MANUAL FOR RETREADING CARGO TYRES

UNIVIPAL VIPAL®

INTRODUCTION

Considering the importance of retreaded tyres sold in the country, this manual is a reference in the tyre retreading process for the Vipal Authorized Network, providing indication of product use and application methods concerning tyre retreading, both with cold and hot cures.

At the same time, this manual helps the retreader to elaborate the description of the processes/procedures of tyre retreading, which aims at meeting current legal and local standards.

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GETTING TO KNOW THE TYRE

TYRE CATEGORY

According to the NBR NM 224, there are tyres for different uses, with diverse constructions, and classified by categories.

Tyre category: identifies the type of application due to the type of vehicle destined to its use.

Tyre categories for use in ground vehicles and their identification are described as follows:

A) Tyres for automobiles or their trailers.

B) Tyres for pick-ups and derivate and their trailers.

C) Tyres for trucks and buses and derivate and their trailers.

D) Tyres for farm tractors, machines, off road vehicles, derivate and their trailers.

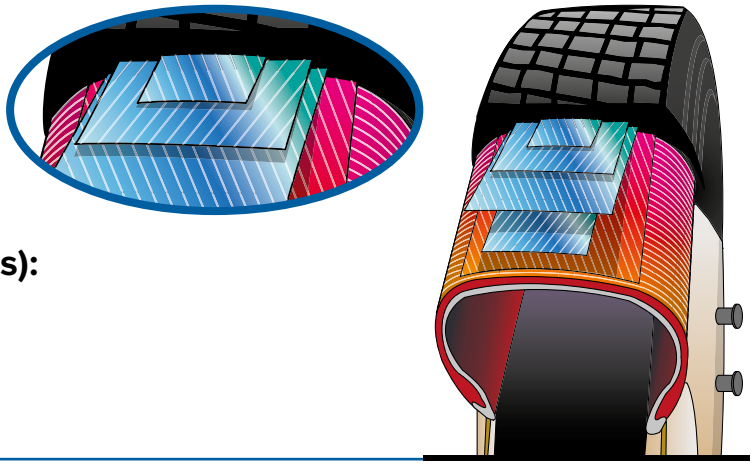
E) Tyres for motorcycles, bicycles, mopeds, and derivate.

TYRE PARTS

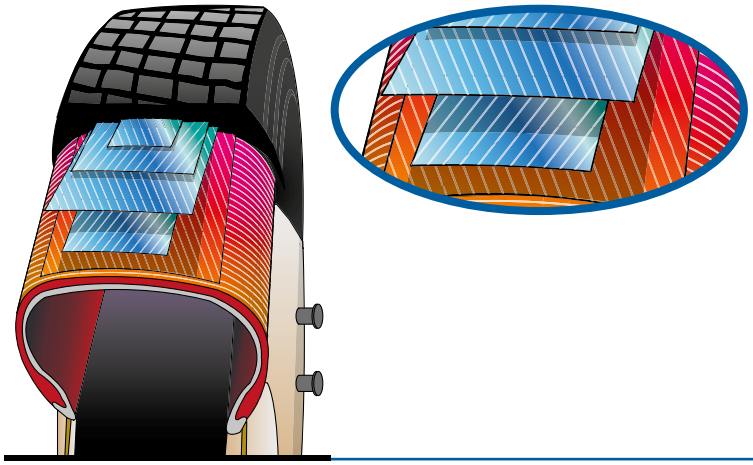
A) Tread:
Part of the tyre that keeps contact with the ground.

B) Grooves:
Cavities that cut the tread's surface longitudinally and/or transversally, defining the design.

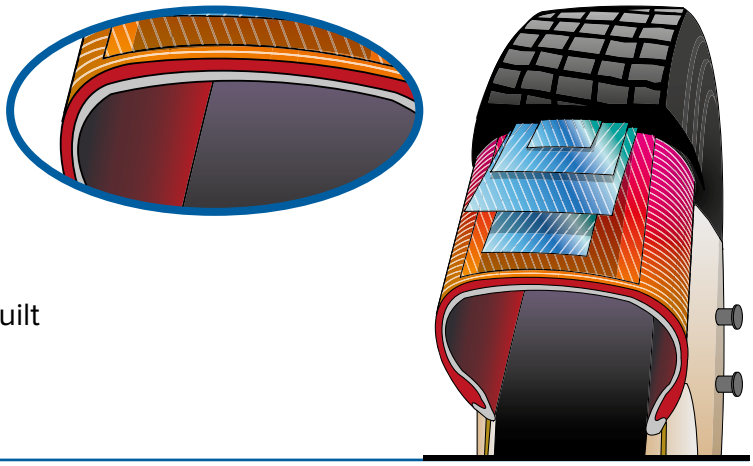
C) Shoulders:
Parts of the tyre between the tread and the sidewall.



D) Ply(ies) or protection belt(s):
Exterior part of the tyres' resistant structure, which protects the plies/ working belts.

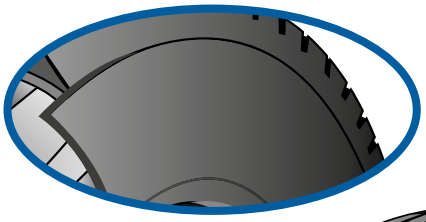


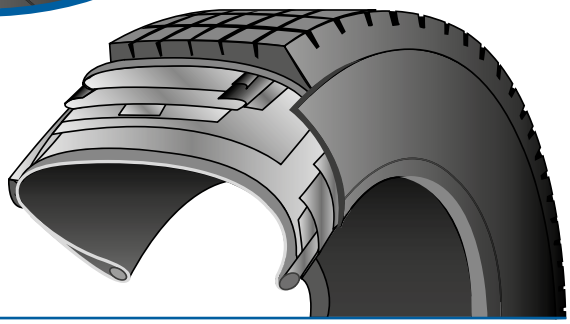
E) Plies or working belts:
Exterior part of the tyre's resistant structure, which stabilizes the tyre.



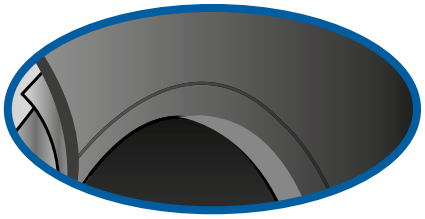
F) Internal lining:
The tyre's whole internal surface built from rubber components aimed at protection.

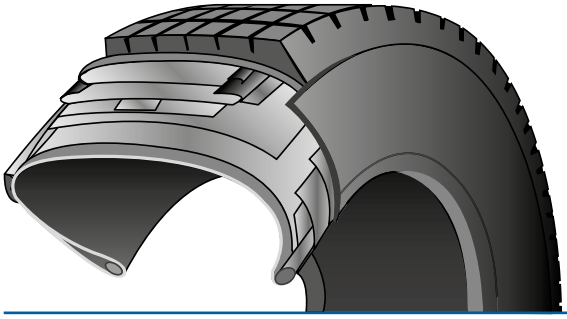
G) Casing's plies:
Internal part of the tyre whose fiber chords extend from bead to bead.



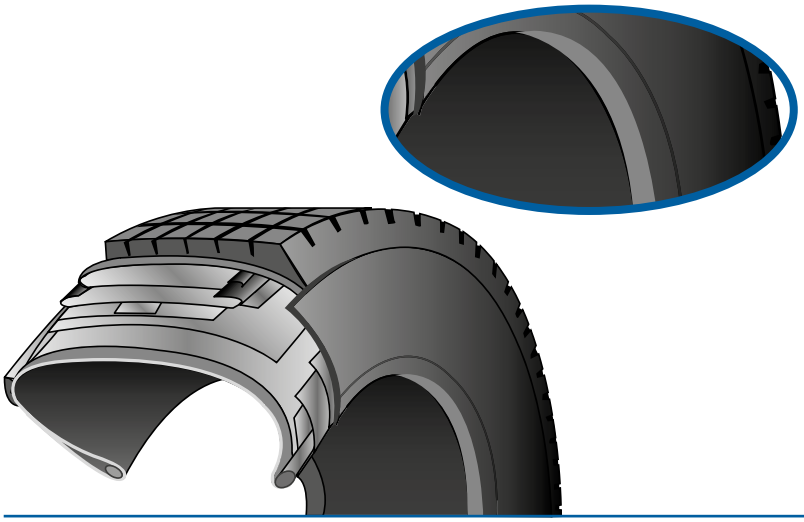


H) Sidewalls or sides:
Parts of the tyre understood as the area between the tread and the beads.



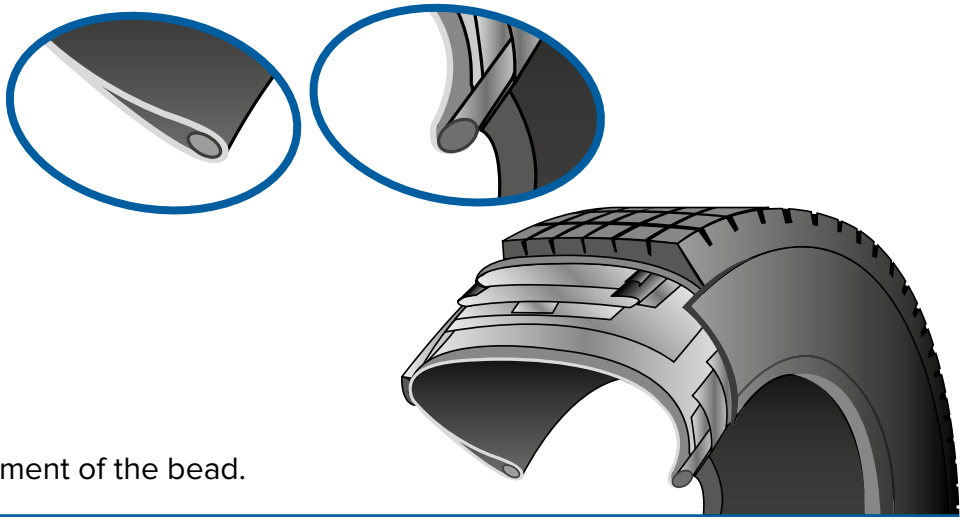


I) GG ring:
Line in relief close to the beads area whose purpose is to visually indicate the correct centralization of the tyre on the rim.



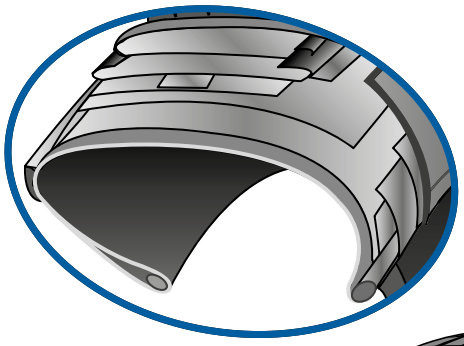
J) Beads:

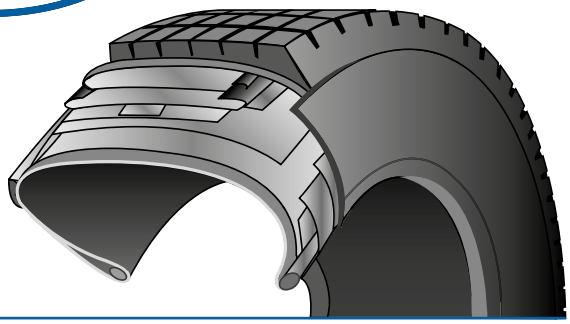
Tyre part that comes in contact with the rim, ensuring its fixation to it.



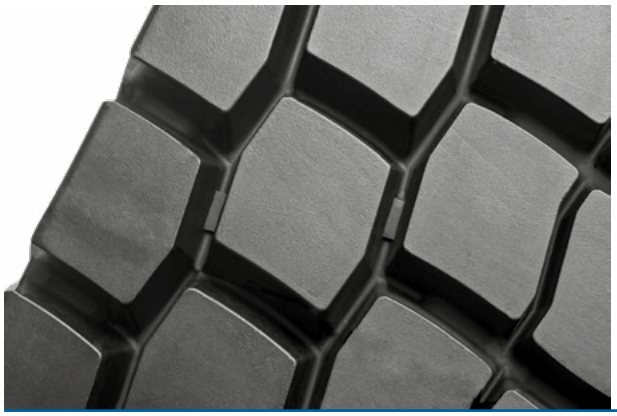
K) Bead's rim:

Internal metallic element of the bead.





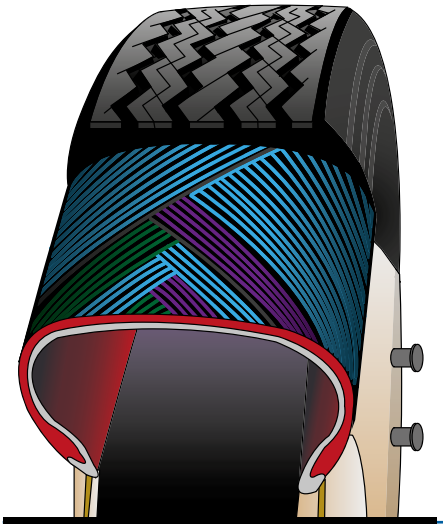
L) Casing:
Resistant structure formed by a set of plies and eventual protection or working belts.



M) Tread's wear indicators - TWI:
Saliences or reliefs placed at the bottom of the groves that visually indicate the maximum limit for the tread use.

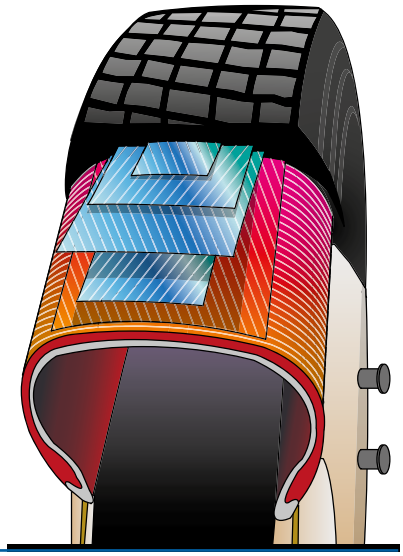
BIAS PLY VERSUS RADIAL TYRE

The basic difference between bias ply and radial tyres is in the casing construction.



Bias ply tyre:
Tyre whose resistant structure is formed by a set of overlapped textile plies whose cables extend from bead to bead, creating alternated angles in relation to the central line of the tread.

Radial tyre:
Tyre whose resistant structure is formed by plies whose cables extend from bead to bead, creating angles of about 90° in relation to the central line of the tread. This structure is stabilized by a set of circumferential belts.



TUBETYPE SET:

Composed by a tyre, with valve, mounted on a rim of determined dimensions and inflated by a pressure higher than the atmospheric pressure. The possible components of the pneumatic set are:

a) Rim: Rigid part of the pneumatic set, with determined profile and diameter, destined to support the tyre's beads.

b) Inner tubes: Toroidal-shaped tubes, with valve, whose function is to contain the fluids under pressure of the interior of the pneumatic set.

c) Tyre: Part of the pneumatic set that is mounted over a rim and is destined to keep contact with the ground, establishing a link between ground and vehicle.

d) Protector: Ring-shaped part whose function is to protect the inner tubes from contact with the rim.

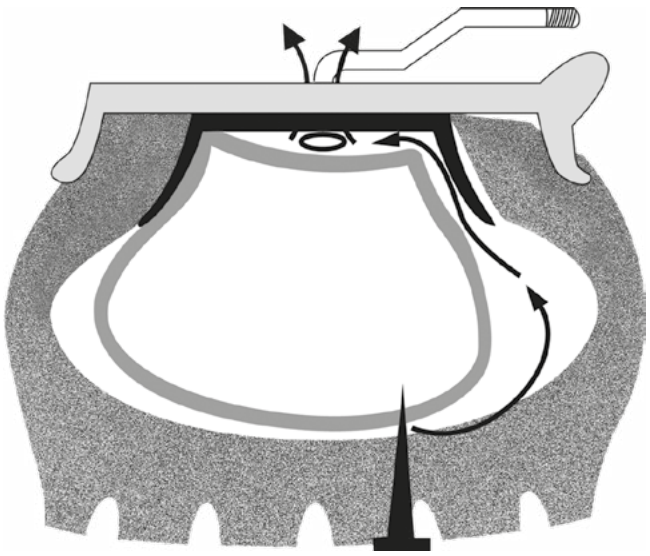
TUBETYPE:

A. Tyre
B. Inner tube
C. Rim
D. Protector

Tubetype:

Tubetypes have the following characteristics:

- Faster emptying when perforated during use;
- Larger number of components for operations of mounting/dismounting;
- 5° angle between the bead's nail and heel.



SET OF TUBELESS TYRES:

Constituted by a tyre, with valve, mounted over a rim of determined dimensions and inflated with pressure higher than the atmospheric pressure.
The possible components of the pneumatic set are:

a) Rim: Rigid part of the pneumatic set, with determined profile and diameter, destined to support the tyre's beads.

b) Tyre: Part of the pneumatic set that is mounted over a rim and is destined to keep contact with the ground, establishing a link between ground and vehicle.

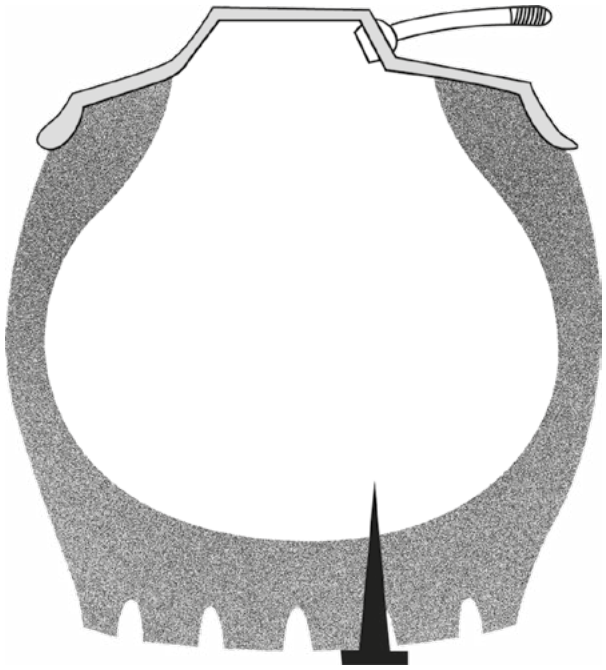
TUBELESS TYRES:

A. Tyre
B. Rim

Tubeless tyres:

Tyres without inner tubes have the following characteristics:

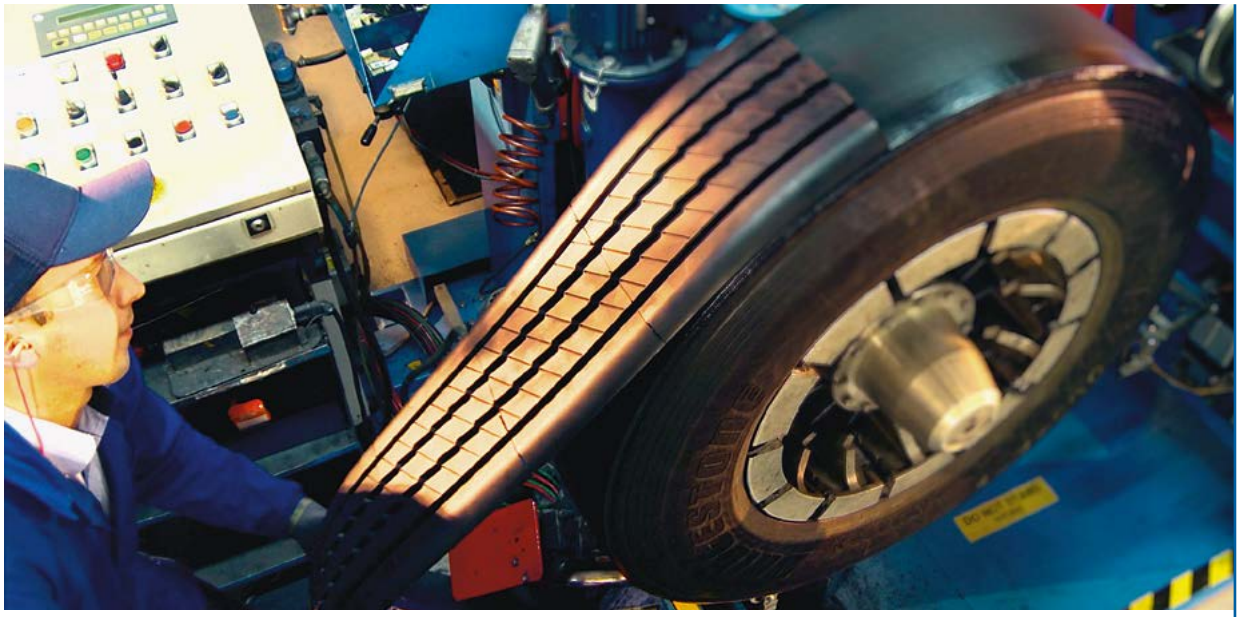
- Greater safety when perforated during use;
- Greater simplicity during operations of mounting and dismounting;
- 15° angle between the bead's nail and heel.



TYRE RETREADING

METHODS OF TYRE RETREADING

Conceptualizing the retreading process of cargo tyres.



Tyre retreading process via cold cure method

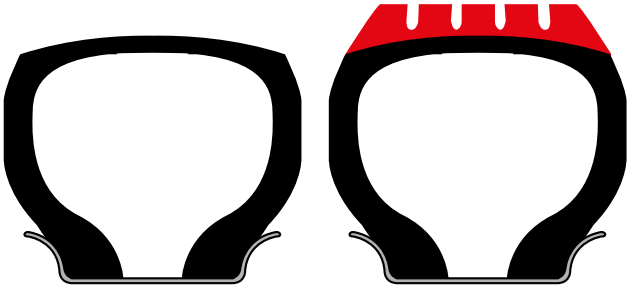
The tread is previously vulcanized – precured and the equipment used for vulcanization is the autoclave.

Tyre retreading process via hot cure method

The tread is not vulcanized. The equipment used for vulcanization is a press that has a mold with the design defined.

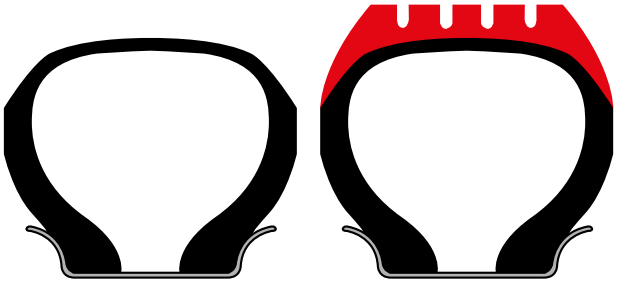
TYPES OF RETREADING

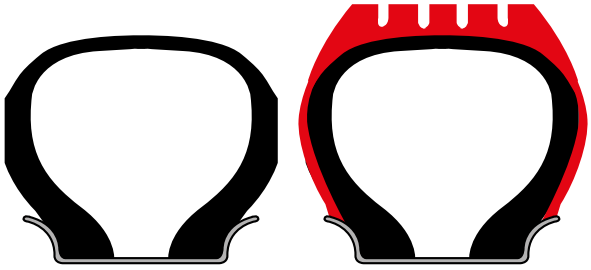
There are three types of tyre retreading: top cap, full cap, and remold/bead to bead.



Top cap: process that replaces only the tread. The top cap can be done by the cold or hot cure process.

Full cap: process that both tread and shoulders are replaced. The mold cure is done via the hot cure process.

