include all radial passenger car tires and some light truck radial fabric body ply tires (up to Load Range E). Light vehicles are defined by 49 C F R § 571.139 of the Federal Motor Vehicle Safety Standards as motor vehicles with a gross vehicle weight rating (GVWR) of 10,000 lbs. or less.

DO NOT make repairs where the injury damage extends into the shoulder/belt edge area OR where the injury extends at an angle into the shoulder area.

B. Steps for Puncture Repair

The steps listed below are essential to repair a puncture in radial passenger car and light truck radial fabric body ply tires. See tire repair images below and on the following pages.

PUNCTURE REPAIR Mark and Probe the Injury



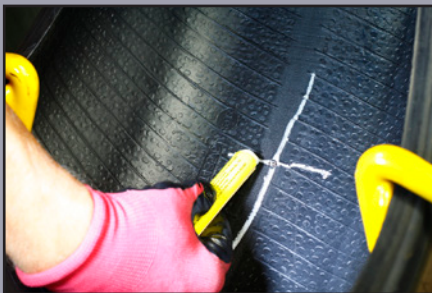
Place Tire on Inspection Machine



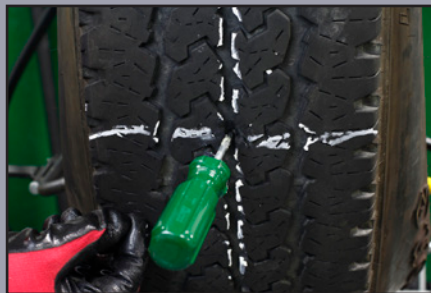
Mark the Injury - Outside Tire



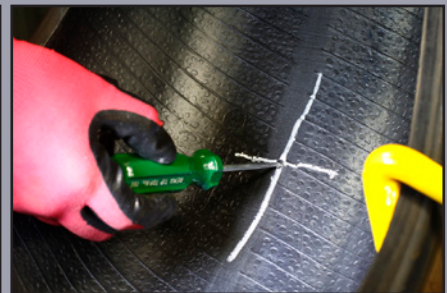
Remove Penetrating Object



Mark the Injury - Inside Tire



Probe the Injury - Outside Tire



Probe the Injury - Inside Tire

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.



WARNING

DO NOT use flammable **solvents** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of solvents could cause serious personal injury or death.

1. Probing and Foreign Material Removal

Probe the injury with a tire probe to determine the angle and size of penetration. Inspect and remove any foreign material that has penetrated the tire.

2. Pre-Cleaning

Remove all contaminants from around the injury.

NOTE:

1.) Tires that contain any type of aftermarket puncture sealant(s) may have been damaged as a result of being run underinflated and/or overloaded, and should be inspected accordingly.

2.) Tires that are manufactured with puncture sealing capabilities require specialized repair techniques. The tire and/or sealant manufacturers should be contacted for recommendations. It may be necessary to repeat step 2, pre-cleaning, to ensure that the repair area is free of contaminants.

3. Preparation of the Injury

When possible, drill the injury from the inside a minimum of three times with the appropriate carbide cutter on a low speed (i.e., 1,200 rpm maximum) air/electric drill, or other suitable tool, following the angle of penetration. Tools used must remove the damaged steel and create a round hole. Repeat this process a minimum of three times from the outside of the tire to ensure complete damage removal, being careful not to elongate the hole.

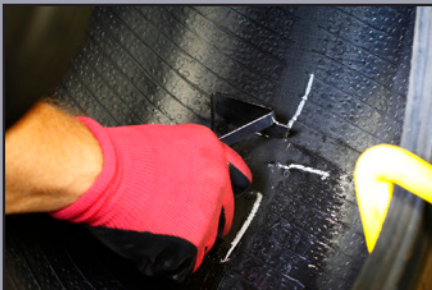
Use a probe to check for any splits in the radial plies surrounding the injury. Remove any additional damage found.

4. Inspection

Inspect the injury, making sure the penetration is 1/4" (6.0 mm) or less. In addition, inspect prepared injury for inner liner splits. If present, this is no longer

PUNCTURE REPAIR cont.

Pre-Clean and Drill



Scrape Away Contaminants



Drill the Injury - Inside Tire



Drill the Injury - Outside Tire

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

PUNCTURE REPAIR cont. Repair Unit Selection



One Piece Repair Unit



Two Piece Repair Unit

a puncture repair. Refer to the Section Repairs portion of this document (see section IX.B.).

5. Repair Unit Selection

Select the appropriate repair unit based on repair material manufacturer

recommendations. Center the unit over the injury and outline an area about 1/2" (13.0 mm) larger than the repair unit, to ensure that crayon marks are not removed when buffing.

For injuries with an angle greater than 25 degrees, depending on repair manufacturer, use a two-piece repair unit system.

PUNCTURE REPAIR cont.

Buff and Clean Repair Area for a One-Piece Repair Unit



Buff the Repair Area



Brush the Repair Area

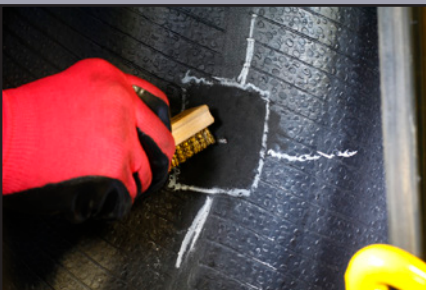


Vacuum the Repair Area

Buff and Clean Repair Area for a Two-Piece Repair Unit



Buff the Repair Area



Brush the Repair Area



Vacuum the Repair Area

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

6. Inner Liner Buffing

To prevent contamination and preserve the outline, buff within the marked area thoroughly and evenly using a low speed (i.e., 5,000 rpm maximum) buffer with a fine wire brush or gritted rasp. Take care not to expose or damage the tire casing body (ply) cords. Buff to a velvet surface; TRMG BT1 or BT2 texture.

7. Cleaning

Remove any rubber dust and contaminants from the buffed area with a fine wire brush and vacuum to provide a clean, dry surface. Do not use compressed air to clean bonding

surfaces because the unfiltered air lines may contain contaminants such as oil and moisture, which can reduce adhesion.



WARNING

DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

8. Cementing

Apply appropriate cement to the buffed surface and, if required, to the back of the

PUNCTURE REPAIR cont.

Cement and Install One-Piece Repair Unit



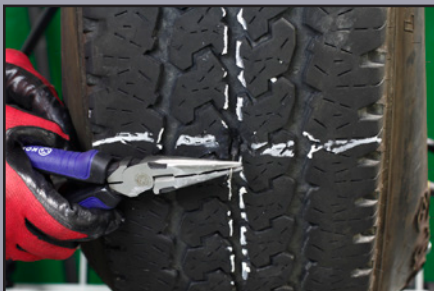
Cement the Injury Channel



Cement the Buffed Area



Install the Repair Unit



Pull Repair Unit Stem Through Tire



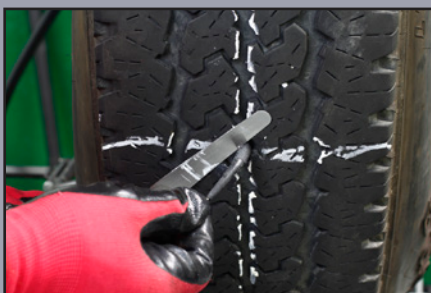
Press Repair Unit into Place



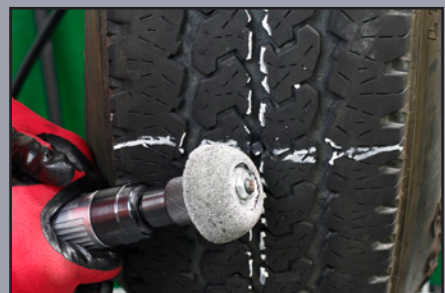
Stitch the Repair Unit



Apply Repair Sealant



Cut the Stem - Outside Tire



Buff the Cut Stem

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

repair unit. Allow the cement to dry for the recommended time. While drying, the tire should be rotated so that the injury is not positioned at the bottom of the tire.

DO NOT use forced air or an outside heat source to accelerate drying time. Refer to repair materials manufacturer recommendations.

9. Fill the Injury

If using uncured/suitable vulcanizing material or a vulcanizing rubber stem, fill the injury with the appropriate material.

10. Repair Unit Installation

Repair units are to be installed while the beads of the tire are in a relaxed position. Align the repair unit according to the markings on the repair unit. Avoid trapping air and/or possible bridging of the unit as it is installed.

- a. When using a one-piece repair unit, cement the injury channel, insert the stem from the inside of the tire, and pull through until the base of the repair unit is snug against the prepared and cemented surface of the inner liner.

PUNCTURE REPAIR cont.

Cement and Install Two-Piece Repair Unit



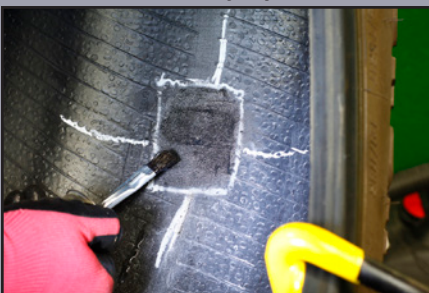
Cement the Injury Channel



Insert the Stem



Cut the Stem - Inside Tire



Cement the Buffed Area



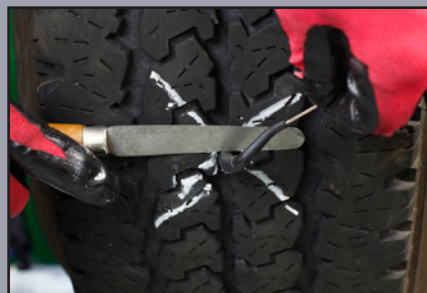
Install the Repair Unit



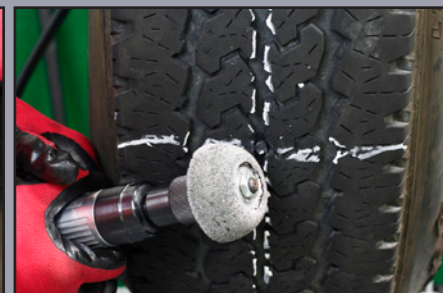
Stitch the Repair Unit



Apply Repair Sealant



Cut the Stem - Outside Tire



Buff the Cut Stem

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

- b. When using a two-piece repair unit (i.e., separate repair unit and filler stem), cement the injury channel and fill the injury from the inside with a suitable vulcanizing rubber stem designed for that size injury. Without stretching the stem, cut/trim the excess material inside the tire, and buff the stem flush with the inner liner to accommodate the appropriate size repair unit.

Remember, for both types of repair units, **DO NOT** cement the stem. Instead, cement the injury channel.

11. Stitching

For all methods, stitch the entire repair unit starting from the center, and work outwards to the edges. Check for proper installation. Cut the fill material flush with the outer tread surface making sure not to stretch or pull the stem while cutting. If the stem is not flush with tread after cutting, buff lightly until it is level with the tread.

12. Curing

The repair unit and uncured/suitable vulcanizing material or vulcanizing rubber stem, must be cured completely. When using a spotter, section mold or curing chamber, follow the manufacturers' recommendations. Also follow the manufacturers' recommendations for calculating cure time. Cure the repair for the specified time, temperature, and pressure according to the equipment and materials manufacturers' recommendations. For chemically activated repairs, allow sufficient time for curing as recommended by the manufacturer.

13. Inspect Repair Areas

If the buffed area extends beyond the repair unit, look for signs of tire casing body cords.

Apply repair sealant to the over-buffed area and the edge of the repair unit. A patch only or a plug (stem) only is not a proper puncture repair. (See section X, Repair Finishing.)

VIII. REINFORCEMENT REPAIRS

Determine the extent and location of any injuries. Repair shops should consult the tire manufacturer and repair material manufacturer regarding specific repair limits. These limits should be based on recommendations of the tire manufacturer, repair materials manufacturer, and type of tire service.

A. Steps for Reinforcement Repairs

Refer to the Section Repairs portion of this document (see section IX.B., Steps for Section Repairs.)



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.



WARNING

DO NOT use flammable **solvents** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of solvents could cause serious personal injury or death.

IX. SECTION REPAIRS

Determine the extent and location of any injuries. Repair shops should consult the tire manufacturer and repair material manufacturer regarding specific repair limits. These limits should be based on recommendations of the tire manufacturer, repair materials manufacturer, and type of tire service.

A. Section Repair Limits

There are several methods of section repairing tires. The method is dependent on the materials and equipment being used.

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

Final measurements to determine repairability and repair unit selection should be made when all of the injury has been removed.

B. Steps for Section Repairs

The steps listed below are essential to make a section repair in a tire.



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.



WARNING

DO NOT use flammable **solvents** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of solvents could cause serious personal injury or death.

1. Probing and Foreign Material Removal

Use a probe to inspect and remove any foreign material that has penetrated the tire.

2. Inspection

Inspect, mark, and measure all injuries to determine repairability and the extent of damage.

3. Pre-Cleaning

Remove all contaminants from around the injury.

NOTE:

- 1.) Tires that contain any type of aftermarket puncture sealant(s) may have been damaged

as a result of being run underinflated and/or overloaded, and should be inspected accordingly.

- 2.) Tires that are manufactured with puncture sealing capabilities require specialized repair techniques. The tire and/or sealant manufacturers should be contacted for recommendations. It may be necessary to repeat step 3, pre-cleaning, to ensure that the repair area is free of contaminants.

4. Skiving

Using a low-speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing texture tool, remove all damaged rubber above the steel cables, taking care to keep the injured area as small as possible. Use an appropriate texture tool on a low-speed (i.e., 5,000 rpm maximum) buffer to buff away remaining rubber and very lightly expose only tread belt cables believed to be damaged (i.e., just until they are visible). All damaged loose fabric must be trimmed back to solid rubber. Buff with a low-speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing texture tool to achieve a uniform TRMG BT2 or BT3 texture. Always probe the repair area after damage removal to ensure that no cuts or separations remain in the tire.

5. Repair Unit Selection

Select the appropriate repair unit based on the construction of the tire and the size of the damage to the body cords or cables. Final measurements should be made when the entire injury has been removed. Refer to Tables I and II and related diagrams (see Tables section at the end of this document) for Maximum Injury Limits, and to repair materials manufacturers' charts for proper repair unit selection.

6. Inner Liner Buffing

Buff the area for the repair unit with a low speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing texture tool to achieve a uniform TRMG BT1 or BT2 buffed texture. The buffed area should be slightly larger than the repair unit.

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

NOTE:

If a suitable vulcanizing material or vulcanizing rubber stem is used to fill an injury, it must be installed before buffing.

Cement the injury channel and fill the injury from the inside with a suitable vulcanizing material or vulcanizing rubber stem. Without stretching the stem, trim the excess material inside the tire, and buff the stem flush with the inner liner to accommodate the appropriate size repair unit.

7. Cleaning

Remove any rubber dust and contaminants from the buffed area with a fine wire brush and vacuum to provide a clean, dry surface. Do not use compressed air to clean bonding surfaces because the unfiltered air lines may contain contaminants such as oil and moisture, which can reduce adhesion.



WARNING

DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

8. Cementing

Apply the appropriate cement to the buffed surface depending on the repair method being used. Also apply the appropriate cement to the back of the repair unit if required. The cement should be applied evenly to all surfaces with no puddling or streaking. Allow the cement to dry for the recommended time. In cold and/or humid climate conditions, extend the drying time as recommended by the manufacturer.

DO NOT use forced air or an outside heat source to accelerate drying time. Refer to repair materials manufacturer recommendations.

9. Fill the Injury

Fill the injury with an uncured/suitable vulcanizing material or vulcanizing rubber stem.

10. Repair Unit Installation

Repair units are to be installed with the beads of the tire in the relaxed position. Align the repair unit according to markings on the repair unit.

- When using a one-piece chemical section repair unit, insert the stem from the inside of the tire and pull through until the base of the repair unit is snug against the prepared and cemented surface of the inner liner.
- Stitch the entire repair unit starting from the center, and move outwards to the edges. Check for proper installation. Inspect repair area. If the buffed area extends beyond the repair unit, look for signs of tire casing body cords.

DO NOT continue the repair if the buffed area exposes radial ply cords.

- If recommended by repair manufacturer, apply repair sealant to the over-buffed area and the edge of the repair unit.

11. Curing

The repair unit and uncured/suitable vulcanizing material or vulcanizing rubber stem must be cured completely. When using a spotter, section mold or curing chamber, follow the manufacturers' recommendations. Also follow the repair material and equipment manufacturers' recommendations for calculating cure time. Cure the repair for the specified time, temperature, and pressure. For chemically activated repair unit application, allow sufficient time for curing as recommended by the manufacturer.

Repairing Radial Passenger Car and Light Truck Radial Fabric Body Ply Tires

12. Inspect Repair Areas

If the buffed area extends beyond the repair unit, look for signs of tire casing body cords.

X. REPAIR FINISHING

A. General Repair Finishing

Finishing is necessary to ensure satisfactory performance and appearance of the repaired tire. Repair identification (typically the DOT-R Plant Code or other internal codes) and dating should be placed on or next to the repair unit. (See section XI.B., Criteria for Repair Inspection.)

B. Steps for Repair Finishing

The steps listed below are essential for proper completion of a tire repair.

1. Buffing

Buff the cured rubber filler material or trim the precured repair stem to the original contour and appearance of the tire. The surface of the rubber repair material may not extend over 2/32" (1.5 mm) above the surrounding surface. (See section XI.B., Criteria for Repair Inspection.)

2. Tread Design

Restore tread design in the crown area.

B. Criteria for Repair Inspection

The steps listed below are essential for proper inspection of a repaired tire. During the inspection process, the same steps used in Initial Tire Inspection should be followed in the Final Repair Inspection.

1. Inside Inspection

The inside of the tire should be checked to ensure that all repairs are properly installed and bonded, and for any internal injuries or conditions that may have been missed during the initial inspection phase.

2. Outside Inspection

The outside of the tire should be checked to ensure that it has been properly molded, cured, trimmed, and has all the required labeling.

3. Approved procedures should be followed when the tire is mounted and inflated. The tire should be inspected at this time for any anomalies not previously detected. Follow the OSHA Standards for Servicing Multi-piece and Single-Piece Rim Wheels (29 C.F.R. § 1910.177).
4. Section repaired tires should not be returned to service for a minimum of 24 hours after the curing cycle, when they have reached ambient air temperature.

XI. FINAL REPAIR INSPECTION

A. General Repair Inspection

Conduct a final examination of the tire while it is mounted on a spreader under adequate lighting (i.e., 200 fc / 2153 lx minimum, 300 fc / 3229 lx recommended) at the work surface. If heat is used to cure the repair, conduct the inspection while the repair is still warm.

Industry Recommended Practices for Tire Retreading

Retreading Light Truck Radial Steel Body Ply Tires Load Range E and Above

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V. PROCESSING	22
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I. PURPOSE

The purpose of this section is to offer Industry Recommended Practices (IRPs) to members of the industry, for the manufacturing of retreaded light truck radial steel body ply tires, or those with similar material body ply, and a load range of E or above, for highway service. These IRPs are not intended to be, and should not be, used as a substitute for the judgment that each industry member should make in establishing and implementing procedures, training, and supervisory practices for the proper inspection, selection, and retreading of worn tires.

II. SCOPE

This section addresses industry terminology, initial casing inspection and selection for retreading, processing, and final inspection guidelines used in the tire retreading industry.

III. INDUSTRY TERMINOLOGY

See Appendix 1 - Common Retread and Repair Terminology - A Compendium of Industry Terms.

IV. INITIAL CASING INSPECTION AND SELECTION FOR RETREADING

A. General Statement

Thorough inspection should be made by a skilled operator and should include placing the tire casing on a tire inspection machine, or other machine capable of spreading the beads under adequate lighting (i.e., 200 footcandles (fc) / 2153 lux (lx) minimum, 300 fc / 3229 lx recommended) at the work surface, so that the interior and exterior of the casing is adequately exposed for visual and manual examination.



All casings should be dry and free of all loose contaminants (e.g., dirt, water, debris, sealants, visual materials, balancing materials, etc.) and/or other foreign materials prior to inspection. All repair units should be replaced unless they can be determined to be sound and have been properly installed. Inspection criteria should be posted in retread plants.

Retreaders should consult new tire manufacturers or material manufacturers

Retreading Light Truck Radial Steel Body Ply Tires Load Range E and Above

regarding the alteration (i.e., retreading or repairing) of speed rated tires.

In addition to visual inspection, it is also recommended that some type of nondestructive inspection equipment (e.g., holography, shearography, X-ray, ultrasonics, electrostatic, high pressure tester, etc.) be utilized for casing inspection.

B. Inspection Criteria for Light Truck Radial Steel Body Ply Tire Casings Used on the Highway

No tire casings should be accepted for retreading having any of the following conditions or injuries which require repairs beyond the limits of the IRPs or beyond the limits outlined in Table I (see Tables section at the end of this document).

1. External

- a. Ply separation beyond repairable limits
- b. Tread separations which cannot be removed during buffing
- c. Broken, damaged, kinked or exposed bead wire bundle
- d. Excessive oxidation (i.e., weather checking) extending to the body plies or deeper than 2/32" (1.5 mm)
- e. Circumferential cracking
- f. Any signs of weakness or non-repairable injury (e.g., softness due to contamination from chemical/petroleum products, ripples, bulges, porosity, etc.) in the sidewall, particularly in the upper sidewall
- g. Crunching or popping sounds when flexed
- h. Surface cuts which exceed the size of a repairable injury and penetrate the cord body

- i. Radial cracking
- j. Improper labeling

2. Internal

- a. Injuries to the body plies in the non-repairable bead area
- b. Loose cords on the inside ply or evidence of having been run underinflated or overloaded
- c. Non-repairable damage to the inner liner or bead area on tires identified as tubeless
- d. Open inner liner splices which expose cord
- e. Flex breaks, X-breaks or impact breaks
- f. Porous, contaminated from chemical degradation, or loose inner liners
- g. Previously installed repairs found to be defective and unrepairable
- h. Suspected of potential zipper damage
 - Cuts, snags or chips exposing body cords
 - Distortions or undulations (i.e., ripples and/or bulges) visible when using an indirect light source which will produce shadows left by any sidewall irregularities
 - Creasing, wrinkling, cracking or discoloration of the inner liner
 - Soft spot(s) in the sidewall flex area
 - Protruding filaments indicating broken cords
 - Any popping sound when feeling for soft spots or when rolling the tire

Retreading Light Truck Radial Steel Body Ply Tires Load Range E and Above

INJURY LIMITS

- Maximum of 3 repairs*
- All shoulder repairs get #22 or larger repair units
- Look closely for run flat conditions; “zipper potential high”
- 6 years or newer casing (drive tires)
- 4 years or newer casing (steer tires)
- Check California Reg. (RFS-1)
- Refer to tire and repair material manufacturers when in doubt

*Refer to retread manufacturer and/or fleet operator guidelines regarding allowable number of and type of repairs.

