

REPAIRING BIAS PLY TRUCK TIRES IN A FULL SERVICE REPAIR FACILITY

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I. PURPOSE

This Recommended Practice (RP) provides step-by-step procedures for repairing bias ply truck tires that are to be returned for continued service. These industry-approved guidelines have been prepared for use by full service tire repair facilities.

WARNING

Serious bodily injury may result from not wearing adequate personal protective equipment (PPE), including eye protection (i.e., goggles or face shields), ear protection, respiratory protection, and gloves while repairing tires.

II. INSPECTION

- A. Tires must be removed from the rim/wheel for proper inspection.
- B. Tires must be inspected on a well-lighted spreader (full-circle or rotating spreader recommended), to allow for inspection of all cuts, breaks and punctures. Adequate lighting (i.e., 200 footcandles (fc)/2153 lux (lx) minimum, 300 fc/3229 lx

recommended) must be provided to the surface being inspected.

- C. Tires with multiple reinforcement or section injuries in the same quadrant, damage due to underinflation or being run flat, separation between plies, separated or damaged beads, or ply turn-ups must be rejected. Tires with evidence of moisture, dirt or other contamination in the injured areas, must be thoroughly cleaned and dried.
- D. No repairs may be made in the bead areas where casing penetration or wire damage has occurred.

III. PERMISSIBLE REPAIRS

The areas where “through-the-tire” repairs may be made are shown in Figure 1. Through-the-tire repairs cannot be made in the bead area “A”.

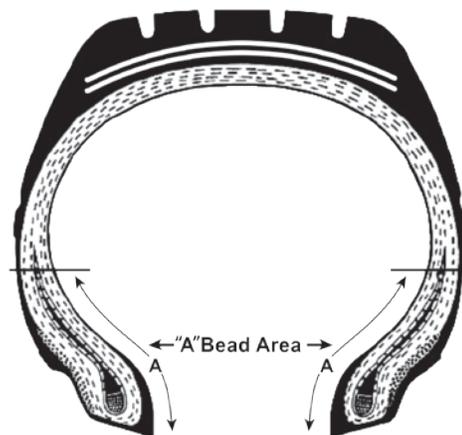


Figure 1

To determine the non-repairable bead area, measure inside the tire with a flexible ruler and follow from the bead toe up along the inside contour. See chart on following page for size of “A” area.

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Non-Repairable Area

Tire Type / Size	"A" Area Dimension
Tube-Type Up to 7.5 8.25 & Above	3 in. (76 mm) 3 1/2 in. (89 mm)
Tubeless Up to 8.5 9 & Above	3 in. (76 mm) 3 1/2 in. (89 mm)

A. For repairs in the bead area "A," the following limits apply:

1. No limit to the repair when the damage is rubber only.
2. If chafer (chipper) fabric is exposed but not damaged (i.e., frayed, worn or torn), repair is limited by economics.
3. If chafer (chipper) fabric is damaged (i.e., frayed, worn or torn), repair to the chafer is limited by economics, repair skill and equipment capabilities.
4. If body ply is exposed only during the repair process, but not damaged, repair is limited to 3" (76 mm) across the cords.
5. If body ply is exposed or damaged (i.e., frayed, worn, torn or deteriorated in appearance) prior to repair, the tire must be rejected for repair and/or retreading.

B. Only bias ply repair units may be used in bias ply tires.

C. The recommended limits of injury to be repaired are as follows:

1. Repair of nail hole punctures up to and including 3/8" (10 mm) can be made in the tread area using a two-piece repair method with a repair unit and vulcanizing rubber fill material, or a one-piece patch/plug repair unit.
2. Use a full section repair for injuries larger than 3/8" (10 mm).

IV. REINFORCEMENT AND SECTION REPAIRS

Bias tire repairing can be broken down into two categories: Reinforcement Repairs and Section Repairs.

A. Reinforcement Repairs

One of the most neglected areas of bias tire repairs is the failure to identify and repair injuries requiring a reinforcement repair unit. A reinforcement repair injury is defined as an injury through 25% but less than 75% of the actual plies as shown in Figure 2.