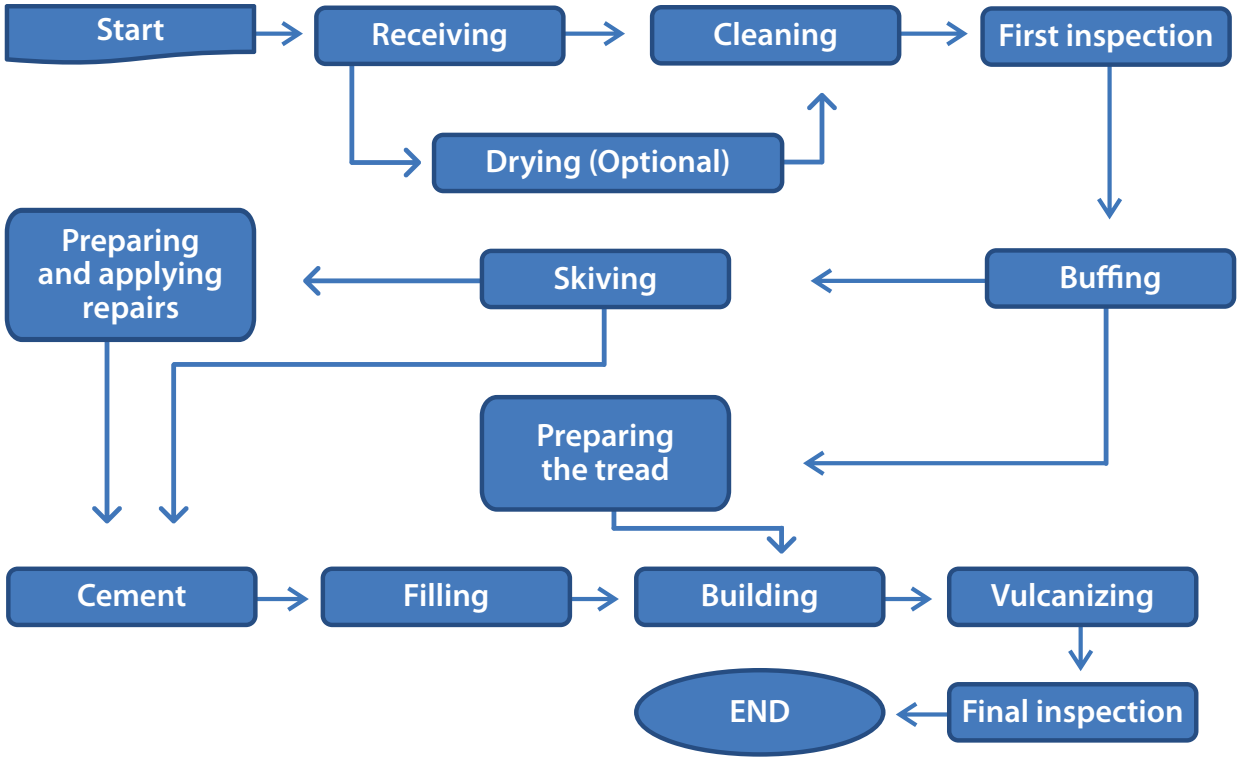




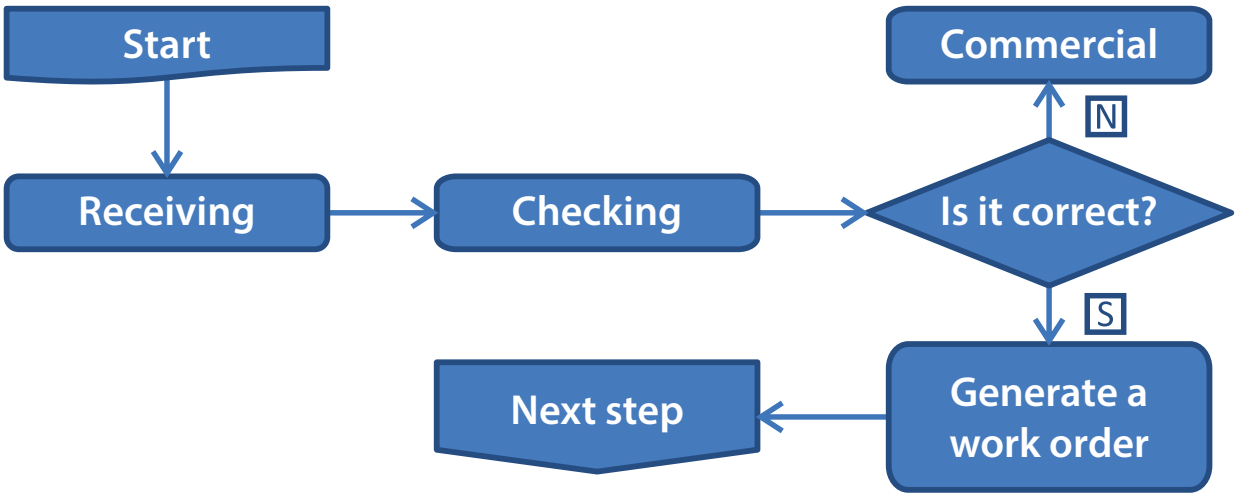
Remolding/Bead to bead: process that replaces the tread, the shoulders, and the complete sidewall surface, giving them a new inscription. The remolding/bead to bead is done via the hot cure process.

STAGES OF RETREADING - AUTOCLAVE, AND PRESS

TYRE RETREADING GENERAL FLOWCHART



RECEIVING AND CHECKING TYRES FLOWCHART



OBJECTIVE:

Receiving, checking, and storing tyres in covered space, organized and formally recorded.

SECTOR:

The receiving sector must be organized, with enough space for handling and storing the tyres.

PROCEDURE:

Perform preliminary tyre analysis and check if the information in the incoming invoice is the same as the ones in the sidewall. See the information that must appear on the tyre:

- identification of manufacturer;
- tyre dimensions;
- tyre's type of construction;
- identification for use of tube type or tubeless;
- load index;
- speed index;
- identification seal of compliance to the SBAC (Brazilian System of Conformity Assessment);

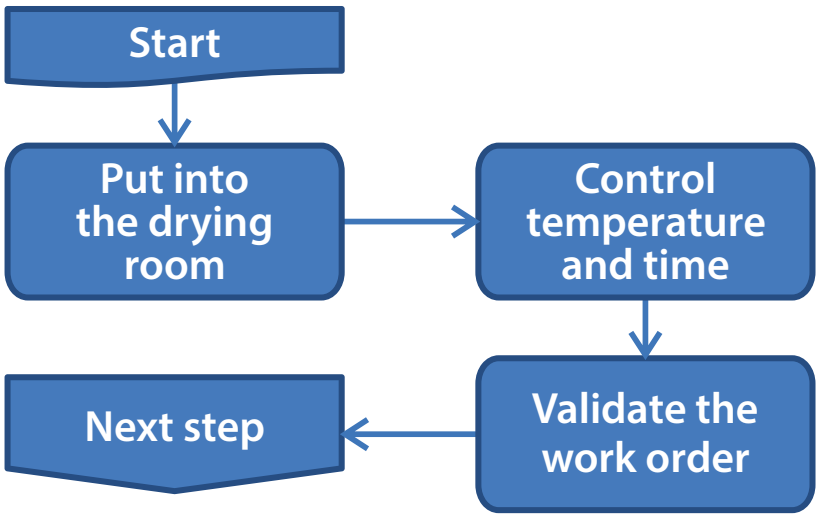
Check local legislation.

If the requirements are met in the first item, generate an internal service order for the tyre.

Store the tyres in covered space, organizing them to facilitate handling.

DRYING

DRYING FLOWCHART



OBJECTIVE:

Drying or eliminating humidity from tyres.

SECTOR:

The drying room must be wide and have controlled temperature and time.

PROCEDURE:

Keep the drying room warm to a temperature of 65°C (+ 10°C).

Leave the tyres to dry for at least 2 hours in the case of radial tyres and 4 hours in the case of bias ply tires.

EQUIPMENT:

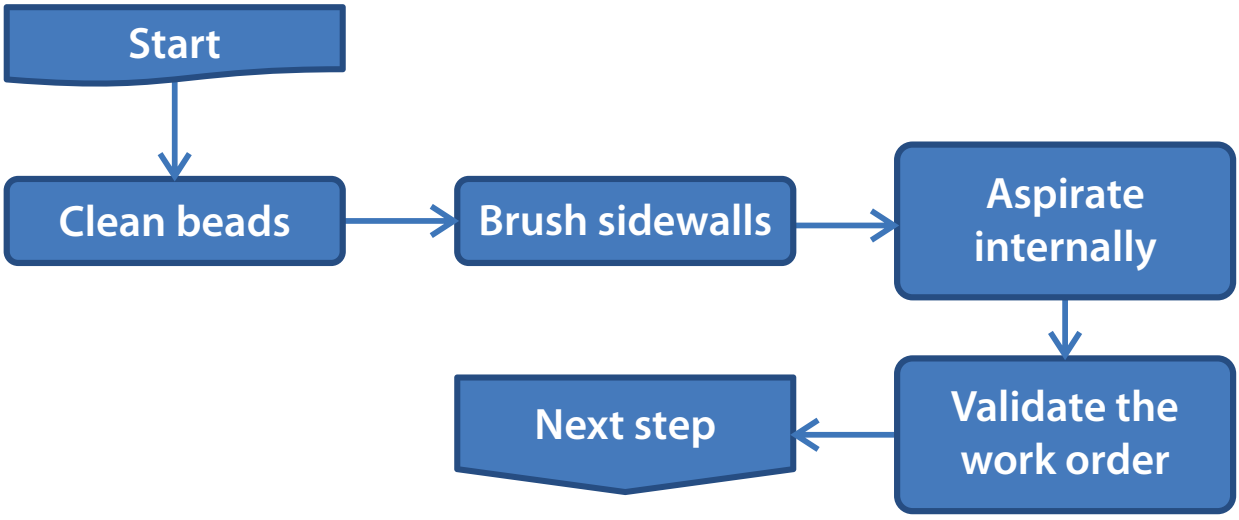
Drying room with moisture exhaustion, controller of temperature and time.

Observation:

This stage is not mandatory in the process. Please check with the Vipal technical team to assess the need for tyre drying.

CLEANING

CLEANING FLOWCHART



OBJECTIVE:

Perform cleaning to facilitate initial tyre inspection and avoid the contamination of other sectors during the process.

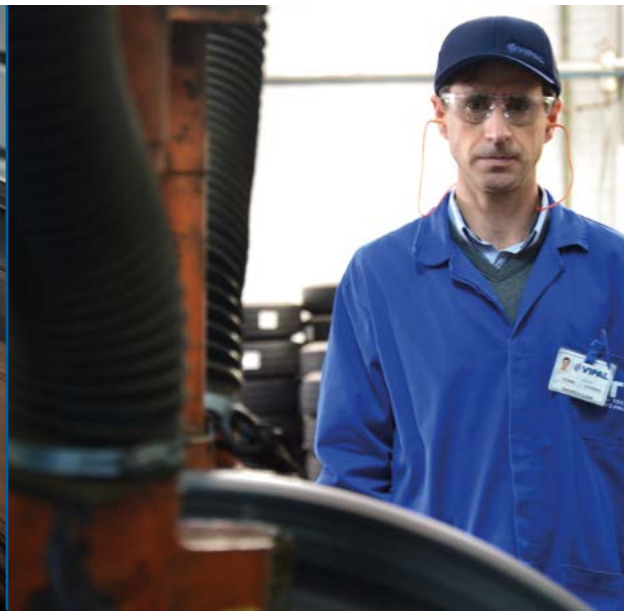
SECTOR:

Ideally, it should be isolated from the other sectors to avoid propagation of dust.

PROCEDURE:

All dirt must be removed from the internal area, as well as the external area and the bead, as follows:

- When wet, dry with a cloth;
- aspirate;
- brush the sidewalls;
- use a cloth humid with Solvulk or Bufpal surface activator on the beads.



The work can be executed with a machine dedicated to this task, brushing the tyres' sidewalls.

It is important to regulate the brushes' speed and pressure so to remove the dirt without damaging the sidewall information.

Any internal dirt should be removed, ideally, by aspiration.

EQUIPMENT:

- Cleaning machine;
- Exhaust system.

TOOLS:

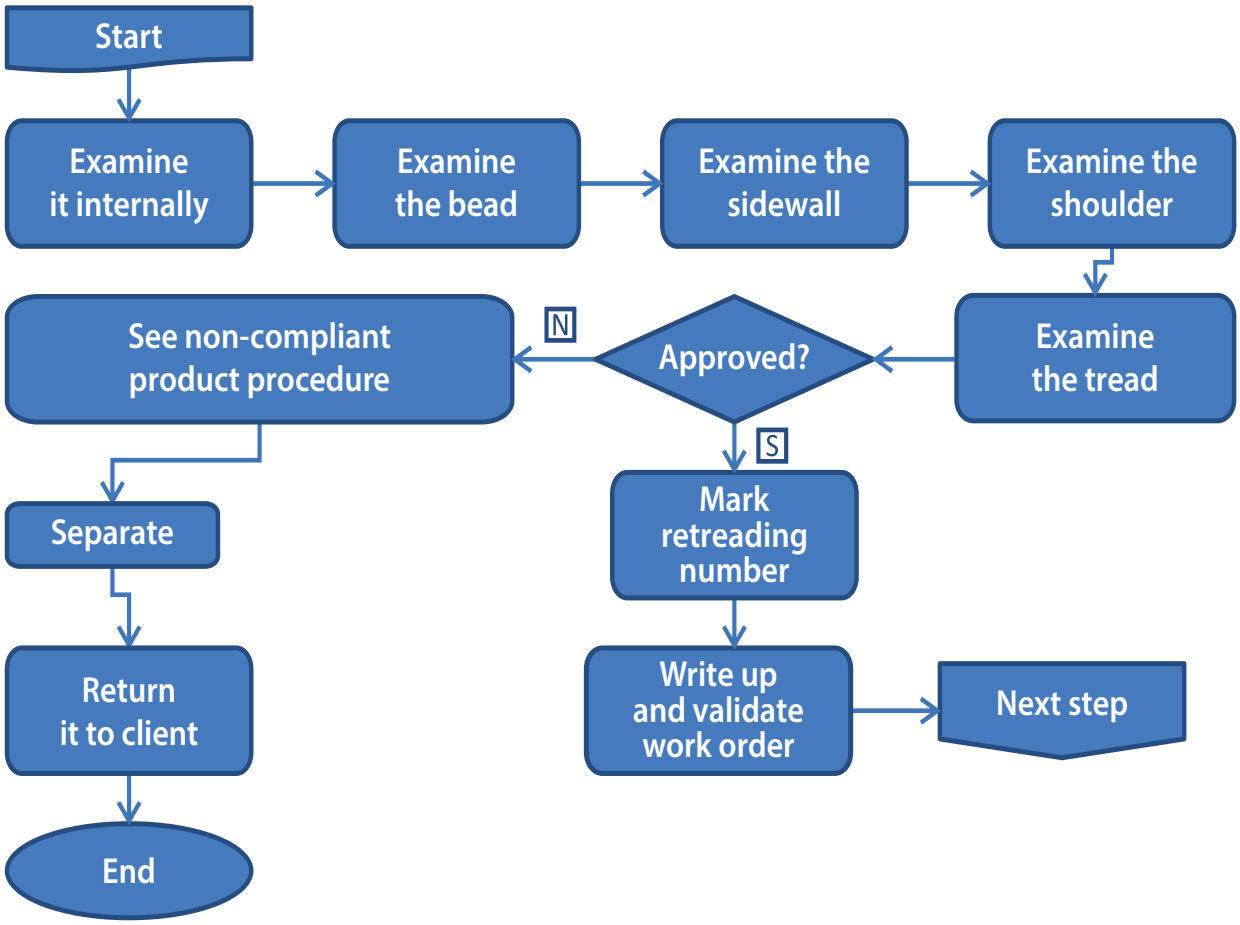
- Industrial vacuum and/or exhaust system;
- Cloth or tow for cleaning/drying the tyre.

Note:

In case of contamination by oil and greases, reject the tyre.

INITIAL INSPECTION AND CLASSIFICATION

FIRST INSPECTION FLOWCHART



OBJECTIVE:

Selecting or classifying tyres that are able or not to be retreaded or repaired.

SECTOR:

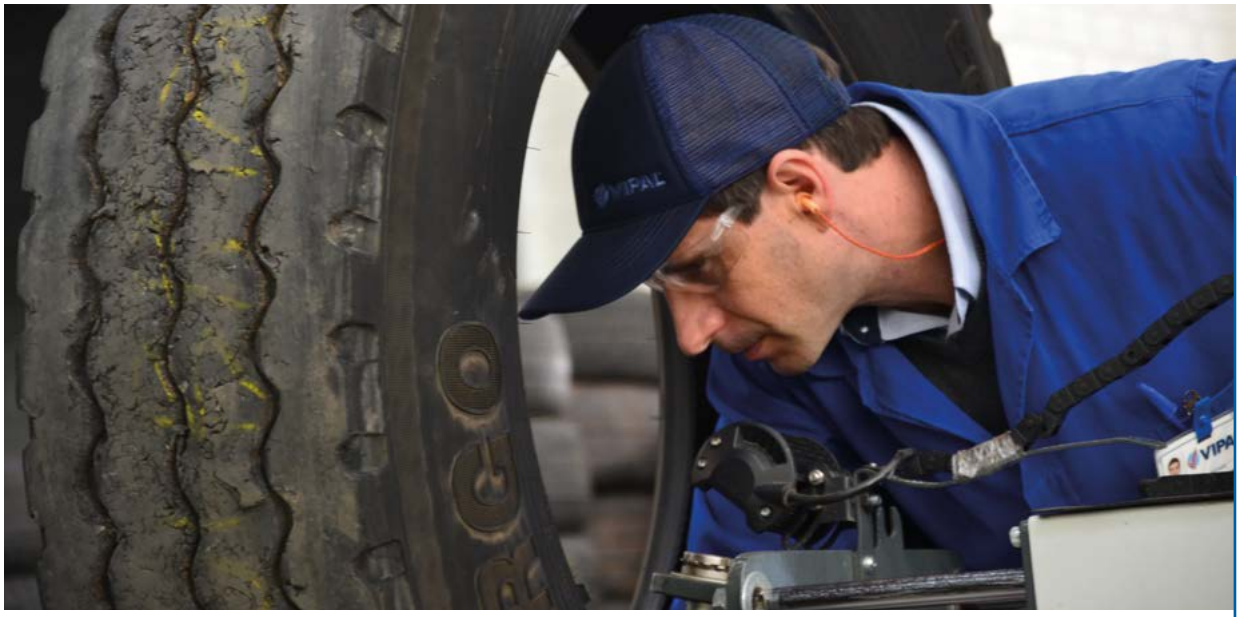
The inspection sector must be well lit to facilitate visualization of all damages.

PROCEDURE:

The operator must be certain that the previous operations were performed.

The tyre must be positioned in the inspection machine. In this stage, besides the operator's technical knowledge, a visual evaluation and the use of his hands (tact) are necessary in order to establish contact with the casing's surface. Using the tools (eyes/ hands), it is possible to identify blisters or small bubbles, which would not be found with visual or mechanical evaluation only.

Due to its critical characteristic, it is important to keep a routine and to perform the inspection in five steps:



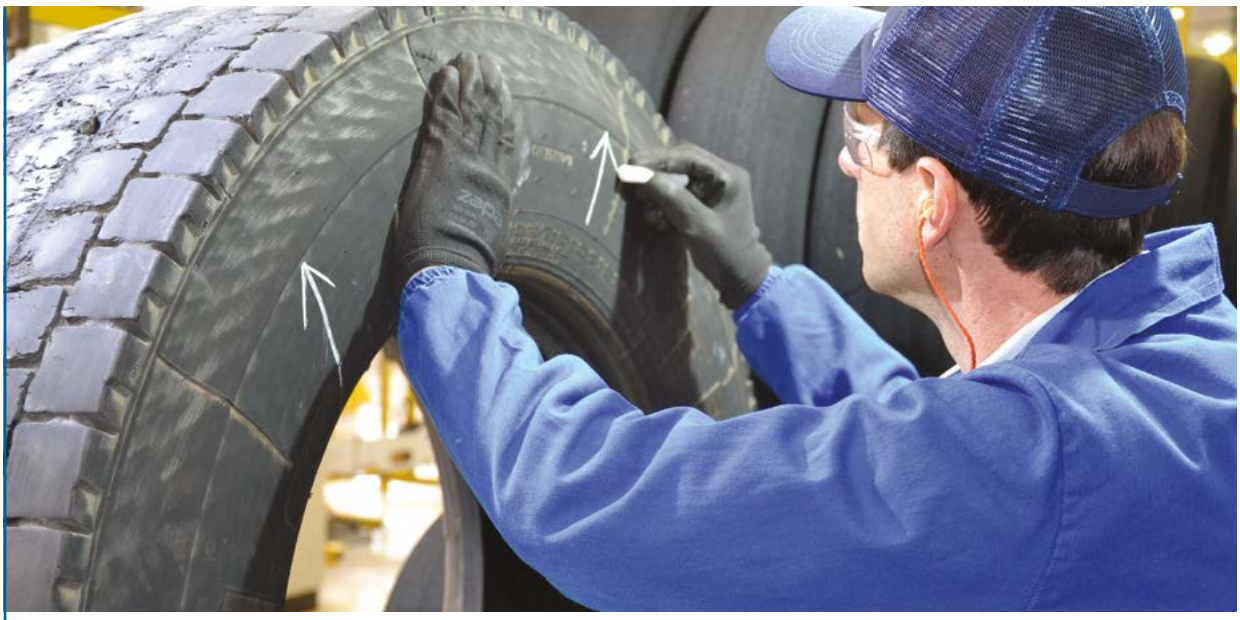
1 - Internal inspection:

In the tyre's internal area, the operator must check:

- Existence of perforation, tyre casing displacement, radial cracks;
- Damages that exceed the limits established in the patch application table;
- Indicators ofrun flat, presenting folds on the casing's ply or blisters perceived by touch;
- Variations of circumferential color or roughness in the bending area, indicating overheating;
- Tubeless tyres presenting innerliner displacement or openings in the splice.

Note:

When you find areas that need to be repaired, mark it on the inside and outside to make it easier to identify.



In order to check if there are displacement in the plies of radial tyres, put your hand in the tyre's internal area corresponding to the tread and the shoulder and turn the tyre.

If there areblisters, make sure it is not a displacement.

2 - Bead:

- Check deformations due to incorrect mounting, folds, and broken wire;
- Check if the tyre presents ebonite (Bakelite/hardening/plasticization) or circumferential cracks, characteristic of overheating;
- Check for signs of damages in the beads' area that harm elements from the structure, such as the casings' plies or the beads' rims;

Note that, according to the ABNT (Brazilian Association of Technical Norms), only the rubber in the beads can be repaired. Check local legislations.

3 - Sidewall:

- Check if there are broken plies, displacement, blisters, marks (folds) that indicaterun flat;
- Contaminations by oil and greases;
- Tyre stress (rubber degraded by several micro cracks).

4 - Shoulder:

- Check, through characteristic color, the existence of possible displacement caused by excessive concentration of heat or impact.

5 - Tread

- Remove any strange object impregnated in the tread area;
- Check for excessive chipping or irregular wear that may have reached the belt closer to the surface, causing its oxidation or deterioration;
- During the inspection of the tread, one must observe possible displacement in the edge belts.

- Separation of the edges of the belts can be checked by punching or hitting the hammer on the edges of the working belts.

In case of doubts, to confirm any displacement, open the shoulder with a gauge. Ifidentify the damage, reject the tyre.

When analyzing all the points of attention mentioned in the previous items, evaluate the possibility of tyre retreading.

Items that disqualify the renovation can be clarified in: “Vipal’s Damage and Wear Guide” or by consulting the Vipal technical team.

Important to check local legislation.

Concerning Brazil, in the retreading process, the Identification Seal of the SBAC Conformity – Brazilian Conformity Assessment System must be buffed.

As for the other countries, check the local legislation.

If the tyre is approved, make a mark indicating this retreading.

Such mark must be made through vertical and successive bars, with maximum height of 10mm, positioned side by side with the tyre's original manufacturing date (DOT).

Fill in the data in the tyre's service order and define the type of retreading that must be performed.

If the tyre is rejected, identify the reason in the service order and send the tyre to the client, accompanied by a technical report.

This process can be carried out at any stage of the process.

EQUIPMENT:

Inspection machine with good lighting, allowing opening and turning of the tyre.

