

## TIRE PROFILING FOR RETREADING

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### I. PURPOSE

This Recommended Practice (RP) describes the buffing and tread sizing of tires for both precure and mold cure retreading.

### II. INTRODUCTION

The buffed tire is the foundation on which every retread is built. Buffing represents the first step in the actual processing of a tire and must be performed with care and purpose in order to produce a quality retread.

Buffing tires for retreading has three major objectives essential to good results in the finished tire:

- To **size** the tire to a width of precured tread rubber or to fit a specific mold.
- To **shape** the tire to the proper crown radius for a precured tread application or buffed contour for a specific mold.
- To **prepare the surface** for the application of the new tread rubber to attain adequate adhesion.

### **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, and respiratory protection while buffing tires.

### A. Buffing

Whether buffing for a precure or mold cure retread process, basic buffer setup criteria need to be met. This includes:

1. Selecting the correct size expanding rim and bead plates to match the bead diameter and running rim width to buff the tire.
2. Lubricating the expanding rim or bead plates.
3. Ensuring rasp blades are in good condition to achieve proper buff texture.
4. Mounting the tire with a recommended inflation pressure of 20 psi +/- 5 psi.

### B. Casing Information

1. Record casing information and save buffing parameters for future processing. Include the following:
  - a. Tire brand
  - b. Tire series
  - c. Tire size
  - d. Manufacturer's DOT
  - e. Country of manufacture
  - f. Load range
  - g. Ply rating
  - h. Number of plies – crown
  - i. Number of plies – sidewall
  - j. Belt material
2. Specific manufacturing location information may be useful if variation is identified for new tires manufactured in more than one manufacturing plant.

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## III. SIZING

The buffer operator has the very important responsibility of preparing each tire for a specific size of precured tread rubber, or to fit a specific mold for mold curing. Improper sizing of tires results in processing problems and could cause product failures and additional expense.

## IV. PRECURE

The rubber remaining on the casing over the top plies must be removed to a desired thickness. The crown width must be buffed for the proper fit of the precured tread rubber to the prepared casing.

Retreaded tires with excessive undertread may run hotter. Incorrect buffed tire width (i.e., too narrow or too wide) will produce a poor appearance and could result in poor performance. Deep shoulder designs should be buffed and trimmed such that the remaining void does not extend more than 1/4" (6 mm) under the edge of the tread per side.

Truck tires retreaded in a precured system must be buffed while inflated. Accurate buffing is essential due to the fixed dimensions of the cured tread rubber.

The radius or contour selected for buffing truck tires will affect both casing and retread performance. The buffing radius will vary depending on tire brand, size, construction and type of tire. The radius selected must permit the removal of all existing tread design grooves, but not cause damage to the tire.

**Note:** Consult new tire manufacturers or retread suppliers for buffing recommendations for specific tire brands, sizes and series of tires.

### A. Finished Buffed Tire Recommendations

1. Crown buff texture should not exceed #4
2. Undertread depth = 2/32" (1.5 mm) to 5/32" (4 mm)
3. Shoulder trim = 1/16" (1.5 mm) to 5/16" (8 mm) per shoulder

4. Total shoulder trim not to exceed 5/8" (16 mm)
5. Shoulder trim length = 1/4" (6 mm) to 3/4" (19 mm)
6. Circumferential shoulder measurements within 1/4" (6 mm)

### B. Buff Radius Determination

A best practice is to profile three (3) worn original casings of the same brand, series and size to understand variation and thus develop buff parameters.

Use buff parameters of a similar casing for initial buff.