Figure 2

The repair will require both a reinforcement repair unit and appropriate injury filling material. A properly sized and installed reinforced repair will restore the required casing integrity to prevent excessive sidewall bulge (see chart below).

Number of Actual Plies in Tire	Damaged Plies* for Reinforcement Repairs	
	From 25% to	Less than 75%
4	1	2
6	2	4
8	2	5
10	3	7
12	3	8

*California has different specifications. Consult state authorities for more information.

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B. Section Repairs

An injury extending through 75% or more of the actual plies, or completely through the casing in the tread and sidewall area, is defined as section repair injury (see chart below).

Number of Actual Plies in Tire	Damaged Plies* for Section Repairs - 75% or More
4	3
6	5
8	6
10	8
12	9

*California has different specifications. Consult state authorities for more information.

NOTE: Any tire with a section repair should not be used on the steering axle of trucks or buses.

V. PREPARING THE INJURIES - ALL METHODS

(see photos at the end of this document)



Serious bodily injury may result from not wearing adequate personal protective equipment (PPE), including eye protection (i.e., goggles or face shields), ear protection, respiratory protection, and gloves while repairing tires.

A. Inspecting the Injury

Probe the injury to remove any foreign materials and determine the extent of the injury. Be careful not to damage any of the cords or enlarge the injury.

B. Preparing the Casing

Tires must be thoroughly dried before proceeding with the repair. It is recommended that the areas to be repaired be cleaned both inside and outside of the tire. On the inside of the tire, mark or outline an area around the

injury that is approximately 1" (25 mm) larger than the injury itself, for cleaning and buffing. (Note: cleaners are subject to OSHA and EPA regulations).

Use the following procedure to clean the liner of all tubeless truck tires:

1. Vacuum as necessary to remove any debris.
2. Apply pre-buff cleaner on the area to be buffed.
3. Scrape the area with a scraper.
4. Remove the debris.
5. Reapply pre-buff cleaner to the scraped area, if necessary.
6. Wipe the scraped area with a clean, lint-free, untreated cloth to remove any remaining contaminants.

Use the following procedure to clean the inside surface of tube-type truck tires that have a thin layer of rubber over the body ply:

1. Dampen a clean, lint-free, untreated cloth with pre-buff cleaner and scrub the area.
2. If the area is not completely clean, repeat the process.

C. Skiving the Injury

Use the following procedures to prepare the injury from the outside of the tire.

IMPORTANT: Avoid cutting or removal of undamaged body cords.

1. Cut and skive only enough to remove all damaged rubber and cord material.

Skive the damaged rubber to an angle measuring between 30° to 45°. Be careful not to burn or scorch the rubber. Lightly buff the area surrounding the skive. Once into the body plies, keep

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the injury as small as possible by skiving at a 90° angle through the damaged plies (see Figures 3 and 4).