There are machine that use electrical current for detecting holes; others use high pressure or comparisons of images from the tyre submitted to vacuum or not (shearography) so to evaluate the casing's structure.

TOOLS:

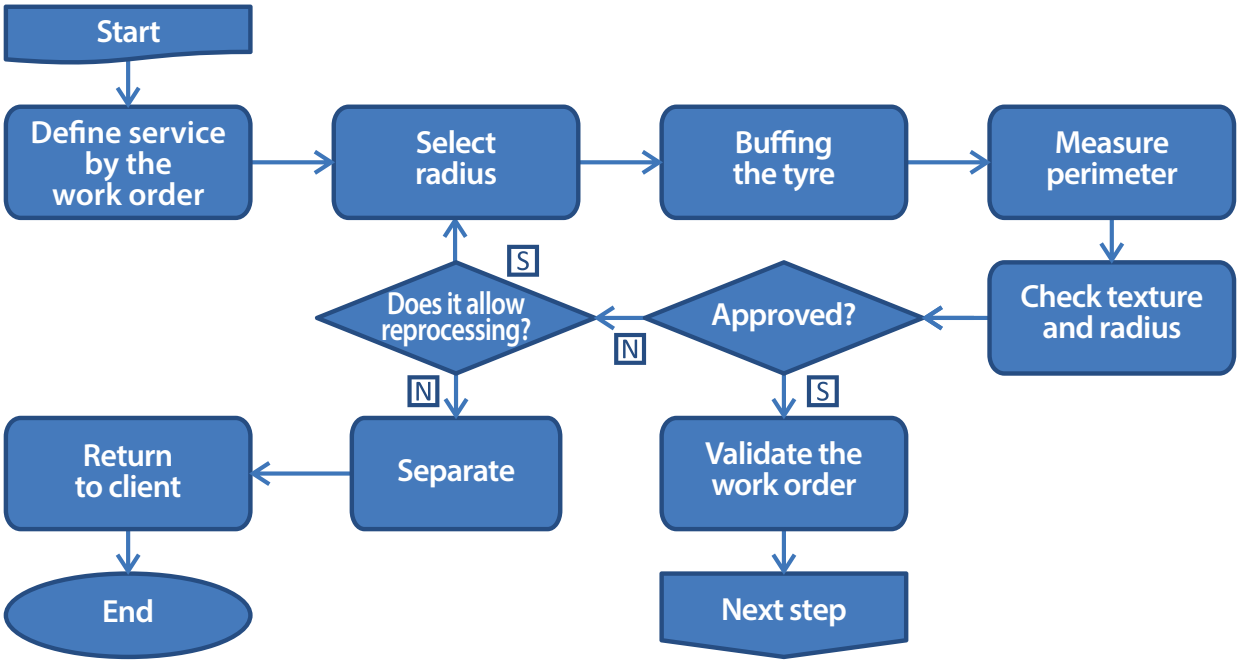
- Probing awl;
- Tape measure;
- Slip joint pliers;
- Skiving knife;
- Tire crayon;
- Buffing/skiving tool;
- Exhaust system.

Note:

On the inside of the tyre, when it is not possible to mark it with school chalk, use another appropriate marker.

BUFFING

BUFFING FLOWCHART



OBJETIVE:

Remove remaining tread and, if necessary, the sidewall's surface, leaving the tyre with the correct dimensions (tread width, radius, andunder tread) and texture to apply the new tread and sidewall.

SECTOR:

Ideally wide, with adequate lighting and exhaust system for dust and smoke.

PROCEDURE:

Verify what kind of retreading the tyre is destined to – top capping, full capping, or remolding/ bead to bead retreading.

Inflate the tyre to reach uniformity when buffing (20 to 30lbs). Check if the beads are correctly seated over the expansive rim. Adjust applying radius.

TABLE OF BUFFING RADIUS

Radial tyres

Width of buffed tread (mm)	Trailer axle (radius in inches)
151 -170	18” a 26”
171 - 190	
191 -210	
211 - 230	28” a 36”
231 - 250	
251 - 270	
271 - 290	38” a 48”
291 - 310	
311 - 330	50” a 70”
331 - 360	
361 - 390	

Variation of the radii and due to the different housings that the market offers.

Observe the width of the wheel used in the scraping - tyre 385 x 11,75’ | 425 x 13’ | 445 x 14’ 275 e 295 x 9’ | 17,5 x 6 3/8’

Note:

For the process in which orbicushion is used to apply the extruder cushion gum, it is recommended to use a radius of over 34”.

Bias ply tyres

Tyre size	Radius in inches	
650-16	20”	***The Buffing Radius for the retreaded tyres through traditional process (hot cure) must be the mold’s radius.***
700-16	22”	
750-16	22”	
825-20	24”	
900-20	28”	***For the buffing process by which orbicushion will be applied, we recommend using a buffing radius of at least 30” (760 mm) regardless of the size of the tyre.***
10.00-20	28”	
11.00-20	30”	
12.00-20	30”	
14.00-20	30”	
11.00-22	30”	

• *Table created at the Technical Center Vicêncio Paludo (CTV) by a specialized technical team.*

Buff the tyre starting from the centre, verifying if the under tread presents a base at least 2mm thick to glue and protect the nylon canvas and steel belts.

Move carefully so that the rubber does not burn.

Excessive heating caused by fast movements or older buffing blades cause superficial degradation of the rubber, which makes it difficult for the cushion gum to adhere.

Note 1:

For long distance road operations, the best would be an under tread of no more than 3 mm. For off-road operations, the best would be an under tread of a least 4 mm.

Note 2:

When the protective belt is removed, the exhaust must be isolated to prevent the spread of flames.

Note 3:

If the equipment does not have a steel belt sensor, check the under tread using the probing awl.

Note 4:

On tyres that have been retreaded more than twice, if you identify that the rubber base is becoming detached, remove all the rubber from previous retreading, otherwise, respect the 2mm minimum base.

It is essential that the buffed surface be clean and with the correct texture to allow great adherence of the new tread. The ideal buffing texture pattern is 3 or 4.

Note 5:
Measure the perimeter with a measuring tape, a mechanical measurer or laser. This will serve to cut the tread and to form pairs when the tyres are from the same customer.

Use the templates for checking the buffing radius.

Use a ruler, a measuring tape or tread templates for adjusting the lateral finishing.

Defining the width of the tread is done at this stage in the process, where the operator evaluates the condition of the casing and the correct measurement of the base according to the available tread measurements.

Write the tyre's perimeter, the radius used and the tread width in the service order or in the software records.

On the tyre with a sidewall veneer, the sidewall inscriptions must be completely removed.

EQUIPMENT:

- Buffing Machine;
- Circumferential measurer;
- Steel mesh gauge.

TOOLS:

- Tungsten discs;
- Table of buffing radius;
- Buffing blades;
- Tread templates;
- Buffing texture pattern;
- 5m measuring tape;
- 1kg rubber hammer;
- Probing awl;
- Slip join pliers;
- Knife;
- Metal tape measure of 40 cm.

Observation 6:

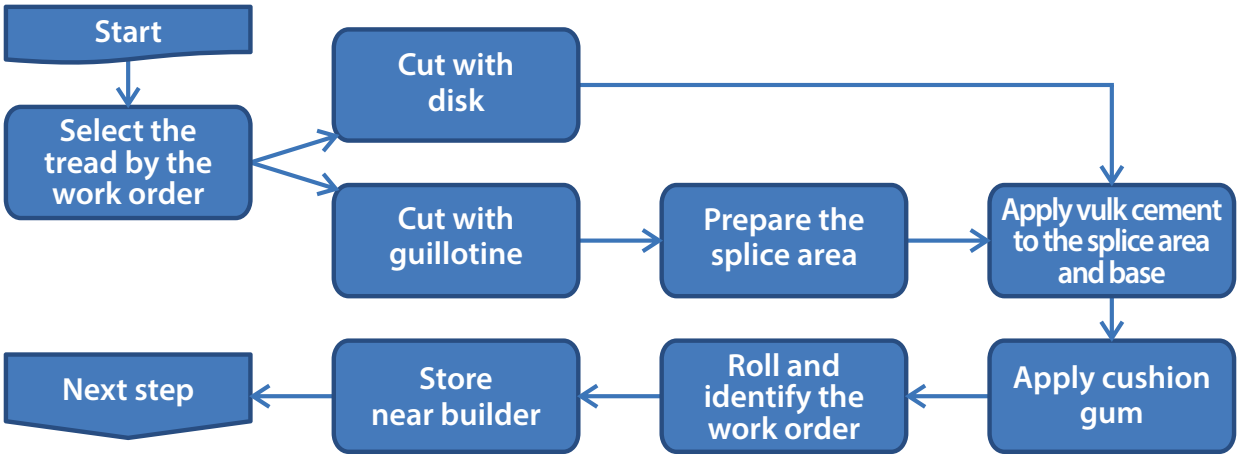
It is important that tyres from the same client, with the same size and tyre construction, must be buffed with the same radius and perimeter.

Observation 7:

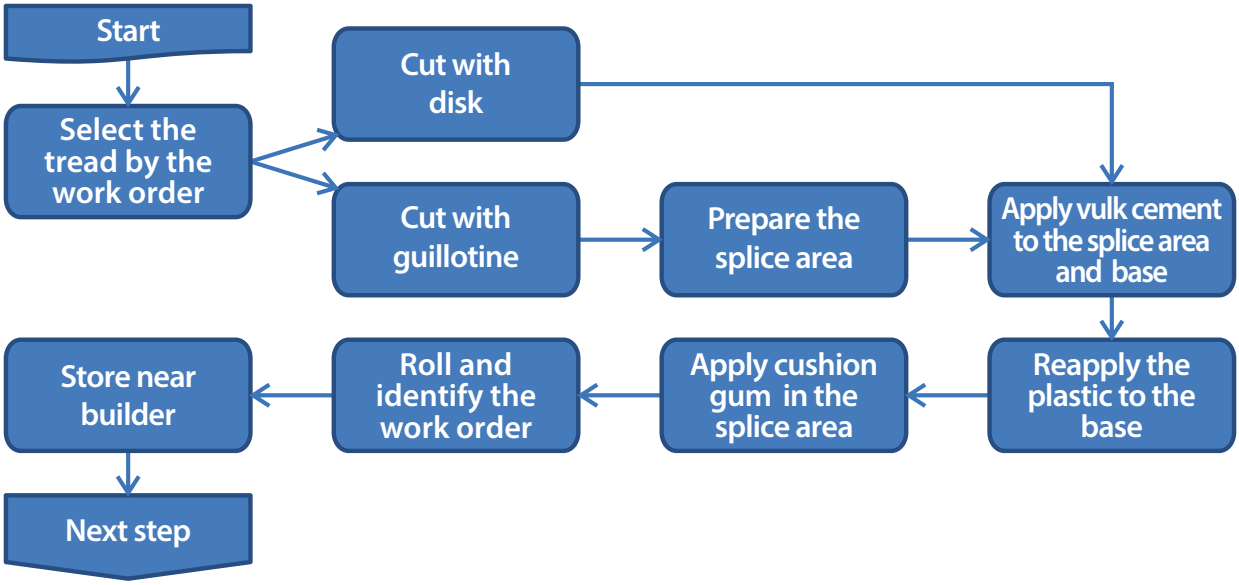
During buffing, damages not previously detected in the initial inspection can appear, such as excessive chipping, tyre displecement, some times,the tyre needs to be rejected.

PREPARING THE PRECURED TREAD

TREAD PREPARATION FLOWCHART OF PRECURED TREAD WITH MB/AC CUSHION GUM



TREAD PREPARATION WITH ORBICUSHION FLOWCHART



OBJECTIVE:

Preparing the tread for application to the tyre.

SECTOR:

Ideally wide, with adequate lighting and clean.

PROCEDURE:

After choosing the most adequate Vipal precured tread and width for the buffed area, you must cut it with the guillotine or tungsten cutting disc to obtain a length that corresponds to the perimeter of the buffed tyre with an ideal tolerance of about 30mm, preferably by observing the continuity of the design on both splice area of the tread.

Buff the procured tread's splice area, obtaining texture standard 1 or 2. If the tread was cut with a cutting disc that provides the ideal texture, this step is not necessary.

Clean it with a soft-bristle brush.

Apply a thin and even coat of vulk cement in the prepared splice area.

If the gum is applied to the cover, orbicushion or directly on the Tyre, the gum or Finishing rubber is usually applied at the time of covering.

If the connection is applied in the tread, the MB/AC connection must go beyond the base, to one of the ends of the tread.

If it is necessary to reapply glue, remove the plastic, otherwise remove it in the coverage (orbicushion) or in the application of the connection.

Reapplying the glue to the precured tread is necessary in the following situations:

1 - 12 months after the manufacturing date;

2 - Whenever the packaging is open or damaged;

3 - When the product is not stored according to the manufacture's Datasheet, in other words, a cool, covered and ventilated place, sheltered from the sunlight, humidity and ozone generating sources.

4 - At the base of the wings, when the tread has a wing.

In these cases, apply a coat of Vipal Vulk Cement and let it dry before applying the cushion.

Select the MB/AC Vipal Cushion Gumaccording to the tread's width so to cover the whole base of the tread and, with the help of the air extruder, remove any trapped air.

If the cushion is applied on the tyre, do not consider this stage.

Note:

To apply cushion gum on the base of treads with wings, do not consider the width of the wings: rather, only consider the width of the tread. In must be applied in a centralized manner.

In these cases, when applying treads with wings that connect to the base of the tread, it is required to use a 30x1 finishing rubber.

The prepared treads must be rolled up with the design facing to the inside, avoiding detachment, cushion gum oxidation, and base contamination.

Note 1:

When there is need for performing more than one mending, the smaller size of the precured tread must have at least 50cm.

Nota 2:

In case of process where the cushion gum is applied to the tyre, the tread can be stored/ rolled with the design facing outwards as long as it does not exceed 2 hours.

EQUIPMENT:

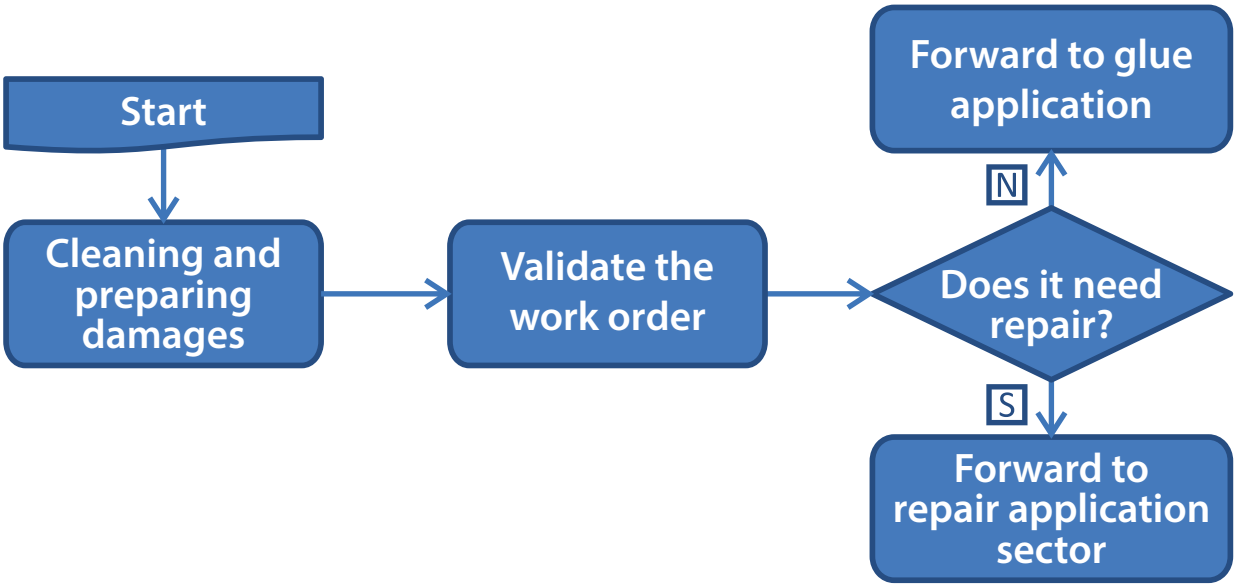
- Tread preparation table with guillotine or cutting machine;
- Extruder air cylinder;
- Tungsten grinding wheel;
- Tread support for drying of glue.

TOOLS:

- Tungsten carbide;
- Hot knife set;
- Chalk;
- Brush;
- Woolen roll;
- Recipient for glue;
- Measuring tape.

SKIVING

SKIVING FLOWCHART



GOAL:

Cleaning and preparing the damages that compromise the retreading process and the casing's integrity, be it on the bead (rubber only), sidewall, shoulder, and/or tread.

SECTOR:

There must be a trestle that allows the tyre to be turned for the skiving preparations, good lighting, and exhaust system for dust and smoke.

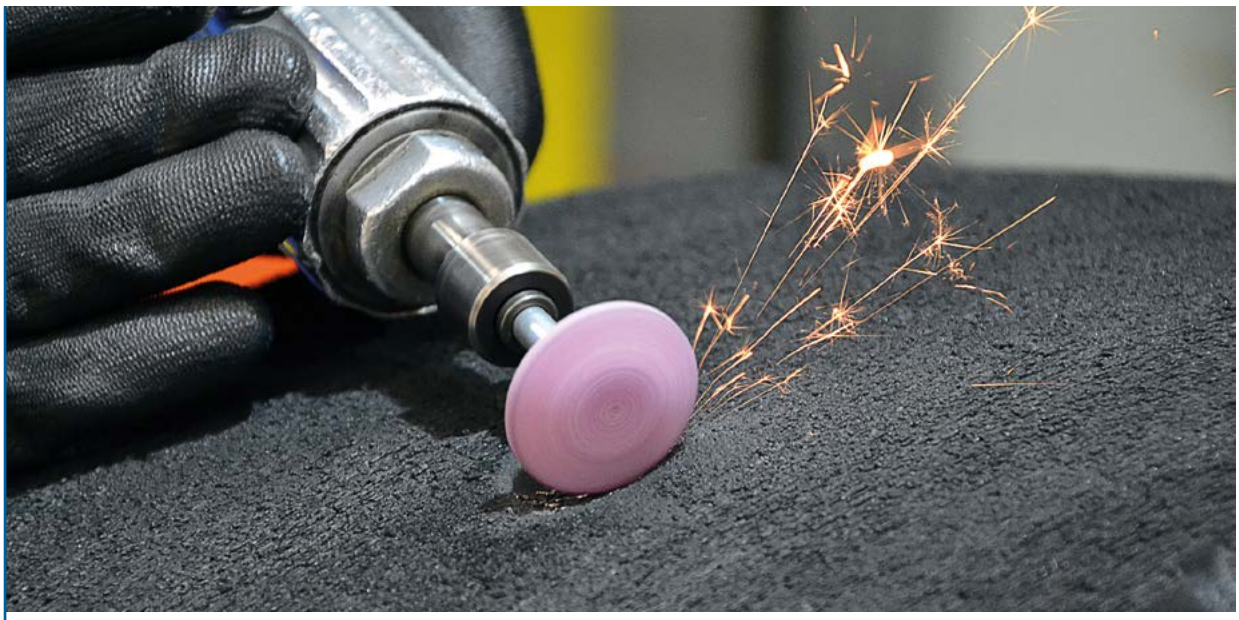
PROCEDURE:

Turn the tyre and identify damages to be skived.

Skive the damage in a concave manner, removing the loose rubber and oxidized cables, preparing the damage so to avoid angles that are too narrow or wide, that hamper the filling's anchorage.

Remove the rubber and the loose canvas/belts with a harness or a turbine with low rotation with the help of a rubber brush or tungsten disk or a circular saw.

Tools with 2.500 rpm and 3.500 rpm are recommended.



In order to cut the damaged steel wires with the help of an abrasive stone, a high rotation turbine or an electric grinder is recommended, between 18.000 and 25.000 rpm.

For leaked damage, use low speed reversible masonry milling cutter/drill bit up to 3.500 rpm. It is important that the milling cutter is in good condition so that it can cut the cables correctly and leave a good finish on the spot.

For damage requiring repairs to be applied that were not identified in the initial exam, they must be identified on the outside in the same way as done in the initial exam.

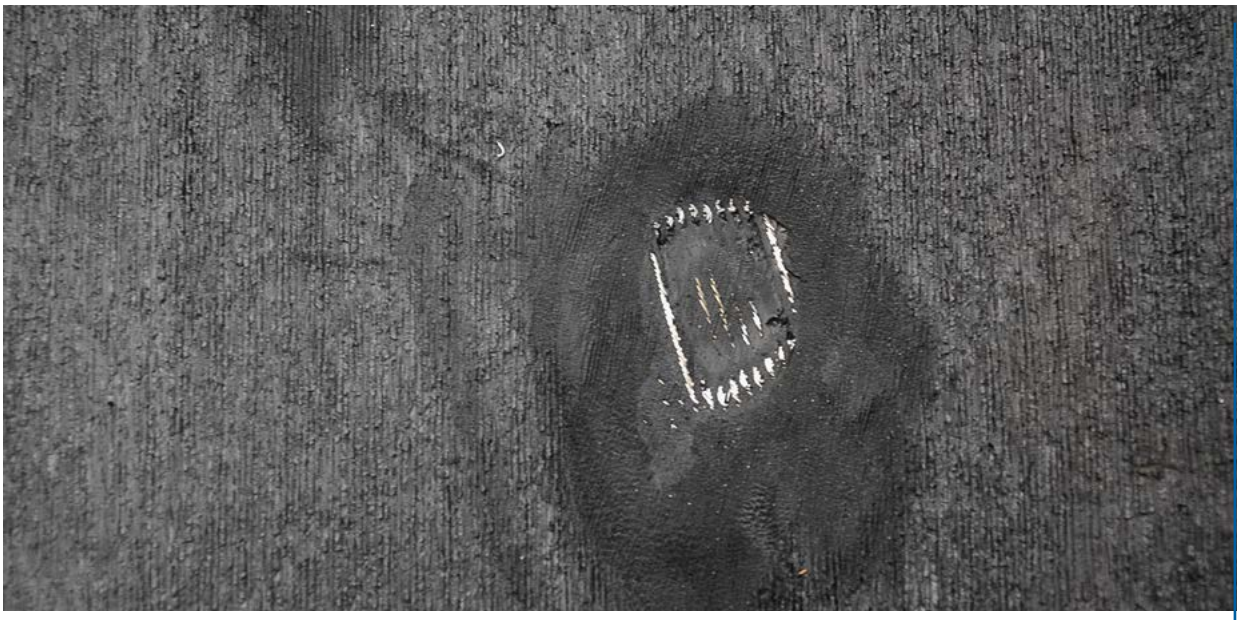
Eliminate the burnt or oxidized rubber at all the skived points, with a brass-steel brush.

Remove excess rubber dust from the tyre with a nylon brush or paintbrush.

Compressed air contains impurities such as oil, water, and metal detritus from the pipe line. Thus, using it for cleaning the tyres is not recommended. Prefer the nylon brush.

This brush should only be used to clean the buffed areas.

If necessary, the tyre should be sent to the repair application department, otherwise, to the glue application department.



Be careful to remove only what is loose or oxidized. The adhesion of rubber with rubber will always be better than rubber and nylon, or rubber and steel. However, the choice of tools must consider the damage.

Limit the skiving area and extension to a minimum.

Note:

Excessive exposed or polished steel cables should be avoided since they compromise the cushion gum´s adherence.

Ideally, in these cases, the cables should be removed in an interspersed manner.