C. Selection Criteria for Light Truck Radial Steel Body Ply Tire Casings to be Retreaded for Use in Steer Axle Applications

Light truck radial steel body ply tire casings retreaded for steer axle applications should be appropriately marked on the sidewall adjacent to the federal retread identification code (see Appendix 5 for federally-required labeling). Note that certain state and/or other government agencies may have specific requirements.

V. PROCESSING

A. General Statement

The processes listed below are essential to proper manufacturing of the retread and should be posted in retread plants. Adequate lighting (i.e., 200 fc / 2153 lx minimum, 300 fc / 3229 lx recommended) at the work surface should be provided in the processing area.

B. Buffing

1. Buffed tire dimensions should be appropriate to the tire brand, size, and type, as well as to the retread system used. After buffing, wait time to build should be minimized in order to avoid

contamination or oxidation. If wait time exceeds two hours, the surface should be brushed to remove possible contamination or oxidation before applying cement or cushion.

2. The tread surface, which is to receive the new rubber, should be prepared to a symmetrical profile and proper texture. The buffed surface should be free from contamination and have a TRMG BT3 or BT4 texture (see RP 01/02-23 “BTS6 - Standard Buffing Textures for Tire Retreading and Repairing”).



WARNING

DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

C. Cementing (if required)

1. Tires to be cemented should be free of loose cords or foreign material such as rubber buffings, dirt, oil, etc.
2. Cementing should be accomplished as soon as possible. Consult the retread materials supplier for further information.
3. Exposed steel should be cemented as soon as possible - recommendation is within 15 minutes after exposure.
4. Cemented tires should be kept free from dust and other contaminants.
5. Cemented tires stored for extended periods should be covered, and may need to be cleaned and/or recemented.
6. Cement, if required, should be handled according to the manufacturer's recommendations. Follow all OSHA requirements and safety precautions. Contact the individual materials manufacturer for a copy of any

Retreading Light Truck Radial Steel Body Ply Tires Load Range E and Above

Material Safety Data Sheets (MSDS) needed. Also refer to federal, state and local regulations, especially as related to Volatile Organic Compound (VOC) emissions.

D. Building/Tread Application

1. If tire cord is exposed on any portion of the buffed area, it should be coated with a suitable vulcanizing material before applying the tread rubber.
2. Skives should be filled with a repair material that is thoroughly stitched or extruded into place to eliminate all trapped air and reinforced if necessary (see Recommended Practices for Tire Repairing).

3. Mold Cure (Uncured Rubber) Retreading

- a. Apply cushion gum according to the material supplier's guidelines. Tread rubber should be of crown, base, and gauge dimensions as required for matrix (i.e., mold) design and size, and should provide a minimum of 2/32" (1.5 mm) replacement undertread.

NOTE:

Tires with thicker tread depth may require additional material.

- b. Tread rubber bonding surfaces are not to be contaminated in any way.
- c. Tread rubber should be centered around the tire +/- 1/8" (3.0 mm) from the centerline.
- d. Tread stitching should be performed in such a way as to avoid trapping air, pulling the tread off center, and distorting, folding or wrinkling in the shoulders.
- e. Splices, if any, should be made in such a manner as to ensure minimum distortion of the rubber.

The shoulder should be cut back at a slight angle to remove excess rubber due to crowding in the smaller tire diameters.

- f. If splices are required, a 1/8" to 1/4" (3.0 mm-6.0 mm) overlap, depending on tire size, should be used to allow for a small amount of crowding of the stock, which serves to apply pressure in holding the two surfaces together. Retreaders should use either a butt splice or a 45 degree beveled splice. If a hot knife is used to make these cuts, the temperature of the knife must be below 250°F to prevent scorching, and all cuts should be wiped with a solvent to prevent contamination.

4. Precure Tread Retreading

- a. Tread rubber should be centered around the buffed circumference of the tire +/- 1/8" (3.0 mm) from the centerline.
- b. Tread pattern should be matched as closely as possible at the splice(s), if required, while assuring proper tread length.
- c. Tread ends should be properly prepared over the entire surface and be free of contaminants. If required, the entire tread end surface should be cemented and gum stripped per posted procedure.
- d. Tread stitching should be performed in such a way as to avoid trapping air, pulling the tread off center, and distorting, folding or wrinkling in the shoulders.

E. Curing

1. Mold Cure (Uncured Rubber) Retreading

- a. Tires should be kept free from contamination and stored in such a

Retreading Light Truck Radial Steel Body Ply Tires Load Range E and Above

manner as to avoid distortion of the uncured rubber.

- b. Follow manufacturers' information and/or specifications on curing time, temperature, pressure, and proper curing equipment (i.e., tubes and rims, if used).

2. Precure Tread Retreading

- a. Envelopes or diaphragms, if used, must be leak free. Various testing methods are available, such as inflation or vacuum.
- b. Wicking, if required, will be used to allow air removal from between the envelope or diaphragm on the enclosed tire surface during cure.
- c. Follow manufacturers' information and/or specifications on curing time, temperature, pressure, and proper curing equipment (i.e., tubes and rims, if used).

service for at least 24 hours since adhesion is reduced until the tire has cooled.

- E. Approved procedures should be followed when the tire is mounted and inflated. The tire should be inspected at this time for any anomalies not previously detected. Follow the OSHA Standards for Servicing Multi-piece and Single-Piece Rim Wheels (29 C.F.R. § 1910.177, as amended).

VI. FINAL INSPECTION

- A. After curing, the retreader should make a final examination of the tire, preferably while still warm, and while mounted on a spreader under adequate lighting (i.e., 200 fc / 2153 lx minimum, 300 fc / 3229 lx recommended) at the work surface, so that the interior and exterior of the tire is adequately exposed for visual and manual examination.
- B. The inside of the tire should be checked to ensure that all repairs are properly installed and bonded, and for any internal injuries or conditions that may have been missed during the initial inspection phase.
- C. The outside of the tire should be checked to ensure that it has been properly molded, cured, trimmed, and has all the required labeling.
- D. Retreaded tires should not be returned to

Industry Recommended Practices for Tire Repairing

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

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IV. GENERAL STATEMENT ABOUT TIRE REPAIRING

Thorough inspection should be made by a skilled technician and should include placing the tire casing on a tire inspection machine, or other machine capable of spreading the beads under adequate lighting (i.e., 200 footcandles (fc) / 2153 lux (lx) minimum, 300 fc / 3229 lx recommended) at the work surface, so that the interior and exterior of the casing is adequately exposed for visual and manual examination.



Tire Casing on Inspection Machine

I. PURPOSE

The purpose of this section is to offer Industry Recommended Practices (IRPs) to members of the industry, for the permanent repairing of light truck radial steel body ply tires, or those with similar material body ply, and a load range of E or above, for highway service. These IRPs are not intended to be, and should not be, used as a substitute for the judgment that each industry member should make in establishing and implementing procedures, training, and supervisory practices for the proper repair of damaged tires.

II. SCOPE

This section addresses industry terminology, initial tire inspection, acceptable repairing criteria, repair finishing, and final inspection practices used in the tire repairing industry.

III. INDUSTRY TERMINOLOGY

See Appendix 1 - Common Retread and Repair Terminology - A Compendium of Industry Terms.

All casings should be dry and free of all loose contaminants (e.g., dirt, water, debris, sealants, visual materials, balancing materials, etc.) and/or other foreign materials prior to inspection. All repair units should be replaced unless they can be determined to be sound and have been properly installed. Inspection criteria should be posted in retread plants.

Tire repair facilities should consult new tire manufacturers or material manufacturers regarding the alteration (i.e., retreading or repairing) of speed rated tires. The selection of the repair materials used should be based on the suppliers' recommendations.

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.

V. INITIAL TIRE INSPECTION

Repair procedures require the following:

- Removing damaged material
- Preparing the injured area
- Filling the injury with a suitable vulcanizing material or vulcanizing rubber stem
- Reinforcing and sealing the repair area

NEVER PERFORM A TIRE REPAIR WITHOUT REMOVING THE TIRE FROM THE RIM/WHEEL ASSEMBLY FOR INTERNAL INSPECTION.

OUTSIDE-IN OR ON-THE-WHEEL TIRE REPAIRS ARE NOT RECOMMENDED.

CONTACT TIRE MANUFACTURERS FOR SPECIFIC REPAIR PROCEDURES.

A. Inspection Criteria for Repairing

No tires should be accepted for repairing if they have any of the following conditions or injuries or which require repairs beyond the limits shown in Tables I and IIA (see Tables section at the end of this document).

1. External

- a. Surface cuts which exceed the size of a repairable injury and penetrate the cord body
- b. Broken, damaged, kinked or exposed bead wire bundle
- c. Damage which requires the repairs to overlap

- d. Broken belts
- e. Excessive oxidation (i.e., weather checking) beyond 2/32" (1.5 mm) in depth
- f. Tires with less than 2/32" (1.5 mm) tread depth (i.e., non-skid) remaining unless retreading is planned
- g. Radial and/or circumferential cracking
- h. Improper or missing sidewall information
- i. Any signs of weakness or non-repairable injury (e.g., softness due to contamination from chemical/petroleum products, ripples, bulges, porosity, etc.) in the sidewall, particularly in the upper sidewall
- j. Crunching or popping sounds when flexed

2. Internal

- a. Injury to the body ply cord beyond repairable limits
- b. Open inner liner splices which expose cord
- c. Porous, contaminated from chemical degradation, or loose inner liners
- d. Loose cords on the inside ply or any evidence of having been run underinflated or overloaded
- e. Previously installed repairs found to be defective and unrepairable
- f. Injuries to the body plies in the non-repairable bead area
- g. Flex breaks, X-breaks or impact breaks
- h. Non-repairable damage to the inner liner or bead area on tires identified as tubeless

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

In addition to checking for non-repairable conditions, check the valve assembly and bead area for leaks using a water or leak detection solution, where practical, *prior to* demounting and deflating the tire. If a leak is found in the valve assembly or in the bead area, certain repairs may not be possible since the tire will not hold air.

Furthermore, along with visual inspection, it is also recommended that some type of nondestructive inspection equipment (e.g., holography, shearography, X-ray, ultrasonics, electrostatic, high pressure tester, etc.) be utilized for casing inspection.

and maintain its air retention capability. Consult casing manufacturer for bead area repair specifications.

D. Steps for Minor Rubber Repair

The steps listed below are essential to perform a minor rubber repair.



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.

VI. MINOR RUBBER REPAIRS

Minor repairs are generally rubber only repairs, but should be performed in a full-service repair facility. See Appendix 1 - Common Retread and Repair Terminology – A Compendium of Industry Terms for a definition of “Full Service Repair Facility”.

A. Spot Repair

Radial tires with damage to the body cords cannot be spot repaired but should be considered for section repairing.



WARNING

DO NOT use flammable **solvents** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of solvents could cause serious personal injury or death.

B. Inner Liner Repair

Open inner liner splices, cracks which do not expose cord, tool damage or blisters may be repaired in tubeless tires. Consult casing manufacturer for inner liner repair specifications.

C. Bead Area Repair

Bead area repairs are limited to rubber only repairs. In no case should a kinked or broken bead be repaired. Tires with evidence of bead area separation or rusting in the body plies should be rejected.

Bead area repairs on all tires should restore the original contour of the bead. In addition, bead repairs on a tubeless tire should restore

1. Probing and Foreign Material Removal

Use a probe to inspect the damage. Remove any foreign material.

2. Inspection

Inspect the injury to determine the extent of damage. If there is ply body damage, refer to the Section Repairs portion of this document (see section IX).

In addition to visual inspection, it is also recommended that some type of nondestructive inspection equipment (e.g., holography, shearography, X-ray, ultrasonics, electrostatic, high pressure tester, etc.) be utilized for casing inspection.

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

3. Pre-Cleaning

Remove all contaminants from around the injury.

NOTE:

1.) Tires that contain any type of aftermarket puncture sealant(s) may have been damaged as a result of being run underinflated and/or overloaded, and should be inspected accordingly.

2.) Tires that are manufactured with puncture sealing capabilities require specialized repair techniques. The tire and/or sealant manufacturers should be contacted for recommendations. It may be necessary to repeat step 3, pre-cleaning, to ensure that the repair area is free of contaminants.

4. Buffing

Buff the injury to achieve a uniform TRMG BT1 or BT2 buff texture for all repairs (see RP 01/02-23 “BTS6 - Standard Buffing Textures for Tire Retreading and Repairing”). Remove all damaged or loose material. Texturize the repair area with a low-speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing tool while keeping the repair area as small as possible.

5. Cleaning

Remove any rubber dust and contaminants from the buffed area with a fine wire brush and vacuum to provide a clean, dry surface. Do not use compressed air to clean bonding surfaces because the unfiltered air lines may contain contaminants such as oil and moisture, which can reduce adhesion.



WARNING

DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

6. Cementing

Apply the appropriate cement to the prepared surface with no puddling or streaking. Allow the cement to dry for the recommended time. In cold and/or humid climate conditions, extend the drying time as recommended by the manufacturer.

7. Filling

Fill the injury with a suitable vulcanizing material.

8. Curing

Cure the repair for the specified time, temperature, and pressure according to the equipment and materials manufacturers’ recommendations. For chemically activated repairs, allow sufficient time for curing as recommended by the manufacturer.

VII. PUNCTURE REPAIR (NAIL HOLE REPAIR)

Prior to demounting and deflating the tire, check the valve and outer surface for leaks using a water or leak detection solution, where practical. If a leak is found in the valve assembly or in the bead area, a puncture repair may not be possible since the tire will not hold air. If no leak is found in valve assembly or bead area, proceed by marking the injury, totally deflate, and demount the tire.

Repair procedures require the following:

- Removal of damaged material
- Preparing the injured area
- Filling the injury with a suitable vulcanizing material or vulcanizing rubber stem
- Reinforcing and sealing the repair area

NEVER PERFORM A TIRE REPAIR WITHOUT REMOVING THE TIRE FROM THE RIM/WHEEL ASSEMBLY FOR INTERNAL INSPECTION.

OUTSIDE-IN OR ON-THE-WHEEL TIRE REPAIRS ARE NOT RECOMMENDED.

CONTACT TIRE MANUFACTURERS FOR SPECIFIC REPAIR PROCEDURES.

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

Determine the extent and location of any injuries. Repair shops should consult the tire manufacturer and repair material manufacturer regarding the alteration (i.e., retreading or repairing) of speed rated tires.

NOTE:

Not all tires can be repaired. Specific repair limits should be based on recommendations or repair policies of the tire manufacturer and/or type of tire service (e.g., service description, run-flat technology, commercial service applications, etc.).



FIGURE 1

A. Light Truck Radial Steel Body Ply Tire Puncture Repair

Tire puncture repairs should be limited to the tread area only and should not exceed 3/8" (10.0 mm) in diameter after preparation. Refer to tire manufacturer for recommended repair limits.

Figure 1 represents a light truck radial steel body ply tire (load range E and above) and indicates that puncture repairs are limited to the tread area only, as generally depicted in the graphic.

DO NOT make repairs where the injury damage extends into the shoulder/belt edge area OR where the injury extends at an angle into the shoulder area.

B. Steps for Puncture Repair

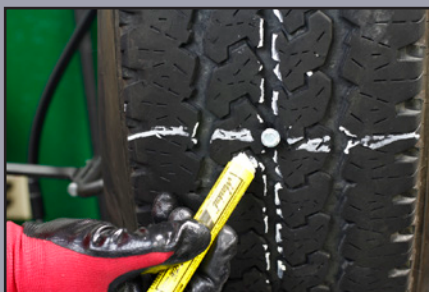
The steps listed below are essential to repair a puncture in light truck radial steel body ply tires. See tire repair images below and on the following pages.

PUNCTURE REPAIR

Mark and Probe the Injury



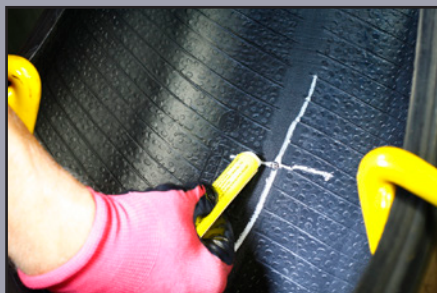
Place Tire on Inspection Machine



Mark the Injury - Outside Tire



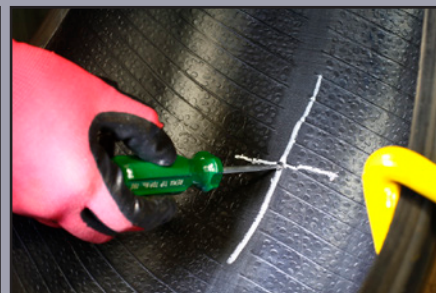
Remove Penetrating Object



Mark the Injury - Inside Tire



Probe the Injury - Outside Tire



Probe the Injury - Inside Tire

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.

NOTE:

1.) Tires that contain any type of aftermarket puncture sealant(s) may have been damaged as a result of being run underinflated and/or overloaded, and should be inspected accordingly.

2.) Tires that are manufactured with puncture sealing capabilities require specialized repair techniques. The tire and/or sealant manufacturers should be contacted for recommendations. It may be necessary to repeat step 2, pre-cleaning, to ensure that the repair area is free of contaminants.



WARNING

DO NOT use flammable **solvents** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of solvents could cause serious personal injury or death.

1. Probing and Foreign Material Removal

Probe the injury with a tire probe to determine the angle and size of penetration. Inspect and remove any foreign material that has penetrated the tire.

2. Pre-Cleaning

Remove all contaminants from around the injury.

3. Preparation of the Injury

When possible, drill the injury from the inside a minimum of three times with the appropriate carbide cutter on a low speed (i.e., 1,200 rpm maximum) air/electric drill, or other suitable tool, following the angle of penetration. Tools used must remove the damaged steel and create a round hole. Repeat this process a minimum of three times from the outside of the tire to ensure complete damage removal, being careful not to elongate the hole.

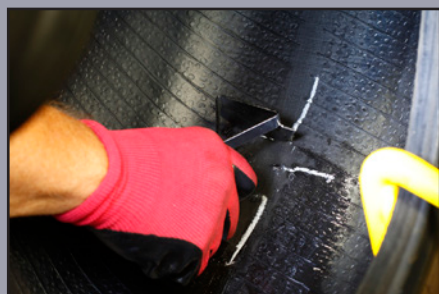
Use a probe to check for any splits in the radial plies surrounding the injury. Remove any additional damage found.

4. Inspection

Inspect the injury, and consult the tire manufacturer regarding injury limits. In addition, inspect the prepared injury for inner liner splits. If present, this is no

PUNCTURE REPAIR cont.

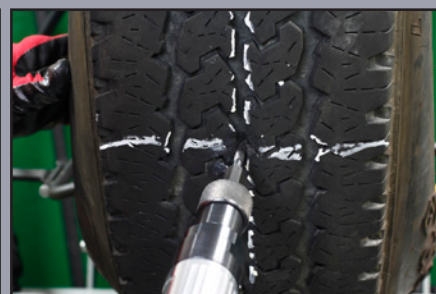
Pre-Clean and Drill



Scrape Away Contaminants



Drill the Injury - Inside Tire



Drill the Injury - Outside Tire

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

PUNCTURE REPAIR cont. Repair Unit Selection



One Piece Repair Unit



Two Piece Repair Unit

longer a puncture repair. Refer to the Section Repair portion of this document (see section IX.B.).

5. Repair Unit Selection

Select the appropriate repair unit based on repair material manufacturer

recommendations. Center the unit over the injury and outline an area about 1/2" (13.0 mm) larger than the repair unit, to ensure that crayon marks are not removed when buffing.

For injuries with an angle greater than 25 degrees, depending on repair manufacturer, use a two-piece repair unit system.

PUNCTURE REPAIR cont.

Buff and Clean Repair Area for a One-Piece Repair Unit



Buff the Repair Area



Brush the Repair Area

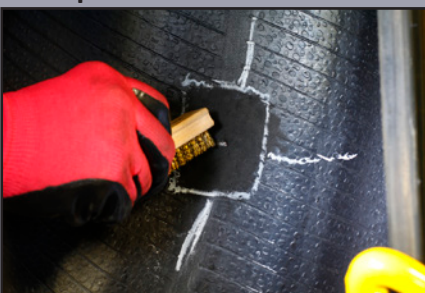


Vacuum the Repair Area

Buff and Clean Area for a Two-Piece Repair Unit



Buff the Repair Area



Brush the Repair Area



Vacuum the Repair Area

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

6. Inner Liner Buffing

To prevent contamination and preserve the outline, buff within the marked area thoroughly and evenly using a low speed (i.e., 5,000 rpm maximum) buffer with a fine wire brush or gritted rasp. Take care not to expose or damage the tire casing body (ply) cords. Buff to a velvet surface; TRMG BT1 or BT2 texture.

7. Cleaning

Remove any rubber dust and contaminants from the buffed area with a fine wire brush and vacuum to provide a clean, dry surface. Do not use compressed air to clean bonding

surfaces because the unfiltered air lines may contain contaminants such as oil and moisture, which can reduce adhesion.



WARNING

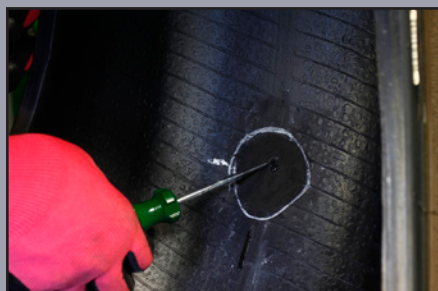
DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

8. Cementing

Apply appropriate cement to the buffed surface and, if required, to the back of the

PUNCTURE REPAIR cont.