### Suggested Initial Buff Radius:

Tire Type	Tire Size	Initial Buff Radius
Radial	Light Truck	26" (660 mm)
Radial	Medium Truck	26" (660 mm)
Radial	Wide Base	42" (1066 mm)
Radial	Ultra LP Wide Base	80" (2032 mm)
Bias	Light Truck	22" (559 mm)
Bias	Medium Truck	22" (559mm)
Bias	Wide Base	26" (660 mm)

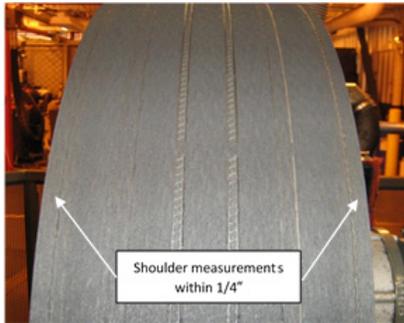
### C. Buffing

1. Divide the tire into three equal sections using a silver ink pen.

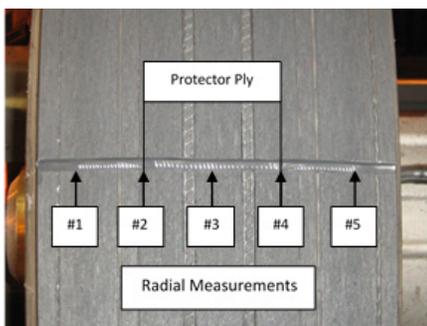


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2. With the initial buff radius determined, buff the casing to remove the tread design.
3. Stop buffing when most or all of the tread grooves are removed. One or more grooves may remain depending on the initial buff radius selected.

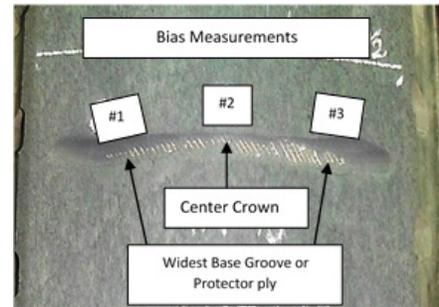


4. Measure the shoulders circumferentially. Measurements must be within 1/4" (6 mm). If more than 1/4" (6 mm), adjust buffer rasp center (per buffer specifications) and make another light pass to confirm adjustment effect on shoulder measurements.
5. Once the tread design has been removed to the base of the voids, make a skive across the crown at three (3) locations marked on the sidewall. Skive to uncover the belt package.
6. For radial tires, measure the undertread depth at the five (5) belt locations within the three (3) sidewall locations around the tire.



7. For bias tires, measure the undertread depth at the three (3) ply locations

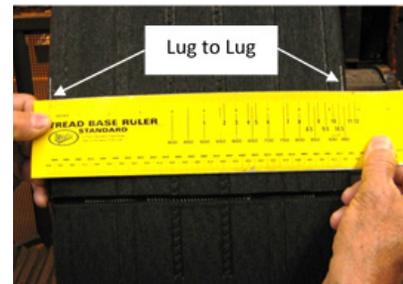
within the three (3) sidewall locations around the tire.



8. For each of the three (3) lateral crown skives, select the location with the smallest undertread measurement.
9. Adjust the buffing radius until uniform undertread depth is achieved within 1/32" (1 mm) across the top belt and belt edges.
10. For radial tires, reduce the undertread thickness to a maximum of 5/32" (4 mm) and a minimum of 2/32" (1.5 mm).
11. For bias tires, reduce the undertread thickness to a maximum of 5/32" (4 mm) and a minimum of 2/32" (1.5 mm).

### D. Tread Sizing

1. Measure across the crown from the untrimmed shoulder from edge to edge. This is the lug to lug untrimmed dimension used to determine the widest tread size possible.



2. From this measurement, select the widest available tread that will allow:

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- a. A minimum of  $1/16''$  (1.5 mm) trim per shoulder or  $1/8''$  (3 mm) total trim.