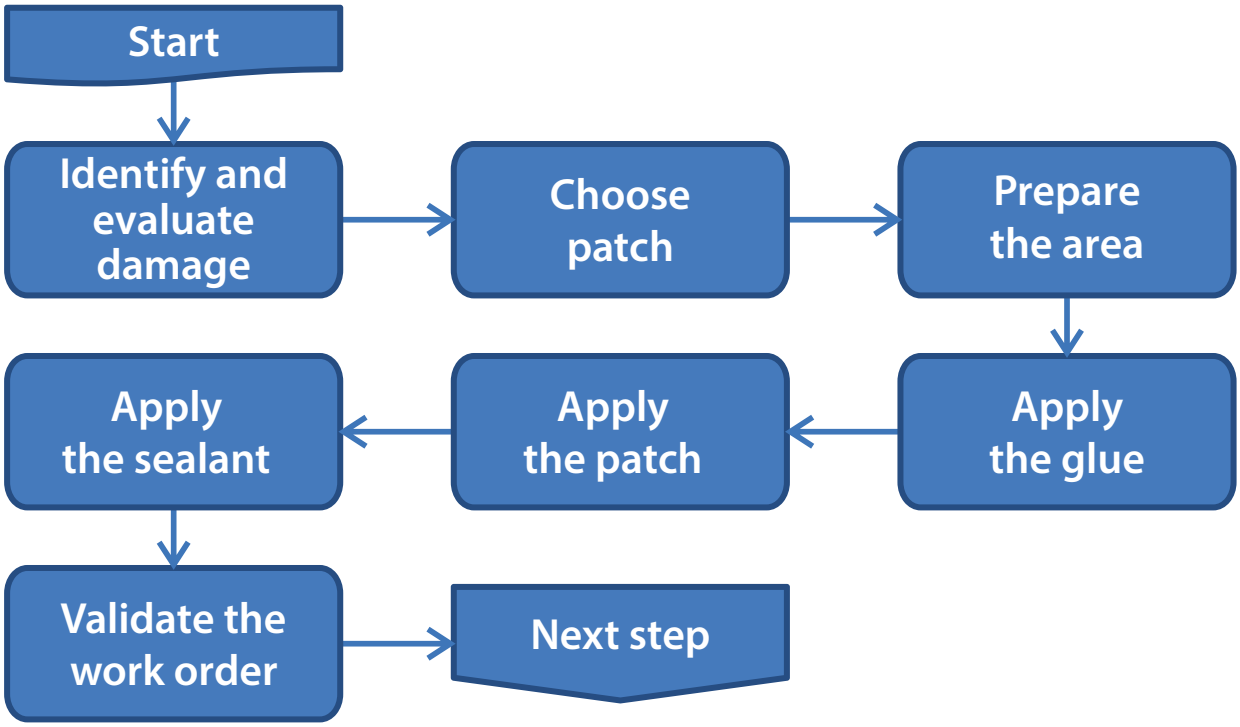
EQUIPMENT:

- Low rotation electrical (harness) or pneumatic grinder operating from 2.500 rpm to 3.500 rpm and high rotation from 18.000 rpm to 25.000 rpm;
- Pneumatic turbine or high rotation electrical grinder from 18.000 to 25.000 rpm;
- Low rotation pneumatic or electrical reversible drill, from 2.500 to 3.500 rpm;
- Trestle for skiving.

TOOLS:

- Awl;
- Cutting pliers;
- Assembled ends;
- Rubberized steel brush;
- Tungsten disk;
- Tungsten pencil;
- Tungsten gauge;
- Tungsten ball pin;
- Milling cutter;
- Circular saw;
- Brass brush.

PREPARATION AND APPLICATION OF REPAIRS FLOWCHART



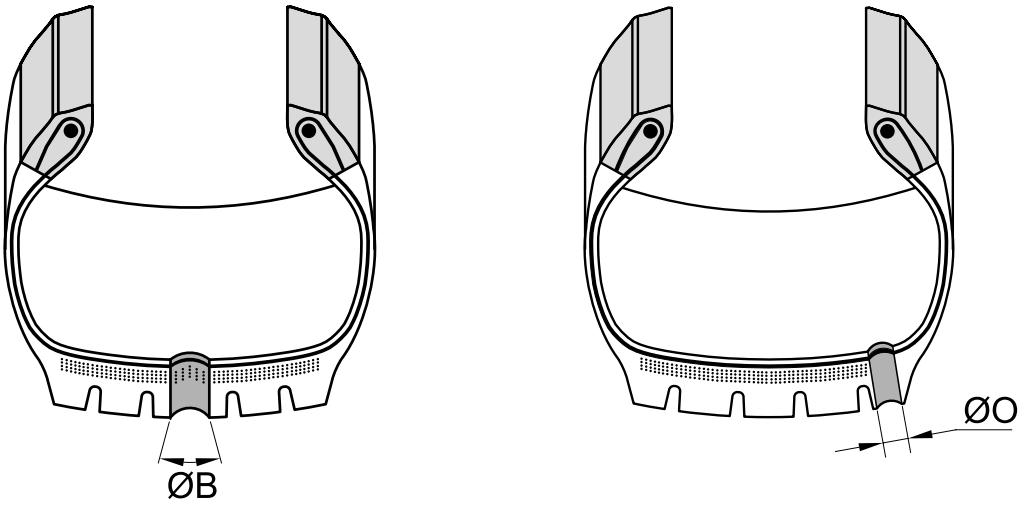
GOAL:

Return the tyre's damaged area the same resistance.

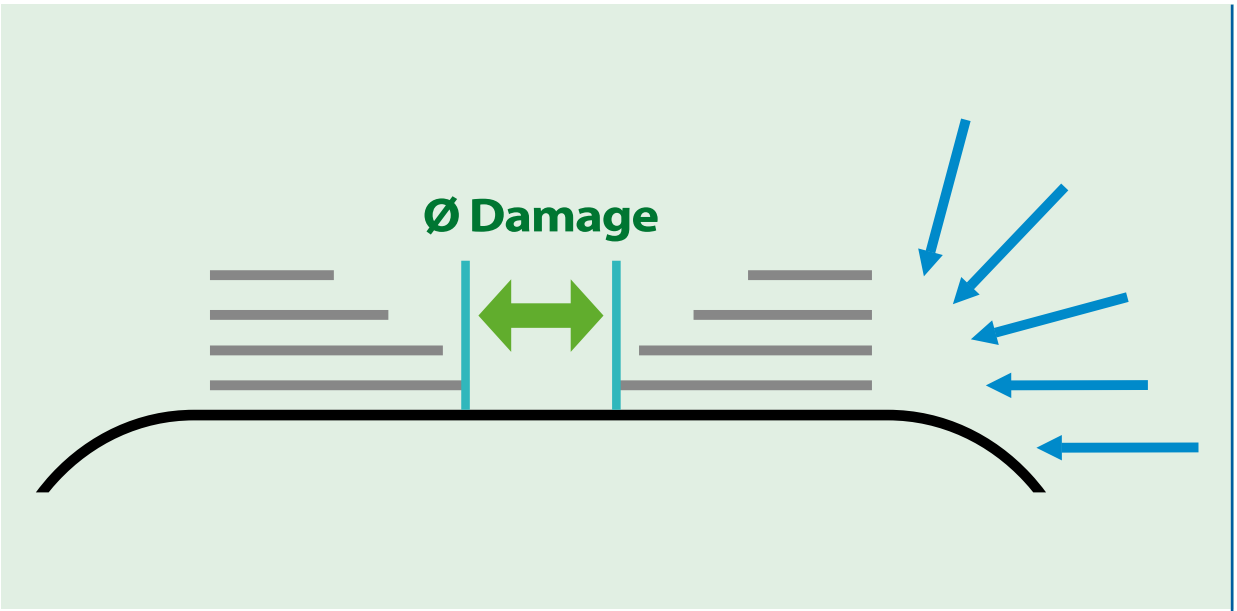
SECTOR:

Well lit, with support for opening the patches, dust aspiration system, and cabinets for storing patches, glues, and accessories.

Choosing radial patches
Circumferential damages



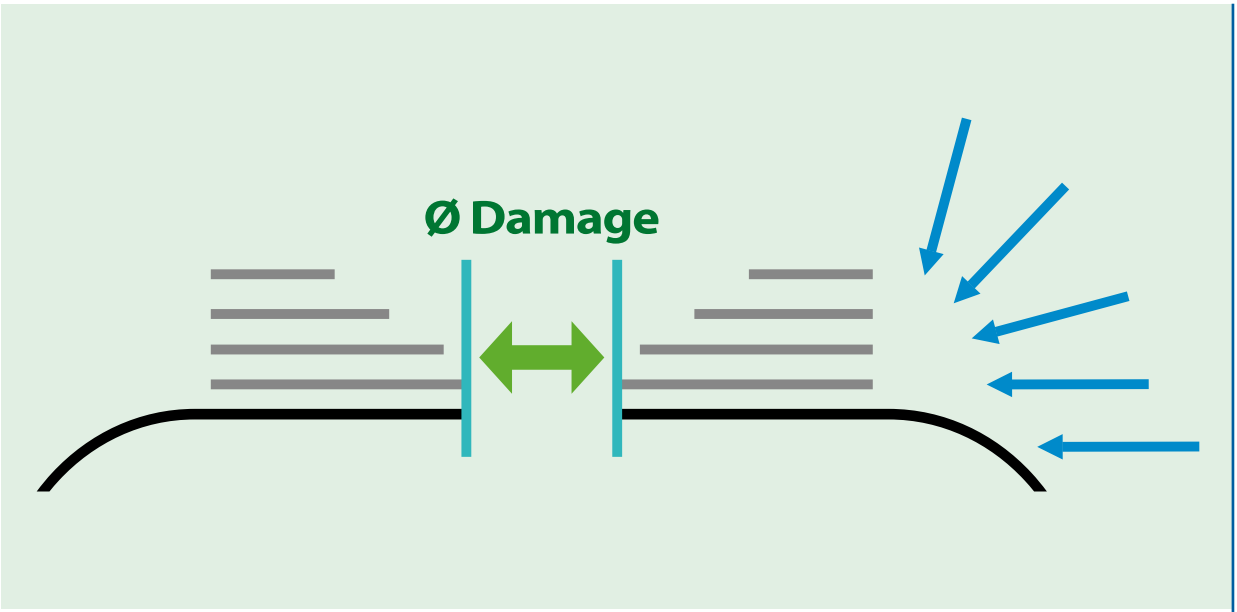
On circumferential damages in the tread and shoulder area, it is necessary to know the damage size in order to choose the patch correctly.



Tread:

Whenever the damage affects the 1st belt, or the ply closest to the casing's structure, over 8mm, it is necessary to use a patch, as shown in the image.

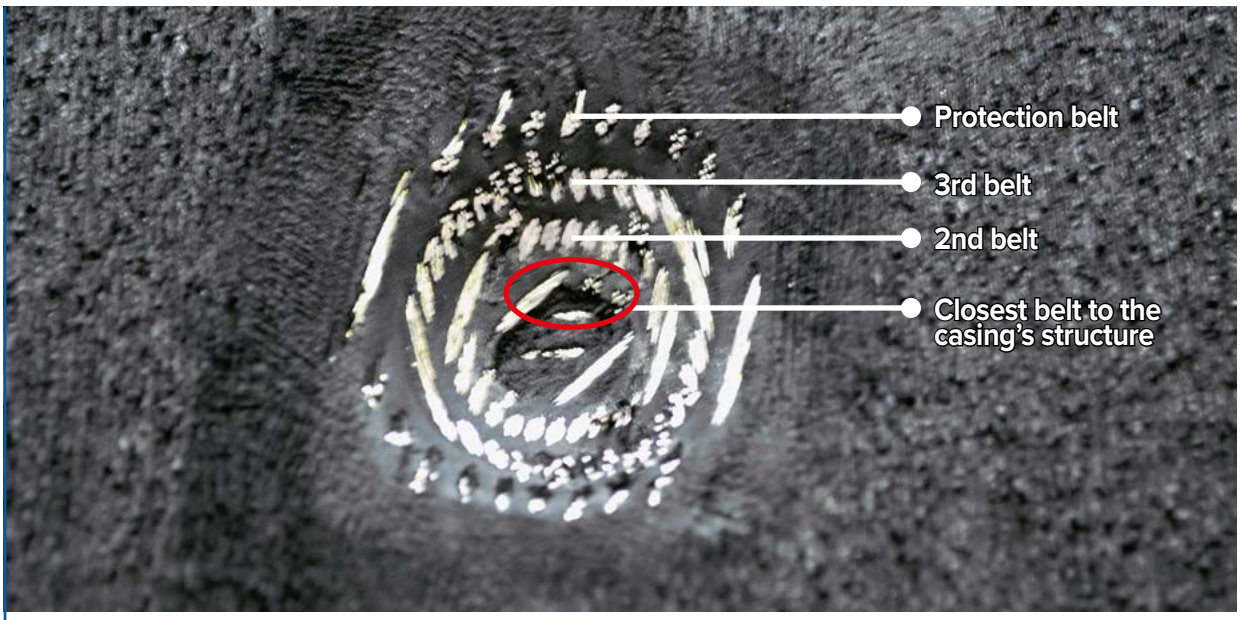
Ø = damage diameter



Tread:

Whenever the damage affects the casing's structure, it is necessary to use a patch.

Ø = damage diameter



Measuring the tread:

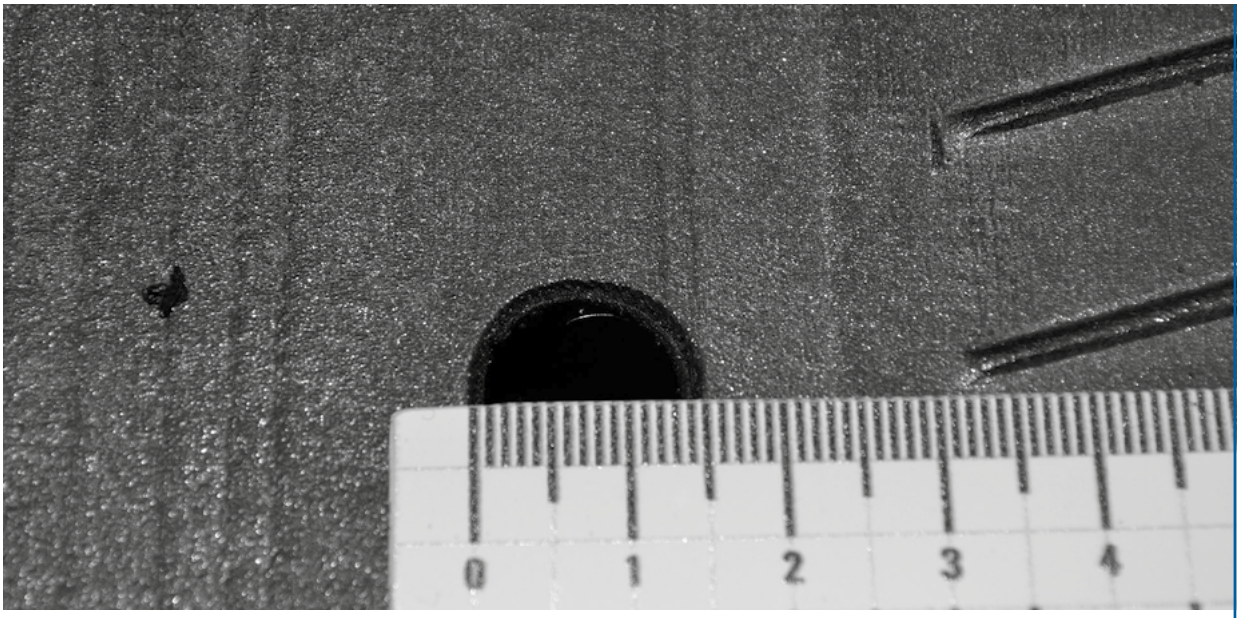
Damages on the tread in radial tyres that affect the working belt closest to the casing's ply, measuring more than 8mm,
require the application of a patch.

Measuring the tread:

Damages on the tread in radial tyres that do not affect the working belt closest to the casing's structure **do not require a patch.**

IMPORTANT:

The measuring of damages in radial tyres is internal; however, when the damages are not hollow, measure them externally on the ply/belt closest to the casing's structure in the largest dimension.



Measuring the tread:

Whenever the damage affects the casing's structure, the measure must be in the largest dimension internally measured in the tyre.

Choosing a patch – tread – nominal damages

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385

ØB (mm)	RA
10	29
15	31
18	25B
20	33
25	35B
30	35
34	37
38	39
42	41
42	45B
46	43

ØB (mm)	RAC
4	10
6	12
8	14
10	15
12	20
15	22
20	25
20	40
30	42
40	35
40	44
45	45
45	46

1

Tyre measures:

295/80 R 22,5

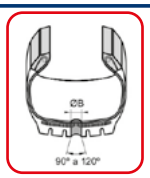
Check tyre measure.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



ØB (mm)	RA
10	29
15	31
18	25B
20	33
25	35B
30	35
34	37
38	39
42	41
42	45B
46	43

ØB (mm)	RAC
4	10
6	12
8	14
10	15
12	20
15	22
20	25
20	40
30	42
40	35
40	44
45	45
45	46

2

Damage position:

Tread

Identify the position of the damage on the tyre.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385

ØB (mm)	RA
10	29
15	31
18	25B
20	33
25	35B
30	35
34	37
38	39
42	41
42	45B
46	43

ØB (mm)	RAC
4	10
6	12
8	14
10	15
12	20
15	22
20	25
20	40
30	42
40	35
40	44
45	45
45	46

3

Damage size:

Ø = 10 mm

Measure the damage dimension and identify it in the table.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385

ØB (mm)	RA
10	29
15	31
18	25B
20	33
25	35B
30	35
34	37
38	39
42	41
42	45B
46	43

ØB (mm)	RAC
4	10
6	12
8	14
10	15
12	20
15	22
20	25
20	40
30	42
40	35
40	44
45	45
45	46

4

Then, identify the patches' options indicated for the damage.

Indicated patches: RAC 15 and RA 29.

Choosing a patch – tread – non-nominal damages

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385

ØB (mm)	RA
10	29
15	31
18	25B
20	33
25	35B
30	35
34	37
38	39
42	41
42	45B
46	43

ØB (mm)	RAC
4	10
6	12
8	14
10	15
12	20
15	22
20	25
20	40
30	42
40	35
40	44
45	45
45	46

1

Tyre size:

275/80 R 22,5

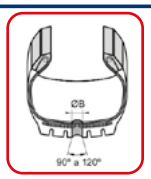
Check tyre measure.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



ØB (mm)	RA
10	29
15	31
18	25B
20	33
25	35B
30	35
34	37
38	39
42	41
42	45B
46	43

ØB (mm)	RAC
4	10
6	12
8	14
10	15
12	20
15	22
20	25
20	40
30	42
40	35
40	44
45	45
45	46

2

Damage position:

Tread

Identify the position of the damage on the tyre.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385

ØB (mm)	RA
10	29
15	31
18	25B
20	33
25	35B
30	35
34	37
38	39
42	41
42	45B
46	43

ØB (mm)	RAC
4	10
6	12
8	14
10	15
12	20
15	22
20	25
20	40
30	42
40	35
40	44
45	45
45	46

3

Damage size:

Ø = 11 mm

Check damage dimension and identify it in the table.

Choosing the repair must be done based on the nominal dimension or the one immediately above.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385

ØB (mm)	RA
10	29
15	31
18	25B
20	33
25	35B
30	35
34	37
38	39
42	41
42	45B
46	43

ØB (mm)	RAC
4	10
6	12
8	14
10	15
12	20
15	22
20	25
20	40
30	42
40	35
40	44
45	45
45	46

4

Then identifying the options of patches indicated for the damage.

Indicated patches: RAC 20 and RA 31.

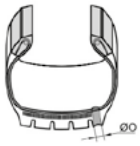
Choosing a patch – shoulder

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



ØO (mm)	RA
10	31
15	33
20	35
25	37
30	39
35	41
40	43

ØO (mm)	RAC
8	24
10	26
15	40
20	42
25	44
40	46

1

Tyre size:
295/80 R 22,5

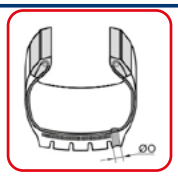
Check tyre measures.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



ØO (mm)	RA
10	31
15	33
20	35
25	37
30	39
35	41
40	43

ØO (mm)	RAC
8	24
10	26
15	40
20	42
25	44
40	46

2

Damage position:
Shoulder

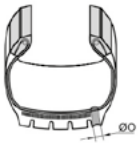
Identify the damage position on the tyre.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



ØO (mm)	RA
10	31
15	33
20	35
25	37
30	39
35	41
40	43

ØO (mm)	RAC
8	24
10	26
15	40
20	42
25	44
40	46

3

Damage size:

Ø = 10 mm

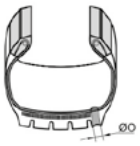
Measure the damage dimension and identify it in the table.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



ØO (mm)	RA
10	31
15	33
20	35
25	37
30	39
35	41
40	43

ØO (mm)	RAC
8	24
10	26
15	40
20	42
25	44
40	46

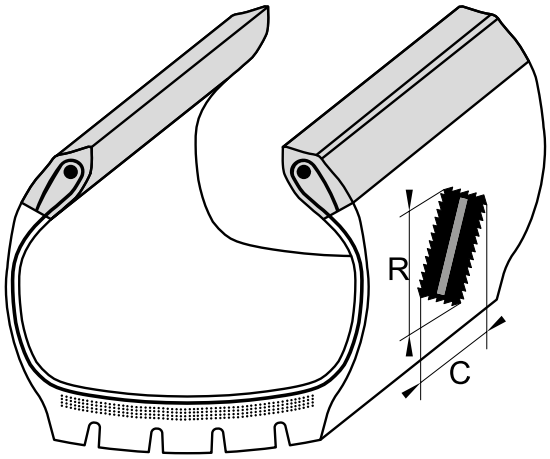
4

Then identify the options of patches indicated for the damage.

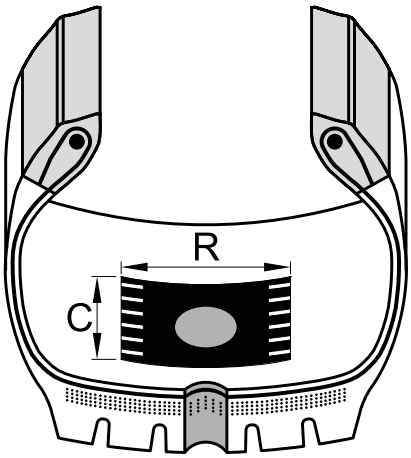
Indicated patches:
RAC 26 and RA 31

Choosing radial patches
Non-circumferential damages

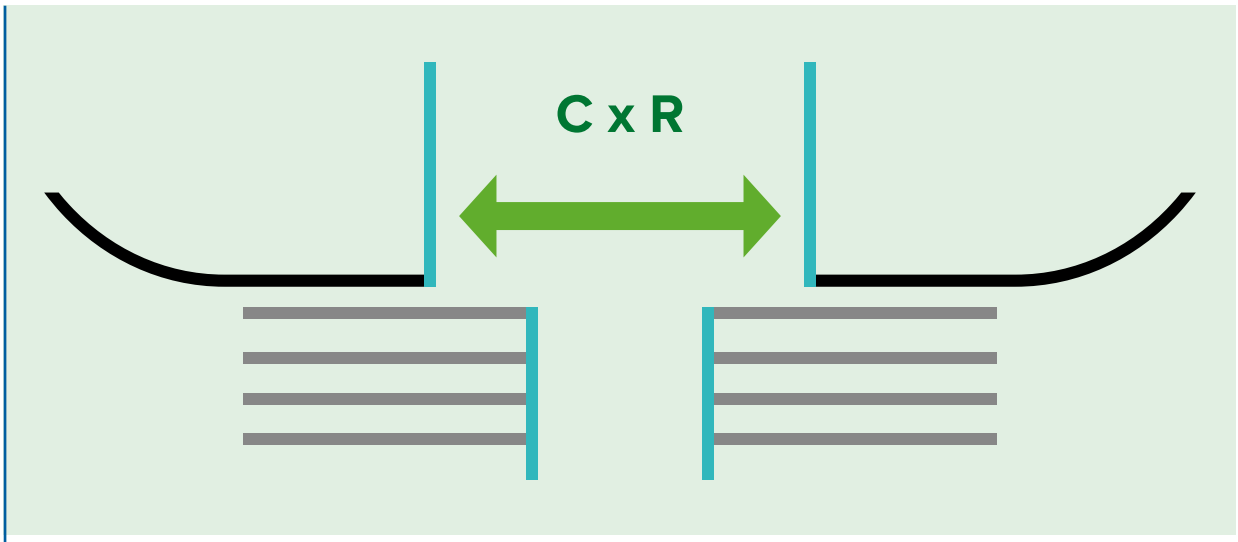
In case of non-circumferential damages that reach the main structure (casing), it is necessary to measure the damages internally in the circumferential radial directions (C x R), as indicated in the image.