Cement and Install One-Piece Repair Unit



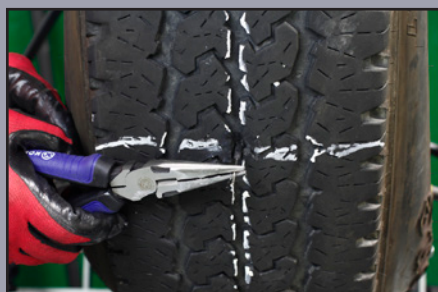
Cement the Injury Channel



Cement the Buffed Area



Install the Repair Unit



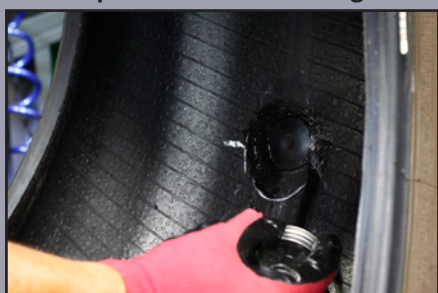
Pull Repair Unit Stem Through Tire



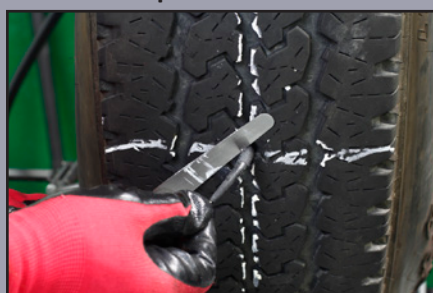
Press Repair Unit into Place



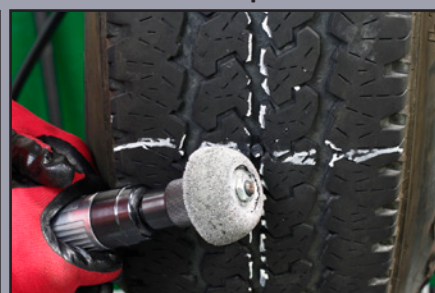
Stitch the Repair Unit



Apply Repair Sealant



Cut the Stem - Outside Tire



Buff the Cut Stem

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

repair unit. Allow the cement to dry for the recommended time. While drying, the tire should be rotated so that the injury is not positioned at the bottom of the tire.

DO NOT use forced air or an outside heat source to accelerate drying time. Refer to repair materials manufacturer recommendations.

9. Fill the Injury

If using an uncured/suitable vulcanizing material or vulcanizing rubber stem, fill the injury with the appropriate material.

10. Repair Unit Installation

Repair units are to be installed while the beads of the tire are in a relaxed position. Align the repair unit according to the markings on the repair unit. Avoid trapping air and/or possible bridging of the unit as it is installed.

- a. When using a one-piece repair unit, cement the injury channel, insert the stem from the inside of the tire, and pull through until the base of the repair unit is snug against the prepared and cemented surface of the inner liner.

PUNCTURE REPAIR cont.

Cement and Install Two-Piece Repair Unit



Cement the Injury Channel



Insert the Stem



Cut the Stem - Inside Tire



Cement the Buffed Area



Install the Repair Unit



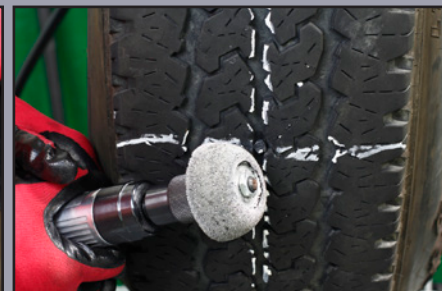
Stitch the Repair Unit



Apply Repair Sealant



Cut the Stem - Outside Tire



Buff the Cut Stem

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

- b. When using a two-piece repair unit (i.e., separate repair unit and filler stem), cement the injury channel and fill the injury from the inside with a suitable vulcanizing rubber stem designed for that size injury. Without stretching the stem, cut/trim the excess material inside the tire, and buff the stem flush with the inner liner to accommodate the appropriate size repair unit.

Remember, for both types of repair units, **DO NOT** cement the stem. Instead, cement the injury channel.

11. Stitching

For all methods, stitch the entire repair unit starting from the center, and work outwards to the edges. Check for proper installation. Cut the fill material flush with the outer tread surface making sure not to stretch or pull the stem while cutting. If the stem is not flush with tread after cutting, buff lightly until it is level with tread.

12. Curing

The repair unit and uncured/suitable vulcanizing material or vulcanizing rubber stem, must be cured completely. When using a spotter, section mold or curing chamber, follow the manufacturers' recommendations. Also follow the manufacturers' recommendations for calculating cure time. Cure the repair for the specified time, temperature, and pressure according to the equipment and materials manufacturers' recommendations. For chemically activated repairs, allow sufficient time for curing as recommended by the manufacturer.

13. Inspect Repair Areas

If the buffed area extends beyond the repair unit, look for signs of tire casing body cords.

Apply repair sealant to the over-buffed area and the edge of the repair unit. A patch only or a plug (stem) only is not a proper puncture repair. (See section X, Repair Finishing.)

VIII. REINFORCEMENT REPAIRS

Determine the extent and location of any injuries. Repair shops should consult the tire manufacturer and repair material manufacturer regarding specific repair limits. These limits should be based on recommendations of the tire manufacturer, repair materials manufacturer, and type of tire service.

A. Steps for Reinforcement Repairs

Refer to the Section Repairs portion of this document (see section IX.B., Steps for Section Repairs).



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.



WARNING

DO NOT use flammable **solvents** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of solvents could cause serious personal injury or death.

IX. SECTION REPAIRS

Determine the extent and location of any injuries. Repair shops should consult the tire manufacturer and repair material manufacturer regarding specific repair limits. These limits should be based on recommendations of the tire manufacturer, repair materials manufacturer, and type of tire service.

A. Section Repair Limits

There are several methods of section repairing tires. The method is dependent on the materials and equipment being used.

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

Final measurements to determine repairability and repair unit selection should be made when all of the injury has been removed.

B. Steps for Section Repairs

The steps listed below are essential to make a section repair in a tire.



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.



WARNING

DO NOT use flammable **solvents** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of solvents could cause serious personal injury or death.

1. Probing and Foreign Material Removal

Use a probe to inspect and remove any foreign material that has penetrated the tire.

2. Inspection

Inspect, mark, and measure all injuries to determine repairability and the extent of damage.

3. Pre-Cleaning

Remove all contaminants from around the injury.

NOTE:

1.) Tires that contain any type of aftermarket puncture sealant(s) may have been damaged

as a result of being run underinflated and/or overloaded, and should be inspected accordingly.

2.) Tires that are manufactured with puncture sealing capabilities require specialized repair techniques. The tire and/or sealant manufacturers should be contacted for recommendations. It may be necessary to repeat step 3, pre-cleaning, to ensure that the repair area is free of contaminants.

4. Skiving

Using a low-speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing texture tool, remove all damaged rubber above the steel cables, taking care to keep the injured area as small as possible. Use an appropriate texture tool on a low-speed (i.e., 5,000 rpm maximum) buffer to buff away remaining rubber and very lightly expose only tread belt cables believed to be damaged (i.e., just until they are visible). All damaged loose body ply must be trimmed back to solid rubber. Buff with a low-speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing texture tool to achieve a uniform TRMG BT2 or BT3 texture. Always probe the repair area after damage removal to ensure that no cuts or separations remain in the tire.

5. Repair Unit Selection

Select the appropriate repair unit based on the construction of the tire and the size of the damage to the body cords or cables. Final measurements should be made when the entire injury has been removed. Refer to Table I and related diagrams for Maximum Injury Limits (see Tables section at the end of this document), and to repair materials manufacturers' charts for proper repair unit selection.

6. Inner Liner Buffing

Buff the area for the repair unit with a low speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing texture tool to achieve a uniform TRMG BT1 or BT2 buffed texture. The buffed area should be slightly larger than the repair unit.

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

NOTE:

If a suitable vulcanizing material or vulcanizing rubber stem is used to fill an injury, it must be installed before buffing.

Cement the injury channel and fill the injury from the inside with a suitable vulcanizing material or vulcanizing rubber stem. Without stretching the stem, trim the excess material inside the tire, and buff the stem flush with the inner liner to accommodate the appropriate size repair unit.

7. Cleaning

Remove any rubber dust and contaminants from the buffed area with a fine wire brush and vacuum to provide a clean, dry surface. Do not use compressed air to clean bonding surfaces because the unfiltered air lines may contain contaminants such as oil and moisture, which can reduce adhesion.



WARNING

DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

8. Cementing

Apply the appropriate cement to the buffed surface depending on the repair method being used. Also apply the appropriate cement to the back of the repair unit if required. The cement should be applied evenly to all surfaces with no puddling or streaking. Allow the cement to dry for the recommended time. In cold and/or humid climate conditions, extend the drying time as recommended by the manufacturer.

DO NOT use forced air or outside heat source to accelerate drying time. Refer to repair materials manufacturer recommendations.

9. Fill the Injury

Fill the injury with an uncured/suitable vulcanizing material or vulcanizing rubber stem.

10. Repair Unit Installation

Repair units are to be installed with the beads of the tire in the relaxed position. Align the repair unit according to markings on the repair unit.

- When using a one-piece chemical section repair unit, insert the stem from the inside of the tire and pull through until the base of the repair unit is snug against the prepared and cemented surface of the inner liner.
- Stitch the entire repair unit starting from the center, and move outwards to the edges. Check for proper installation. Inspect repair area. If the buffed area extends beyond the repair unit, look for signs of tire casing body cords.

DO NOT continue the repair if the buffed area exposes radial ply cords.

- If recommended by repair manufacturer, apply repair sealant to the over-buffed area and the edge of the repair unit.

11. Curing

The repair unit and uncured/suitable vulcanizing material, or vulcanizing rubber stem, must be cured completely. When using a spotter, section mold or curing chamber, follow the manufacturers' recommendations. Also follow the repair material and equipment manufacturers' recommendations for calculating cure time. Cure the repair for the specified time, temperature, and pressure. For chemically activated repair unit application, allow sufficient time for curing as recommended by the manufacturer.

Repairing Light Truck Radial Steel Body Ply Tires Load Range E and Above

12. Inspect Repair Areas

If the buffed area extends beyond the repair unit, look for signs of tire casing body cords.

X. REPAIR FINISHING

A. General Repair Finishing

Finishing is necessary to ensure satisfactory performance and appearance of the repaired tire. Repair identification (typically the DOT-R Plant Code or other internal codes) and dating should be placed on or next to the repair unit. (See section XI.B., Criteria for Repair Inspection.)

B. Steps for Repair Finishing

The steps listed below are essential for proper completion of a tire repair.

1. Buffing

Buff the cured rubber filler material or trim the precured repair stem to the original contour and appearance of the tire. The surface of the rubber repair material may not extend over 2/32" (1.5 mm) above the surrounding surface. (See section XI.B., Criteria for Repair Inspection.)

2. Tread Design

Restore tread design in the crown area.

B. Criteria for Repair Inspection

The steps listed below are essential for proper inspection of a repaired tire. During the inspection process, the same steps used in Initial Tire Inspection should be followed in the Final Repair Inspection.

1. Inside Inspection

The inside of the tire should be checked to ensure that all repairs are properly installed and bonded, and for any internal injuries or conditions that may have been missed during the initial inspection phase.

2. Outside Inspection

The outside of the tire should be checked to ensure that it has been properly molded, cured, trimmed, and has all the required labeling.

3. Approved procedures should be followed when the tire is mounted and inflated. The tire should be inspected at this time for any anomalies not previously detected. Follow the OSHA Standards for Servicing Multi-Piece and Single-Piece Rim Wheels (29 C.F.R. § 1910.177).

4. Section repaired tires should not be returned to service for a minimum of 24 hours after curing, when they have reached ambient air temperature.

XI. FINAL REPAIR INSPECTION

A. General Repair Inspection

Conduct a final examination of the tire while it is mounted on a spreader under adequate lighting (i.e., 200 fc / 2153 lx minimum, 300 fc / 3229 lx recommended) at the work surface. If heat is used to cure the repair, conduct the inspection while the repair is still warm.



Industry Recommended Practices for Tire Retreading

Retreading Medium Truck, Heavy Radial Truck, and Bus Tires

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I. PURPOSE

The purpose of this section is to offer Industry Recommended Practices (IRPs) to members of the industry, for the manufacturing of retreaded medium truck, heavy radial truck, and bus tires for highway service. These IRPs are not intended to be, and should not be, used as a substitute for the judgment that each industry member should make in establishing and implementing procedures, training, and supervisory practices for the proper inspection, selection, and retreading of worn tires.

II. SCOPE

This section addresses industry terminology, initial casing inspection and selection for retreading, processing, and final inspection guidelines used in the tire retreading industry.

III. INDUSTRY TERMINOLOGY

See Appendix 1 - Common Retread and Repair Terminology - A Compendium of Industry Terms.

IV. INITIAL CASING INSPECTION AND SELECTION FOR RETREADING

A. General Statement

Thorough inspection should be made by a skilled operator and should include placing the tire casing on a tire inspection machine, or other machine capable of spreading the beads under adequate lighting (i.e., 200 footcandles (fc) / 2153 lux (lx) minimum, 300 fc / 3229 lx recommended) at the work surface so that the interior and exterior of the casing is adequately exposed for visual and manual examination. See casing inspection images on the following page.

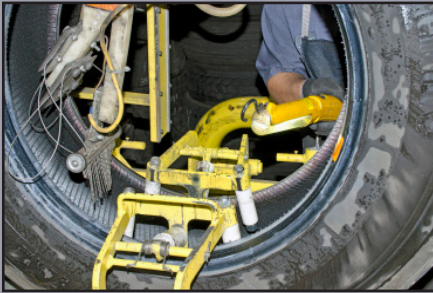


Tire Casing on Inspection Machine

All casings should be dry and free of all loose contaminants (e.g., dirt, water, debris, sealants, visual materials, balancing materials, etc.) and/or other foreign materials prior to inspection. All repair units should be replaced unless they can be determined to be sound and have been properly installed. Inspection criteria should be posted in retread plants.

Retreading Medium Truck, Heavy Radial Truck, and Bus Tires

INITIAL CASING INSPECTION



Inspect Inside of Casing



Mark Inspection Starting Point



Inspect Outside of Casing



Probe Injury



Remove Foreign Material



Casing on Shearography Machine

In addition to visual inspection, it is also recommended that some type of nondestructive inspection equipment (e.g., holography, shearography, X-ray, ultrasonics, electrostatic, high pressure tester, etc.) be utilized for casing inspection.

B. Inspection Criteria for Medium Truck, Heavy Radial Truck, and Bus Casings Used on the Highway

No medium truck, heavy radial truck or bus tire casings should be accepted for retreading having any of the following conditions or injuries which require repairs beyond the limits of the IRPs or beyond the limits outlined in Tables I and II-A (see Tables section at the end of this document). Medium truck, heavy radial truck, and bus tires should meet the labeling requirements outlined in section VI.C. of this document.

1. External

- a. Ply separation beyond repairable limits
- b. Tread separations which cannot be removed during buffing
- c. Broken, damaged, kinked or exposed bead wire bundle
- d. Excessive oxidation (i.e., weather checking) extending to the body plies or deeper than 2/32" (1.5 mm)
- e. Tires worn to exposed belt wires on more than 10% of the worn tire circumference, unless a protector belt is to be removed or damaged belts are to be replaced
- f. Circumferential cracking
- g. Tires with rust or corrosion beyond repairable limits
- h. Any signs of weakness or non-repairable injury (e.g., softness due to contamination from chemical/petroleum products, ripples, bulges, porosity, etc.) in the

Retreading Medium Truck, Heavy Radial Truck, and Bus Tires

sidewall, particularly in the upper sidewall

- i. Crunching or popping sounds when flexed
- j. Surface cuts which exceed the size of a repairable injury and penetrate the cord body
- k. Radial ply cracking
- l. Improper labeling

2. Internal

- a. Injuries to the body plies in the non-repairable bead area
- b. Loose cords on the inside ply or evidence of having been run underinflated or overloaded
- c. Non-repairable damage to the inner liner or bead area on tires identified as tubeless
- d. Open inner liner splices which expose cord
- e. Flex breaks, X-breaks or impact breaks
- f. Porous, contaminated from chemical degradation, or loose inner liners
- g. Previously installed repairs found to be defective and unrepairable
- h. Suspected of potential zipper damage (see section VI.D. Zipper Damage Indicators)

C. Selection Criteria for Medium Truck, Heavy Radial Truck, and Bus Tire Casings to be Retreaded for Use in Steer Axle Applications

Medium truck, heavy radial truck or bus tire casings retreaded for steer axle applications, should be appropriately marked on the

sidewall adjacent to the federal retread identification code (see Appendix 5 for federally-required labeling). Note that certain state and/or other government agencies may have specific requirements.

NOTE:

Federal Motor Carrier Safety Regulations, 9C.F.R. § 393.75 (d), specify that "No bus shall be operated with regrooved, recapped or retreaded tires on the front wheels."

D. Zipper Damage Indicators

Indications of zipper damage include any signs of weakness or non-repairable injury (e.g., ripples, bulges, porosity, softness, etc.) in the sidewall, particularly the upper sidewall. Steel belted radial tires exhibiting such conditions should be rejected and scrapped.

- 1. Cuts, snags or chips exposing body cords or steel
- 2. Distortions or undulations (ripples and/or bulges) visible when using an indirect light source which will produce shadows left by any sidewall irregularities
- 3. Creasing, wrinkling, cracking or discoloration of the inner liner
- 4. Soft spot(s) in the sidewall flex area
- 5. Protruding filaments indicating broken cords
- 6. Any popping sound when feeling for soft spots or when rolling the tire

V. PROCESSING

A. General Statement

The processes listed below are essential to proper manufacturing of the retread and should be posted in retread plants. Adequate lighting (i.e., 200 fc / 2153 lx minimum, 300 fc / 3229 lx recommended) at the work surface should be provided in the processing area.

Retreading Medium Truck, Heavy Radial Truck, and Bus Tires

BUFFING AND INJURY REMOVAL



Casing on a Buffing Machine



Buff Tread Surface



Remove Injury - Tread Area



Remove Injury - Shoulder



Fill Skives



Fill Skives

B. Buffing

1. Buffed tire dimensions should be appropriate to the tire brand, size, and type, as well as to the retread system used. After buffing, wait time to build should be minimized in order to avoid contamination or oxidation. If wait time exceeds two hours, the surface should be brushed to remove possible contamination or oxidation before applying cement or cushion.
2. The tread surface, which is to receive the new rubber, should be prepared to a symmetrical profile and proper texture.

All frayed cord should be trimmed back to solid rubber. The buffed surface should be free from contamination and have a texture equivalent to a TRMG BT3 or BT4 (see RP 01/02-23 "BTS6 - Standard Buffing Textures for Tire Retreading and Repairing").

3. The buffed surface should be examined

and penetrations of tread cuts skived to remove injured material.

4. Any damage larger than 3/8" (10.0 mm) to the first working belt (i.e., belt closest to radial ply) requires a section repair (refer to Appendix 2). Damage to the #2 or #3 belt greater than 3/8" (10.0 mm) may require a section repair. Consult the new tire manufacturer and/or the tire repair materials manufacturer for further information.



WARNING

DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

C. Cementing (if required)

1. Tires to be cemented should be free of

Retreading Medium Truck, Heavy Radial Truck, and Bus Tires

- loose cords or foreign material such as rubber buffings, dirt, oil, etc.
 2. Cementing should be accomplished as soon as possible. Consult the retread materials supplier for additional information.
 3. Exposed steel should be cemented as soon as possible - recommendation is within 15 minutes after exposure.
 4. Cemented tires should be kept free from dust and other contaminants.
 5. Cemented tires stored for extended periods should be covered, and may need to be cleaned and/or recemented.
 6. Cement, if required, should be handled according to manufacturers' recommendations. Follow all OSHA requirements and safety precautions. Contact the individual materials manufacturer for a copy of any Material Safety Data Sheets (MSDS) needed. Also refer to federal, state and local regulations, especially as related to Volatile Organic Compound (VOC) emissions.
2. Skives should be filled with a repair material that is thoroughly stitched or extruded into place to eliminate all trapped air and reinforced if necessary (see Recommended Practices for Tire Repairing).
3. **Mold Cure (Uncured Rubber) Retreading**
 - a. Apply cushion gum according to material suppliers' guidelines. Tread rubber should be of crown, base, and gauge dimensions as required for matrix (i.e., mold) design and size in which the tire is to be cured, and should provide a minimum of 3/32" (2.5 mm) replacement undertread.

NOTE:

Tires with thicker tread depth may require additional material.

- b. Tread rubber bonding surfaces are not to be contaminated in any way.
- c. Tread rubber should be centered around the tire +/- 1/8" (3.0 mm) from the centerline.
- d. Tread stitching should be performed in such a way as to avoid trapping air, pulling the tread off center, and distorting, folding or wrinkling in the shoulders.

D. Building/Tread Application

1. If tire cord is exposed on any portion of the buffed area, it should be coated with a suitable vulcanizing material before applying the tread rubber.

MOLD CURE RETREADING



Stock Rubber - Extruder Application



Apply Rubber to Buffed Casing



Apply Rubber to Buffed Casing

Retreading Medium Truck, Heavy Radial Truck, and Bus Tires

- e. Splices, if any, should be made in such a manner as to ensure minimum distortion of the rubber. No heavy bulging or open light joints. The shoulder area should be cut back at a slight angle to remove excess rubber due to crowding in the smaller tire diameters.
- f. If splices are required, a 1/8" to 1/4" (3.0 mm-6.0 mm) overlap, depending on tire size, should be used to allow for a small amount of crowding of the stock, which serves to apply pressure in holding the two surfaces together. Retreaders should use either a butt splice or a 45 degree beveled splice. If a hot knife is used to make these cuts, the temperature of the knife must be below 250°F to prevent scorching, and all cuts should be wiped with a solvent to prevent contamination.

4. Precure Tread Retreading

- a. Tread rubber should be centered around the buffed circumference of the tire +/- 1/8" (3.0 mm) from the centerline.
- b. Tread pattern should be matched as closely as possible at the splice(s), if required, while assuring proper tread length.
- c. Tread ends should be properly prepared over the entire surface and be free of contaminants. If required, the entire tread end surface should be cemented and gum stripped per posted procedure.
- d. Tread stitching should be performed in such a way as to avoid trapping air, pulling the tread off center, and distorting, folding or wrinkling in the shoulders.

PRECURE TREAD RETREADING



Apply Tread to Buffed Casing



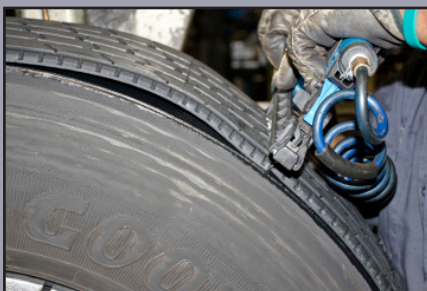
Cut Tread Ends to Proper Length



Cement Tread Ends



Match Tread Pattern at the Splice



Staple Seam



Casing Ready for Curing Chamber

Retreading Medium Truck, Heavy Radial Truck, and Bus Tires

E. Curing

(See images on the following page.)