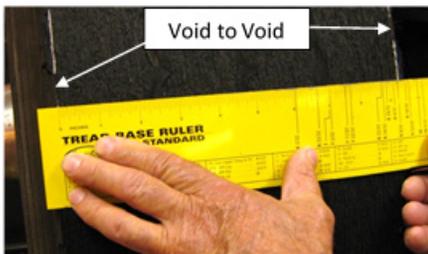
Or

- b. A maximum of  $5/16''$  (8 mm) trim per shoulder or  $5/8''$  (16 mm) total trim.
- c. Note: Target shoulder trim is  $1/8''$  (3 mm) per shoulder.

Example:

- L – L width =  $9 \frac{1}{2}''$  (241 mm)
- Requires a 230 mm (9.06'') width tread to trim within the minimum and maximum trim specification
- Trim approximately  $1/4''$  (6 mm) per side to achieve 230 mm (9.06'') width

3. For a tire with shoulder voids, measure the crown from the inner most part of the void on each shoulder.



4. No more than  $1/4''$  (6 mm) of void, per side, will be allowed under the tread edge.

- a. A minimum of  $1/16''$  (1.5 mm) trim per shoulder or  $1/8''$  (3 mm) total trim
- b. A maximum of  $5/16''$  (8 mm) trim per shoulder or  $5/8''$  (16 mm) total trim

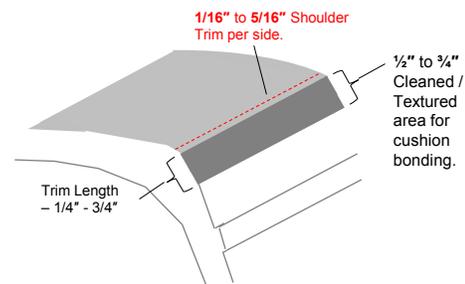
Example:

- L-L =  $9 \frac{5}{8}''$  (245 mm)
- V-V =  $9 \frac{1}{4}''$  (235 mm)
- $1/16''$  Trim per side =  $1/8''$  (3 mm) total trim
- $9 \frac{5}{8}'' - 1/8'' = 9 \frac{1}{2}''$  (241 mm) widest tread width.
- Check for void left for widest tread fitment

- $9 \frac{1}{2}'' - 9 \frac{1}{4}'' = \frac{1}{4}'' < \frac{1}{2}''$
- Widest tread width would have a  $1/4''$  total void or  $1/8''$  (3 mm) per side which is acceptable.

### E. Trim Angle

1. Shoulder trim angle is used to transition the appearance of the tread to the casing. The length of shoulder trim is dependent on the amount of shoulder trim and the angle required to achieve the length best recommended for the precure process.
2. A typical shoulder trim angle is  $45^\circ$ . Tires dictate what shoulder trim angle is required to achieve a target trim length of  $1/4''$  (6 mm).



## V. MOLD CURE

Every mold has limitations with respect to the size of tires that it will accommodate thus allowing them to cure properly. These recommended limitations, or tolerances, are specified by equipment manufacturers in their mold specification charts. In general, tolerances for mold cure are: diameter  $\pm 1/32''$  (1 mm) and bead to bead  $3/8''$  (9 mm) max. While these recommended tolerances for fitment are typically acceptable, it is still suggested that you check with your mold manufacturer.

Proper fit is important because tires that are too large will distort, have crooked treads or buckle. Tires that are too small will not allow for sufficient pressure on the curing rubber and cause spongy or porous cures and other defects in the retreads.

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## A. Tire Measurements

Sizing specifications for mold cure are written in two or three ways: diameter measurements and bead-to-bead measurements, or by using a newer method that measures cross-section fitment.

### 1. Diameter Measurements

Very accurate diameter measurements of inflated tires on the buffer, should be made by wrapping a steel tape around the center of the buffed tire. Steel tapes, or bands, which show the actual diameter in inches or millimeters, rather than the circumferential length, are available. Circumferential figures may also be used and can be specified on the operating charts.