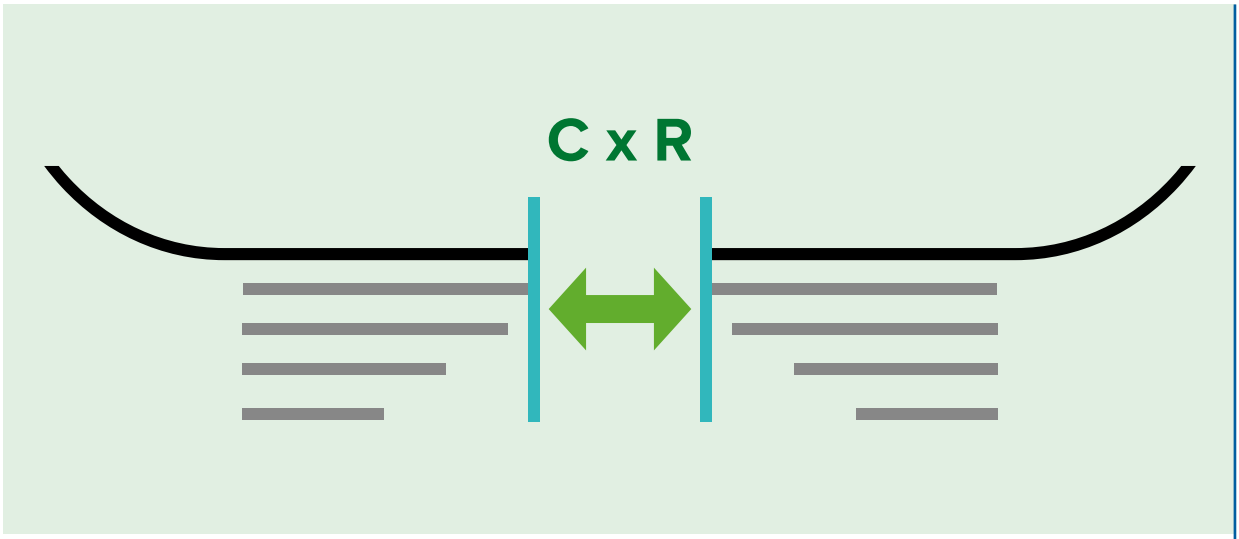


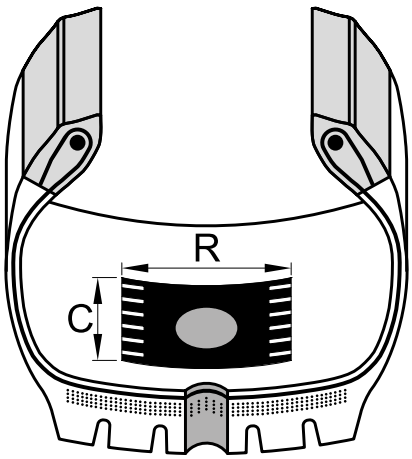
How to measure lateral damages.



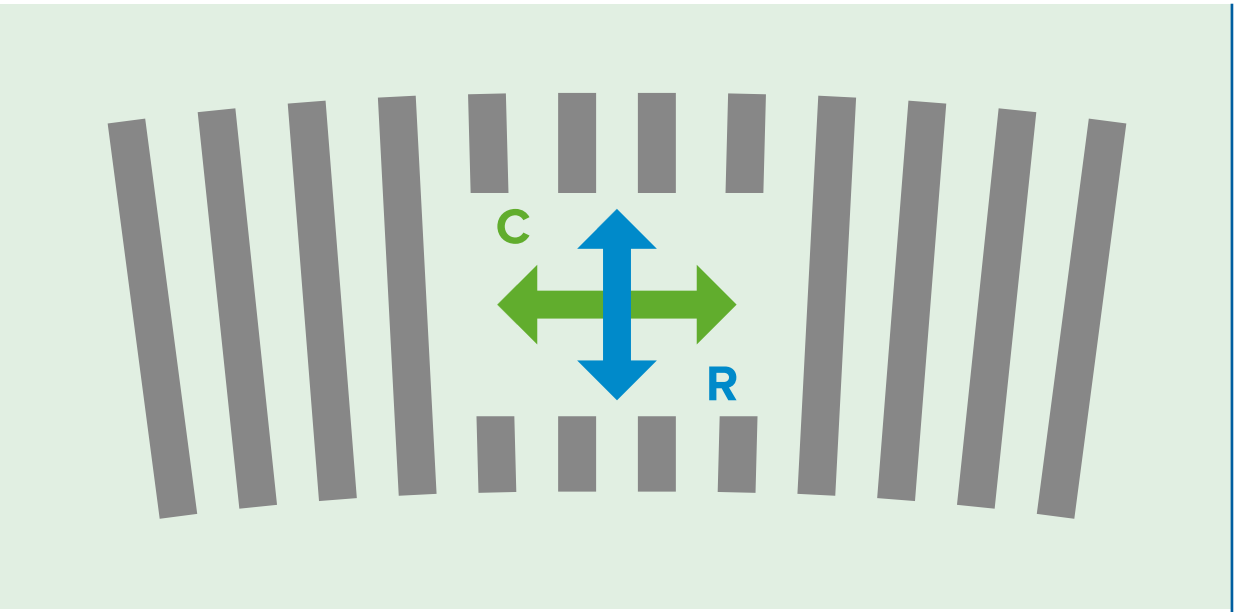
How to measure the tread.

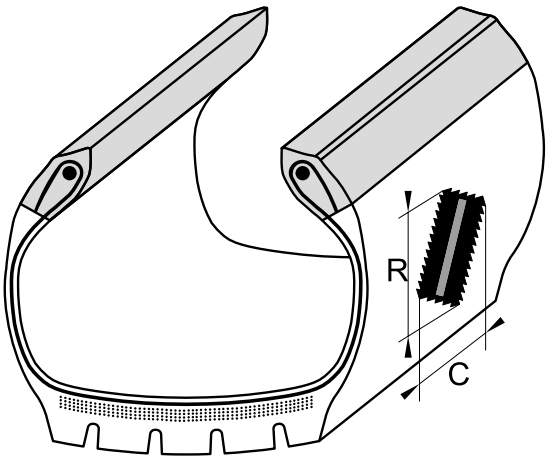






When the damage is in the tread, it must be repaired whenever it reaches the casing.

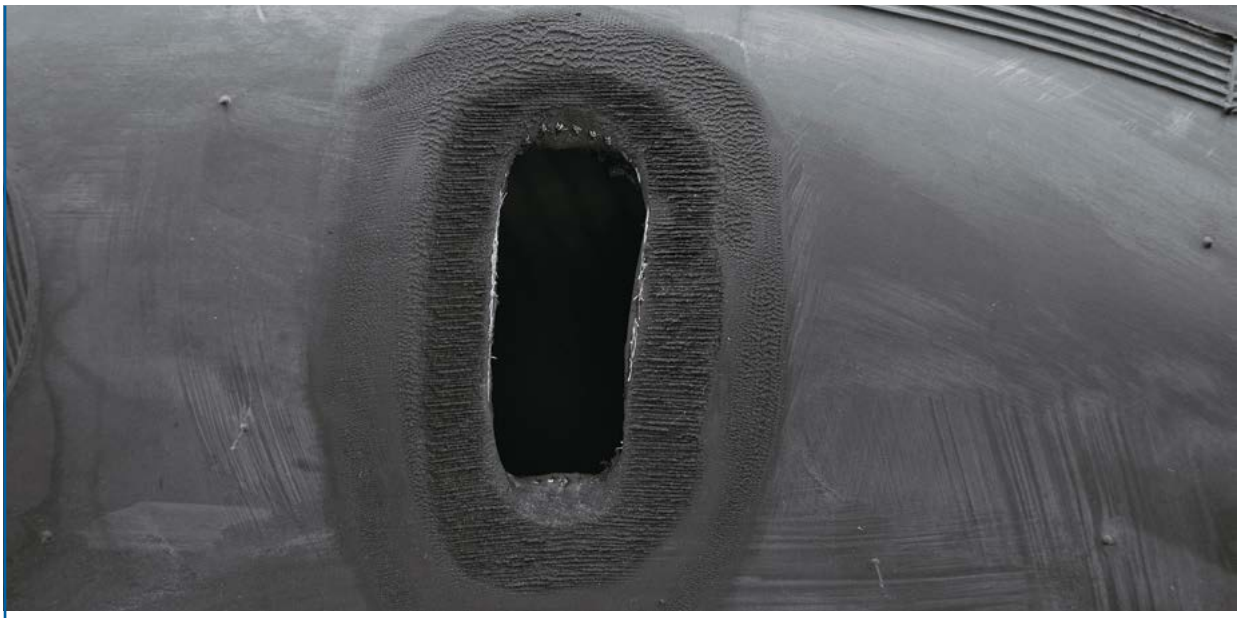


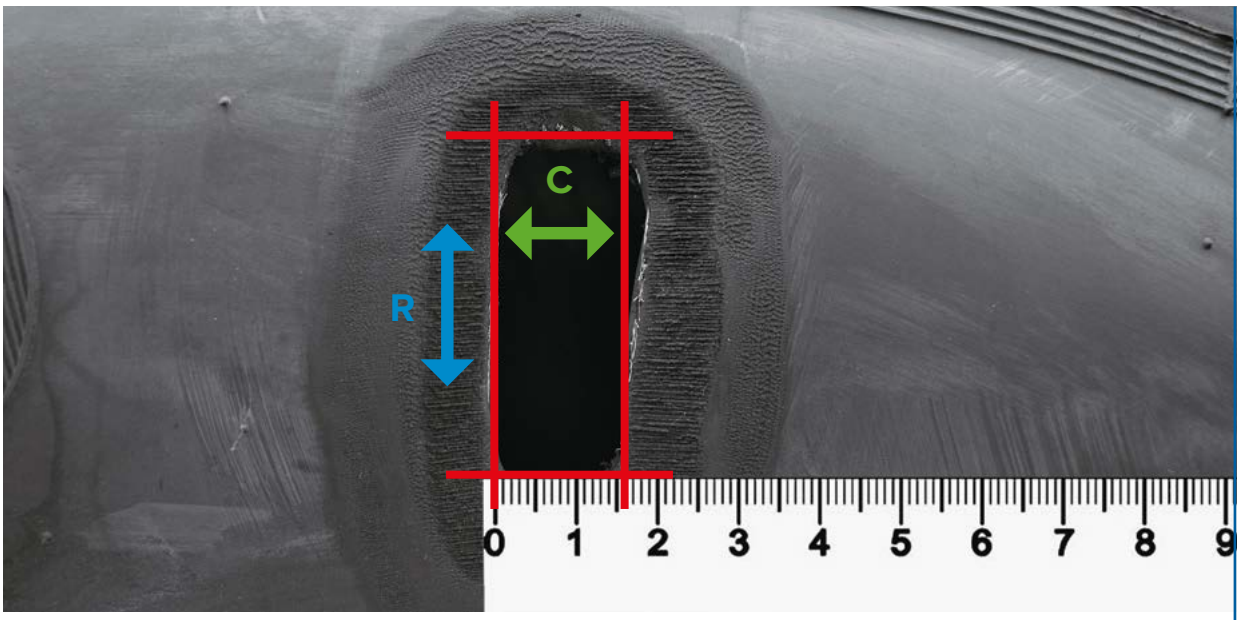


In order to perform the casing's repair, it is important to know how to measure the damage.

C = dimension in direction.

R = dimension in radial direction.





Example of lateral measuring.

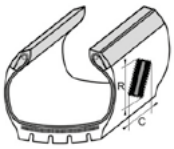
Choosing a patch in the lateral - nominal damages

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



C x R (mm)	RA
10 x 140	37
12 x 30	31
12 x 75	33
15 x 130	37
15 x 150	39
20 x 135	41
20 x 90	35
25 x 120	37
25 x 140	43
30 x 100	39
35 x 80	37
40 x 85	39
40 x 90	41
45 x 90	43

C x R (mm)	RAC
4 x 80	24
6 x 10	20
8 x 60	24
10 x 30	22
10 x 70	26
10 x 110	42
12 x 60	26
20 x 60	40
20 x 135	44
25 x 80	42
25 x 140	46
40 x 80	44
45 x 90	46

1

Tyre measure:
295/80 R 22,5

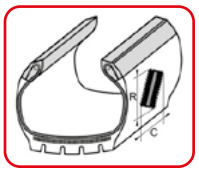
Check tyre measures.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



C x R (mm)	RA
10 x 140	37
12 x 30	31
12 x 75	33
15 x 130	37
15 x 150	39
20 x 135	41
20 x 90	35
25 x 120	37
25 x 140	43
30 x 100	39
35 x 80	37
40 x 85	39
40 x 90	41
45 x 90	43

C x R (mm)	RAC
4 x 80	24
6 x 10	20
8 x 60	24
10 x 30	22
10 x 70	26
10 x 110	42
12 x 60	26
20 x 60	40
20 x 135	44
25 x 80	42
25 x 140	46
40 x 80	44
45 x 90	46

2

Damage position:
Lateral

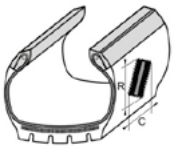
Identify the damage position on the tyre.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



C x R (mm)	RA
10 x 140	37
12 x 30	31
12 x 75	33
15 x 130	37
15 x 150	39
20 x 135	41
20 x 90	35
25 x 120	37
25 x 140	43
30 x 100	39
35 x 80	37
40 x 85	39
40 x 90	41
45 x 90	43

C x R (mm)	RAC
4 x 80	24
6 x 10	20
8 x 60	24
10 x 30	22
10 x 70	26
10 x 110	42
12 x 60	26
20 x 60	40
20 x 135	44
25 x 80	42
25 x 140	46
40 x 80	44
45 x 90	46

3

Damage size:

C = 10 mm

R = 70 mm

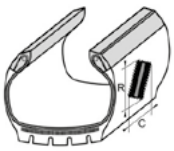
Measure the damage dimension Circumferential x Radial (C x R).

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



C x R (mm)	RA
10 x 140	37
12 x 30	31
12 x 75	33
15 x 130	37
15 x 150	39
20 x 135	41
20 x 90	35
25 x 120	37
25 x 140	43
30 x 100	39
35 x 80	37
40 x 85	39
40 x 90	41
45 x 90	43

C x R (mm)	RAC
4 x 80	24
6 x 10	20
8 x 60	24
10 x 30	22
10 x 70	26
10 x 110	42
12 x 60	26
20 x 60	40
20 x 135	44
25 x 80	42
25 x 140	46
40 x 80	44
45 x 90	46

4

Then, identify the patches' options indicated for the damage.

Indicated patches:
RAC 26 and RA33

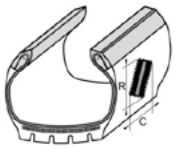
Choosing a lateral patch - Non-nominal damages

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



C x R (mm)	RA
10 x 140	37
12 x 30	31
12 x 75	33
15 x 130	37
15 x 150	39
20 x 135	41
20 x 90	35
25 x 120	37
25 x 140	43
30 x 100	39
35 x 80	37
40 x 85	39
40 x 90	41
45 x 90	43

C x R (mm)	RAC
4 x 80	24
6 x 10	20
8 x 60	24
10 x 30	22
10 x 70	26
10 x 110	42
12 x 60	26
20 x 60	40
20 x 135	44
25 x 80	42
25 x 140	46
40 x 80	44
45 x 90	46

1

Tyre measure:
275/80 R 22,5

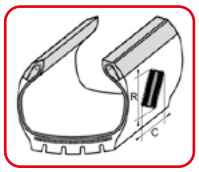
Check tyre measures.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



C x R (mm)	RA
10 x 140	37
12 x 30	31
12 x 75	33
15 x 130	37
15 x 150	39
20 x 135	41
20 x 90	35
25 x 120	37
25 x 140	43
30 x 100	39
35 x 80	37
40 x 85	39
40 x 90	41
45 x 90	43

C x R (mm)	RAC
4 x 80	24
6 x 10	20
8 x 60	24
10 x 30	22
10 x 70	26
10 x 110	42
12 x 60	26
20 x 60	40
20 x 135	44
25 x 80	42
25 x 140	46
40 x 80	44
45 x 90	46

2

Damage position:
Lateral

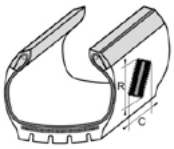
Identify the damage position on the tyre.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



C x R (mm)	RA
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12 x 30	31
12 x 75	33
15 x 130	37
15 x 150	39
20 x 135	41
20 x 90	35
25 x 120	37
25 x 140	43
30 x 100	39
35 x 80	37
40 x 85	39
40 x 90	41
45 x 90	43

C x R (mm)	RAC
4 x 80	24
6 x 10	20
8 x 60	24
10 x 30	22
10 x 70	26
10 x 110	42
12 x 60	26
20 x 60	40
20 x 135	44
25 x 80	42
25 x 140	46
40 x 80	44
45 x 90	46

3

Damage size:

C = 11 mm

R = 40 mm

Measure the damage dimension.

Circumferential x Radial (C x R).

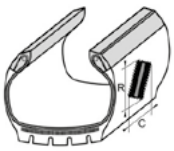
Localized in the table C ≥ 11 and R ≥ 40.

RAC AND RA - COMMERCIAL VEHICLES
LI min. 122 - LI max. 158

Radial Tyres

Dimensions

8.25 - 14.75	9R - 13R	205 - 285	295 - 385



C x R (mm)	RA
10 x 140	37
12 x 30	31
12 x 75	33
15 x 130	37
15 x 150	39
20 x 135	41
20 x 90	35
25 x 120	37
25 x 140	43
30 x 100	39
35 x 80	37
40 x 85	39
40 x 90	41
45 x 90	43

C x R (mm)	RAC
4 x 80	24
6 x 10	20
8 x 60	24
10 x 30	22
10 x 70	26
10 x 110	42
12 x 60	26
20 x 60	40
20 x 135	44
25 x 80	42
25 x 140	46
40 x 80	44
45 x 90	46

4

Then, identify the patches' options indicated for the damage.

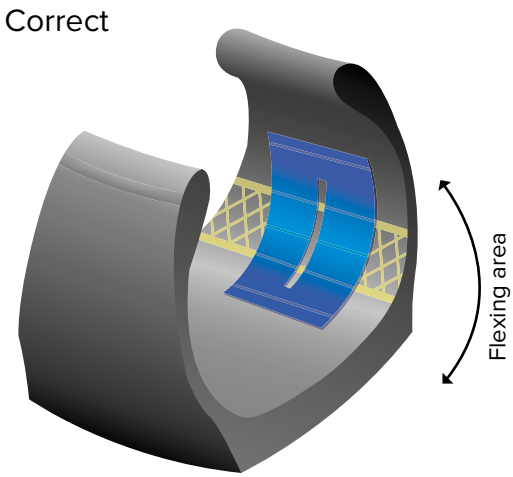
Indicated patches: RAC 26 and RA33.

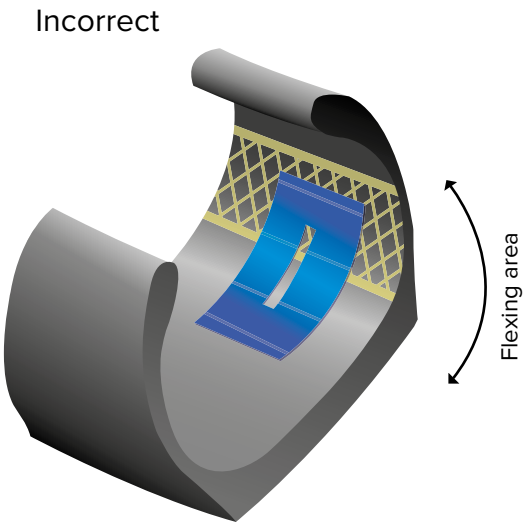
Procedure for applying the patch

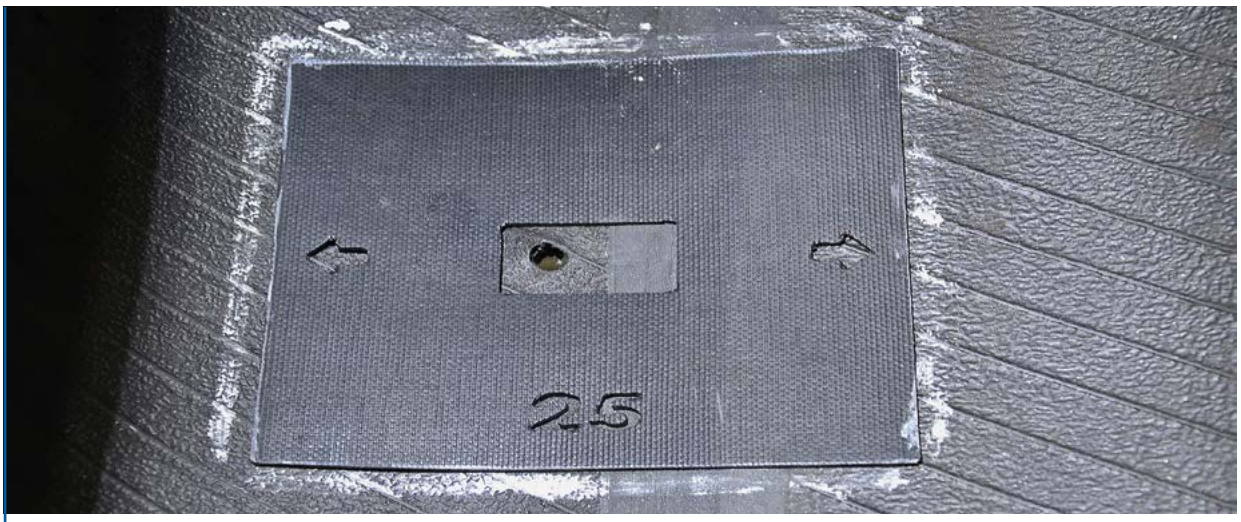
Identify the areas where repairs will be applied on the sides of the tyres.

When applying radial patches, cracks and tears may occur when their ends are positioned in the tyre bending zone.

Therefore, the gauge for defining the area to be repaired on radial commercial tyres has a window where it can be moved so that the reinforcement area of the patch is not in the bending zone.

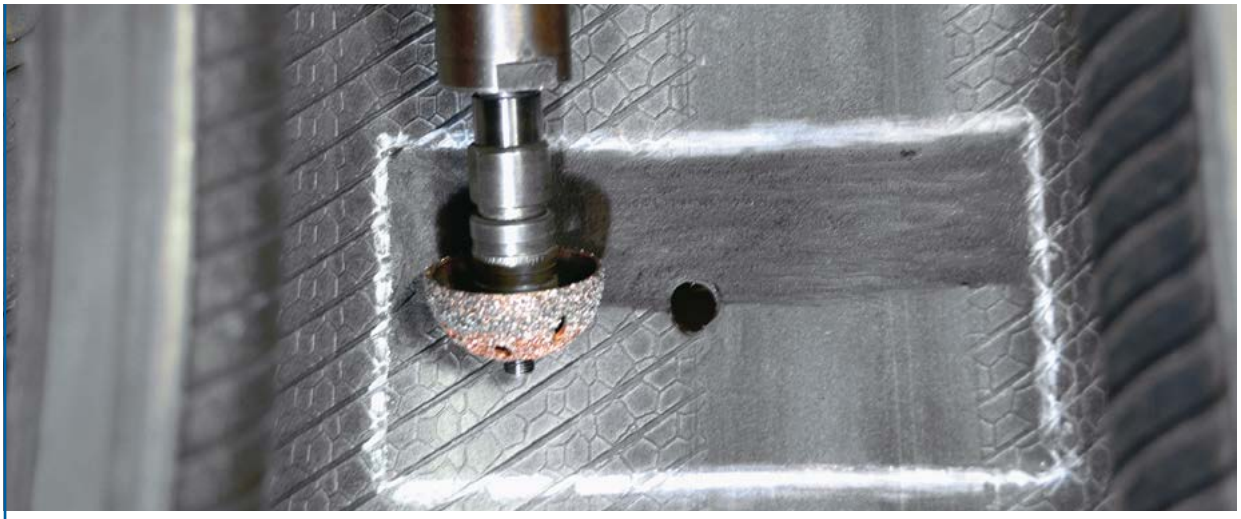






Maintain the tyre in normal position, without opening the beads.
Position the template in the center of the damage and outline it with chalk.