1. Mold Cure (Uncured Rubber) Retreading

- a. Tires should be kept free from contamination and stored in such a manner as to avoid distortion of the uncured rubber.
- b. Follow manufacturers' information and/or specifications on curing time, temperature, pressure, and proper curing equipment (i.e., tubes and rims if used).

2. Precure Tread Retreading

- a. Envelopes or diaphragms, if used, must be leak free. Various testing methods are available, such as inflation or vacuum.
- b. Wicking, if required, will be used to allow air removal from between the envelope or diaphragm on the enclosed tire surface during cure.
- c. Follow manufacturers' information and/or specifications on curing time, temperature, pressure, and proper curing equipment (i.e., tubes and rims if used).

- C. The outside of the tire should be checked to ensure that it has been properly molded, cured, trimmed and has all the required labeling, including as federally required in 49 C.F.R. Part 574 – Tire Identification and Record Keeping (as amended). Retreads used in certain states may require additional labeling indicating that a tire has been retreaded in accordance with this retreading standard, and whether or not it qualifies for use in steer axle applications (see Appendices at the end of this document and Reference Documents list following the Table of Contents).

- D. Retreaded tires should not be returned to service for at least 24 hours since adhesion is reduced until the tire has cooled.

- E. Approved procedures should be followed when the tire is mounted and inflated. The tire should be inspected at this time for any anomalies not previously detected. Follow the OSHA Standards for Servicing Multi-piece and Single-Piece Rim Wheels (29 C.F.R. § 1910.177, as amended).

VI. FINAL INSPECTION

- A. After curing, the retreader should make a final examination of the tire, preferably while still warm, and while mounted on a spreader under adequate lighting (i.e., 200 fc / 2153 lx minimum, 300 fc / 3229 lx recommended) at the work surface, so that the interior and exterior of the tire is adequately exposed for visual and manual examination.
- B. The inside of the tire should be checked to ensure that all repairs are properly installed and bonded, and for any internal injuries or conditions that may have been missed during the initial inspection phase.

Retreading Medium Truck, Heavy Radial Truck, and Bus Tires

CURING

Mold Cure Retreading



Place Casing in Tire Curing Press



Casing in Tire Curing Press



Mold Cure Complete

CURING

Precure Retreading



Apply Envelope



Casing in Envelope



Casings Ready for Curing Chamber



Remove Air from Envelope



Casings Placed in Curing Chamber



Casings Ready for Envelope Removal



Envelope Removal



Envelope Removal



Envelope Removal

Industry Recommended Practices for Tire Repairing

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

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I. PURPOSE

The purpose of this section is to offer Industry Recommended Practices (IRPs) to members of the industry, for the permanent repairing of medium truck, heavy radial truck, and bus tires for highway service. These IRPs are not intended to be, and should not be, used as a substitute for the judgment that each industry member should make in establishing and implementing procedures, training, and supervisory practices for the proper repair of damaged tires.

II. SCOPE

This section addresses industry terminology, initial tire inspection, acceptable repairing criteria, repair finishing, and final inspection practices used in the tire repairing industry.

III. INDUSTRY TERMINOLOGY

See Appendix 1 - Common Retread and Repair Terminology - A Compendium of Industry Terms.

IV. GENERAL STATEMENT ABOUT TIRE REPAIRING

Thorough inspection should be made by a skilled technician and should include placing the tire casing on a tire inspection machine, or other machine capable of spreading the beads under adequate lighting (i.e., 200 footcandles (fc) / 2153 lux (lx) minimum, 300 fc / 3229 lx recommended) at the work surface, so that the interior and exterior of the casing is adequately exposed for visual and manual examination.



All casings should be dry and free of all loose contaminants (e.g., dirt, water, debris, sealants, visual materials, balancing materials, etc.) and/or other foreign materials prior to inspection.

All repair units should be replaced unless they can be determined to be sound and have been properly installed. Inspection criteria should be posted in retread plants. The selection of the repair materials used should be based on the suppliers' recommendations.

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.

V. INITIAL TIRE INSPECTION

Repair procedures require the following:

- Removing damaged material
- Preparing the injured area
- Filling the injury with a suitable vulcanizing material or vulcanizing rubber stem
- Reinforcing and sealing the area

NEVER PERFORM A TIRE REPAIR WITHOUT REMOVING THE TIRE FROM THE RIM/WHEEL ASSEMBLY FOR INTERNAL INSPECTION.

OUTSIDE-IN OR ON-THE-WHEEL TIRE REPAIRS ARE NOT RECOMMENDED.

CONTACT TIRE MANUFACTURERS FOR SPECIFIC REPAIR PROCEDURES.

A. Inspection Criteria for Repairing

No tires should be accepted for repairing if they have any of the following conditions or injuries, or which require repairs beyond the limits shown in Tables I and II-A (see Tables section at the end of this document).

1. External

- a. Surface cuts which exceed the size of a repairable injury and penetrate the cord body
- b. Broken, damaged, kinked or exposed bead wire bundle
- c. Broken belts

- d. Separations beyond repairable limits
- e. Excessive oxidation (i.e., weather checking) beyond 2/32" (1.5 mm) in depth
- f. Damage which requires the repairs to overlap; requires more than one repair to the same radial body ply cord
- g. Damage exposing the radial ply tire body in the bead area
- h. Tires with less than 2/32" (1.5 mm) tread depth (non-skid) remaining unless retreading is planned
- i. Tires with rust or corrosion beyond repairable limits
- j. Radial and/or circumferential cracking
- k. Improper or missing sidewall information
- l. Any signs of weakness or non-repairable injury (e.g., softness due to contamination from chemical/petroleum products, ripples, bulges, porosity, etc.) in the sidewall, particularly in the upper sidewall
- m. Crunching or popping sounds when flexed
- n. Tires worn to exposed belt wires on more than 10% of the worn tire circumference, unless a protector belt is to be removed or damaged belts are to be replaced

2. Internal

- a. Porous, contaminated from chemical degradation, or loose inner liners
- b. Open inner liner splices which expose cord

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

- c. Loose cords on the inside ply or any evidence of having been run underinflated or overloaded
- d. Injury to the body ply cords beyond repairable limits
- e. Flex breaks, X-breaks or impact breaks
- f. Previously installed repairs found to be defective and unrepairable
- g. Injuries to the body plies in the non-repairable bead area
- h. Non-repairable damage to the inner liner or bead area on tires identified as tubeless
- 3. Creasing, wrinkling, cracking or discoloration of the inner liner
- 4. Soft spot(s) in the sidewall flex area
- 5. Protruding filaments indicating broken cords
- 6. Any popping sound when feeling for soft spots or when rolling the tire

VI. MINOR RUBBER REPAIRS

Minor repairs are generally rubber only repairs, but should be performed in a full-service repair facility. See Appendix 1 - Common Retread and Repair Terminology - A Compendium of Industry Terms for a definition of "Full Service Repair Facility".

A. Spot Repair

A spot repair is one that is performed to the exterior of a tire, generally to avoid moisture penetration into the casing, limit cut growth or improve appearance. A spot repair does not require the use of a reinforcing repair unit. Medium truck, heavy radial truck or bus tires with damage to the body cords cannot be spot repaired, but should be considered for section repairing.

B. Inner Liner Repair

Open inner liner splices, cracks which do not expose cord, tool damage or blisters may be repaired in tubeless tires. Consult casing manufacturer for inner liner repair specifications.

C. Bead Area Repair

(See images on the following page.)

Bead area repairs are limited to rubber only repairs, except where the chafer is exposed or damaged on medium truck, heavy radial truck or bus tires. In no case should a kinked or broken bead be repaired. Tires with evidence of bead area separation or rusting in the body plies should be rejected.

In addition to checking for non-repairable conditions, check the valve assembly and bead area for leaks using a water or leak detection solution, where practical, *prior to* demounting and deflating the tire. If a leak is found in the valve assembly or in the bead area, certain repairs may not be possible since the tire will not hold air.

Furthermore, along with visual inspection, it is also recommended that some type of nondestructive inspection equipment (e.g., holography, shearography, X-ray, ultrasonics, electrostatic, high pressure tester, etc.) be utilized for casing inspection.

B. Zipper Damage Indicators

Indications of zipper damage include any signs of weakness or non-repairable injury (e.g., ripples, bulges, porosity, softness, etc.) in the sidewall, particularly the upper sidewall. Steel belted radial tires exhibiting such conditions should be rejected and scrapped.

- 1. Cuts, snags or chips exposing body cords or steel
- 2. Distortions or undulations (ripples and/or bulges) visible when using an indirect light source which will produce shadows left by any sidewall irregularities

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

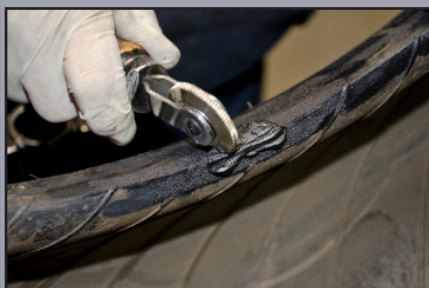
Bead area repairs on all tires should restore the original contour of the bead. In addition, bead repairs on a tubeless tire should restore and maintain its air retention capability.

Minor chafer damage is allowed in some tube type truck tires, without repair. Some cord trimming may be necessary. Consult tire manufacturer for bead area repair specifications.

BEAD AREA REPAIR



Fill Injury



Stitch Repair Area



Trim Excess Rubber

D. Steps for Minor Rubber Repairs

The steps listed below are essential to perform a minor rubber repair.



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.



WARNING

DO NOT use flammable **solvents** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of solvents could cause serious personal injury or death.

1. Probing and Foreign Material Removal

Use a probe to inspect the damage. Remove any foreign material.

2. Inspection

Inspect the injury to determine the extent of damage. If the damage extends to the body cables and there is no rust or damage to the body cables, treat as a spot repair. If there is body cable damage, refer to the Section Repairs portion of this document (see section X).

In addition to visual inspection, it is also recommended that some type of nondestructive inspection equipment (e.g., holography, shearography, X-ray, ultrasonics, electrostatic, high pressure tester, etc.) be utilized for casing inspection.

3. Pre-Cleaning

Remove all contaminants from around the injury.

NOTE:

1.) Tires that contain any type of aftermarket puncture sealant(s) may have been damaged as a result of being run underinflated and/or overloaded, and should be inspected accordingly.

2.) Tires that are manufactured with puncture sealing capabilities require specialized repair techniques. The tire and/or sealant manufacturers should be contacted for recommendations. It may

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

be necessary to repeat step 3, pre-cleaning, to ensure that the repair area is free of contaminants.

4. Buffing

Buff the injury to achieve a uniform TRMG BT1 or BT2 buff texture for all repairs (see RP 01/02-23 “BTS6 - Standard Buffing Textures for Tire Retreading and Repairing”). Remove all damaged or loose material. Shape the repair with a low-speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing tool, while keeping the repair area as small as possible.

5. Cleaning

Remove any rubber dust and contaminants from the buffed area with a fine wire brush and vacuum to provide a clean, dry surface. Do not use compressed air to clean bonding surfaces because the unfiltered air lines may contain contaminants such as oil and moisture, which can reduce adhesion.



WARNING

DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

6. Cementing

Apply the appropriate cement to the prepared surface with no puddling or streaking. Allow the cement to dry for the recommended time. In cold and/or humid climate conditions, extend the drying time as recommended by the manufacturer.

7. Filling

Fill the injury with a suitable vulcanizing material.

8. Curing

Cure the repair for the specified time, temperature, and pressure according to the

equipment and materials manufacturers’ recommendations. For chemically activated repairs, allow sufficient time for curing as recommended by the manufacturer.

VII. PUNCTURE REPAIR (NAIL HOLE REPAIR)

Prior to demounting and deflating the tire, check the valve and outer surface for leaks using a water or leak detection solution, where practical. If a leak is found in the valve assembly or in the bead area, a puncture repair may not be possible since the tire will not hold air. If no leak is found in the valve assembly or bead area, proceed by marking the injury, totally deflate, and demount the tire.

Repair procedures require the following:

- Removal of damaged material
- Preparing the injured area
- Filling the injury with a suitable vulcanizing material or vulcanizing rubber stem
- Reinforcing and sealing the repair area

NEVER PERFORM A TIRE REPAIR WITHOUT REMOVING THE TIRE FROM THE RIM/WHEEL ASSEMBLY FOR INTERNAL INSPECTION.

OUTSIDE-IN OR ON-THE-WHEEL TIRE REPAIRS ARE NOT RECOMMENDED.

CONTACT TIRE MANUFACTURERS FOR SPECIFIC REPAIR PROCEDURES.

Determine the extent and location of any injuries.

NOTE:

Not all tires can be repaired. Specific repair limits should be based on recommendations or repair policy of the tire manufacturer and/or type of tire service (e.g., service description, run-flat technology, commercial service applications, etc.).

A. Medium Truck, Heavy Radial Truck, and Bus Tire Puncture Repair

Puncture repairs for medium truck, heavy radial truck, and bus tires should be limited to the tread area only, and not exceed 3/8”

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

(10.0 mm) diameter after preparation. Larger injuries, and those in the shoulder and sidewall areas, should only be repaired in a full-service repair facility. (Refer to Tables I, II-A and Appendices located at the end of this document.)

Figure 1 represents a medium truck/heavy radial truck/bus tire, and indicates that puncture repairs are limited to the tread belt package area only as generally depicted in the graphic. If the injury damage exceeds the puncture repair limits, then the injury must be considered a section repair. Follow instructions in section X, Section Repairs.



FIGURE 1

B. Steps for Puncture Repair

The steps listed below are essential to repair a puncture in medium truck, heavy radial truck, and bus tires. (See repair images below and on the following pages.)



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.



WARNING

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PUNCTURE REPAIR

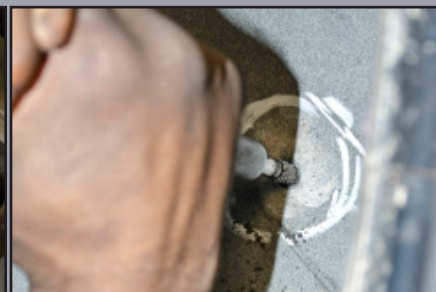
Mark and Remove the Injury



Spread Beads for Inspection



Mark Injury - Inside Tire



Drill Injury - Inside Tire



Drill Injury - Outside of Tire



Remove Injury - Outside of Tire



Buff Injury - Outside of Tire

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

1. Probing and Foreign Material Removal

Probe the injury with a tire probe to determine the angle of penetration. Inspect and remove any foreign material that has penetrated the tire.

2. Pre-Cleaning

Remove all contaminants from around the injury.

NOTE:

1.) Tires that contain any type of aftermarket puncture sealant(s) may have been damaged as a result of being run underinflated and/or overloaded, and should be inspected accordingly.

2.) Tires that are manufactured with puncture sealing capabilities require specialized repair techniques. The tire and/or sealant manufacturers should be contacted for recommendations. It may be necessary to repeat step 2, pre-cleaning, to ensure that the repair area is free of contaminants.

3. Preparation of the Injury

When possible, drill the injury from the inside a minimum of three times with the appropriate carbide cutter on a low speed (i.e., 1,200 rpm maximum) air/electric drill, following the angle of penetration. Tools used must remove the damaged steel and create a round hole. Repeat this process a minimum of three times from the outside of the tire to ensure complete damage removal, being careful not to elongate the hole. Use a probe to check for any splits in the radial plies surrounding the injury. Remove any additional damage found.

4. Inspection

Inspect the injury, making sure the penetration is 3/8" (10.0 mm) or less for medium truck, heavy radial truck, and bus tires. If the injury exceeds puncture repair limits, refer to section X, Section

PUNCTURE REPAIR cont.

Measure for Repair Unit and Buff - Inside Tire



Measure the Injury



Measure for Repair Unit



Trace Around Repair Unit Template



Remove Injury



Buff Injury



Texturize Repair Area

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

Repairs. Inspect prepared injury for inner liner splits. If present, this is no longer a puncture repair. Refer to the Section Repair portion of this document (see section X.B.).

5. Repair Unit Selection

Select the appropriate repair unit based on repair material manufacturer recommendations. Center the unit over the injury and outline an area about 1/2" (13.0 mm) larger than the repair unit, to ensure that crayon marks are not removed when buffing. For injuries with an angle greater than 25 degrees, depending on repair manufacturer, use a two-piece repair unit system.

6. Inner Liner Buffing

To prevent contamination and preserve the outline, buff within the marked area thoroughly and evenly using a low speed (i.e., 5,000 rpm maximum) buffer with a fine wire brush or gritted rasp. Take care not to expose or damage the tire casing body (ply) cords. Buff to a velvet surface; TRMG BT1 or BT2 texture.

7. Cleaning

Remove any rubber dust and contaminants from the buffed area with a fine wire brush and vacuum to provide a clean, dry surface.

Do not use compressed air to clean bonding surfaces because the unfiltered air lines may contain contaminants such as oil and moisture, which can reduce adhesion.



WARNING

DO NOT use flammable **cement** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of cement could cause serious personal injury or death.

8. Cementing

Apply appropriate cement to the buffed surface and, if required, to the back of the repair unit. Allow the cement to dry for the recommended time. While drying, the tire should be rotated so that the injury is not positioned at the bottom of the tire.

DO NOT use forced air or an outside heat source to accelerate drying time. Refer to repair materials manufacturer recommendations.

9. Fill the Injury

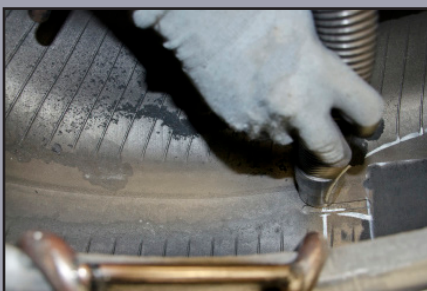
If using uncured/suitable vulcanizing material or a vulcanizing rubber stem, fill the injury with the appropriate material.

PUNCTURE REPAIR cont.

Clean Repair Area and Apply Cement - Inside Tire



Repair Area After Filling and Buffing



Vacuum Buffing Dust



Cement Repair Area

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

PUNCTURE REPAIR cont.

Install Repair Unit - Inside Tire



Install Repair Unit



Stitch Repair Unit



Remove Film from Repair Unit

10. Repair Unit Installation

Repair units are to be installed while the beads of the tire are in a relaxed position. Align the repair unit according to the markings on the repair unit. Avoid trapping air and/or possible bridging of the unit as it is installed.

- When using a one-piece repair unit, cement the injury channel, insert the stem from the inside of the tire, and pull through until the base of the repair unit is snug against the prepared and cemented surface of the inner liner.
- When using a two-piece repair unit (i.e., separate repair unit and filler stem), cement the injury channel and fill the injury from the inside with a suitable vulcanizing rubber stem designed for that size injury. Without stretching the stem, cut/trim the excess material inside the tire, and buff the stem flush with the inner liner to accommodate the appropriate size repair unit.

Remember, for both types of repair units, **DO NOT** cement the stem. Instead, cement the injury channel.

11. Stitching

For all methods, stitch the entire repair unit starting from the center, and work

outwards to the edges. Check for proper installation. Cut the fill material flush with the outer tread surface making sure not to stretch or pull the stem while cutting. If the stem is not flush with tread after cutting, buff lightly until it is level with tread.

DO NOT continue repair if the buffed area exposes body cords.

Apply repair sealant to the over-buffed area and the edge of the repair unit. A patch only or a plug (stem) only is not a proper puncture repair. (See section XI, Repair Finishing.)

12. Curing

The repair unit and uncured/suitable vulcanizing material or vulcanizing rubber stem, must be cured completely. When using a spotter, section mold or curing chamber, follow the manufacturers' recommendations. Also follow the manufacturers' recommendations for calculating cure time. Cure the repair for the specified time, temperature, and pressure according to the equipment and materials manufacturers' recommendations. For chemically activated repairs, allow sufficient time for curing as recommended by the manufacturer.

13. Inspect Repair Areas

If the buffed area extends beyond the repair unit, look for signs of tire casing body cords.

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

VIII. REINFORCED SHOULDER REPAIR

The industry has experienced repair unit issues specific to injuries in the shoulder area of tires because of incorrect repair unit selection and placement. Repair unit construction design normally allows for 50% of the repair unit to be shifted off-center to accommodate full injury security. When the anchor portion of the repair unit, 25% on each end of the repair body, ends in a high-flex portion of the tire, the additional stress on the repair unit body structure can result in the repair unit's cord breakout and/or edge lifting.

Repair unit manufacturers typically produce “templates” that indicate the injury width and length a repair unit can be shifted over an injury so that the unit placement can be anchored in non-flex zones of the tire casing. Because shoulder injuries are directly adjacent to the sidewall FLEX ZONE of tires, placement and size selection of the repair unit is vital to attaining permanent repair results. These guidelines are written to explain the selection methods and placement of the appropriate repair unit to achieve permanent repair results in a full service repair facility.

WHY REINFORCED SHOULDER REPAIR (RSR)?

Improves repair reliability for small punctures/injuries (i.e., maximum 8.0 mm) in or near the shoulder.

A. Reinforced Shoulder Repair (RSR) Unit Placement

The repair unit should not be installed any closer than 3/8" (10.0 mm) to the bead toe. Shoulder and sidewall injuries generally require one anchor point in the crown area and another anchor point out of the FLEX ZONE, near the bead area of the tire. This procedure will require an up-sizing of the repair unit in an effort to gain additional length, so as to accomplish proper repair placement (i.e., non-flex to non-flex position). See Figure 2 and Appendix 6.

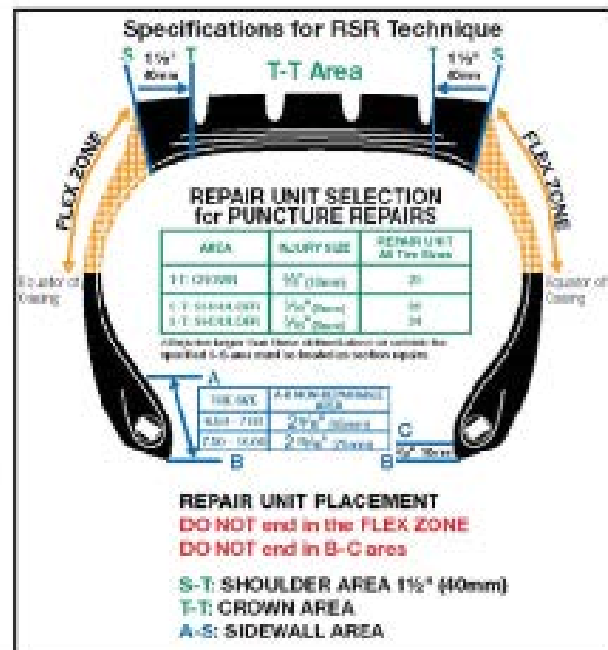


FIGURE 2

B. Benefit of Offsetting a Repair Unit (non-centered)

Moves edge of repair unit away from the FLEX ZONE.