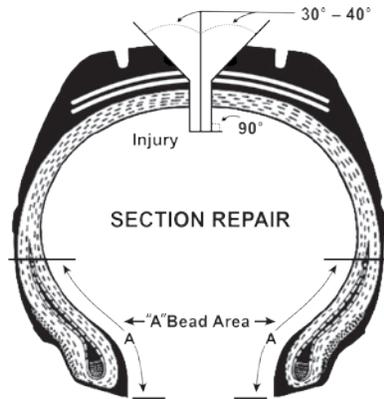


Figure 3

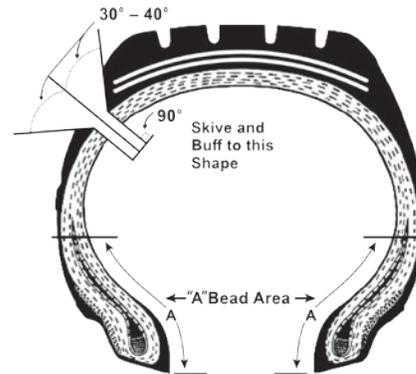


Figure 4

2. Use a sharp, tapered-point knife or rotary gouge to remove large amounts of loose or damaged rubber.
3. Use a coarse-grit rasp mounted on a low-speed buffer (5,000 rpm maximum), to remove smaller areas of damaged rubber.
4. Use a medium-grit rasp mounted on a low-speed buffer (5,000 rpm maximum), to texturize the knife and rotary gouge marks and remove any frayed cords. A TRMG BT2 or BT3 buff textured rubber surface (see RP 01/02-23 "BTS6 - Standard Buffing Textures for Tire Retreading and Repairing"), free of loose rubber ends and grooves, is necessary for good adhesion.
5. Check the area carefully with a blunt probe to be sure all traces of damage and separation have been removed.

VI. MEASURING THE INJURY

Maximum section repair limits for bias truck tires are shown below.

(NOTE: Dimensions shown are for general guidance based on type of tire service.)

Chart A - Highway Drive or Trailer Tires - to determine maximum size for these tires:

Tire Size	Maximum Injury Size in the Crown Area (25% of the tire cross section minus 1")	Maximum Injury Size in the Sidewall Area (1/2 the maximum crown injury size)
7.50-20/8-22.5	7/8 in. (22 mm)	7/16 in. (11 mm)
8.25-20/9-22.5	1 – 1 1/16 in. (27 mm)	17/32 in. (13 mm)
9.00-20/10-22.5	1 – 1 1/4 in. (32 mm)	5/8 in. (16 mm)
10.00-20/11-22.5	1 – 1 1/4 in. (32 mm)	5/8 in. (16 mm)
10.00-22/11-24.5	1 – 1/2 in. (38 mm)	3/4 in. (19 mm)
11.00-20/12-22.5	1 – 1/2 in. (38 mm)	3/4 in. (19 mm)
11.00-22/12-24.5	1 – 1/2 in. (38 mm)	3/4 in. (19 mm)
11.00-24	1 – 3/4 in. (44 mm)	7/8 in. (22 mm)
12.00-20/12.00-24	2 in. (51 mm)	1 in. (25 mm)

Note: All measurements are made across the widest point of the skive at the top ply.

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For repair material recommendations, consult repair material manufacturer. Consult tire manufacturer for tire sizes not covered.

To determine what size section or reinforcement repair unit to use, measure the injury across the widest point of the skive in the ply. This will be the “injury” size for repair unit selection.

To calculate proper cure time, measure the depth of the skive at its deepest spot. Write this measurement on the tire sidewall or work order for future reference. Contact the fill rubber manufacturer for recommended cure rate of the rubber.

VII. REPAIR METHODS

A. Using the Spotter Method and a Chemical Repair Unit

1. Buffing – Draw an outline approximately 1/2" (13 mm) larger than the repair unit, and buff the inner liner or the thin layer of rubber over the body ply approximately 1" (25 mm) around the injury by using a low-speed air tool (5,000 rpm maximum), to achieve a TRMG BT1 or BT2 buff textured surface. Make sure all the inner liner design in this area is removed.

NOTE: Avoid buffing through the inner liner of tubeless tires and through the body ply of tube-type tires.

2. Cleaning – After buffing, use a fine wire brush on a low-speed buffer (5,000 rpm maximum) to remove buffing dust from the buffed surface. Use a vacuum to remove the debris from the tire without contacting the buffed surface.

NOTE: Do not use an air hose. Air lines contain contaminants such as oil, moisture and lubricants which reduce adhesion.

3. Cementing – Apply black brush-type vulcanizing cement to the inner liner and skived area. Allow the cement to dry thoroughly. If recommended by the repair manufacturer, apply a second coat of cement to any exposed fabric cords.

4. Venting the Tire - Place cotton string in the tire, ensuring that the stings come into contact with the fabric plies to aid in dissipating intra ply pressure. Failure to properly vent the tire may result in separations between plies.
5. Filling the Skive – Apply a piece of cushion gum large enough to cover the buffed and cemented area on the inner liner of the tire. Stitch into place and remove protective film from the back of the cushion gum.

Using a repair gum or an extruder gun with rope rubber, fill the injury slightly higher than the surrounding surfaces of the outside of the tire.