Clean the area by using either Bufpal or Solvullk surface activators and, if necessary, outline the area again.



Open the tyre beads and buff the marked area, with low speed turbine between 2.500 rpm and 3.500 rpm getting a buffing texture pattern 1 or 2, using a sandpaper tungsten cup No. 36.

Aspirate the buffed area, eliminating residues.

Apply either the Bufpal or Solvulk surface activator to increase the patch's anchorage and adhesion.

With circular motions, apply the vulcanizing cement for cold repairs or Vulk glue for hot repairs and wait until it is completely dry.

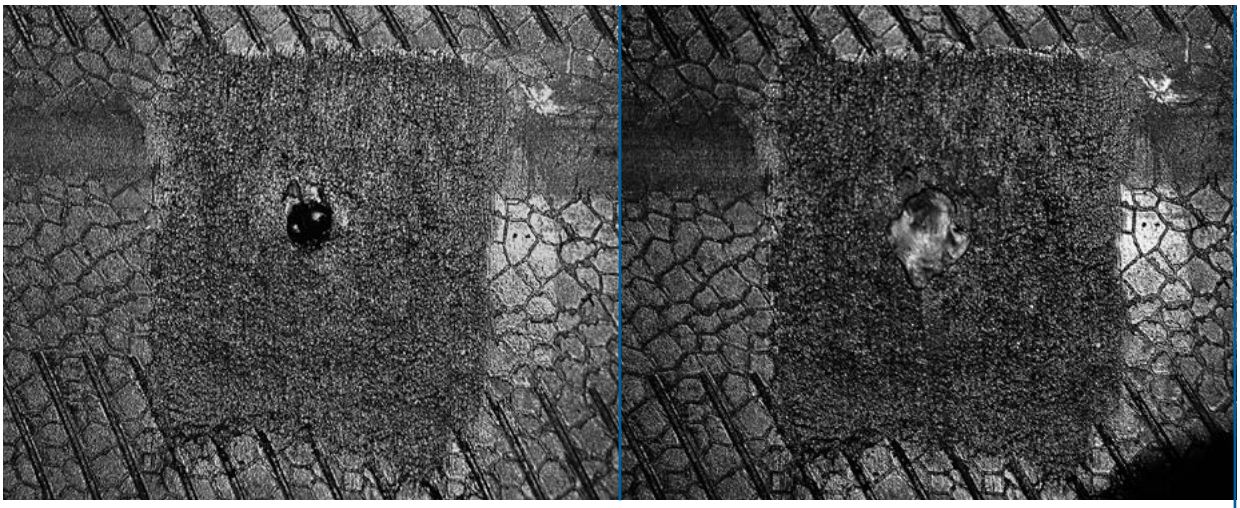
Observation:

Follow the instructions of drying displayed in the product's packaging.

With your hands, bend the patch so that the dotted outline of the plastic film is broken and partially remove the other parts.

Patches showing white plastic are cold, that is, vulcanization takes place through a chemical reaction.

Patches showing blue plastic are hot, need to be exposed to hot temperature to be vulcanized.

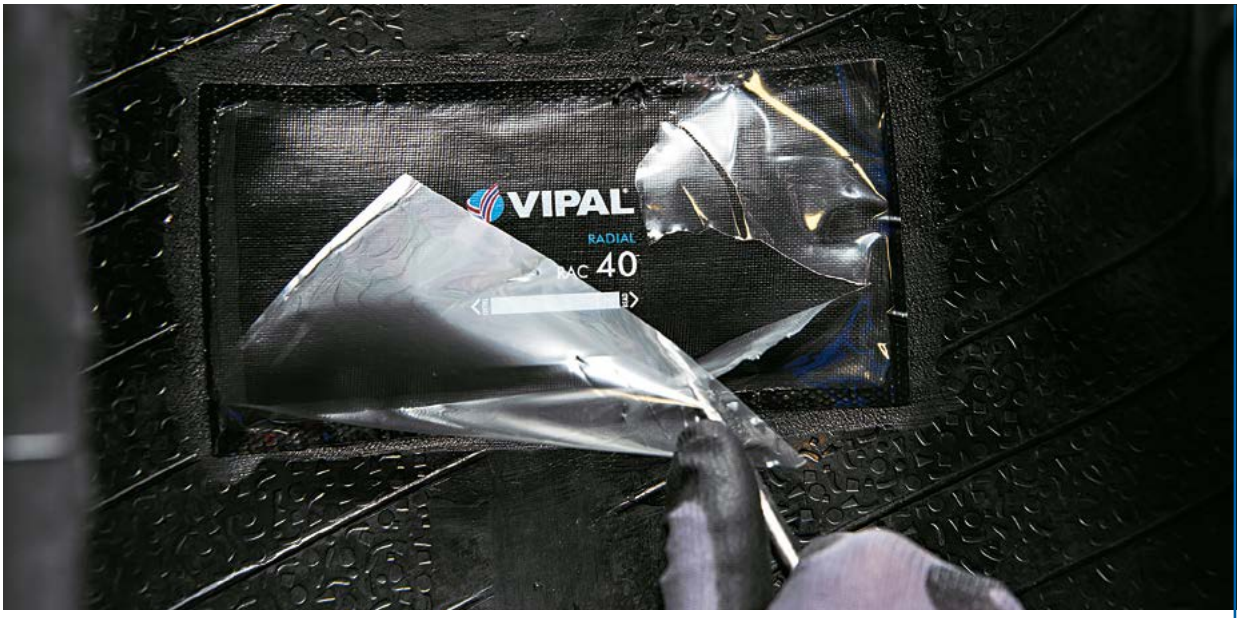


Observation:

For hollow damages, before applying the patch, the damage should be filled in using the pinhole extruder, from the outside in, making sure the filled area is level with the prepared area.

Apply the patch, bent and centralized to the damage, observing the direction of the arrows pointing to the tyre's beads. Then, remove the remaining film.

Strongly stitch the patch, from the center to the laterals, eliminating possible air bubbles.



If the patch is applied via hot cure, remove the plastic film.

Apply the sealant over the patch's borders and on the unprotected buffed area.

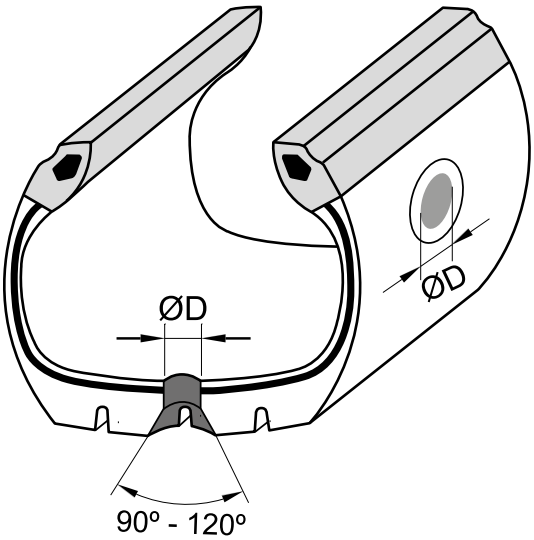
Finally, let the sealer dry for at least 10 minutes before mounting or inflating the tyre.

Even with the patch being applied with vulcanizing cement, using the cold cure, it can be vulcanized in an autoclave.

Choosing bias ply patches

It is necessary to have the measurement of the largest extent of the damage in order to make the correct choice, measuring the tyre externally.

The tyre must be repaired whenever the damage exceeds 30mm and reaches 3 or more plies of the casing.



Identifying plies' capacity

For choosing the patch, it is necessary to know the capacity of the tyre's plies, which is identified on the lateral.

Type of damage dimension

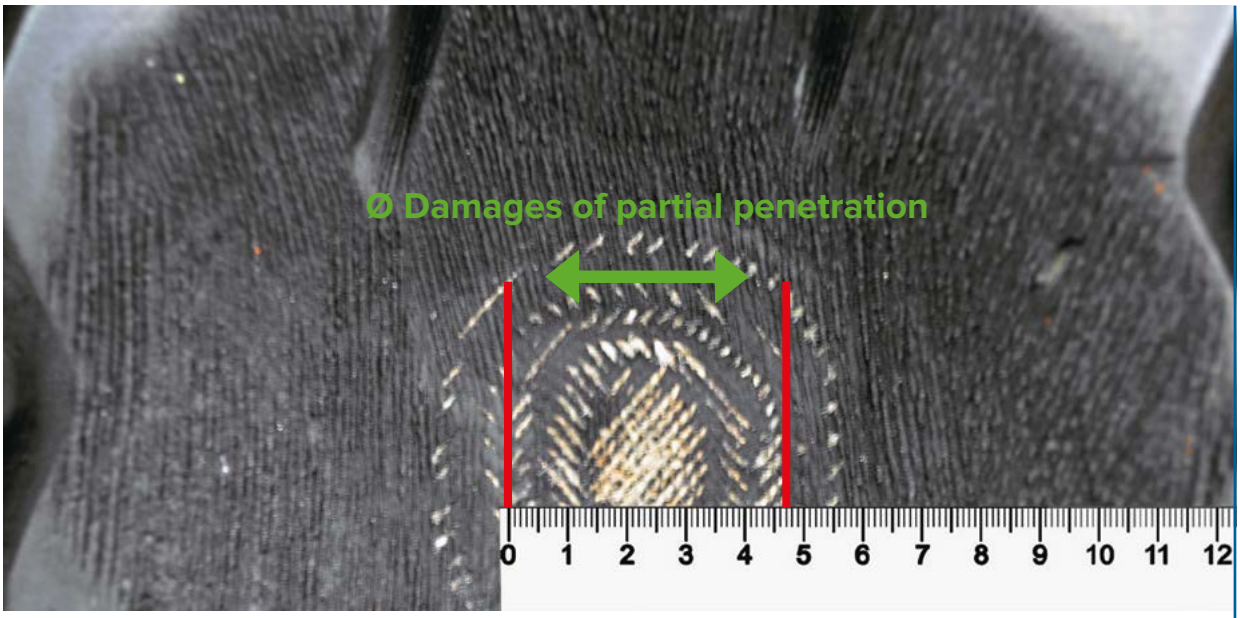
The patch's size varies according to the load capacity (plies) and if the damage is through-the-tyre penetration or partial penetration.

The damage should be considered a through-the-tyre penetration when the structure has **more than 75%** of its main plies compromised or completely perforated.

The damages that affect less than 25% of the plies **do not need patch application**.

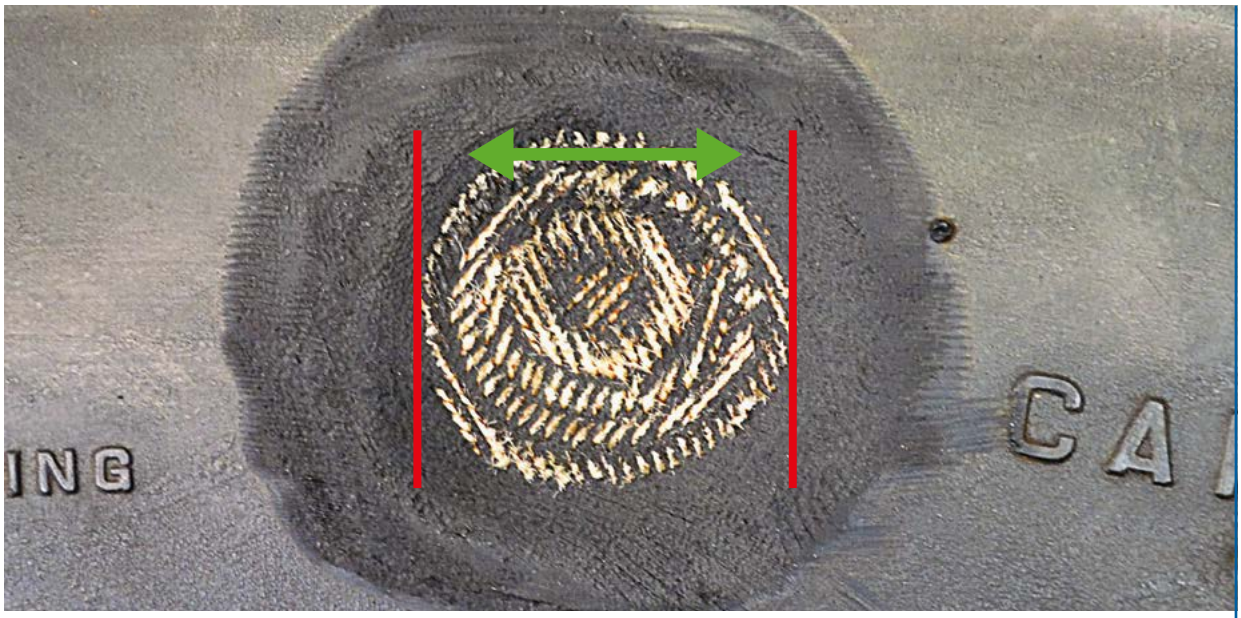
Type and dimension of damage

For damages of partial penetration, where the structure has from 25% to 75% of its main plies damaged, the patch application is recommended for reinforcement.



How to measure the damage

For damages in the tread, do not considered the two external plies, which must be ignored for measuring and choosing the patch.

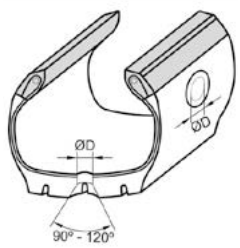


When there are damages to the sidewall, all plies must be considered for measuring and choosing the patch (measure on the first external ply).

Choosing patches - Through-the-tyre penetration

VD AND VDL
Commercial Vehicles and Passenger Cars

Bias Ply Tyres



Ply Capacity	THROUGH THE TYRE PENETRATION D (max.)						
	5mm	10mm	15mm	25mm	30mm	35mm	50mm
_4	1	2	3	3	4	4	5
6_8	1	2	3	4	4	4	5
10_12	2	3	4	5	5	5	6
14_16	3	3	4	6	6	6	7
18_20	4	4	5	6	7	7	8
22_24	4	4	5	6	7	7	8

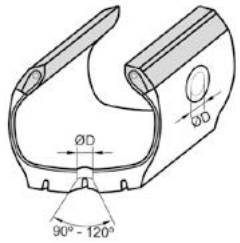
1

11.00-22
Capacity
16 plies.

Check the capacity of the tyre's plies.

VD AND VDL
Commercial Vehicles and Passenger Cars

Bias Ply Tyres



Ply Capacity	THROUGH THE TYRE PENETRATION D (max.)						
	5mm	10mm	15mm	25mm	30mm	35mm	50mm
_4	1	2	3	3	4	4	5
6_8	1	2	3	4	4	4	5
10_12	2	3	4	5	5	5	6
14_16	3	3	4	6	6	6	7
18_20	4	4	5	6	7	7	8
22_24	4	4	5	6	7	7	8

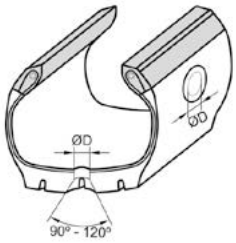
2

Through-the-tyre penetration

Check if the damage is a through-the-tyre penetration or partial penetration.

VD AND VDL
Commercial Vehicles and Passenger Cars

Bias Ply Tyres



Ply Capacity	THROUGH THE TYRE PENETRATION						
	D (max.)						
	5mm	10mm	15mm	25mm	30mm	35mm	50mm
_4	1	2	3	3	4	4	5
6_8	1	2	3	4	4	4	5
10_12	2	3	4	5	5	5	6
14_16	3	3	4	6	6	6	7
18_20	4	4	5	6	7	7	8
22_24	4	4	5	6	7	7	8

3

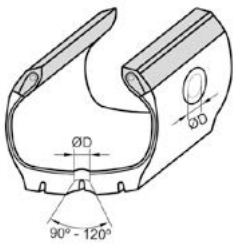
Dimension of damage

35 mm

Identify the value in the table.

VD AND VDL
Commercial Vehicles and Passenger Cars

Bias Ply Tyres



Ply Capacity	THROUGH THE TYRE PENETRATION						
	D (max.)						
	5mm	10mm	15mm	25mm	30mm	35mm	50mm
_4	1	2	3	3	4	4	5
6_8	1	2	3	4	4	4	5
10_12	2	3	4	5	5	5	6
14_16	3	3	4	6	6	6	7
18_20	4	4	5	6	7	7	8
22_24	4	4	5	6	7	7	8

4

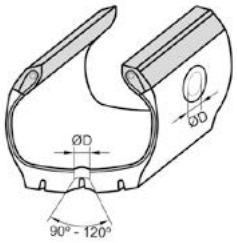
Then, identify the patch option indicated for the damage.

Indicated patch:
VD 6

Choosing patches for partial penetration

VD AND VDL
Commercial Vehicles and Passenger Cars

Bias Ply Tyres



Ply Capacity	DAMAGES THAT DO NOT GO THROUGH THE TYRE						
	D (max.)						
	5mm	10mm	15mm	25mm	30mm	35mm	50mm
10_12	1	2	2	3	3	3	4
14_16	2	2	3	3	4	4	4
18_20	3	3	4	4	5	5	5
22_24	3	4	4	5	5	5	6

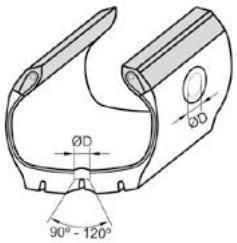
1

1000-20
Capacity 14
plies

Check capacity
of the tyres
plies.

VD AND VDL
Commercial Vehicles and Passenger Cars

Bias Ply Tyres

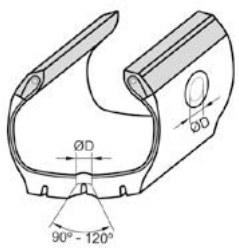


Ply Capacity	DAMAGES THAT DO NOT GO THROUGH THE TYRE						
	D (max.)						
	5mm	10mm	15mm	25mm	30mm	35mm	50mm
10_12	1	2	2	3	3	3	4
14_16	2	2	3	3	4	4	4
18_20	3	3	4	4	5	5	5
22_24	3	4	4	5	5	5	6

2

Partial penetration

Check if the damage
is a through-the-tyre
penetration or partial
penetration.

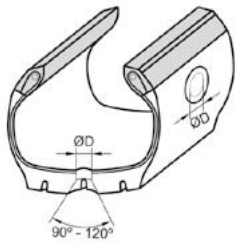
VD AND VDL Commercial Vehicles and Passenger Cars Bias Ply Tyres							
							
	DAMAGES THAT DO NOT GO THROUGH THE TYRE						
Ply Capacity	D (max.)						
	5mm	10mm	15mm	25mm	30mm	35mm	50mm
10_12	1	2	2	3	3	3	4
14_16	2	2	3	3	4	4	4
18_20	3	3	4	4	5	5	5
22_24	3	4	4	5	5	5	6

3

Damage dimension

32 mm

Identify the value in the table.

VD AND VDL Commercial Vehicles and Passenger Cars Bias Ply Tyres							
							
	DAMAGES THAT DO NOT GO THROUGH THE TYRE						
Ply Capacity	D (max.)						
	5mm	10mm	15mm	25mm	30mm	35mm	50mm
10_12	1	2	2	3	3	3	4
14_16	~~2~~	~~2~~	~~3~~	~~3~~	~~4~~	4	4
18_20	3	3	4	4	5	5	5
22_24	3	4	4	5	5	5	6

4

Then, identify the patch option indicated for the damage.

Indicated patch:
VD 4

For applying the VD patch on bias ply tyres, the same orientation applies as to the application on radial tyres.

Observation:

In order to do a good repair, it is essential to follow closely the procedures and to respect the application tables to the letter.

EQUIPMENT:

- Low rotation electrical grinder (2.500 to 3.500 rpm).

TOOLS:

- Template;
- Chalk;
- Ruler;
- Pincers;
- Rollers;
- Tungsten gauge.

VIPAL®
TYRE REPAIRS

www.vipal.com

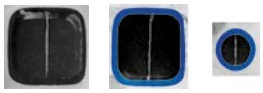
TYRE REPAIR APPLICATION CHART

Commercial Vehicles and Passenger Cars

RAC - Passenger Cars

Radial Tyres	Dimensions	Speed Index	C x R (mm)	ØO (mm)	ØB (mm)	RAC
	145	S - T	10 X 15	6	10	10
	155		15 X 30	-	12	12
	165		20 X 35	8	20	14
	175	U - H	6 X 6	3	6	10
	185		10 X 10	6	10	14
	195	≥V	3 X 3	3	6	10
	205		-	-	8	15

VF AND VFP - Commercial Vehicles and Passenger Cars



Radial and Bias Ply Tyres	Damages	VF/VFP	
	mm		
	3	-	3
	6	-	6
	8	-	8

• VF/VFP application on passenger vehicles: speed index T on damage up to 8mm, H-V up to 6mm and ≥ V up to 3mm.

VD AND VDL - Commercial Vehicles and Passenger Cars

Bias Ply Tyres

THROUGH THE TYRE PENETRATION

Ply Capacity	D (max.) 5mm	10mm	15mm	25mm	30mm	35mm	50mm	70mm	75mm	100mm	125mm
_4	1	2	3	3	4	4	5	-	-	-	-
6_8	1	2	3	4	4	4	5	-	-	-	-
10_12	2	3	4	5	5	5	6	7	7	8	-
14_16	3	3	4	6	6	6	7	7	7	8	10
18_20	4	4	5	6	7	7	8	9	9	9	10
22_24	4	4	5	6	7	7	8	9	9	10	10
DAMAGES THAT DO NOT GO THROUGH THE TYRE*											
10_12	1	2	2	3	3	3	4	4	4	5	-
14_16	2	2	3	3	4	4	4	5	5	5	6
18_20	3	3	4	4	5	5	5	5	6	6	7
22_24	3	4	4	5	5	5	6	6	6	7	8

*Damages that do not go through the tyre in bias ply tyres of trucks and buses require the application of repair when the damage exceeds 30mm, reaching 3 or more casing plies.

ØO - Diameter of damage measured on the 2nd external tyre ply.