- A longer repair unit than a #20 is required for a maximum 5/16" (8.0 mm) injury in the shoulder area. This type of injury requires the use of a #22 or longer repair unit (if using the RSR recommendations). Otherwise refer to manufacturers' recommendations.

SUMMARY - REINFORCED SHOULDER REPAIRS

1. Avoid ending repair unit placement in any FLEX ZONE.
2. Keep prepared damage within the guidelines of the template.
3. Use a BLUE TRIANGLE on the sidewall of the tire nearest the RSR injury to indicate that a repair unit is installed.

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

4. Educate your fleet customers and service providers.
5. TRMG is working with other industry associations to revise and update repair specification changes:
 - New RSR designation
 - Fleet specifications to retreaders

IX. REINFORCEMENT REPAIRS

Determine the extent and location of any injuries. Repair shops should consult the tire manufacturer and repair material manufacturer regarding specific repair limits. These limits should be based on recommendations of the tire manufacturer, repair materials manufacturer and type of tire service.

A. Reinforcement Repair Limits

Medium truck, heavy radial truck, and bus tires cannot be repaired with a reinforcement repair; a section repair is required.

B. Steps for Reinforcement Repairs

Refer to the Section Repairs portion of this document (See section X.B., Steps for Section Repairs.)



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.



WARNING

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X. SECTION REPAIRS

Determine the extent and location of any injuries. Repair shops should consult the tire manufacturer and repair material manufacturer regarding specific repair limits. These limits should be based on recommendations of the tire manufacturer, repair materials manufacturer, and type of tire service.

A. Section Repair Limits

1. There are several methods for section repairing tires. The method is dependent on the materials and equipment being used.
2. Medium truck, heavy radial truck, and bus tires with damage to body ply cords in excess of puncture (i.e., nail hole) repair limits, require a section repair. Tables I and II-A (located at the end of this document) show the maximum allowable limits for medium and heavy radial truck tires.
3. Final measurements to determine repairability and repair unit selection should be made when all of the injury has been removed.

B. Steps for Section Repairs

The steps listed below are essential to making a section repair in a tire. (See repair images on the following pages.)



CAUTION

DO NOT MIX PRODUCTS FROM DIFFERENT REPAIR MATERIAL MANUFACTURERS

Follow repair materials manufacturers' recommendations for installation and instructions. Refer to the information on the product or manufacturers' Material Safety Data Sheets (MSDS) and follow guidelines for handling and disposal.

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires



WARNING

DO NOT use flammable **solvents** near fire, flame or any other source of ignition. Explosive force and/or fire from ignition of solvents could cause serious personal injury or death.

1. Probing and Foreign Material Removal

Use a probe to inspect and remove any foreign material that has penetrated the tire.

2. Inspection

Inspect, mark, and measure all injuries to determine reparability and the extent of damages.

3. Pre-Cleaning

Remove all contaminants from around the injury.

NOTE:

1.) Tires that contain any type of aftermarket puncture sealant(s) may have been damaged as a result of being run underinflated and/or overloaded, and should be inspected accordingly.

SECTION REPAIR

Mark and Remove Injury



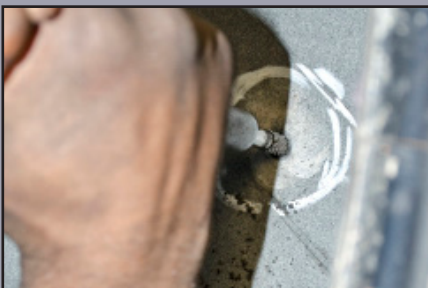
Spread Beads for Inspection



Mark Injury - Inside Tire



Mark Injury - Outside Tire



Drill Injury - Inside Tire



Drill Injury - Outside Tire



Remove Injury



Remove Injury



Texturize Injury



Injured Area Ready for Cement

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

2.) Tires that are manufactured with puncture sealing capabilities require specialized repair techniques. The tire and/or sealant manufacturers should be contacted for recommendations. It may be necessary to repeat step 3, pre-cleaning, to ensure that the repair area is free of contaminants.

4. Skiving

Using a low-speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing texture tool, remove all damaged rubber above the steel cables, keeping the injury as small as possible. Use an appropriate texture tool on a low-speed (i.e., 5,000 rpm maximum) to buff away remaining

rubber and very lightly expose only the cables believed to be damaged (i.e., just until they are visible). All damaged steel cables must be trimmed back to solid rubber. For trimming steel, use a 20,000 rpm minimum air/electric buffer and the appropriate grinding tool. Buff with a low-speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing texture tool to achieve a uniform TRMG BT2 or BT3 texture. Always probe the repair area after damage removal to ensure that no cuts or separations remain in the tire.

5. Repair Unit Selection

Select the appropriate repair unit based on the construction of the tire and the size

SECTION REPAIR cont.

Injury Preparation and Repair Unit Selection - Inside Tire



Remove Injury



Measure for Repair Unit



Trace Around Repair Unit



Area Marked for Repair Unit



Buff Repair Area



Texturize Repair



Area After Buffing and Texturizing



Vacuum Buffing Dust



Apply Cement to Repair Area

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

of the damage to the body cords or cables. Final measurements should be made when the entire injury has been removed. Refer to Tables I, II-A and related diagrams for Maximum Injury Limits (see Tables section at the end of this document), and to repair materials manufacturers' charts for proper repair unit selection.

6. Inner Liner Buffing

Buff the area for the repair unit with a low speed (i.e., 5,000 rpm maximum) buffer and appropriate buffing texture tool to achieve a uniform TRMG BT1 or BT2 buffed texture. The buffed area should be slightly larger than the repair unit.

NOTE:

If a suitable vulcanizing material or vulcanizing rubber stem is used to fill an injury, it must be installed before buffing.

Cement the injury channel and fill the injury from the inside with a suitable vulcanizing material or vulcanizing rubber stem. Without stretching the stem, trim the excess material inside the tire, and buff the stem flush with the inner liner to accommodate the appropriate size repair unit.

7. Cleaning

Remove any rubber dust and contaminants from the buffed area with a fine wire brush and vacuum to provide a clean, dry surface. Do not use compressed air to clean bonding surfaces because the unfiltered air lines may contain contaminants such as oil and moisture, which can reduce adhesion.



WARNING

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8. Cementing

Apply the appropriate cement on the buffed surface depending on the repair method being used. Also apply the appropriate cement to the back of the repair unit if required. The cement should be applied evenly to all surfaces with no puddling or streaking. Allow the cement to dry for the recommended time. In cold and/or humid climate conditions, extend the drying time as recommended by the manufacturer.

DO NOT use forced air or outside heat source to accelerate drying time.

9. Fill the Injury

Fill the injury with an uncured/suitable vulcanizing material or vulcanizing rubber stem.

10. Repair Unit Installation

Repair units are to be installed with the beads of the tire in the relaxed position. Align the repair unit according to markings on the repair unit.

- a. When using a one-piece chemical section repair unit, insert the stem from the inside of the tire and pull through until the base of the repair unit is snug against the prepared and cemented surface of the inner liner.
- b. Stitch the entire repair unit starting from the center, and move out to the edges. Check for proper installation. Inspect repair area. If the buffed area extends beyond the repair unit, look for signs of tire casing body cords.

DO NOT continue the repair if the buffed area exposes radial ply cords.

- c. If recommended by repair manufacturer, apply repair sealant to the over-buffed area and the edge of the repair unit.

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

SECTION REPAIR cont.

Repair Unit Installation - Inside Tire



Install Repair Unit



Stitch Repair Unit



Remove Film from Repair Unit

Fill Injury - Outside Tire



Cement Repair Area



Fill Repair Area



Stitch Repair

NOTE:

When repairing the shoulder or sidewall area, it is recommended to use a blue triangle to identify the area as a section repair, as seen in Figure 3. Use the inner liner wheel to buff for the blue triangle.



FIGURE 3

11. Curing

The repair unit and uncured/suitable vulcanizing material or vulcanizing rubber stem, must be cured completely. When using a spotter, section mold or curing chamber, follow the manufacturers'

recommendations. Also follow the repair material and equipment manufacturers' recommendations for calculating cure time. Cure the repair for the specified time, temperature, and pressure. For chemically activated repair unit application, allow sufficient time for curing as recommended by the manufacturer.

12. Inspect Repair Areas

If the buffed area extends beyond the repair unit, look for signs of tire casing body cords.

XI. REPAIR FINISHING

A. General Repair Finishing

Finishing is necessary to ensure satisfactory performance and appearance of the repaired tire. Repair identification, typically the DOT-R Plant Code or other internal codes and dating, should be placed on or next to the repair

Repairing Medium Truck, Heavy Radial Truck, and Bus Tires

unit. The presence of a section repair may be noted by placing a blue triangle near the repair on the lower sidewall of the tire, as seen in Figure 3. (See Section XII.B., Criteria for Repair Inspection.)

B. Steps for Repair Finishing

The steps listed below are essential to complete a repair.

1. Buffing

Buff the cured rubber filler material or trim the precured repair stem to the original contour and appearance of the tire. The surface of the rubber repair material may not extend over 2/32" (1.5 mm) above the surrounding surface. (See Section XII.B., Criteria for Repair Inspection.)

2. Tread Design

Restore tread design in the crown area.

2. Outside Inspection

The outside of the tire should be checked to ensure that it has been properly molded, cured, trimmed, and has all the required labeling.

3. Sidewall Inspection

The sidewall repaired area in a medium truck, heavy radial or bus truck tire may bulge. The bulge should not exceed 2/32" (1.5 mm) uninflated or 3/8" (10.0 mm) in height when inflated to the recommended pressure.

The presence of a section repair may be noted by placing a blue triangle near the repair on the lower sidewall of the tire, as seen in Figure 4.



FIGURE 4

XII. FINAL REPAIR INSPECTION

A. General Repair Inspection

Conduct a final examination of the tire while mounted on a spreader under adequate lighting (i.e., 200 fc / 2153 lx minimum, 300 fc / 3229 lx recommended) at the work surface. If heat is used to cure the repair, conduct the inspection while the repair is still warm.

B. Criteria for Repair Inspection

The steps listed below are essential for proper inspection of a repaired tire. During the inspection process, the same steps used in Initial Tire Inspection should be followed in the Final Repair Inspection.

1. Inside Inspection

The inside of the tire should be checked to ensure that all repairs are properly installed and bonded, and for any internal injuries or conditions that may have been missed during the initial inspection phase.

4. Approved procedures should be followed when the tire is mounted and inflated. The tire should be inspected at this time for any anomalies not previously detected. Follow the OSHA Standards for Servicing Multi-piece and Single-Piece Rim Wheels (29 C.F.R. § 1910.177).
5. Section repaired tires should not be returned to service for a minimum of 24 hours after curing, when they have reached ambient air temperature.

TABLES

TABLE I
NON-REPAIRABLE BEAD AREA FOR BODY PLY DAMAGE*

To determine the non-repairable bead area, measure with a narrow flexible rule following the inside contour of the liner from the bead toe.

RADIAL TIRE CROSS SECTION	DIMENSION OF TIRE AREA*
All Radial Passenger Car	1-1/2 in. (40 mm)
Light and Medium Truck - Tube-type up to 7.50 (195mm) 8.25 (205mm) and above	3 in. (75 mm) 3-1/2 in. (90 mm)
Light and Medium Truck - Tubeless up to 8.5 (215mm) 9 (225mm) and above	3 in. (75 mm) 3-1/2 in. (90 mm)

*Rubber spot repair only in this area. Repair to body ply and/or bead wire in this area is not permissible, and rust or damage to the bead bundle is non-repairable.

NOTE: Dimensions shown are for general guidance. Repair material manufacturers' and new tire manufacturers' recommendations may differ. Specific limits should be based on recommendations of tire manufacturer, repair material manufacturer, and type of service.

TABLE II
**MAXIMUM SECTION REPAIR LIMITS FOR RADIAL PASSENGER CAR AND
LIGHT TRUCK RADIAL FABRIC BODY PLY TIRES**

Repair material manufacturers and new tire manufacturers recommendations differ. Specific limits should be based on recommendations of tire manufacturers, repair material manufacturer, and type of tire service. Consult tire manufacturer and repair material manufacturer for acceptability of any repair beyond a tread area nail hole as previously covered in this document.

TABLE II-A
MAXIMUM SECTION REPAIR LIMITS FOR RADIAL TRUCK TIRES

See Appendix 3 - *Measuring Injuries in Radial Tires*

RADIAL LIGHT TRUCK AND TRUCK TIRE REPAIR CHART				
Tire Type and Size	Sidewall Width	Sidewall Length	Shoulder Diameter	Crown Diameter
Light Truck Load Range D and Above 6.50 – 12.50 215/85 – 255/85 215/75 – 265/75	3/8" (10mm) 1/2" (15mm) 3/4" (20mm) 1" (25mm)	3-3/4" (95mm) 3-3/4" (95mm) 2-1/2" (60mm) 2" (50mm)	1/2" (15mm)	1" (25mm)
Medium Truck 7.50 – 10.00 8 – 11 215/75 – 285/75	3/8" (10mm) 1/2" (15mm) 3/4" (20mm) 1" (25mm)	3-3/4" (95mm) 3-3/4" (95mm) 2-1/2" (60mm) 2" (50mm) 4" (100mm)	1/2" (15mm)	1" (25mm)
Heavy Truck 11.00 – 16.00 12 – 18 295/80 – 445/65 435/50 – 495/50	3/8" (10mm) 1/2" (15mm) 3/4" (20mm) 1" (25mm) 1-1/2" (40mm)	5-1/8" (130mm) 5-1/8" (130mm) 5" (125mm) 4" (100mm) 3" (75mm)	1" (25mm)	1-1/2" (40mm)

Wider sidewall repairs should be shorter in length. Any "in-service" repair-related sidewall bulge should be no greater than 3/8" (10 mm) above the surrounding surface of an inflated tire.

NOTE: Dimensions shown are for general guidance. Repair material manufacturers' and new tire manufacturers' recommendations may differ. Specific limits should be based on recommendations of tire manufacturer, repair material manufacturer, and type of tire service. Consult tire manufacturer and repair material manufacturer for tire size not covered.

See Appendix 4, *Repairable Areas in Radial Tires*, for additional reference information.

APPENDICES

Appendix 1

Common Retread and Repair Terminology - A Compendium of Industry Terms

ABRASION - The rapid wearing away of a tire in-service by scraping or rubbing.

ABRASION, SIDEWALL - An injury to the tire caused by scraping or rubbing it against another material or structure.

ACCELERATOR - A chemical that affects the rate of vulcanization of rubber compounds.

ACTIVATOR - Chemicals added to rubber compounds to activate accelerators to speed up the vulcanization process.

ADHESION - Bond between two cured surfaces.

ADHESIVE - See CEMENT.

AFTER CURE - The process of cool down after the rubber product is removed from direct heat vulcanization.

AGING - Evolution or change of physical and chemical properties of rubber by oxidation, heat, operating stresses or moisture over a period of time.

AIR INJECTION - An inspection method using a high-pressure air probe to detect separation.

AIR PRESSURE - Force exerted by air within a tire, expressed in pounds per square inch (psi), kilopascals (kPa) or bars.

AIRBAG - An inflated flexible bag used to impart positive pressure on the article being vulcanized.

ALIGNMENT - The requirement to have all wheels on a vehicle running in the same direction. This is accomplished by adjusting various parts of the vehicle's suspension system to ensure proper handling stability and to minimize abnormal treadwear.

AMBIENT TEMPERATURE - Temperature (°F or °C) of immediate surroundings, usually room temperature.

ANTIOXIDANT - A chemical used to retard deterioration due to heat, light, oxygen or combinations thereof.

ARAMID - A class of heat resistant, high-strength synthetic fiber-type material used to form a ply cord.

ARC - See TREAD RADIUS.

ASPECT RATIO - Ratio of the section height to the section width of a tire.

ASYMMETRIC - A tread pattern or crown plies that differ in aspect or construction between the outer and inner shoulder areas of a tire. Such tires are directional.

AUTOCLAVE - A heated pressurized vessel used for vulcanizing rubber products.

AWL - A pointed, round or flat tool used to probe punctures and/or other injuries.

AWLING - See VENTING.

BACKING - A removable protective material used on the application side of retread rubber and repair materials to preserve cleanliness and tackiness.

BALANCING - A process to correct for heavy or light areas of weight of a tire and/or tire/rim/wheel and wheel end assembly.

BALLAST - The addition of fluids inside a tire or external weights applied to a vehicle to increase the load of drive axles on vehicles.

BANBURY - An enclosed machine for mixing rubber and compounds.

BAND LUGGING - A method of retreading earthmover tires using hand built-up extruded lugs and autoclave cure.

BAR - Measure of pressure in international units. 1 bar = 0.9869 atm = 14.50 psi = 100 kPa. See USEFUL CONVERSION FORMULAS on page following industry terms.

BASE WIDTH - A measurement of the width of the tread rubber which joins to the buffed surface of the tire.

BEAD - The anchoring part of the tire which is shaped to fit the rim/wheel; made of high tensile steel wires wrapped and reinforced by the plies.

BEAD AREA (Non-Repairable) - a specific measured dimension, based on a tire size, where an injury through the body ply material should not be repaired. These dimensions are generally found on repair material manufacturers wall charts.

BEAD AREA COVERING - The outermost material protecting the bead area while providing a tapered seat to fit the rim configuration.

BEAD BUNDLE (Non-Repairable) - Central core of the bead. A high strength, high tensile, brass plated carbon steel wire wound from a continuous strand into a high strength unit. This major structural unit provides the anchor of the tire to the rim.

BEAD CENTERING PLATE - An alignment device used to reduce tire diameter and center the casing in the retread matrix.

BEAD FACE/LEDGE/SOLE - The flat portion of the bead between the heel and toe that contacts the rim/wheel.

BEAD FILLER - Sometimes called an "apex", it is designed to provide stiffness, stability, and durability in the bead area.

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BEAD HEEL - The rounded portion of the bead that contacts the rim/wheel between the bead seat and flange.

BEAD PLATE- Ring-shaped plates in molds which may be adjusted to alter the cross section of tires.

BEAD REINFORCE - May be steel, fabric or a combination of reinforcing materials to give the bead stability and strength. See CHAFER.

BEAD SEALING AREA - The face/ledge/sole and heel of the bead that contacts the rim. With tubeless tires, the bead seals to the rim and rim flange to retain air.

BEAD SEAT - The flat portion of the rim/wheel on which the bead face/ledge/sole rests.

BEAD SEPARATION - Separation between components in the bead area.

BEAD-TO-BEAD MEASUREMENT - The distance from the heel of one bead, straight up at 90°, over the crown and down the other side to a position on the heel of the other bead directly opposite the starting point. Measurement is used before retreading to predetermine the correct buffing dimensions, rubber size, and curing matrix to be used in the processing.

BEAD-TO-BEAD RETREADING - A retreading process which includes veneering of the sidewall from the shoulder to the bead.

BEAD TOE - The pointed part of the bead, opposite the heel, which faces the inside of the tire.

BEAD WIDTH - Measurement commonly used for the proper fit (bead spread) during buffing process.

BEAD WIRE - See BEAD BUNDLE.

BELT - A reinforced cord layer located circumferentially around the tire and under the tread.

BELT EDGE FILLER - A special rubber covering over steel belt edges to resist belt edge fatigue.

BELT EDGE INSERT - Helps optimize belt and body ply contours.

BELT OVERLAY - A reinforced fabric layer extending over the belts to reinforce the belt package.

BELT SEPARATION - Separation of the belts from the plies or tread, or from each other.

BELTED BIAS - See TIRE, BELTED BIAS.

BEVEL CUT - An angle cut used on tread or other splices.

BEVELED SPLICE - An approximately 45° angle cut through the gauge which allows the tread ends to diagonally overlap themselves.

BIAS PLY (DIAGONAL PLY) - See TIRE, BIAS PLY.

BLADDER CURE - A method of shaping and curing a tire using an expandable cylindrical rubber assembly.

BLOW - A porous condition caused by a loss of pressure or undercure. See POROSITY.

BLOW OUT - Rapid loss of air due to rupture.

BLOW POINT - The curing time which is just less than that needed to develop a non-porous cure.

BLUE TRIANGLE - A bulge due to a section repair is allowed not to exceed 3/8" (10 mm) in height. This bulge may sometimes be identified by a blue triangular label in the immediate vicinity.

BODY - Tire structure excluding tread and sidewall rubber.

BODY PLY(IES) - Layers of rubber-coated parallel cords extending from bead to bead that encase both bead bundles and provide strength to withstand inflation pressures and tire dimensions.

BODY PLY INSERT - An additional layer of rubber on top of the body ply to add to body ply durability.

BONDING - The joining of two materials by use of adhesives or vulcanization.

BRAND NUMBER - A number branded into one or both sidewalls of a tire for identification purposes.

BREAK - A surface opening and/or damage extending into or through the cord.

BREAKER (BELT OR STRIP) - In bias/diagonal tires, a band or strip of rubber-coated bias-cut tire cord placed circumferentially around the tire between the last ply of casing fabric and tread. Sometimes called the impact or shock ply.

BUCKLE - Tire distortion caused by improper molding, evidenced by wrinkling on the inside of the casing.

BUFF CONTOUR - The specified shape of a buffed area.

BUFF(ING) - Removal of the previously vulcanized rubber surface.

BUFF LINE - The dividing line in the cross section of a tire between the buffed surface of the original tire and the new retread rubber.

BUFFED RADIUS - A measurement of the buffed surface curvature from shoulder to shoulder.

BUFFED SURFACE - A specifically prepared surface of a tire casing or repair area to provide proper texture to help promote adhesion to the new rubber.

BUFFED TEXTURE - That surface produced by buffing, rasping or cutting.

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BUFFER - A machine used to rasp the old tread from the casing. A powered rotary rasp provides a clean, even surface for adhesion of the new tread rubber.

BUFFING TEMPLATE - A machined device of a specified shape used to obtain the required buffed radius.