### 2. Bead to Bead Measurements

To take a bead-to-bead measurement of an uninflated tire after buffing, start at the heel of one bead. For accuracy and consistency the following method is recommended:

- Using a 1/4" flat tape, engage the rule hook on the heel of the bead and make sure the "0" point on the rule lines up with the heel on the bead.
- Measure straight up at 90° to the bead over the crown and down the other side to a position on the other bead directly opposite the starting point (see Figure 1).

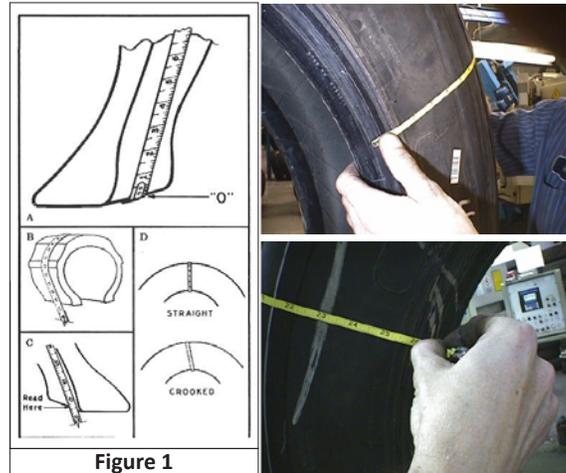


Figure 1

- Be sure rule is radially straight over the tire, and read the rule straight in at the heel of the bead.
- Record the measurement taken on the casing.

Once outside diameter and bead-to-bead measurements have been taken, refer to the mold specification chart to determine in which mold and bead plate the tire will fit. Some tire brands can require up to two to three different bead plates. The mold specification chart will show dimensional limitations established by the equipment manufacturer for their mold. (In most cases, the fitment will be done by selecting the correct buff program.)

### 3. Cross Section Measurement

The cross-section measurement method, as shown below, involves measuring the tire cross section at the widest point of the sidewall while the tire is inflated to its proper rim width.



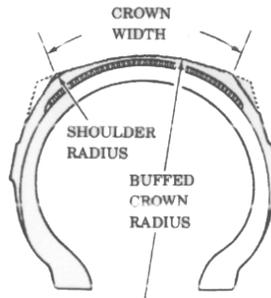
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## B. Buffing Tires for a Top Tread Mold

When buffing tires for a top tread mold, only the rubber on the tread area is replaced. The tire is buffed to provide the desired diameter and undertread in the processing specification. When using the top tread mold method, it is extremely important that the crown radius and width are buffed wide enough to contact the mold skirt or pinch point and confine the rubber to the tread area of the tire.

Lack of shoulder seal in a top tread mold, due to a narrow tire crown or a deep shoulder design, can result in the escape of the tread rubber and lack of pressure in the shoulder. This can cause loosening and failure of the top tread. This type of tire could be buffed and cured in a full tread mold. A crown buffed too wide will result in interference at the skirt of the mold and cause poor molding, improper pressure and crooked treads.

must be of correct diameter and bead-to-bead dimensions to fit the fixed cavity of a specific mold. The tire must be buffed to the proper crown width, crown radius, shoulder radius and angles to fit the mold cavity.

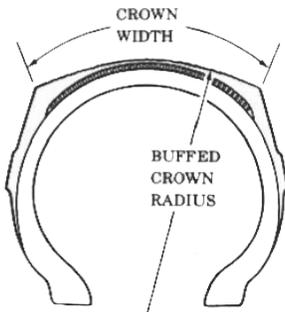


Buffed for Full Tread Mold Cure

Excessive undertread will cause the retreaded tire to run hotter. Casing and retread performance will be adversely affected. It is desirable when buffing to leave no more than 3/32" (2.5 mm) of undertread covering the top ply or belt.

Improperly buffed tires will cause poor distribution of the tread rubber. This results in insufficient undertread and improper tread radius when the tire is inflated. Too wide a crown can cause crooked tread problems or buckling of shoulder area and loose treads due to insufficient pressure.