RAC AND RA - Commercial Vehicles

RAC AND RA - COMMERCIAL VEHICLES Ll max. 121

Radial Tyres

Dimensions: 6.00 - 7.50 | 7R - 8.5R | 165 - 265

C x R (mm)	RA
10 x 75	33
15 x 30	31
20 x 60	33
20 x 90	35
30 x 60	35

C x R (mm)	RAC
8 x 8	14
10 x 80	40
15 x 30	20
15 x 60	22
20 x 50	22
25 x 60	40

ØO (mm)	RA
10	31
12	33
15	35

ØO (mm)	RAC
5	14
8	20
10	22
15	40

ØB (mm)	RA
10	29
12	31
15	25B
20	33
25	35

ØB (mm)	RAC
6	12
12	15
14	14
15	20
25	40

C x R (mm)	RA
10 x 10	29
12 x 12	31
15 x 15	25B
20 x 30	33
25 x 40	35

C x R (mm)	RAC
6 x 6	12
12 x 15	15
12 x 20	14
15 x 20	20
15 x 25	22
25 x 40	40

RAC AND RA - COMMERCIAL VEHICLES Ll min. 122 - Ll max. 158

Radial Tyres

Dimensions: 8.25 - 14.75 | 9R - 13R | 205 - 285 | 295 - 385

C x R (mm)	RA
10 x 140	37
12 x 30	31
12 x 75	33
15 x 130	37
15 x 150	39
20 x 135	41
20 x 90	35
25 x 120	37
25 x 140	43
30 x 100	39
35 x 80	37
40 x 85	39
40 x 90	41
45 x 90	43

C x R (mm)	RAC
4 x 80	24
6 x 10	20
8 x 60	24
10 x 30	22
10 x 70	26
10 x 110	42
12 x 60	26
20 x 60	40
20 x 135	44
25 x 80	42
25 x 140	46
40 x 80	44
45 x 90	46

ØO (mm)	RA
10	31
15	33
20	35
25	37
30	39
35	41
40	43

ØO (mm)	RAC
8	24
10	26
15	40
20	42
25	44
40	46

ØB (mm)	RA
10	29
15	31
18	25B
20	33
25	35B
30	35
34	37
38	39
42	41
42	45B
46	43

ØB (mm)	RAC
4	10
6	12
8	14
10	15
12	20
15	22
20	25
20	40
30	42
40	35
40	44
45	45
45	46

C x R (mm)	RA
10 x 10	29
15 x 15	31
18 x 25	25B
20 x 30	33
25 x 35	35B
30 x 50	35
35 x 70	37
40 x 60	45B
40 x 85	39
40 x 90	41
45 x 90	43

C x R (mm)	RAC
10 x 12	15
10 x 25	22
12 x 20	20
20 x 35	25
20 x 40	40
30 x 50	42
40 x 60	35
40 x 65	45
40 x 70	44
40 x 80	46

RAC AND RA - COMMERCIAL VEHICLES Ll min. 159 - Ll max. 178

Radial Tyres

Dimensions: 14.00 - 16.00 | 15R - 24R | 375 - 495

C x R (mm)	RA
10 x 20	31
10 x 50	33
10 x 90	35
10 x 160	39
12 x 110	37
15 x 120	39
15 x 170	43
20 x 60	35
20 x 130	41
25 x 70	37
30 x 80	39
40 x 80	41
45 x 100	43

C x R (mm)	RAC
10 x 100	42
12 x 30	40
20 x 60	42
20 x 130	44
30 x 60	44
30 x 140	46
45 x 100	46

ØO (mm)	RA
8	31
10	33
15	35
20	37
25	39
30	43

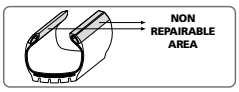
ØO (mm)	RAC
10	40
20	42
25	44
30	46

ØB (mm)	RA
12	31
15	33
18	25B
20	35
25	35B
30	39
35	41
40	45B

ØB (mm)	RAC
10	20
15	25
15	40
20	42
30	44
35	35
38	45
40	46

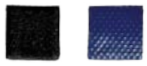
C x R (mm)	RA
12 x 12	31
15 x 25	33
18 x 18	25B
20 x 30	35
25 x 25	35B
25 x 40	37
30 x 50	39
35 x 60	41
40 x 40	45B
40 x 70	43

C x R (mm)	RAC
10 x 15	20
15 x 25	25
15 x 30	40
20 x 30	42
30 x 55	44
35 x 50	35
40 x 70	46



For the same size of damage, there can be indications of different sizes of RAC patches. The RAC paches that have ending "S" are destined for damages centralized in the tread. The others are for damages where the patch's edge is close to the shoulders. In the RA line, the patches that have ending "B" are indicated for damages in the center of the tread.

REMOPAT - Passenger Cars



Radial and Bias Ply Tyres	ø DAMAGES [mm]		
	3	-	Remopat 36mm

Remopat is designed for repairing damages in the tread area, of a 3mm maximum, in radial and bias ply passenger car tyres retreaded via the bead to bead process.

DECLARATION FOR REPAIR APPLICATION

In order to guide the application of tyre repairs, Vipal Rubber certifies that all materials for tyre repairing provided by the company follow the characteristics required by the Mercosul NM225/2000 norm, which regulates the tyre retreading process and are effective via INMETRO, the European Union regulations ECE-R 108 (passenger car tyres) and ECE-R 109 (commercial vehicle tyres). This declaration is valid as long as all technical orientations are followed according to Vipal's Repair Handbooks and/or use instructions accompanying products. The permitted repair area must be respected, as well as the maximum damage limit, and the maximum amount of repairs per tyre. Repairs should never be overlapped. When these conditions are respected, Vipal's Radial and Bias Ply repairs support up to twice as much pressure than that established by the tyre manufacturer. See the chart with the specifications of patch amounts per tyre.

Norm Mercosul NM - 225 - OCT/2000

	Types of tyre categories	Maximum amount of repairs allowed per tyre
BIAS PLY	Automobiles and light-weight trailers.	2
	Mixed use pick-up trucks and trailers	4
	Trucks, buses, microbuses, and trailers/semitrailers < 9.00-20.	6
	≥ 9.00-20.	6
RADIAL	Automobiles and lightweight trailers. Speed index S and T.	2
	Speed index H and above.	1
	Pick-up trucks or their derivatives and trailers.	6
	Trucks and buses and their derivatives and trailers with sectional height below or equal to 230 mm.	6
	Trucks and buses and their derivatives and trailers with sectional height above 230 mm.	6

ATTENTION!

These application charts are valid globally for Vipal repairs. The magnitude of the damages in the charts is the result of on-field experiences. The applicator must always analyze whether the tyre's physical conditions allow safe repairing. Inspecting the casing is essential for checking for other non-apparent damages. Maximum limits of damages must be respected. Repairs with dimensions over the ones estimated in this chart, which may be allowed by law in some countries, are not taken into consideration here. The responsability over the repair's quality falls into the hands of the applicator, who judges and increases or reduces the values if necessary, always respecting local legislation. The correct methods of application and mounting must always be considered, as well as the tyre's manufacturer instructions of repair.

NOMENCLATURE

C - Circumference - Damage size measured in the direction of tyre rotation.
R - Radial - Damage size measured from bead to bead (Radial).
ØB - Tread - Diameter of through the tyre penetration in the tread.
ØO - Shoulder - Diameter of through the tyre penetration in tyre's shoulder.
Through the tyre penetrations in the tread area of radial tyres in trucks and buses that reach the working belt closer to the casing ply, with measure over 8mm, always require a repair.

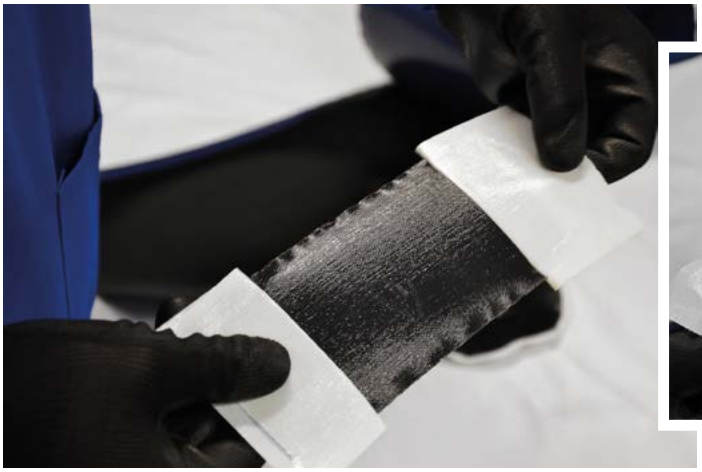
44-VREP-T-In-D-7/20

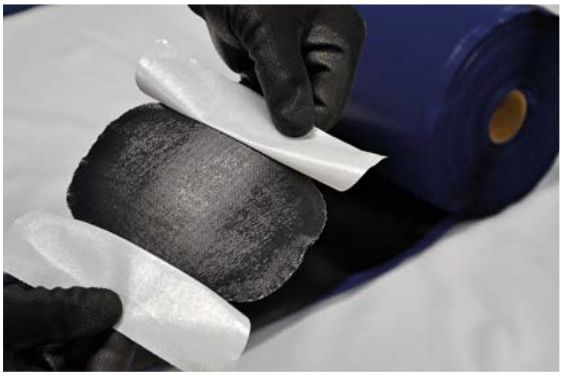
Cold patches can be transformed in hot patches.

The benefit of this process is in terms of the product's shelf life, as hot patches have a shorter shelf life. In addition it reduces the volume of stocks.

Remove the film from the patch avoiding contact of the base with your hands.

If, after removing the film, contamination of the base of the repair occurs, apply a thin layer of vulk glue and wait for it to dry.





Coat the base of the patch with the MB/AC cushion gum.

Roll from center to edges to prevent air occlusion.

Cut the MB/AC cushion gum approximately 5mm larger than the contour of the patch.

Take care not to contaminate the link.

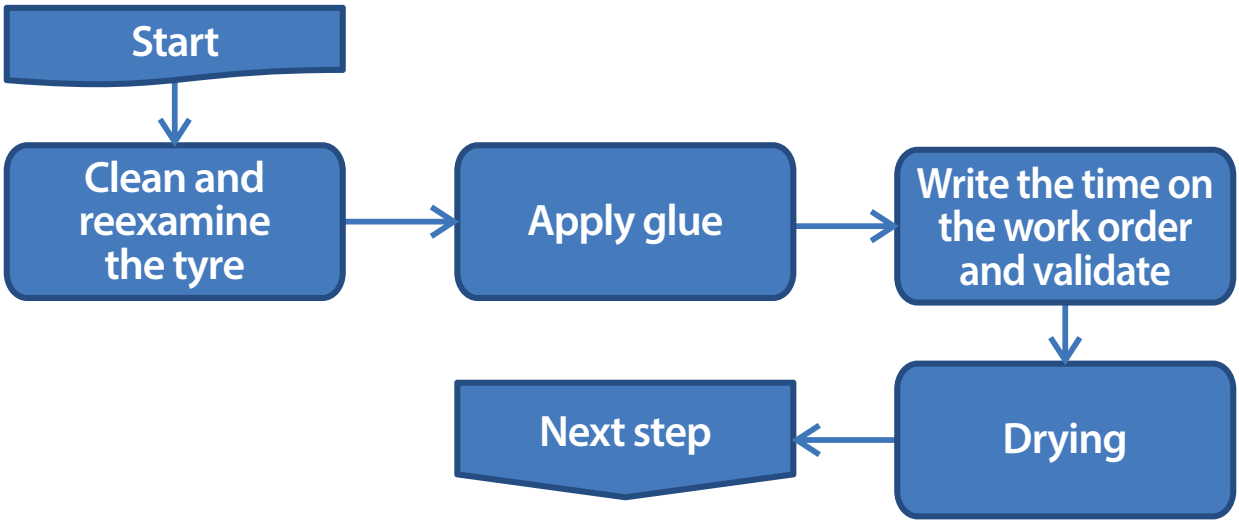
After coating, the patch must be used immediately.
It is not advisable to keep the processed product in stock.
Then cure it in an autoclave or sectional machine.

In the portfolio we have the line of RA OTR SL patches (without connection) that can also be go through this process. Remove the fabric from the base of the patch avoiding contact of the base with your hands. Apply a layer of vulk glue, wait for the drying time and follow the same process as for cold stains.

From the beginning of the process until now, if there is a need to leave the tyre on the monorail for period, it is possible without harming the process. There is a caveat in the tyres with countersinks, these should be glued on the countersinks and covered with plastic to protect the area from contamination.

APPLYING THE GLUE

APPLYING THE GLUE FLOWCHART



GOAL:

To reexamine the previous steps. To ensure the necessary adhesion among tyre, cushion, and tread so to allow their fixation until the set is vulcanized. To protect the buffed area from oxidation and tyre separation.

SECTOR:

Environment with exhaust and good ventilation without contamination by dust and presence of humidity.

PROCEDURE:

Evaluate if the previous steps were correctly done and aspirate the tyre internally.

Clean the tyre with a soft-bristled brush (nylon).

For better homogenization of the glue, it is necessary to shake before its application.

Then, with a spray, apply a thin and even layer of cement in all buffed area that will be covered.

After applying the cement, check for accumulations of product; if there are, distribute it over the area with a paintbrush.

Note:

When not in use, keep the gun's nozzle inside a recipient with solvent to avoid clogging, and keep the paintbrush inside the cement recipient so the bristles do not harden.

Note:

Check the complete drying of the glue before continuing the retreading process.

Drying time varies according to the temperature and relative air humidity.

Thus, each retreader must established standards according to local climate conditions.

To ensure that the cement is dry, test its tackiness with a piece of rubber Cushion MB/AC or a finishsing Rubber of about 4cm wide by 10cm of length, observing the following procedure:

- Stitch 50% of the length of the rubber sample over the buffed surface with cement;
- Remove the protective plastic. In a 90° angle, pull the the rubber, if it offers resistance and stretches, it is ready for next stages;
- If, when pulling, the rubber detaches itself easily, drying time must be longer.

Observation:

1 - After this stage, it is necessary to be careful so that the surface onto which cement was applied is not contaminated by the touch of hand or any object and neither rolls over the floor.

2 - After cementing, the tyre must receive the coverage in a maximum period of 2 hours. After this period, the cement must be reapplied.

3 - In regions where the temperature goes lower than 12°C and humidity above 90%, we recommend the controlled use of a tunnel for drying cement, observing the following parameters:

Tunnel temperature: 35°C (± 5°C)

Permanence time of the tyre in the tunnel: 20 minutes.

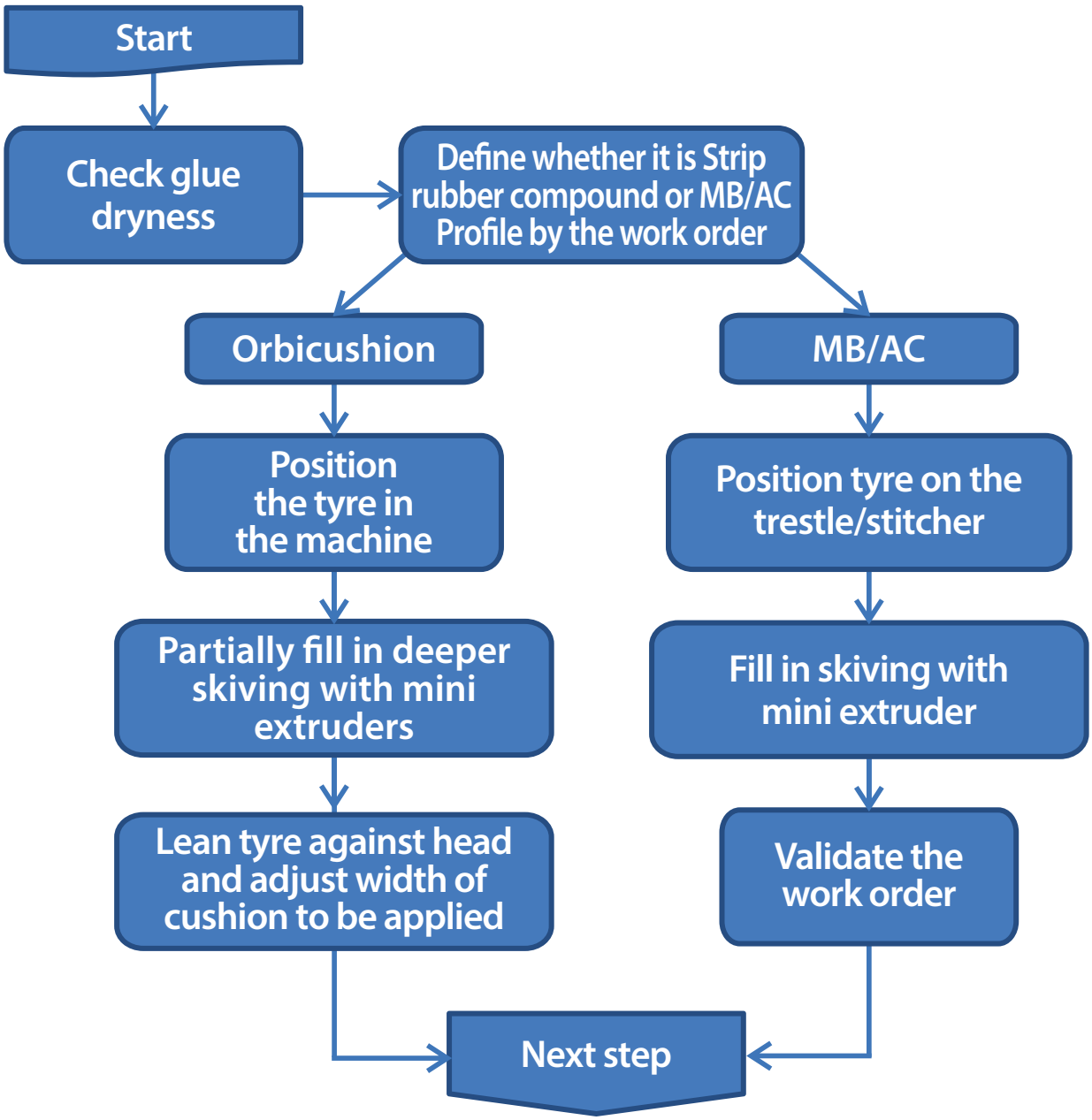
EQUIPMENT:

- Trestle with automatic swivel;
- Glue pulverizing pump;
- Cabin for glue application with exhaust system;
- Vacuum cleaner or exhaust system.

TOOLS:

- Paintbrush;
- Glue recipient;
- Solvent recipient;
- Soft-bristled brush.

FILLING FLOWCHART



GOAL:

To fill in skived damages.

SECTOR:

Well-lit and free of impurities.

PROCEDURE:

Process Cushion gum MB/AC:

Position the tyre on the trestle or on the stitcher's expansive rim inflating it to a pressure of 20 to 30 psi.

Fill in the skiving with mini extruder heated to 75°C (± 5°C), leaving an excess of maximum 1mm above the tyre's level.

Orbicushion Process:

Position the tyre on the expansive rim, inflating it to a pressure of 20 to 30 lbs/psi, keeping it centralized on all levels (vertical and horizontal). With the mini extruder heated to 75°C (+ 5°C), partially fill in the skiving deeper than 4mm with a dimensional above 50mm, with Vipal MB/AC Cushion gum.

With the tyre positioned on the expansive rim of the extruder, get the tyre close to the head, and adjust the wingforms to the tyre's width.

Observation:

The buffing must be performed taking into consideration the shape and size of the conformers, that is, the material should only be applied to the scraped area of the tyre.

Start the extrusion process according to the equipment's settings, respecting a minimum thickness of about 1mm of product.

Maintain the temperature of the product, in the extruder's output or Orbicushion applicator at 80°C (± 5°C).

Note 1:

In case of interruptions longer than 15 minutes, activate the equipment for 1 second per minute of time stopped, and avoid applying the pre-vulcanized product to the tyre.

Note 2:

After applying the Orbicushion, the tread must be applied in a maximum period of 20 minutes and sent to mounting and vulcanization; if this period is exceeded, reapply the glue over the Orbicushion and respect the drying time.

Observation 3:

Follow the manufacturer's instructions for stopping and cleaning the machine.

EQUIPAMENT:

- Extruder

COVERAGE WITH PRECURED TREAD OR CAMELBACK

GOAL:

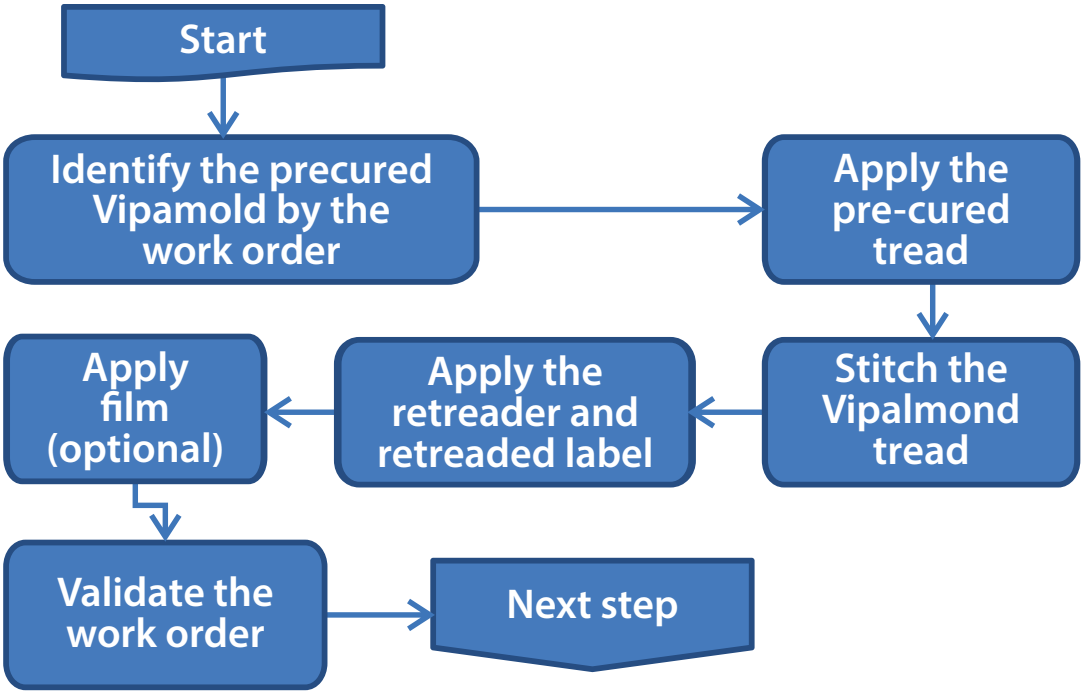
To replace a new tread in the tyre (pre-cured or camelback).

SECTOR:

Well-lit and free of impurities.

Coverage with tread

COVERAGE WITH PRECURED TREAD FLOWCHART



PROCEDURE:

Identify the pre-cured tread previously prepared according to the service order.

When there is an apparent buff, to improve the finish, apply, with the plastic, a strip of Finishing Rubber on the shoulders of the tyre.

Roll manually, then remove the plastic, avoiding contamination.

If applied without the protective plastic, make sure the product is moulded to the shoulder and do not stretch the material as it may reduce the thickness that will put the treads adhesion to the shoulder at risk.

Applying tread with MB/AC cushion gum.

Applying tread with cushion gum to the casing (orbicushion).

Remove a piece of the precured plastic, centralize it and fixate one of the ends to the tyre, preferably where there is no skiving. For correctly centralizing the coverage, use the laser centralizer.

Without removing the rest of the plastic, check if the length of the precured tread fits the tyre's perimeter. This operation serves to decide how the necessary stretching or shrinking will be when applying the tread.

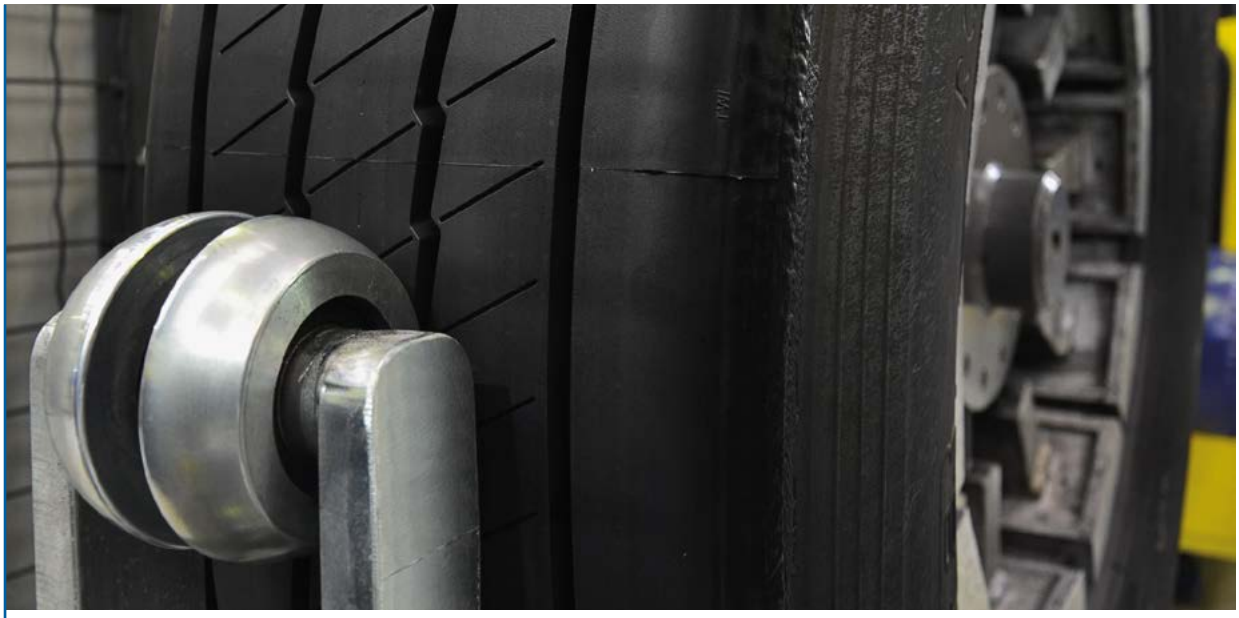
Junction of the precured with depth up to 18mm

To correctly and perfectly join the Vipalmond precured tread's seam, with the aid of metallic ruler, position the borders, preferably observing the sequence of the design.