BUILD-UP - Application of tread rubber or repair rubber to a casing.

BUILDER - A machine used to apply and stitch tread rubber to a casing.

BULGE - A protrusion or raised area, usually in the tire sidewall.

BUMPING - Opening and closing of mold to center a tire, allow rubber to flow, and gases to escape.

BUTT SPLICE - A 90° angle cut across the tread crown and through the gauge which permits full matching of the tread ends when they meet.

BUTTONHOLE - Circular hole made at the end of an injury (usually a tear or split) that may help prevent propagation of the injury.

BUTYL RUBBER - A general purpose synthetic elastomer (rubber) produced by copolymerizing isobutylene with small amounts of isoprene. Butyl rubber has a high resistance to chemicals and low permeability to gases. Its permeability to air is 70% better than that of natural rubber and for this reason is superior for tire tubes and for tubeless tire inner liners.

BUZZ-OUT - See SKIVE.

CABLE - See CORD.

CAD/CAM (CADAM) - A computer programmed system that aids in the design and manufacture of tires, equipment or facilities.

CALCIUM CHLORIDE (CaCl₂) - Chemical added to prevent freezing of water ballast in farm tires.

CALENDER - A multi-rolled machine which impregnates fabric or cord with rubber and/or forms a thin-layered sheet of rubber or other material.

CALIBRATE - To measure against and adjust to a standard.

CALIPER - A device for measuring inside or outside dimensions.

CAMELBACK - Former name for die-size rubber used in retreading. See DIE-SIZE (UNCURED RUBBER).

CARBIDE CUTTER / CARBIDE BURR - A rotary cutting tool. Carbide is a hard, metallic material.

CASING - A used tire to which additional tread may be attached for the purpose of retreading.

CASING DISTORTION - Processing defect in which the natural shape of the tire is deformed by constriction in matrix during the retreading process.

CASING PLY - See BODY PLY(IES).

CAUTION - Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury; may also be used to alert against unsafe practices (ANSI Z535.3, Environmental and Facility Safety Signs).

CEMENT - An adhesive rubber compound usually dissolved in solvent used to provide building tack and cured adhesion. May be brushed or sprayed on the buffed surface. Some cements may be water-based.

CENTERLINE - Circumferential line at the center of the tire's crown area; aids in centering of the new tread.

CHAFER - Reinforcing material (rubber or fabric) in the rim flange area to prevent chafing of the tire by the rim parts. See BEAD REINFORCE.

CHAMBER - See AUTOCLAVE.

CHANNELING - Voids in the shoulder area between the tread and the buffed surface.

CHECK TEMPLATE - A precut pattern used to determine the contour of a buffed tire to check compatibility to a matrix.

CHECK VALVE - A one-way valve used to prevent pressure loss or back flow.

CHEMICAL CLEANER - A rapid-drying rubber solvent for removing matrix lubricant, dirt, and other foreign material.

CHEMICAL CURE - Vulcanization at room temperature activated by chemical agents without the application of heat from an outside source.

CHEMICAL DAMAGE - Damage from petroleum products causing a softness or degradation in the sidewall rubber of the tire or in the liner.

CHEMICAL LEAK DETECTOR - A liquid capable of detecting air not discernible by visual inspection.

CHEMICAL RUBBER COMPOUND - A two-part rubber putty which, when mixed together thoroughly, begins curing at room temperature.

CHEMICAL RUBBER GUM - An especially compounded repair gum which cures at room temperature by chemical action.

CHEMICAL VULCANIZING CEMENT (CHEMICAL CURE CEMENT) - Cement which when used with compatible materials will produce a chemical cure.

CHIPPER - A narrow band of fabric or steel cord located in the bead area whose function is to reinforce the bead area and stabilize the lower sidewall.

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CHLOROBUTYL (BROMOBUTYL) - Butyl rubber with a chlorine atom bonded to the butyl backbone. Chlorobutyl has a high air retention and good heat stability; is frequently used in tire innerliner compounds. Bromobutyl is another polymer used with equivalent properties.

CHUNKING - Also known as “chipping” or “chip chunk”. The breaking away of pieces of the tread.

CIRCUMFERENTIAL BREAK - A break parallel to the beads in the sidewall area.

CIRCUMFERENTIAL CRACKS - Continuous cracking on the tire or in the grooves of the tire tread running parallel to the beads.

COLD INFLATION PRESSURE - The pressure that exists when the tire has not been run for at least three hours or has been driven less than one mile at moderate speed. These are the recommended conditions at which to measure tire pressure and reflects the reference pressure(s) used by industry standardizing bodies.

COLD PATCH - See REPAIR UNIT and CHEMICAL CURE.

COLD PROCESS RETREADING - See PRECURE PROCESS.

COLLAPSIBLE RIM - A rim used in retreading that can be folded and unfolded for insertion into the tire, where it holds the curing tube in place, which exerts pressure on the tire interior.

COMPOUND - A thorough mixture of natural and/or synthetic polymers and various ingredients designed for specific components of the tire.

CORD - The fabric or steel filaments forming the reinforcement structure in the tire.

CORD ANGLE - The angle at which the cord(s) within a tire crosses the centerline of the tread face.

CORROSION - The oxidation of steel cords and/or rim components.

COST-PER-MILE - Total cost including repairs and retreads, if any, divided by total mileage obtained from tire. In some cases “down time” may be taken into consideration.

CRACKING (TREAD or GROOVE) - Any tearing within the tread or tread grooves.

CROSS PLY - Sometimes used to refer to a bias ply tire. See TIRE, BIAS PLY.

CROSS RIB TIRE - A deep tread, drive wheel position tire with deep molded grooves that extend radially from near the center of the tread into the shoulder area.

CROSS-SECTION - A section or piece of the tire cut off at right angles to the bead.

CROSS-SECTION SIZE - External sidewall to sidewall measure of tire exclusive of ribs.

CROSS-SECTION WIDTH - See SECTION WIDTH.

CROWN - The middle part of the tread. It is the section between the should areas of a tire.

CROWN PLY - A layer or layers of ply material underneath the tread surface that stabilizes the tread area and restricts growth of the tire casing.

CROWN RADIUS - See TREAD RADIUS.

CROWN WIDTH - Term used as one of the three measurements of die size rubber. Also referred to as TREAD WIDTH.

CURE - The process of vulcanization of rubber by applying heat and pressure over a period of time. See CHEMICAL CURE.

CURE RATE - The speed at which a compound cures and develops its physical properties.

CURE RATE FACTOR (CFR) - Used in curing calculations.

CURE TIME - The length of time established to achieve a desired cure state.

CURING RIM - The rim used to support the tire and/or the tube in place while curing. Not intended for vehicle/road use.

CURING TUBE - A special, heavy-duty tube placed within the tire while curing the retread or repair.

CUSHION GUM (BONDING GUM) - A tacky, rubber compound used for adhesion of tread rubber, undertread repair, build-up of other repairs or on the bottom of some repair units.

CUT-OFF RIB - The rubber pattern left on the casing as a result of the mold’s stop or flow ring. See FLOW STOP and STOP RING.

DANGER - Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury; limited to the most extreme situations (ANSI Z535.2, Environmental and Facility Safety Signs).

DEBAGGER - A device for inserting and removing curing tubes from a retreaded tire.

DEFLATION - When a tire is in a state of collapse due to the absence of inflation pressure.

DELAMINATION - A somewhat smooth separation between layers of material.

DELOGGER - A machine used to cut the lugs from tires prior to buffing.

DESIGN RIM WIDTH - The measuring rim width assigned to each tire size designation to determine basic tire dimensions.

DETREADER - A machine that delugs and buffs a tire.

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DIAPHRAGM - See ENVELOPE.

DIE - Two piece metal plate with an orifice through which rubber compounds are shaped when forced through the opening by an extruder.

DIE SIZE (UNCURED RUBBER) - Dimensional size designation for retread rubber. (Example -72-76-18) First two digits are crown width in inches and 8ths. Second two digits give base width in inches and 8ths. Third number is thickness in 32nds of an inch.

DIE SIZER - Machine used to extrude tread rubber and build tires for retreading.

DIE SWELL - Swelling or expansion of rubber during extrusion.

DOT - The letters "DOT" (Department of Transportation) precedes the tire identification number (TIN) and must be molded into the sidewall of all over-the-highway tires produced by tire manufacturers and retreaders that distribute and sell tires in the U.S. This mark certifies that the tire meets or exceeds all applicable safety standards established by the Code of Federal Regulations, Federal Motor Vehicle Safety Standards.

DRYER (DRYING ROOM) - Equipment or an enclosed space (usually heated) used to remove moisture from casings prior to inspection and processing.

DUROMETER - A device to measure the hardness of rubber. The term is also applied to the readings obtained with this device; for example, a tire tread may be defined as 60 durometer, which means that it shows this degree of hardness when tested with the durometer.

DUROMETER HARDNESS - A numerical value obtained from the durometer that measures the resistance to indentation (hardness) of the rubber.

EDGE LIFTING - A separation of the outer edge of the tread from the casing's shoulder.

ENCAPSULATED - One material enclosed by another material.

ENVELOPE - A flexible rubber covering used to cover and retain air for a tire being retreaded.

ETRTO - European Tyre and Rim Technical Organisation. This group develops European standards for tires, rims, and valves.

EXTRUDATE - Uncured rubber compound after being passed through the die of an extruder.

EXTRUDER - A machine that shapes a rubber compound, by the process of extruding, into a usable, heated form (Example: strip or die size).

EXTRUDER GUN - A small hand-held portable extruder used for spot application of heated rubber to the casing.

EXTRUDING - Process of forming uncured rubber compound into a given shape by passing through an extruder.

FABRIC FATIGUE - Fabric degradation and resultant loss of tire cord strength due to repeated flexing, accentuated by overloading and/or under inflating.

FAST-CURE GUM - Rubber compound which cures at a faster rate than retread rubber, and is tested at 260°F (127°C).

FEATHERING - Reduction in thickness to allow a smooth transition to match the contour of the adjacent material.

FILLER PLUG - See REPAIR PLUG.

FILLER STRIP - An uncured calendered rubber strip (usually fast-curing) used under the tread when added thickness is needed in retreading.

FILLER GUM (FILLING STOCK, REPAIR GUM) - An uncured rubber compound (usually fast-curing) used to fill in low spots or repairs on a casing.

FINGER BULGE - A localized distortion normally in the sidewall indicating a slight opening between body cord spacing or can be caused by a penetrating injury.

FINISHED BUFF - See BUFFED TEXTURE.

FLAP - A cured, shaped rubber strip which fits inside the tire to protect the tube from pinching by beads or rubbing on rim. Normally used with tube-type tires.

FLASH - Excess rubber squeezed out between edges of mold during curing process.

FLEX AREA - Circumferential area in a tire where maximum bending or flexing occurs.

FLEX BREAK - A circumferential break in fabric cords usually parallel to the beads in the mid-sidewall area.

FLEX CURE - Proprietary system using uncured tread rubber and flexible rubber molds to produce a retread in a pressure curing chamber.

FLEX ZONE - Reference to the area of a radial tire from the shoulder apex to mid-sidewall where only the body ply supports the casing profile.

FLOW CRACK(ING) - A surface crack caused by improper rubber flow when a tire (or retread rubber) is shaped in the curing process.

FLOW STOP - A design feature in the mold which stops the flow of new retread rubber. See STOP RING.

FOOTCANDLE (FC) - A unit of illuminance or illumination, equivalent to the illumination produced by a source of one candle at a distance of one foot and equal to one lumen incident per square foot.

FULL CAPPING/TREADING - A mold cure process that replaces the sidewall shoulder area and the tread area. This process would cover to the stop ring of the mold or matrix.

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FULL-CIRCLE MATRIX (MOLD) - Mold or curing band for retreading made in a continuous circle as opposed to a segmented mold.

FULL-SERVICE REPAIR FACILITY - A facility with the proper equipment, repair materials, and trained personnel to perform a full range of tire repairs -- such as puncture, spot, reinforcement, and section -- off the rim.

GAUGE - Thickness, usually expressed in 32nds of an inch for tread rubber or by the decimal system for repair gums (millimeters for metric system). See TREAD DEPTH GAUGE.

GG RING - See GUIDE RING (RIB).

GLYCERINE - A syrupy liquid used in air bags to help prolong the life of the rubber. It should only be used if specifically prescribed on the instruction tag from the air bag manufacturer.

GREEN TIRE - A built tire (new or retreaded) before being cured.

GROOVE - Space between two adjacent tread ribs or lugs.

GROOVE CRACKING - See CRACKING.

GROOVE VOID DEPTH - Measurement of the perpendicular distance from a real or calculated reference, defined by edges of two adjacent ribs (lugs) to the lowest point of contact in the groove (void).

GROOVING (SCULPTING) - The cutting of a tread design into tread rubber when a design does not already exist.

GUIDE RING (RIB) - A rib of raised rubber running around a tire just above the bead to indicate proper mounting and seating of the tire on the rim.

GUM STRIP - A thin gauge piece of rubber normally wrapped around the end of a cut fabric or steel belt ending to relieve stress.

HARDNESS TEST - Measure of resistance to penetration of rubber by use of durometer. See DUROMETER HARDNESS.

HEAT CURE - Repair unit activated by heat and pressure.

HEAT PAD (HEAT BOOSTER) - An electric heating unit which provides heat to cure repairs.

HEEL - See BEAD HEEL.

HOLLAND CLOTH - A completely filled, woven fabric with a smooth finish on both sides, used to separate rubber from adjacent materials.

HOT CAPPING - See MOLD CURE RETREAD PROCESS.

HYSTERESIS - Measure of energy loss expressed in degree of temperature build up.

IMPACT BREAK - In a tire, a break usually in the shape of an "X", "Y" or star, which can be seen from the inside of

the tire, or a break usually in the shape of an "I" which can be seen from outside of the tire.

INFLATION (PRESSURE) - The minimum cold tire inflation pressure required for specific load and speed conditions. See COLD INFLATION PRESSURE.

INJURY (INJURIES) - Any damage caused by a penetrating object or severe scuff or impact.

INJURY SIZE - Widest opening in the cord body after skiving and buffing.

INNER LINER (LINER) - The layer(s) forming the inside surface of a tubeless tire that contains the inflating medium within the tire.

INNER LINER REPAIR MATERIAL - A special repair material specifically for inner liners.

INNER LINER SEALANT - Liquid or semi-solid material which is used to coat the inner liner.

INNER LINER SEPARATION - The parting of the inner liner from the body ply material.

INNER TUBE (TUBE) - An airtight rubber membrane (bladder) placed inside the casing of a pneumatic tire to hold air.

INSIDE CURING RIM - A metal support for a curing tube, fitting inside the tire, not intended for vehicle use. See COLLAPSIBLE RIM.

INSPECTION (TIRE) - The process of checking and assessing the suitability of a tire or casing for further stage of manufacturer or service.

INTERNATIONAL TIRE AND RUBBER ASSOCIATION (ITRA) - Formerly the ARA. See TIRE INDUSTRY ASSOCIATION.

JATMA - Japan Automobile Tyre Manufacturers Association. This group develops Japanese standards for tires, rims and valves.

KETTLE CURE - See AUTOCLAVE.

KEVLAR - A high-strength synthetic fiber-type material used to form a ply cord and is a registered trademark of DuPont.

KILOPASCAL (kPa) - A unit of pressure. 1 kPa = 0.1450 psi. See USEFUL CONVERSION FORMULAS on page following industry terms.

KINKED BEAD(S) - Damage resulting in a sharp permanent bend in the bead wire at one or more points around the circumference of the bead.

LIGHT TREAD - Failure of tread stock to completely fill the mold, especially at the edges of design elements.

LINER - This term can also refer to protective poly materials used for packaging precured tread rubber. See INNER LINER.

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LIQUID BALLAST - A liquid solution (usually calcium chloride) placed inside a tire to add unsprung weight.

LOAD INDEX - A numerical code associated with the maximum load a tire can carry at the speed indicated by its speed symbol under specified conditions.

LOAD RANGE - A letter designation (example A, B, C, D, E, etc.) following tire size designation, used to identify a given size tire with its load and inflation limits when used in a specific type of service, as defined in the Tire and Rim Association, Inc. tables.

LOAD RATING - The maximum load a tire is rated to carry for a given usage at a specified cold inflation pressure.

LOCAL SERVICE - An application in which operation is limited to speeds not to exceed 55 mph for not more than 60 continuous minutes.

LOW PROFILE (ASPECT RATIO) - A tire in which the ratio of cross-section height to section width (80% or less) is lower than that of a conventional tire.

LOW-TEMPERATURE GUM - A rubber compound which cures at a faster rate than fast-cure gum, usually tested at 260°F (127°C) or 200°F (93°C).

LUBRICANT - A substance that lessens or prevents friction or difficulty and eases release.

LOCK RING - Removable, split rim locking ring that holds rim flange on a multi-piece rim.

LUG - A discontinuous tread element.

LUG REINFORCEMENT - Supporting tie bar or buttress designed to reinforce tread elements.

LUG TEARING - Ripping of the lug, sometimes resulting in removal by violent operation or mechanical interference.

LUX (LX) - A unit of illumination, equivalent to 0.0929 foot-candle and equal to the illumination produced by luminous flux of one lumen falling perpendicularly on a surface one meter square.

"M" DIAMETER - Diameter at the base of the tread design; matrix undertread diameter.

MANDREL - A curved support inserted in a tire to prevent the casing from collapsing while building and curing a repair.

MANUFACTURER (TIRE) - The name of a company or wholly owned subsidiary making the tire.

MASTER BATCH - Homogeneous mixture of rubber and other materials for use as raw material to produce tread compound.

MATRIX (MATRICES) - Aluminum or steel rings or segments which form the cavity in which the retread is actually cured and from which the tread design is formed.

MATRIX SKIRT - The sidewall flange of the matrix. In a short-skirt matrix, the flange extends from the shoulder to the flow stop, and in a long-skirt matrix, it extends below the flow stop.

MILL - Machine composed of two large iron or steel counter rotating rolls, used to warm, mix, and blend rubber.

MILLIMETER (mm) - A metric unit of measure. 1 mm = 0.039 inches (or 25.4 mm = 1 inch). See USEFUL CONVERSION FORMULAS on page following industry terms.

MILLING - Process of breaking down raw rubber and blending with curative ingredients and other compounds.

MODULE - Small pressure chamber used in precure systems holding one to four tires at a time.

MODULUS - The force expressed in pounds per square inch (or kilograms per square centimeter) required to stretch a piece of rubber to a given elongation.

MOISTURE BLOWS - Ply separations caused by the expansion of moisture in the casing when heated during curing; usually shows up when removed from matrix.

MOLD - The heated cavity in which tires, retreads, and repairs are vulcanized. Includes the curing chamber, matrices, and adjusting devices.

MOLD BLOW - A porous condition caused by a loss of pressure or under cure.

MOLD CURE RETREAD PROCESS - The fitment and vulcanizing of uncured tread rubber to a properly buffed and sized casing in a mold or matrix system.

MOLD LUBRICANT - Material used as release agent to facilitate removal of the tire from the mold after curing.

MOLD SIZING - Measuring the tire casing to determine proper mold fit. Usually a combination of bead-to-bead or cross section and tire circumference is used.

MOLDING SHRINK - Shrinkage in rubber gauge as the rubber is vulcanized, usually within a 2-3% range.

MONSANTO RHEOMETER (ODR) - Instrument used to determine curing characteristics of rubber compounds.

MOONEY SCORCH - See SCORCH TIME.

MOONEY VISCOSITY - Common expression for uncured compound plasticity measured by a laboratory machine.

NAIL HOLE - See PUNCTURE.

NATIONAL TIRE DEALERS & RETREADERS ASSOCIATION (NTDRA) - See TIRE INDUSTRY ASSOCIATION (TIA).

NON-FILL - Failure of rubber to properly fill the matrix during cure, resulting in imperfectly formed tread elements and rounded lug edges.

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NON-SKID DEPTH - See TREAD DEPTH.

OFF-CENTER TREAD - A tread that is not symmetrically distributed from the centerline of the casing; or lateral displacement of the tread with respect to the centerline of the casing.

OFF-REGISTER TREAD - A tread with the design off (i.e., not matching up) at the mold parting line either circumferentially or radially.

OPEN SPLICE - Any parting of a splice.

OPTIMUM CURE - That state of cure at which the rubber compound exhibits the most satisfactory physical properties.

OCCUPATIONAL HEALTH & SAFETY ADMINISTRATION (OSHA) - The federal agency responsible for establishing and enforcing safety and health regulations in the workplace.

ORBITREAD MACHINE - A combined tuber-builder that applies tread rubber to a tire in ribbon form, and in a spiral configuration.

OUT OF ROUND - The eccentricity of a tire or tire and wheel assembly.

OVERALL BUFF WIDTH - The specified amount of buff required to properly fit a tread to a casing.

OVERALL DIAMETER (O.D.) - Measurement of a tire when inflated and mounted on rim. Or, the measurement used to size a buffed tire (while the tire is inflated) usually checked by using a diameter tape rule.

OVERCURE - Curing in excess of optimum cure. Excessive overcure can result in the deterioration of certain physical properties. See REVERSION.

OVERFLOW - Excessive tread compound at the mold parting line or at the edge of the matrix skirt which should be trimmed or buffed off. See FLASH.

OVER INFLATION - Inflation of a tire beyond the tire's recommended pressure.

OVERLOADING (TIRE) - A condition in which the vehicle is carrying more weight than the tire is rated to carry at a specific inflation pressure. Tire overloading can be dangerous and is not recommended. However, note that tire load capacity can be increased in certain cases by increased inflation or control to lower speeds. See TIRE AND RIM ASSOCIATION YEARBOOK.

OXIDATION - The reaction of oxygen with rubber or steel, usually evidenced by a change in the appearance (discoloration) of the surface, a change in physical properties, corrosion or wire rust.

OZONE - A form of oxygen which accelerates aging and weathering in tires.

OZONE CHECKING - Formation of fine cracks in surface of rubber due to ozone in the environment.

PADDING GUM - Heat resistant rubber used under tread rubber to build up its size for mold fit. See FILLER GUM.

PANTOGRAPHING - Angular movement of diagonal plies in tire shaping or deflecting.

PATCH - See REPAIR UNIT.

PATCH-PLUG - Combination of a patch repair unit and a repair plug. See REPAIR UNIT.

PEAKING - A condition, usually in the cushion, resulting from local material starvation and excessive flow from adjacent areas.

PENETRATION - Damage to a tire caused by a piercing object that may or may not puncture the inner liner of the tire casing.