Processing specifications assume that the buffed tire will fill a certain portion of the mold cavity, and the tread rubber the rest. Therefore, the shape of the buff is critical to properly distribute the rubber.



Shoulder Contour on Top Retread



Checking for Proper Buffed Width



Checking for Centered Buff



Be sure that shoulders are of equal height and that the tires are buffed completely over the area to be covered by the new full

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tread. This is referred to as overall buff. If the tire must be buffed in such a way that the shoulders are taken off, and do not meet the prescribed contour, this situation may be compensated for in the building stage by modifying the volume of rubber in the shoulders or adjusting the buffer. The max tolerance between the two shoulders should, preferably, be less than 1/32" (1 mm) .

A coding system has been developed to describe the three dimensions involved in shaping the buffed tire. The coding specification applies to a typical new worn tire mounted on a Tire and Rim Association, Inc. "preferred" rim, and inflated to recommended pressure. This is required to provide standard measurements to:

1. the mold manufacturer in setting up specifications and buffing templates
2. the buffing machine manufacturer for templates or instructions
3. the retreader who will process the tires

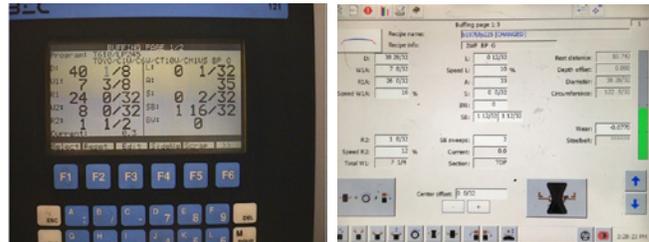
Standard coding specifications for the three dimensions are as follows:

1. Crown Width or W1 - designated by letter "C" and reported in 1/8" increments measured across the arc of the tread. In some processes, increments are reported in millimeters.
2. Buffed Crown Radius - designated by letter "R" and reported in whole numbers like 24. In some processes increments are reported in millimeters (i.e. 609).
3. Shoulder Radius or R2 - designated by letter "S" and reported in 1/8" increments. In some processes increments are reported in millimeters.
4. Length - designed by an "L" in 32nds of an inch or in millimeters.
5. Angle or A – designated in degrees with a range of 25-45.

The following tables show how buffing radii are derived, and how they apply to buffing templates and buffed tires. They also show, the exact points which determine the buffed crown width.

For a Top Tread Truck Tire Mounted on a Buffer		
C80	R240	S00
Crown Width 8 3/8"	Buffed Crown Radius 24 3/8"	Shoulder Radius Not Specified 0 inch

For a Full Tread Truck Tire Mounted on a Buffer		
C84	R240	S20
Crown Width 8 3/8"	Buffed Crown Radius 24 3/8"	Shoulder Radius 2 3/8"



Different types of buffer screens showing variations in coding

A relaxed, unmounted tire generally does not shape up to the contour measurements of the inflated buffed contour mentioned above. Therefore, these variables have been considered and compensated for by the manufacturer of the buffing equipment to allow for any deviation on their machines from the tire mounted and inflated per Tire and Rim Association, Inc. specifications.



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All grooves and old tread design on the tire should be removed to improve adhesion and help prevent separations when the tire is in service.

Inspect the tire during the buffing operation for any possible injuries or conditions that might require special attention or make the tire unsuitable for retreading.

Care should be taken to avoid removing any required identification labeling.

Buffing often discloses conditions that were overlooked or undetectable during previous inspection. The operator should listen for a change in the sound of the tire being buffed,

which can indicate a separation between tread and casing or in the plies of the casing itself. Such tires should be scrapped.

A final check should be taken of “after buff” measurements to verify that the buffed tire falls within the allowable tolerance for the mold in using the recommended buffed template. The outside diameter, the bead-to-bead measurement or cross section dimension and the contour, will determine the mold size.

Mark the tires for the mold and bead plate for which they have been buffed so that the builder and the mold operator will know how to build and cure it.

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