NOTE: In the tread area, it may be necessary to block the tread design to keep the uncured rubber from flowing into the design and causing improper cure due to loss of pressure.

6. Curing – Cure the area using a spotter, following equipment manufacturer’s directions, or adjust the specified thermocouple cure time and temperature.
7. Cleaning – After curing and the area has cooled, reclean the inner liner area using a pre-buff cleaner available from your repair materials supplier.
8. Marking the Inner Liner - Use a template or center the repair unit over the injury and mark an outline on the inner liner approximately 1" (25 mm) larger than the repair unit.
9. Buffing Inside the Tire – Buff the inner liner or the thin layer of rubber over the body ply and cured rubber overflow to an area large enough to accommodate the repair unit. Using a low-speed air tool (5,000 rpm maximum), buff to a finely textured surface (TRMG BT1 or BT2 buff texture). Make sure all of the design is removed in the repair unit area.

NOTE: Avoid buffing through the inner liner of tubeless tires and through the band or body ply of tube-type tires.

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10. Cleaning – After buffing, use a fine wire brush on a low-speed buffer (5,000 rpm maximum) to remove buffing dust from the buffed surface. Use a vacuum to remove the debris from the tire without contacting buffed surface.

NOTE: Do not use an air hose. Air lines contain contaminants such as oil, moisture and lubricants which reduce adhesion.

11. Cementing – Remove the protective film from the bottom of the chemical repair unit. Using a chemical vulcanizing cement, cement the entire buffed area of the tire and the bottom of the chemical repair unit. Apply cement according to repair manufacturer's procedures. Allow the cement to dry according to repair manufacturer's recommendations.

For chemical cure repairs, ensure that the chemical vulcanizing cement being used is from the same manufacturer as the repair unit. Using materials from different manufacturers could result in lower repair unit adhesion, and may lead to premature repair failure.

12. Installing the Repair Unit – With the beads in a relaxed, normal rim width, place the repair unit (without bridging) over the cemented and buffed area of the tire. Stitch from the center of the repair unit out, being careful not to trap any air. After stitching, remove the protective film from the repair unit and check for proper installation.
13. Buffing Cured Plug – Using a low-speed air tool (5,000 rpm maximum) and a fine-grit rasp, remove any excess rubber on the outside of the plug.

NOTE: In some cases, the tread area plug may require the use of a grooving tool to restore the tread design and flexibility.

14. For finishing, refer to IX. Finishing.

B. Using a Section Mold Type Repair System and Uncured Repair Unit (see photos at the end of this document)

1. Buffing Inside the Tire – Mark or outline the area around the repair unit for cleaning and buffing. Buff the inner liner or the thin layer of rubber over the body ply to an area large enough to accommodate the repair unit. Using a low-speed air tool (5,000 rpm maximum), buff to a finely textured surface (TRMG BT1 or BT2 buff texture). Make sure all of the design in the repair unit area is removed.
2. Cleaning – After buffing, use a fine wire brush on a low-speed buffer (5,000 rpm maximum) to remove buffing dust from the buffed surface. Use a vacuum to remove the debris from the tire without contacting buffed surface.

NOTE: Do not use an air hose. Air lines contain contaminants such as oil, moisture and lubricants which reduce adhesion.

3. Cementing – Following repair material manufacturer's procedures, apply cement to the repaired prepared surface of the inner liner and skive. Allow the cement to dry according to repair manufacturer's recommendations.

For an uncured repair unit, use black brush-type vulcanizing cement on the buffed area of the inner liner.

For a chemical cure repair unit, use a chemical cement following the manufacturer's recommendations.

4. Installing the Repair Unit – With the beads in a relaxed, normal rim width, place the repair unit (without bridging) over the cemented and buffed area of the tire. Stitch from the center of the repair unit out, being careful not to trap any air. After stitching, remove the protective tabs and/or film from the repair unit and check for proper installation.

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5. Venting the Tire - Place cotton string in the tire, ensuring that the stings come into contact with the fabric plies to aid in dissipating intra ply pressure. Failure to properly vent the tire may result in separations between plies.