PERFORATED POLY - Polyfilm that covers the tread to create lubrication between the tread and envelope during curing.

PERFORATION - Damage completely through a tire caused by a piercing object.

PERMANENT TIRE REPAIR - An off-the-wheel tire repair performed by a trained technician. The tire is fully inspected and a repair, which meets the manufacturers' recommendations for injury size and is completed using industry approved procedures, is installed on the inner liner of the tire after the penetrating injury is filled with rubber.

PLASTICITY - Resistance of an uncured rubber compound to distort or flow under pressure.

PLASTICIZER - A chemical compound added to natural and synthetic rubber to impart softness, flexibility or resiliency.

PLY (PLIES) - A layer of rubber-coated parallel cords.

PLY ADHESION - Strength of bonding between adjacent plies, usually expressed as the force required to separate them.

PLY RATING - An indication of tire casing strength and load-carrying capacity, expressed as numbers, letters, and/or symbols; does not necessarily represent the number of cord plies in the tire. See LOAD INDEX and LOAD RANGE.

PLY SEPARATION - The loss of adhesion between adjacent plies.

PLY TURN-UP - The part of the body ply that wraps under the bead bundle and ends in the tire sidewall.

PNEUMATIC PRESSURE - Air pressure.

Common Retread and Repair Terminology - A Compendium of Industry Terms

POLYFILM - A thin strip of polyethylene applied to the precure tread surface, after building, that helps to extend the life of an envelope and helps eliminate sticking to the cushion.

POROSITY - Small air bubbles created when rubber is cured at insufficient pressure and/or time.

POTENTIOMETER - A voltmeter that reads the extremely low voltage developed at the thermocouple junction and thus shows the temperature. Usually read directly in degrees of temperature.

POUNDS PER SQUARE INCH (psi) - A measurement of pressure. 1 psi = 6.895 kPa (or 1 kPa = 0.1450 psi). See **USEFUL CONVERSION FORMULAS** on page following industry terms.

PRECURE PROCESS - The process of using precured tread and bonding it to a prepared casing with a thin layer of cushion gum (compound reach in natural rubber). Temperatures used range from 210°F (100°C) to 320°F (161°C).

PRECURED TREAD - Tread which is vulcanized with the tread configuration molded into it prior to being placed on the buffed casing.

PRECURED TREAD CUSHION GUM - A tacky rubber compound used to bond the precured tread to the prepared surface.

PRE-DRYING - Drying of a tire in a heated room, chamber or device to remove moisture before retreading. See **DRYER**.

PRESS (LOADING) - A machine designed to open and close a matrix, load, and eject retreaded tires.

PRESSURE TREAD - Proprietary system for applying extruded, patterned, uncured tread onto a buffed casing, without use of molds, in a single operation.

PROCESSING - Various stages in the production of a new or retreaded tire.

PROFILE DIE - An extruded die size configuration other than a rectangle.

PROTECTOR PLY/BELT - A ply added primarily to protect the structural belts, which may be removed during retreading (if extensively damaged).

PUNCTURE - A penetration through the tire, made by a small object.

PUNCTURE REPAIR - See **REPAIRED TIRE**.

PYROMETER - An instrument to measure temperatures, usually by the generation of electric current by a thermocouple when acted on by direct heat or an infrared sensor. Commonly used to measure surface mold temperatures or (if a penetrating needle is used) tread rubber temperatures.

R.A.R. - Returned As Received. A casing rejected for retreading.

RADIAL CRACKING/CRACKS - Cracks in the shoulder or sidewall of a tire, running perpendicular to the beads.

RADIAL PLY - See **TIRE**, **RADIAL**.

RADIAL RUNOUT - A measure of out-of-roundness; tested by rotating the inflated tire and observing or measuring how far the surface of the tread varies from a true circle.

RADIAL SPLIT - See **BREAKS**.

RADIAL SPLIT BREAK - A break of the sidewall perpendicular to the beads that has not damaged the cords.

RADIAL TIRE - See **TIRE**, **RADIAL**.

RAM EXTRUDER - Hydraulically operated batch loading machine for producing various extruded shapes of rubber.

RASP - A tool with raised points used for removing and texturizing rubber surfaces.

REAM - To clean an injury or hole prior to repair.

RECAPPING - An improper term for retreading. Often refers to process known as "top-capping" in which rubber is applied to tread surface only.

REGULATOR (REDUCING VALVE) - Pressure-regulating device used for controlling steam or air pressure to a desired level.

REGROOVING - The cutting into an existing tread design to a depth greater than that provided by the new tire manufacturer or retreader. 49 CFR Federal Motor Vehicle Safety Standards Part 569 regulations apply.

REINFORCED SHOULDER REPAIR (RSR) - Procedure guidelines for size selection and placement of repairs for penetrations up to 5/16" in the shoulder of truck tires.

REINFORCEMENT - Material, usually rubber and fabric, vulcanized to the tire to add strength to the tire cord body at an injury.

REINFORCEMENT REPAIR - See **REPAIRED TIRE**.

RELUGGING - A method of retreading agricultural and off-the-road tires using hand-applied preformed lugs and kettle cure. See **BAND LUGGING**.

REMOLDING - A bead-to-bead retreading process by which tread and sidewalls are renewed to give a new tire appearance.

REPAIR GUM - A soft, tacky, usually fast-curing rubber compound used in tire repairing; available in sheet, strip and rope form. Typically used in section and spot repairs.

REPAIR MATERIAL - Specifically designed material (repair units, repair gums, cements, etc.) used during the repair process of a tire or tube.

Common Retread and Repair Terminology - A Compendium of Industry Terms

REPAIR PLUG - Specifically designed material (stems, repair gums, cements, etc.) used during the repair process of a tire.

REPAIR SEALANT - Liquid or semi-solid materials used to cover over-buffed areas around repair units.

REPAIR UNIT (PATCH, PLUG, PATCH/PLUG COMBO) - A specially designed unit made of fabric and/or rubber that is applied to a tire or tube to restore tire and/or tube integrity.

REPAIRED TIRE - Any tire with punctures, cuts or other types of injuries that have been reconditioned as required to provide additional service life.

Common repair types are:

Puncture Repair: Off-the-wheel repair(s) of any injury caused by a penetrating object. (NOTE: The type of repair is determined by size, depth and location of injury.)

Reinforcement Repair: Repairs, larger than a reinforced puncture repair, made to the casing when an injury has extended through 25% but less than 75% of the tire body, requiring both filling material and reinforcing patch.

Section Repair (Bias/Radial Tire): Repairs, larger than a reinforced puncture repair, made to the casing when an injury has extended through 75% or more of the actual plies, or completely through the casing in the tread or sidewall areas. The damaged cord is removed and new cord is replaced in the form of a patch. (NOTE: The type of repair is determined by size, depth and location of injury.)

Spot/Surface Repair (Bias Tire): Repairs made to the casing by vulcanizing rubber to a tire without using reinforcing materials and the injury penetrates less than 25% of the body plies.

Spot/Surface Repair (Radial Tire): Repairs made to the casing by vulcanizing rubber to a tire without using reinforcing materials and the injury does not extend to the cords.

RESILIENCE - Capacity of rubber to recover its original size and shape after deformation.

RETREADABILITY - Ability of the tire casing to be retreaded and provide acceptable performance.

RETREAD TIRE (RETREADING) - A casing to which new tread rubber has been vulcanized to the prepared surface to extend the service life of the tire.

RETREAD SEPARATION - A separation between the tread rubber and the buffed tire casing.

REVERSION - Deterioration of a rubber compound's physical properties due to an excessive accumulation of heat history.

RIM - The outer support part of a wheel, usually metal, for a tire or a tire and tube assembly on which the tire beads are seated. See WHEEL.

RIM DIAMETER (NOMINAL) - The named rim diameter within 0.5 inch increments, (22", 22.5", 17.5", etc.).

RIM FLANGE - The part of the rim that supports the bead above the heel and resists lateral internal pressure.

ROLLING RESISTANCE - The resistance of a tire to free rolling.

ROPE RUBBER - Uncured repair gum supplied in continuous cylindrical form to be used in a hand-held extruder, generally for tire repairing.

RUBBER BUFFINGS (BUFFING DUST) - Loosened rubber particles from buffing the tire.

RUBBER CEMENT - See CEMENT.

RUBBER HARDNESS - Resistance of rubber to penetration by blunt point. Durometer "A" hardness tester is commonly used to measure hardness. See DUROMETER HARDNESS.

RUBBER MANUFACTURERS ASSOCIATION (RMA) - See US TIRE MANUFACTURES ASSOCIATION (USTMA).

RUBBER SEPARATION - The lifting or parting of component parts from adjacent rubber parts of the tire.

RUN FLAT CONDITION - Tire damage resulting from operating with low or no air pressure, sometimes identified by repetitive liner cracking or discoloration.

RUN-FLAT TIRE - A pneumatic tire designed to carry the load for a limited distance if the tire is deflated.

RUST - See CORROSION.

SCORCH (CURED RUBBER) - A soft, tacky surface that occurs during the buffing or skiving processes due to excessive heat. Bonding/adhesion will be adversely affected by scorched rubber. See REVERSION.

SCORCH (GREEN RUBBER) - Premature vulcanization of rubber caused by excessive heat during processing. Scorched compounds will not mold properly nor develop satisfactory adhesive properties.

SCORCH TIME - Time (in minutes) as measured by a laboratory test instrument at which the compound starts to cross-link or vulcanize. It relates to the shelf life and processability of the compound.

SCRAPER - A hand-held tool used to remove contaminants from the inner liner surface prior to mechanical buffing.

SECTION REPAIR - See REPAIRED TIRE.

SECTION WIDTH (CROSS-SECTION WIDTH) - The maximum width of the inflated tire including the normal sidewalls, but not including side ribs, scuff bars or decorations.

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SECTIONAL BAG (AIR-STEAM) - A rubberized fabric bag, which is placed inside a tire and inflated in a section mold, that applies pressure for curing to the injured/repaired area.

SEGMENTED MOLD - Multi-piece mold segments which open to insert a tire and then close together to form a continuous circle.

SEPARATION - Lack of adhesion between any adjacent materials in a tire.

SET-UP - Premature vulcanization of a rubber compound during process or storage.

SHEAROGRAPHY - A non-destructive inspection method using laser technology.

SHELF LIFE - The recommended period of time (stated by the product's manufacturer) for which that product may be applied and/or utilized before it degrades and/or is no longer effective or serviceable.

SHOULDER AREA - Transitional area between the tread and sidewall (including the outer edge of the tread and uppermost sidewall area of the tire); in radial tires includes the outer edges of the belts.

SHOULDER RADIUS (BUFFED) - The buffed contour as applied to the shoulder area of the tire.

SIDEWALL AREA - That portion of a tire between the tread and bead area.

SIDEWALL RUBBER - A non-structural element designed to protect the body ply from contact with damaging objects or weathering.

SIDEWALL SEPARATION - A lack of adhesion between components in the sidewall.

SIPE - Relatively small straight, angular or curved slots, other than grooves, molded or cut in the tread surface.

SKID DEPTH - The distance between the tread surface and the deepest groove as measured in the mold. See TREAD DEPTH.

SKIM (SKIM COAT) - Rubber surrounding ply fabric or steel cords.

SKIRT - See MATRIX SKIRT.

SKIVE (SKIVING) - The removal of injured or damaged materials.

SLAB STOCK - Rubber compound cut and taken from a mill in wide, thick strips or sheets.

SOAPSTONE - A soft talc-like powder used as a mold release agent or as an anti-stick.

SOLVENT (RUBBER SOLVENT) - A liquid which will soften and dissolve uncured rubber, dilute cement, remove

contaminants and increase the tackiness of uncured rubber surfaces.

SPACER RING (SPACERS) - A ring inserted between two halves of a matrix which enables the matrix to handle tires of the same diameter, but with greater tread widths and larger cross sections.

SPECIFICATION - Written requirements for process or materials.

SPECIFIC GRAVITY - Ratio of the weight of a given volume of any substance to that of the same volume of water. The higher the specific gravity, the denser or heavier the substance.

SPLICE - The junction formed by joining the two ends of a tire component.

SPOT REPAIR (BIAS) - See REPAIRED TIRE.

SPOT REPAIR (RADIAL) - See REPAIRED TIRE.

SPOTTER (SPOT PRESS) - A small heat vulcanizing unit used in localized repairing tires and tubes.

SPREADER (TIRE SPREADER) - A machine used for spreading the beads of a tire during inspection and/or repairing.

STANDARD PROFILE (ASPECT RATIO) - Tube-type tires that are 100 aspect ratio; tubeless tires that are 90 aspect ratio.

STANDARD RIM - A rim that meets the precise measurements specified by the Tire and Rim Association, Inc., or other standardizing bodies.

STEAM TRAP - An automatic device for discharging the accumulated water of a steam pipe or vessel, while maintaining pressure.

STEEL BELT PACKAGE - The layering of multiple steel belts designed to stabilize the tread, provide strength, and protect the air chamber from punctures.

STICKLEBACK - A rounded metal hand tool with raised points used to clean and ream injuries in bias ply tires.

STIPPLE (STIPLING) - To aggressively apply and work in cement with a brush to a buffed surface or exposed cords.

STITCHER - A hand held tool (or power equipment) used for stitching. See STITCHING.

STITCHING - A procedure of applying pressure to remove trapped air and improve rubber contact for better adhesion.

STOP RING - A design feature in the mold which stops the flow of new retread rubber. See FLOW RING.

STRIP RUBBER - Uncured rubber in strip form most commonly used in cold feed extruders.

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STRIPPING STOCK - An uncured rubber stock used to extend or build up an area.

STRUCTURAL PLIES - Body and belt plies that contribute to casing strength.

TACK - Stickiness of a rubber surface.

TALC - See SOAPSTONE.

TECHNICIAN - A person who has undergone a formal, structured training program and demonstrates the ability and skill to perform specific technical functions.

TEMPLATE (BUFFING TEMPLATE) - A pattern used as a guide in repairing and retreading tires. In repairing, it serves to outline the area to be buffed inside the casing. In retreading, it is used to determine the correct contour of the buffed casing.

TEMPORARY TIRE FIX - A system capable of addressing a through-the-tire penetration (or puncture) by restoring and maintaining air pressure to provide temporary mobility of the tire. None of these methods are considered permanent tire repairs and may have speed or distance warnings on the package labels. Temporary tire fix methods include (but may not be limited to):

- Canisters containing pressurized foam which is applied through the valve stem.
- Sealant kits that include a compressor and liquid media applied through the valve stem.
- A rubberized string or rope 'plug' installed in the penetrating channel.

TEXTURE - See BUFFED TEXTURE.

THERMOCOUPLE TEST - A cumulative heat study using special equipment to determine the proper cure time.

TIE BARS - Bridge of rubber molded across base of tread groove to stabilize some designs.

TIRE - See below.

TIRE, BIAS PLY/DIAGONAL - A pneumatic tire in which the ply cords extending to the beads are laid at alternate angles substantially less than 90° angle to the center line of the tread.

TIRE, BELTED BIAS - A pneumatic tire with a bias ply casing and reinforcing belts extending from shoulder to shoulder (usually at about a 25° angle).

TIRE, RADIAL - A pneumatic tire structure in which the casing ply cords extend to the beads and are laid substantially at 90° angle to the center line of the tread, the casing being stabilized by an essentially inextensible circumferential belt.

TIRE AND RIM ASSOCIATION, INC. (TRA) - Industrial association of tire, rim and valve manufacturers. The purposes of TRA include the establishment and promulgation of interchangeability standards for tires, rims, and allied parts for the guidance of manufacturers of such products,

designers and manufacturers of motor vehicles, aircraft and other wheeled vehicles and equipment, and governmental and other regulatory bodies.

TIRE ASSOCIATION OF NORTH AMERICA (TANA) - Formerly NTDR. See TIRE INDUSTRY ASSOCIATION.

TIRE INDUSTRY ASSOCIATION (TIA) - TIA was created out of the merger between TANA and ITRA. This group represents all sectors of the North American replacement tire market and provides technical assistance and training to the tire and transportation industries in all areas relating to tires and wheels, including tire service, retreading, repairing, and rubber recycling.

TIRE PAINT - A black paint, compatible with the tire, used to enhance the appearance of a tire.

TIRE RETREAD AND REPAIR INFORMATION BUREAU (TRIB) - An industry-supported association dedicated to the recycling of tires through tire retreading and repairing.

TOLERANCE - The amount of variation allowed from a specification.

TOP CAPPING - A mold cure retread process where only the tread is replaced.

TREAD - That portion of a tire that comes in contact with the road surface.

TREAD DEPTH - The distance measured from the tread surface to the bottom of the grooves in a tire.

TREAD DEPTH GAUGE - Instrument used for measurement of depth of tread design grooves in 32nds of an inch or in millimeters.

TREAD DESIGN - The pattern/design on the tire's tread.

TREAD GROOVES - The space between two adjacent tread ribs, lugs or bars.

TREAD GUM - A rubber compound designed to make a tread-area repair.

TREAD RADIUS - A measure of the tread surface curvature from shoulder to shoulder.

TREAD RIB - A continuous circumferential element of a tread design.

TREAD ROLLER - A roller, either manual or power, used to help apply the tread rubber, remove trapped air, and improve adhesion.

TREAD RUBBER - Compounded, natural or synthetic rubber which is placed on a buffed casing and vulcanized to provide a new wearing surface.

TREAD RUBBER EXTRUDER - A machine designed to convert strip rubber into the required profile for application directly to the prepared casing.

TREAD RUBBER (TREAD STOCK) - Rubber compound which will replace the worn tire tread.

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TREAD RUBBER & TIRE REPAIR MATERIALS

MANUFACTURERS GROUP (TRMG) - A national trade association for manufacturers of tread rubber and other retreading and repair materials.

TREAD SEPARATION - A lack of adhesion between the tread and the tire casing.

TREAD WEAR - The normal loss of tread rubber due to abrasion during tire service.

TREAD WEAR INDICATORS - Narrow bars of rubber molded at a height of 2/32-inch (2 mm) across the bottom of the tread grooves. Tire tread worn to 2/32nds must be removed from service.

TREAD WIDTH - The measurement across the tread face of a tire from shoulder edge, which defines the usable width of the tread pattern.

TUBELESS - A pneumatic tire that does not require an inner tube for air retention.

TUBE-TYPE - A pneumatic tire that requires an inner tube for air retention.

UNDERCURE - A condition which describes less than acceptable vulcanization.

UNDERINFLATION - Tire having less than recommended air pressure for the load being carried. Tire may build up excessive heat that may be dangerous and could result in sudden tire destruction.

UNDERTREAD - The gauge of the rubber between the bottom of the tread grooves and outermost ply or belt.

UNIFORMITY - A measure of the tire's ability to run smoothly and vibration free. Some examples of uniformity measurements are, tire balance, out of round condition or radial and lateral run-out.

UNSERVICEABLE - See R.A.R.

US TIRE MANUFACTURES ASSOCIATION (USTMA) - The national trade association for the rubber products industry. Its membership includes the major domestic tire manufacturers in the U.S. as well as manufacturers of various rubber products including tires, hoses, belts, seals, molded goods, etc. USTMA represents the industry before legislative and regulatory bodies as well as provides consumer, scrap tire, statistical/market information analysis, technical, maintenance, and safety publications.

VALLEY DIE - An extruded die size configuration, which from a cross view shows the shoulders higher than the center portion.

VALVE STEM - Tube through which air flows in or out of a tube or tubeless tire.

VENEERING - Application of a thin layer of rubber materials used in bead-to-bead retreading to cover the prepared sidewall.

VENT HOLE - Small holes through the matrix, which allow air to escape and the rubber to flow and fill out the tread design.

VENTING - A procedure performed on bias tires to facilitate the evacuation of air.

VENTING, CASING - The act of partially perforating a bias tire through the outer rubber into the fabric, which allows trapped air to escape without loss of tire air-retention ability.

VENTING, REPAIR - Cord or string used to allow air to escape from the repaired area and the fabric tire casing to the exterior of the tire.

VISCOSITY - See MOONEY VISCOSITY and PLASTICITY.

VOIDS - Air pockets within the structure of a tire (Example: within or under the retread tread rubber.)

VULCANIZATION - A chemical reaction which takes place under appropriate time, temperature, and pressure. See CURE.

VULCANIZING CEMENT - See CEMENT and CHEMICAL VULCANIZING CEMENT for chemical curing.

WARNING - Indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury (ANSI-535.2, Environmental and Facility Safety Signs).

WEATHER CHECKING - See OZONE CHECKING.

WHEEL - A combined rim and disk with a bolthole pattern for securing the tire assembly to the vehicle.

WICK (WICKING MATERIAL) - Material or device used in precured retread systems to allow free passage of air to atmosphere. In mold cure retreading, wicks may be built into tire using cord to allow trapped air in casing to escape during cure.

WICKING - An act of air escapement from the tire casing or from under an envelope by means of the wick.

WIRE BRUSH - A hand held tool (or attachment to a power tool) that is used to clean and texturize surfaces prior to retreading and/or repairing.

X-RAY - A non-destructive inspection method using electromagnetic radiation passed through an object to provide a photographic image.

ZIPPER RUPTURE - As a result of being operated significantly underinflated and/or overloaded, multiple ply cords break, thus creating a circumferential rupture in the upper sidewall area of a steel cord radial tire and is accompanied by instantaneous air loss and explosive force. (For inspection procedures, please see the RMA TISB Vol. 33 Inspection Procedures for Zipper Ruptures in Steel Cord Radial Medium or Light Truck Tires and accompanying wall chart.)