NOTE: An alternate method is to reverse steps 4 and 5.

6. Filling the Skive – Using a repair gum or an extruder gun with rope rubber, fill the injury slightly higher than the surrounding surface of the outside of the tire, being careful not to lift or unseat the repair unit.

NOTE: In the tread area, it may be necessary to block the tread design to keep the uncured rubber from flowing into the design and causing improper cure due to loss of pressure.

7. Curing – Cure the repair in accordance with the recommendations of the section mold manufacturer and repair material manufacturer.
8. Buffing Cured Plug – After the tire is cured and cooled, inspect for proper cure. Use a low-speed air tool (5,000 rpm maximum) and fine-grit rasp to remove any excess rubber on the outside of the plug.

NOTE: In some cases the tread area may require the use of a grooving tool to restore the tread design.

9. For finishing, refer to IX. Finishing

VIII. SECTION REPAIR CURING WHILE RETREADING

Some types of retread curing systems allow for curing the section repair during the retread curing cycle. A back-up plate must be used with the inside curing tube system. Contact your equipment manufacturer for recommendations.

For precured retreading, trim the cushion gum flush with the buffed surface using a cold, sharp knife.

IX. FINISHING

- A. Inspect the repair for separations, sunken spots or evidence of under cure. Reject, or reprocess, if possible, those found unacceptable.
- B. Remove tread blocking from tread grooves and restore original tread design.
- C. Buff off high spots so tire will run smoothly.
- D. Recommend balancing the tires when mounted for service.
- E. Some manufacturers recommend that a tire with chemical cure repair units be mounted and inflated after cure or the tire not be put into service until 24 hours after curing. Consult repair material manufacturer for recommendation.

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STEPS FOR INJURY PREPARATION AND REPAIR



Probe Injury



Mark Repair Area for
Cleaning and Buffing - Inside Tire



Clean Area to Be Buffed
Inside Tire



Scrape Repair Area
Inside Tire



Skive to Remove Damaged Rubber
and Cord Material



Use Knife to Remove
Loose or Damaged Rubber



Use a Coarse-Grit Rasp to
Remove Damaged Rubber



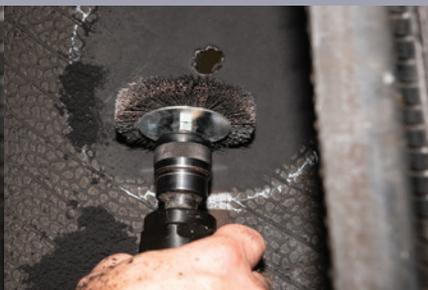
Use a Medium-Grit Rasp to
Texturize Repair Area



Measure the Injury and
Trace Around Repair Unit



Buff Inner Liner



Remove Buffing Dust With a
Fine Wire Brush



Vacuum Debris
(without contacting buffed surface)

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STEPS FOR INJURY PREPARATION AND REPAIR CONT.



Apply Cement to Inner Liner and Skived Area



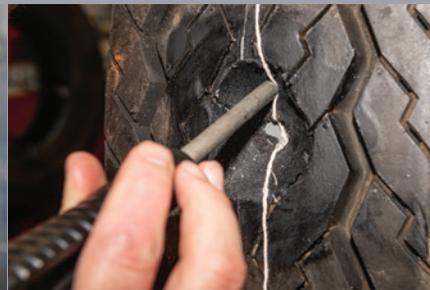
Place Repair Unit Over Cemented Area



Stitch Repair Unit From the Center Out



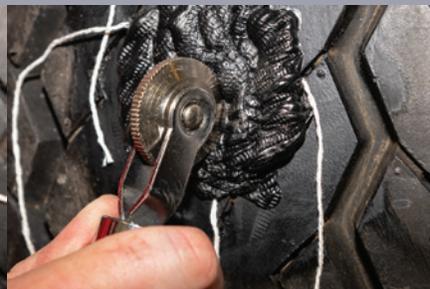
Remove Protective Film and Check for Proper Installation



Venting the Tire



Fill Skive



Stitch

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