Reference: This glossary is based on RP-01/02-10 "Retread and Repair Materials Glossary of Terms"

Useful Conversion Formulas

Tire Speed Rating

$$\text{mph} \times 1.609344 = \text{Kph}$$

$$\text{Kph} / 1.609344 = \text{mph}$$

Speed Symbol	F	G	J	K	L	M	N	P	Q	R	S	T	U	H	V	Z
MPH	50	55	62	68	75	80	87	93	99	105	112	118	124	130	150	150+
km/h	80	90	100	110	120	130	140	150	160	170	180	190	200	210	240	240+

Air Pressure

$$1 \text{ bar} = 14.5 \text{ psi}$$

$$1 \text{ bar} = 100 \text{ kPa}$$

psi	15	22	29	36	44	51	58	65	73	80	87	94	102	109	116	123	131	138	145	152	160
bar	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11
kPa	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100

Temperature Chart

$$(\text{Celsius}) \times 9 / 5 + 32 = \text{Fahrenheit}$$

$$(\text{Fahrenheit}) - 32 \times 5 / 9 = \text{Celsius}$$

Fahrenheit	-4	5	14	23	32	41	50	59	68	77	86	95	104	113	122	131	140	149	158	167	176	185	194	203	212
Celsius	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

Length Conversion

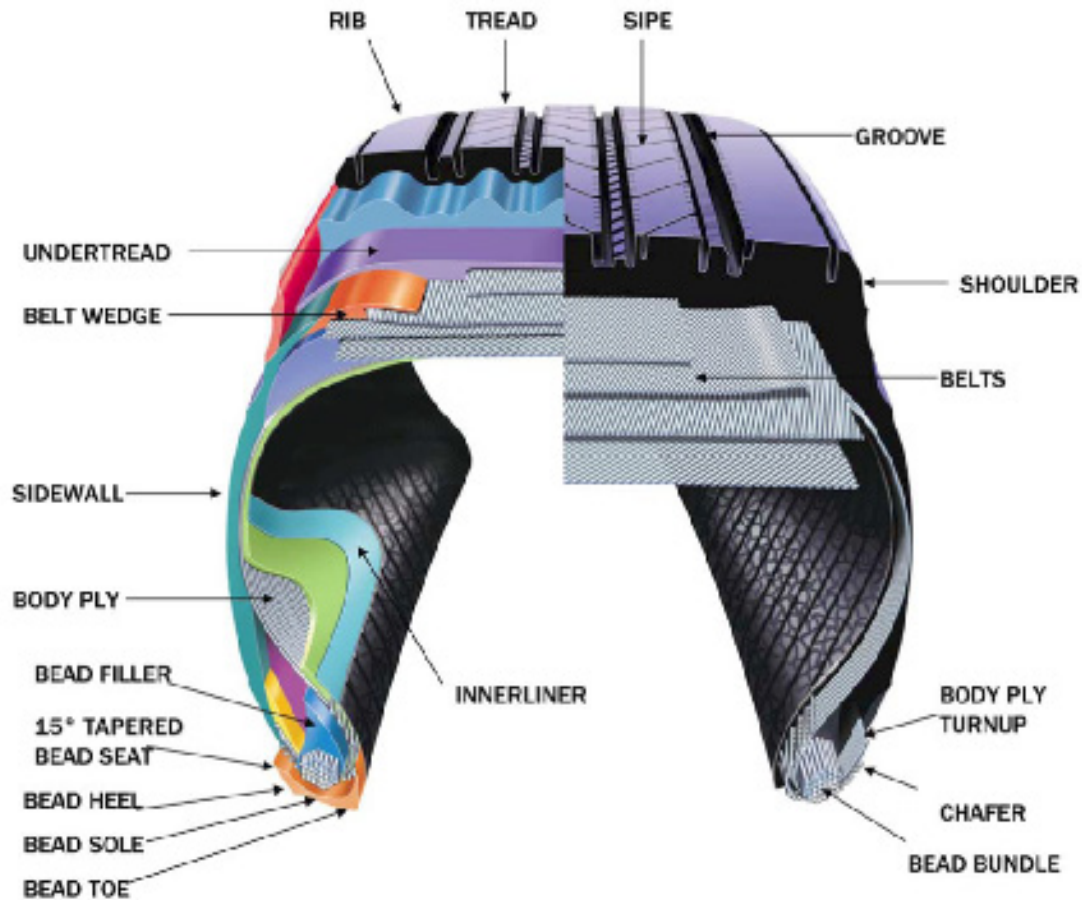
$$\text{Inches} \times 25.4 = \text{MM}$$

$$\text{MM} / 25.4 = \text{Inches}$$

Inches	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.00
Millimeters	6.3	12.7	19.0	25.4	31.7	38.1	44.4	50.8	57.1	63.5	69.8	76.2	82.5	88.9	95.2	101.6	107.9	114.3	120.6	127.0	133.3	139.7	146.0	152.4

Appendix 2

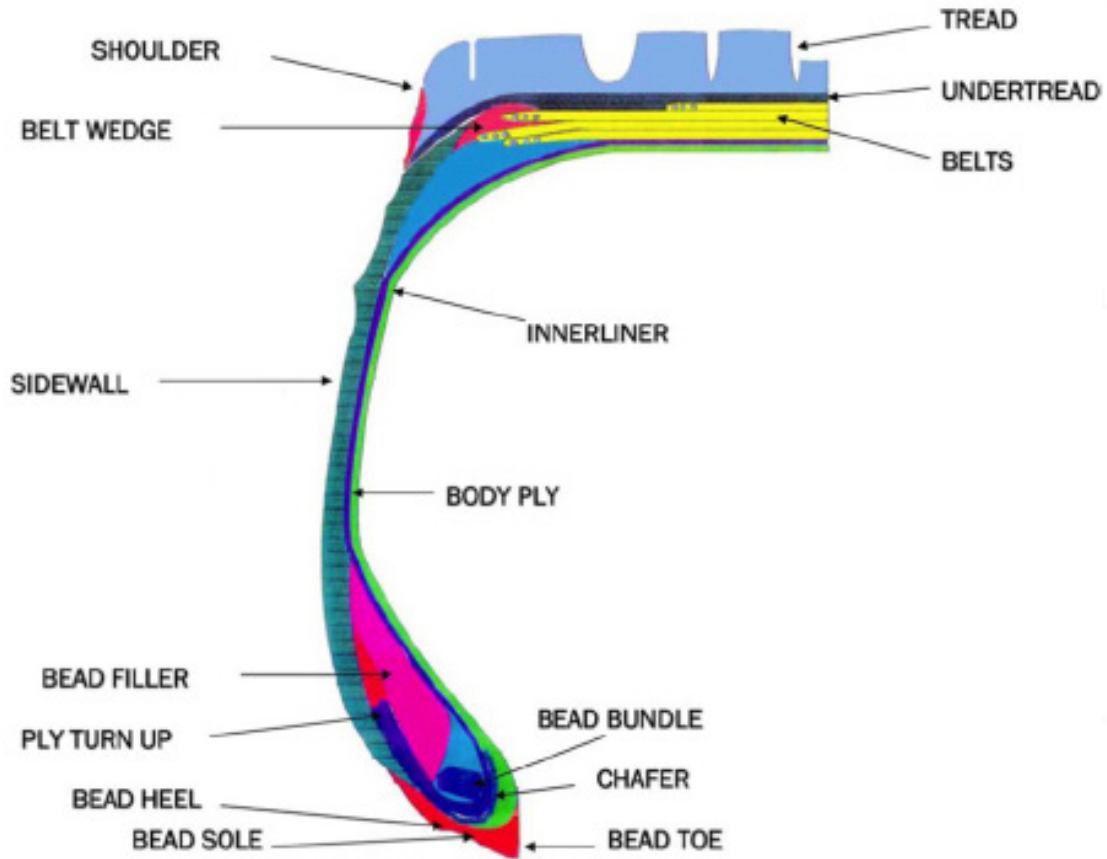
Radial Truck Tire Diagrams



Note: Appendix 2 is referenced in *Retreading Medium Truck, Heavy Radial Truck, and Bus Tires*

Appendix 2 cont.

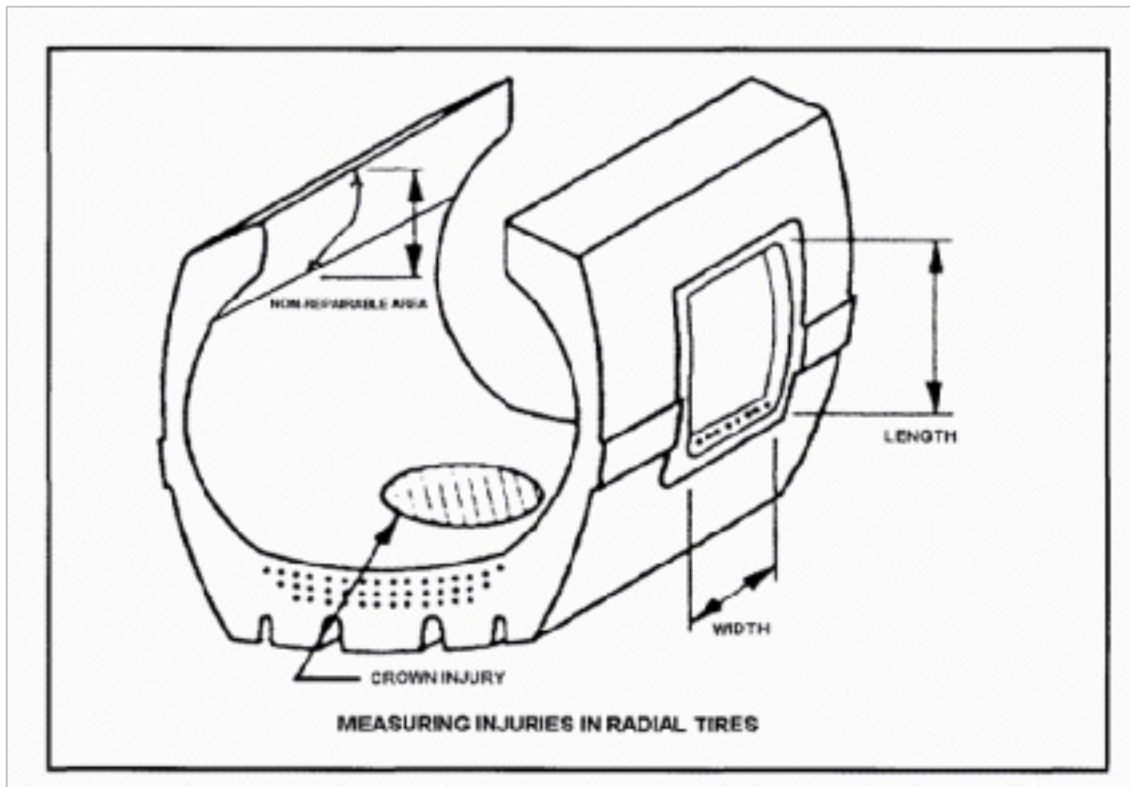
Radial Truck Tire Diagrams



Note: Appendix 2 is referenced in *Retreading Medium Truck, Heavy Radial Truck, and Bus Tires*

Appendix 3

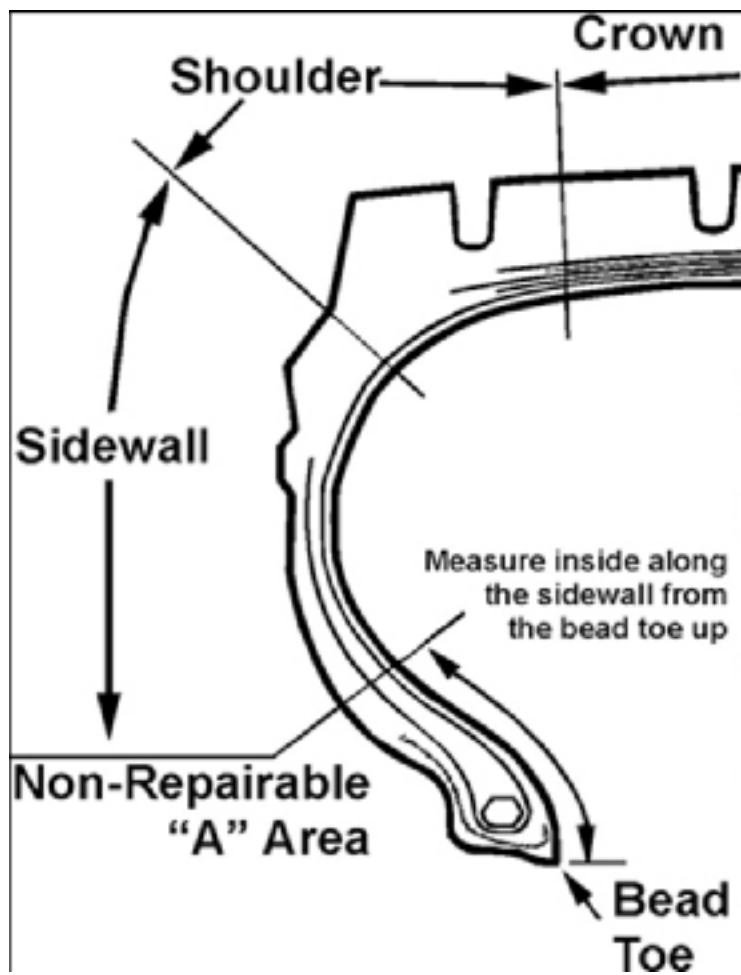
Measuring Injuries in Radial Tires



Note: Appendix 3 is referenced in *Table IIA*.

Appendix 4

Repairable Areas in Radial Tires



Appendix 5

Sidewall Labeling FEDERAL MOTOR VEHICLE SAFETY REGULATIONS 49 C.F.R. § 574.5 – TIRE IDENTIFICATION REQUIREMENTS

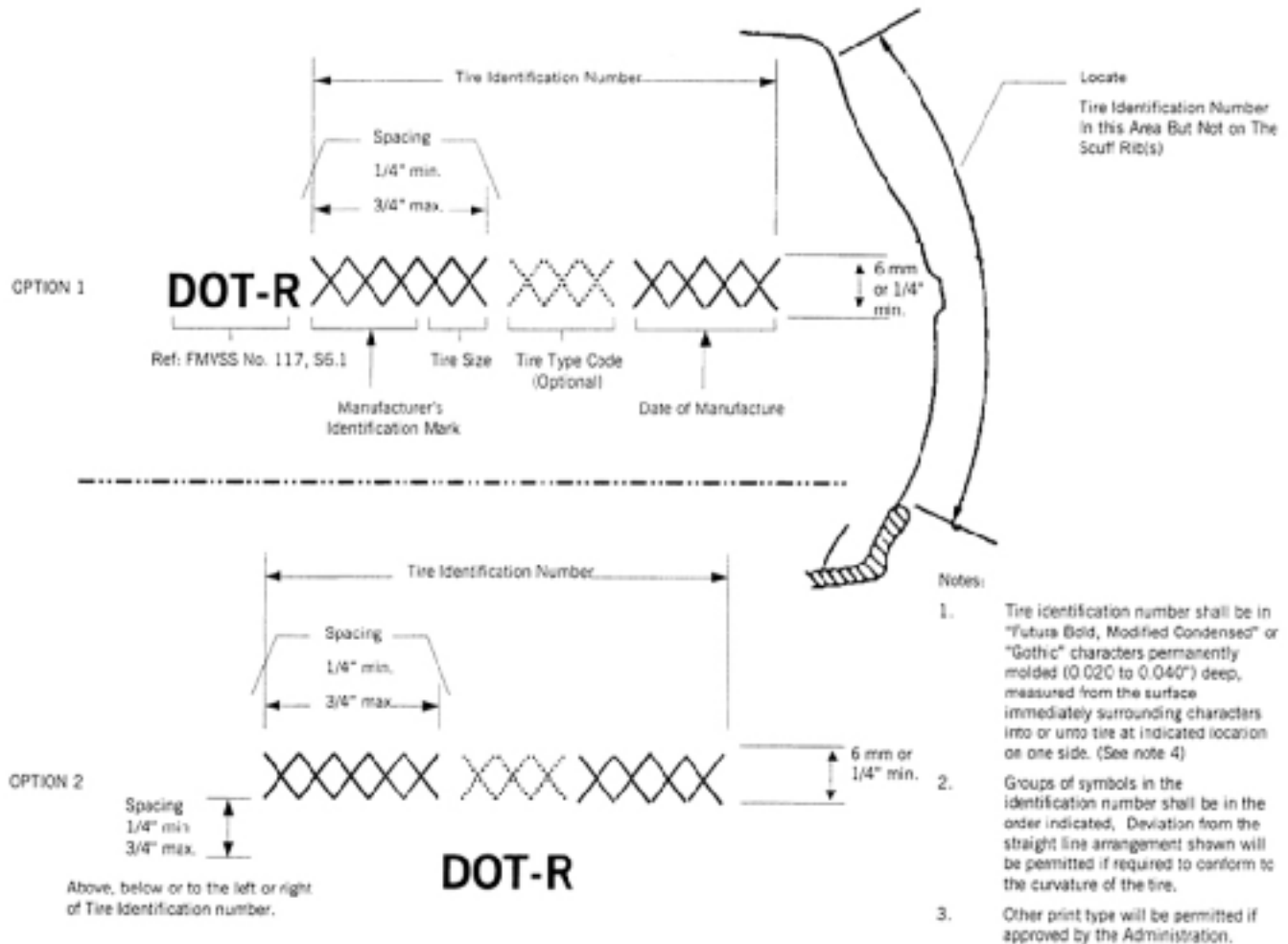


FIGURE 2. IDENTIFICATION NUMBER FOR RETREADED TIRES

Note: Appendix 5 is referenced in *Retreading Passenger Car and Light Truck Radial Fabric Body Ply Tires*, in *Retreading Light Truck Radial Steel Body Ply Tires Load Range E and Above*, and in *Retreading Medium Truck, Heavy Radial Truck, and Bus Tires*.

Appendix 5 cont.

Sidewall Labeling

TIRE MARKINGS FOR ALL NEW TIRES AS REQUIRED BY THE DEPARTMENT OF TRANSPORTATION

<u>DOT</u>	<u>XXX</u>	<u>XX</u>	<u>XXX</u>	<u>0101</u>
Meets Department of Transportation Standards	Manufacturer 3-Digit Identification Mark	Tire Size 2-Digit (Mold/Chamber Identification Mark)	Tire Type Code (Optional)	Date of Manufacture (Week/Year) Identification Mark

TRUCK TIRE RETREAD MARKINGS AS REQUIRED BY THE DEPARTMENT OF TRANSPORTATION

<u>R</u>	<u>XXX</u>	<u>XX</u>	<u>XXX</u>	<u>0101</u>	<u>RSF2</u>
Indicates Retread	Manufacturer 3-Digit Identification Mark	Tire Size 2-Digit (Mold/Chamber) Identification Mark	Tire Type Code (Optional)	Date of Manufacture (Week/Year) Identification Mark	Required for retreads in California only*

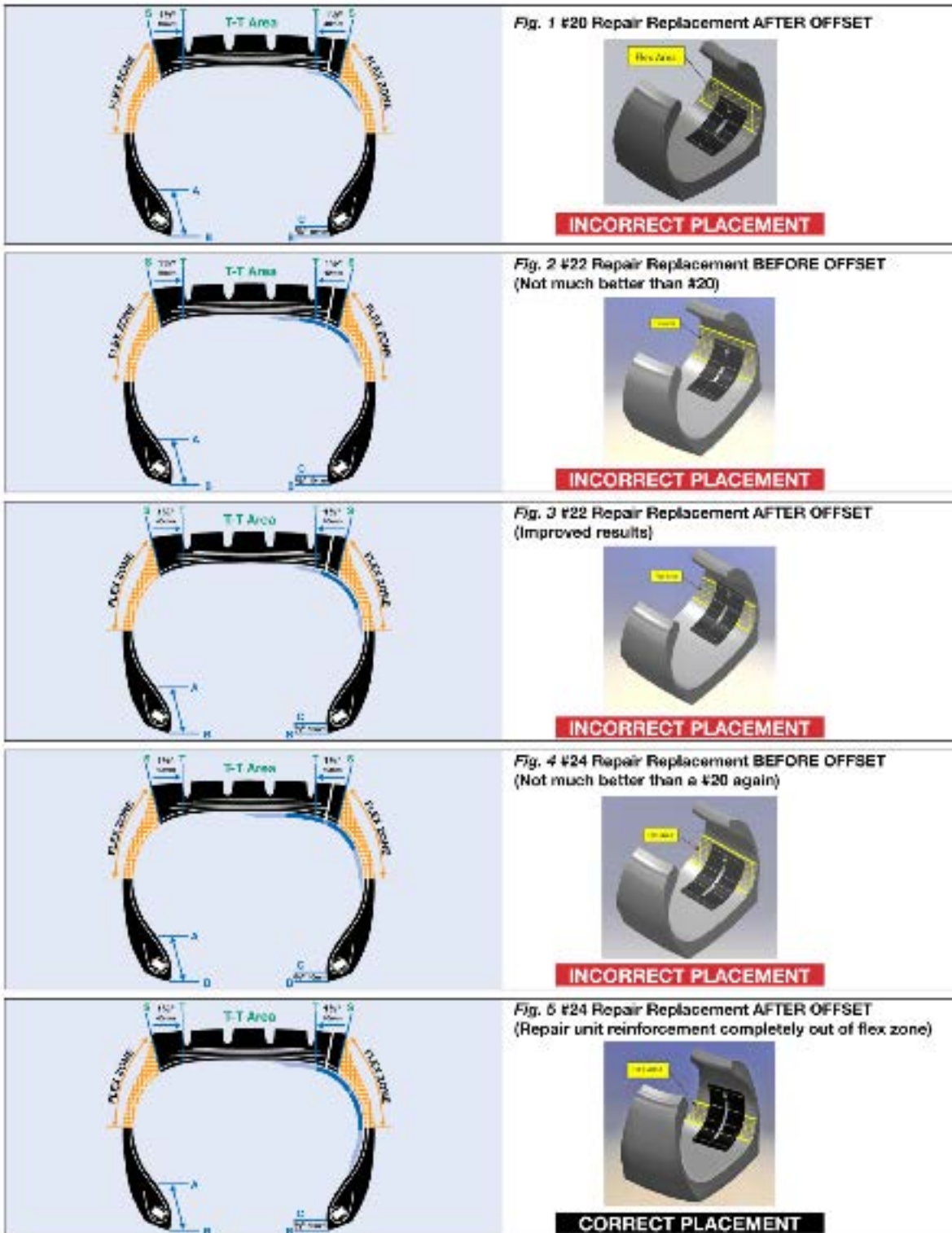
* RS indicates retread was produced under Industry Retread Standards. The F1 or F2 symbol is required on retreaded tires for steer axle use in the state of California; F2 indicates the tire is acceptable for steer axle use and has been retreaded twice. California does not require the RS marking on passenger or truck retreads that have the original new tire DOT code intact.

Note: Appendix 5 is referenced in *Retreading Passenger Car and Light Truck Radial Fabric Body Ply Tires*, in *Retreading Light Truck Radial Steel Body Ply Tires Load Range E and Above*, and in *Retreading Medium Truck, Heavy Radial Truck, and Bus Tires*.

Appendix 6

Reinforced Shoulder Repair Unit Placement

For any truck tire puncture repair, offset the repair unit over the injury within the designated window of the template, until the ends of the repair unit fall outside of the FLEX ZONE.



Note: Appendix 6 is referenced in *Repairing Medium Truck, Heavy Radial Truck, and Bus Tires*