Junction of the precured tread's seam with depth above 18 mm

Place the base of the edges and then press them against the housing, joining the splice and preferably, refer to the drawing sequence.

Fixate the tread's shoulders by pressing them against the casing, and then tap it with the rubber hammer, increasing the pressure of the seam.



Activate the stitcher's pneumatic rollers, so that they work from the center to the edges, ensuring perfect fixation of the tread to the casing.

Observation:
For treads with wings, reduce the speed and the pressure of the rollers to stitch the wings.

Apply the retreader label and the label with the word Retreaded or meeting the local legislation.

Observation:

If the retreader chooses Viplex demoulding, it is not necessary to use polyester or polypropylene film.

Apply the polyester or the polypropylene film that works as protection to the envelope.

Observation:

The pressure of the inflated tyre on the expansive rim must be of 20 to 30psi.

EQUIPAMENT:

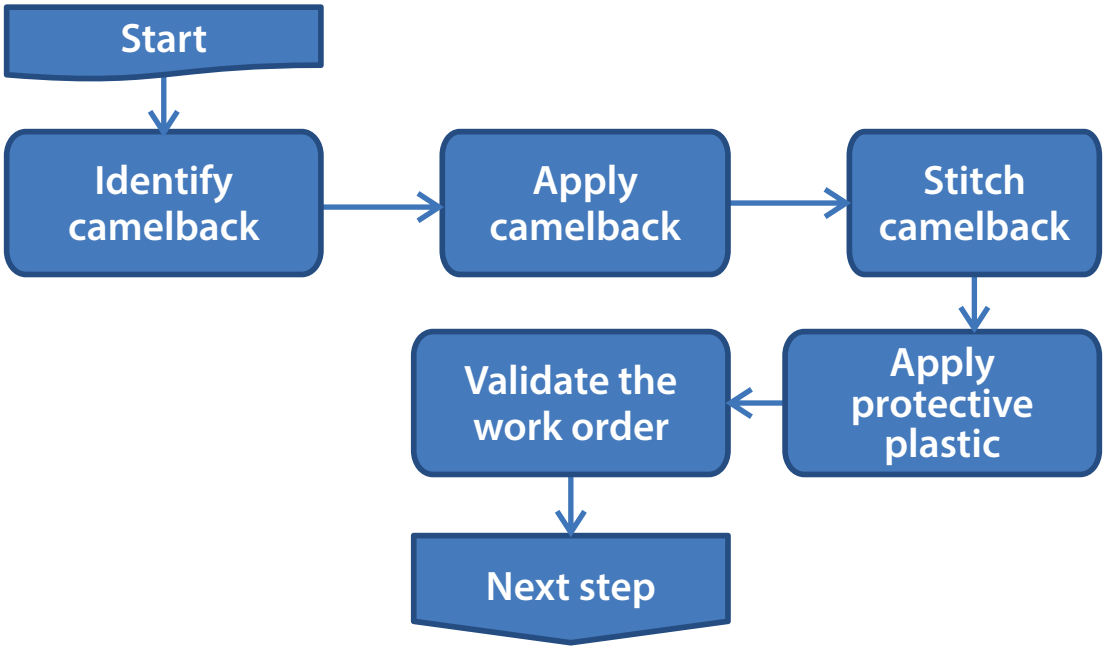
- Builder;
- Support to avoid putting the tread on the floor;
- Laser centralizer.

TOOLS:

- 1kg rubber hammer;
- Metallic ruler;
- Hot knife set.

Coverage with camelback

COVERAGE WITH CAMELBACK FLOWCHART



PROCEDURE:

Identify the previously determined camelback according to the service order or software.

Remove a piece of the camelback plastic, centralize it and fix on of the borders of the tyre, preferably where there are no skiving.

Carefully, apply the rest of the camelback, removing the plastic and maintaining it centralized.

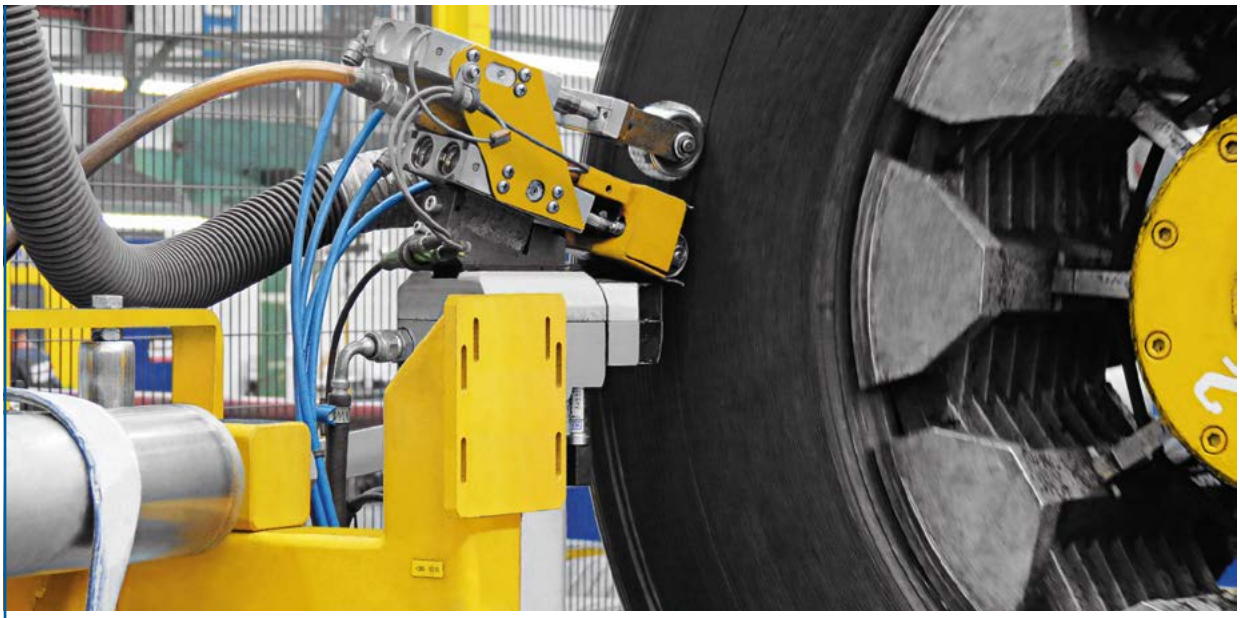
For the process of remold covering with orbitread, make sure that the equipment applies the amount of material corresponding to the tyre and mold size.

When you reach the other end of the camelback, with a hot knife, make a 90° cut and, with the help of metallic ruler, join the seam.

Tap it with a rubber hammer, ensuring more pressure on the seam.

Activate the stitcher's pneumatic rollers, so that they work from the center to the edges, ensuring perfect fixation of the camelback to the casing.

Apply again the protective camelback plastic.



For remoulded tyres, apply a layer of shoulder veneer remould or lateral orbitread to the sidewall, where the new tyre inscriptions will be placed.

EQUIPMENT:

- Builder;
- Laser centralizer.

TOOLS:

- 1kg rubber hammer;
- 5-meter measuring tape;
- Metallic ruler;
- Hot knife set.

CURING IN AUTOCLAVE AND PRESS SYSTEM

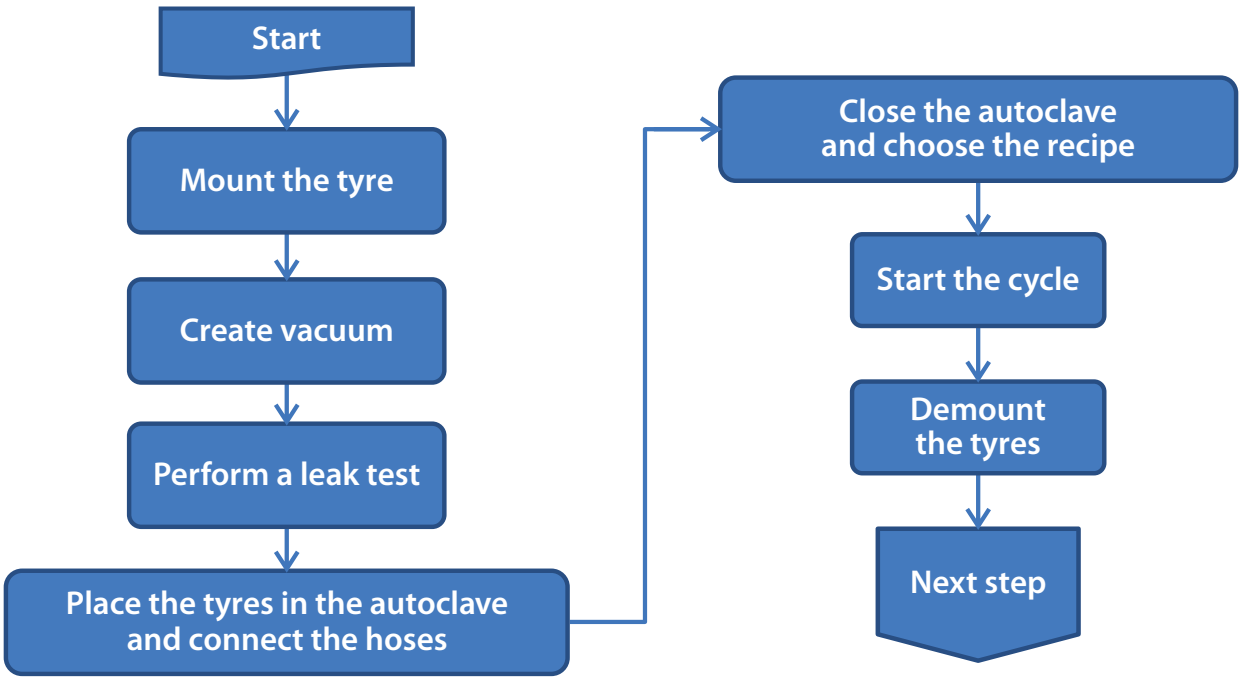
GOAL:

This step aims at changing the physical properties of rubber, from a plastic state to an elastic state through time, temperature, and pressure so to obtain adequate adhesion of the tread or camelback to the tyre.

SECTOR:

It´s expected to be located in a wide area, well lit to allow the distribution of equipment and accessories.

FLOWCHART VULCANIZATION AUTOCLAVE SYSTEM



DIMENSIONAL TABLE OF ENVELOPES

ENVELOPES	APPLICATION	ENVELOPES	APPLICATION
ASSEMBLED		DISASSEMBLED	
13	Rim 13	16	Rim 15 e 16
14	Rim 13 e 14	9.00-20 275/80-22.5	9.00-20 9.00R20 275/80R22.5
15	Rim 14 e 15	10.00-20 295/80-22.5	10.00-20 10.00R20 295/80R22.5
16	Rim 15 e 16	11.00-22 385/65-22.5	11.00-20 11.00R22 385/65R22.5
9.00-20 275/80-22.5	9.00-20 9.00R20 275/80R22.5		
10.00-20 295/80-22.5	10.00-20 10.00R20 295/80R22.5		
11.00-22 385/65-22.5	11.00-20 11.00R22 385/65R22.5		
6.00-9	6.00-9		
6.50-10	6.50-10		
7.00-12	7.00-12		
VOS		VOE	
620	6.00-9	930	Rim 15 e 16
680	6.50-10	1200	9.00-20 9.00R20 275/80R22.5
710	Aro 13	1230	10.00-20 10.00R20 295/80R22.5
740	7.00-12	1310	11.00-20 11.00R22 385/65R22.5
760	Rim 14 | Aro 13		
810	Rim 15 | Aro 14		
950	Rim 16 | Aro 17.5		
1180	275/80R22.5 | 9.00R20 | 10R22.5 305/70R22.5 | 9.00-20 | 305/75R24.5		
1230	295/80R22.5 | 10.00R20 | 11R22.5 10.00-20 | 425/65R19.5 | 445/65R19.5 285/75R24.5 | 315/70R22.5		
1330	11.00-20 | 11.00R22 | 11R22.5 | 11.00-20 12.00R22 | 12.00R24 | 12R20 | 12R22.5 13R22.5 | 285/65R22.5		

- Select the external envelope corresponding to the tyre's size.

Using a cloth dampened with Vipflex, apply a very thin and uniform layer in the region of the seam between the tread and the tyre, finish. Vipflex should be applied to the area in the same way if there are side fillings.

This process is indicated when the polyester or polypropylene films are not used.

Positioned the envelope in the envelope spreader, making sure that the valve position remains the same, this makes the entire assembly process easier.

Envelope the tyre, positioning the rubber wicking pad below the valve and 90° to 180° from de tread splice.

Centralize the external envelope linearly to the tyre to facilitate mounting.

DIMENSIONAL TABLE OF CURING TUBES AND PROTECTORS

CURING TUBES	APPLICATION (TYRE)							
R 13	145R13	155R13	165R13	175R13	185R13	6.15-13		
R 14	175R14	185R14	195R14	5.90-14	6.45-14	6.95-14	7.35-14	
R 15	185R15	195R15	205R15	215R15	225R15	5.60-15		
R 16	205R16	215R16	225R16	235R16	6.50-16	7.00-16	7.50-16	
9.00-20	8.25-20	9.00-20	9.00R20					
10.00-20	10.00-20	10.00R20						
11.00-22	11.00-22	11.00R22	10R22,5	11R22,5	12R22,5	275R22,5	295R22,5	315R22,5

TABLE OF PROTECTORS

PRESENTATION	Top cap	Top cap	Top cap	Top cap
RIM	16	20	22	24

Position the tyre on the table, making sure that the valve position remains the same.

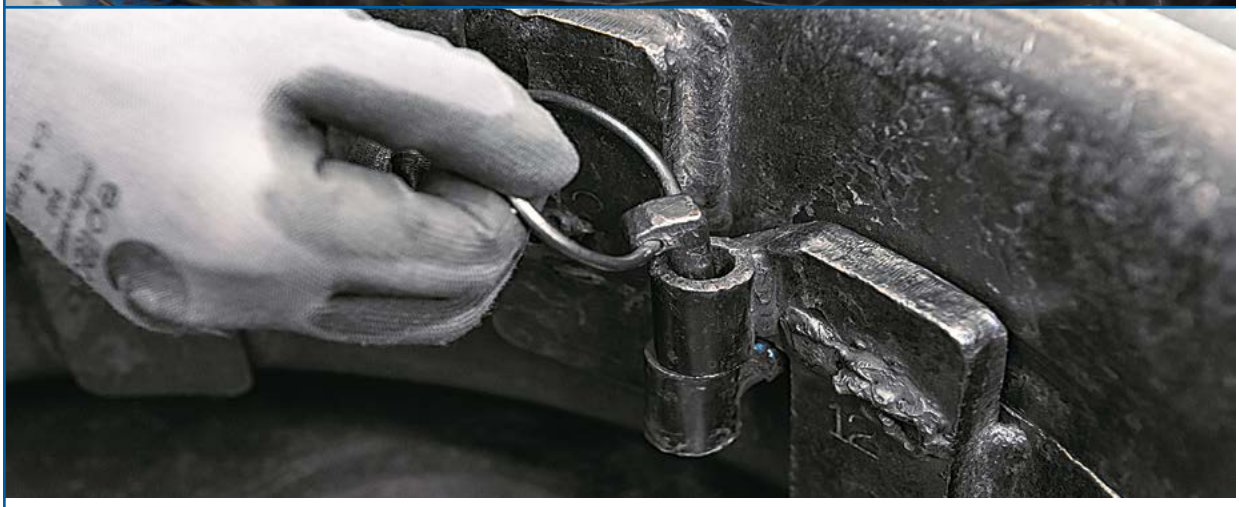
Select the corresponding curing tube and put it inside the tyre; inflate it until it is accommodated without any folds.

Select the corresponding flap and put it over the curing tube. Slide your hands over the wings, checking for folds.

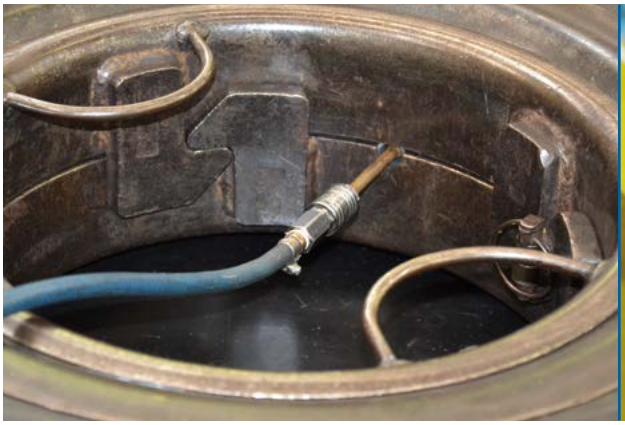
Observation:

Although a curing tube has as indication of use for several tyre measures, we recommend that each size of tyre have a distinct curing tube, avoiding swaps during the mounting process, increasing the accessory's service life.

Ex.: Curing tubes 10.00-22 used in tyres 10.00-20 and 10.00R20 must not be used in tyres 11.00R22 and/or 11.00-22



Select the corresponding wheel, mount one side and, using the table, turn the tyre to mount and close the other part of the wheel.



With the tyre laid on the mounting table, connect the spiral hose to drain the air (form a vacuum).

Inflate the curing tube with a maximum of 30psi.

Check for leakages using the vacuum gauge.

After forming the vacuum, close the valve and wait for the glycerinated vacuum gauge to stabilize.

If it does not stabilize, there is leakage.

In this case, check the origin and eliminate leakages by repairing the envelope or adjusting the equipment.

To be able to identify micro holes, it must be kept a vacuum pressure between 450 and 600 mmHg.

Seal the curing tube and the envelope and store the tyre in the monorail.

Observation 1:

If after sucking there is relaxation of the tightness, there is leakage. Check the its origin and eliminate it through repairs in the envelope and in the set's adjustment.

Observation 2:

Take advantage of this step to classify the tyres by size in the monorail. This allows better air circulation in the autoclave's interior.

Also, take the time to classify the tyres by the grooves' depth, since it allows choosing better the prescribed vulcanization in optimized times.

EQUIPAMENT:

- Vertical envelope spreader;
- Mounting table;
- vacuum pump;
- Glycerin vacuum gauge;
- Wheel.

ACCESSORIES:

- Rubber wicking pad;
- Lid;
- Curing tube;
- Flap;
- Envelope.

PROCEDURE:

For the steps of applying the envelope until its centralization, proceed as indicated for the mounted tyre.

The rubber wicking pad used in assembling the tyre with innlop must be the proper one for this use.

DIMENSIONAL TABLE INNLOP

Internal envelope INNLOP	**1100 x 500**	**1100R22; 12R22.5; 13R22.5; 15R22.5; 305/70R22.5; 315/75R22.5; 315/80R22.5; 385/65R22.5**
Internal envelope INNLOP	**1060 x 500**	**11R22.5; 275/80R22.5; 295/80R22.5**
Internal envelope INNLOP	**1010 x 480**	**9.00R20; 10.00R20; 10R22.5; 11R22.5; 305/70R22.5**
Internal envelope INNLOP	**780 x 480**	**215/75R16; 225/75R16; 8R17.5; 8.5R17.5; 9R17.5; 205/75R17.5; 215/75R17.5**

- For applying the INNLOP, select the corresponding size.

Although the same Innlop has as indication of use for several tyre measures, we recommend that each size of tyre have a distinct Innlop, avoiding swaps during the mounting process.

Ex.: Innlop 1060 x 500 used in tyres 275/80R22.5 must not be used in tyres 295/80R22.5

Fold and place the INNLOP completely inside the tyre.

Pull the INNLOP's upper wing outside the tyre.

Place the rubber wicking pad (drain) inside the tyre to facilitate air removal. Maintain the rubber positioned and without folds, avoiding possible leakages.

Positioned the INNLOP's wing under the envelope. Be careful not to leave any point for airflow between the INNLOP and the envelope. Turn the tyre for mounting the other wing and repeat the operation, checking again if the rubber wicking pad is well positioned and without folds.

With the tyre laid on the mounting table, connect the spiral hose to drain the air (form vacuum).

Check for leakages using the vacuum gauge.

After forming the vacuum, close the valve and wait for the glycerinated vacuum gauge to stabilize.

If it does not stabilize, there is leakage.

In this case, check the origin and eliminate leakages by repairing the envelope or adjusting the equipment.

To be able to identify micro holes, it must have a vacuum pressure between 450 and 600 mmHg.

To speed up the vacuum formation and reduce the operation time, the use of an auxiliary vacuum cleaner or the application of a metal flange to facilitate sealing is indicated.

IMPORTANT:

Use the appropriate saddle for using INNLOP.

Keep the tyre sucked, conduct it to the vacuum's surge tank and connect the secondary hoses, leaving them so until the autoclave.

The standby tyre must be kept in vacuum connected by hose or capped.

with nozzle to maintain vacuum.

Ideally, it should be connected to the vacuum bag for a maximum of one cycle time, if you need to stay longer, disconnect the hose and cover with a nozzle to maintain the vacuum.

With this, it does not delay production and we avoid detachments from the tread.

IMPORTANT:

When the vacuum's surge tank is used, the vacuum sensor's presence saves energy, avoids equipment wear and maintains the tyres connected to it under the desired pressure.

Observation 2:

Take advantage of this step to classify the tyres by size in the monorail. This allows better air circulation in the autoclave's interior.

Also, take the time to classify the tyres by the grooves' depth, since it allows choosing better the prescribed vulcanization in optimized times.

Observation 3:

During the utilization of the INNLOP, avoid its contact with rough surfaces, friezes or cutting edges. Analyze the conservation of tyre's beads for the application.

EQUIPAMENT:

- Envelope spreader;
- Mounting table;
- Hooks;
- Vacuum pump;
- Vacuum's surge tank;
- Glycinerated vacuum gauge;
- Vacuum sensor;
- Saddle or platform;

ACCESSORIES:

- Rubber wicking pad;
- Envelope;
- INNLOP.

Set of wheel: Put tyres in the autoclave, from smaller to larger, quickly connecting the inflating hose to the curing tube and the vacuum hose to the envelope.

Set with INNLOP: Put tyres in the autoclave, from smaller to larger, quickly connecting the wicking pad hose to the envelope.

Close the autoclave's door and select the corresponding recipe, starting the cycle.

MASTER SYSTEM TABLES

MASTER SYSTEM PROGRAMS

WHEEL TYRE PROGRAMS

Revenue	P1 - Cars	P2 - Half load	P3 - Load	P4 - OTR
Curing Tubes Pressure	75	105	105	105
Autoclave Pressure	45	75	75	75
Envelopes Pressure	30	60	60	60
Vulcanization Time	120	150	180	210
Operating Temperature	112°C	112°C	112°C	112°C
Precast with Incavo	≤ 7,5 mm	≤ 14 mm	≤ 19 mm	≥ 20 mm

MASTER SYSTEM PROGRAMS

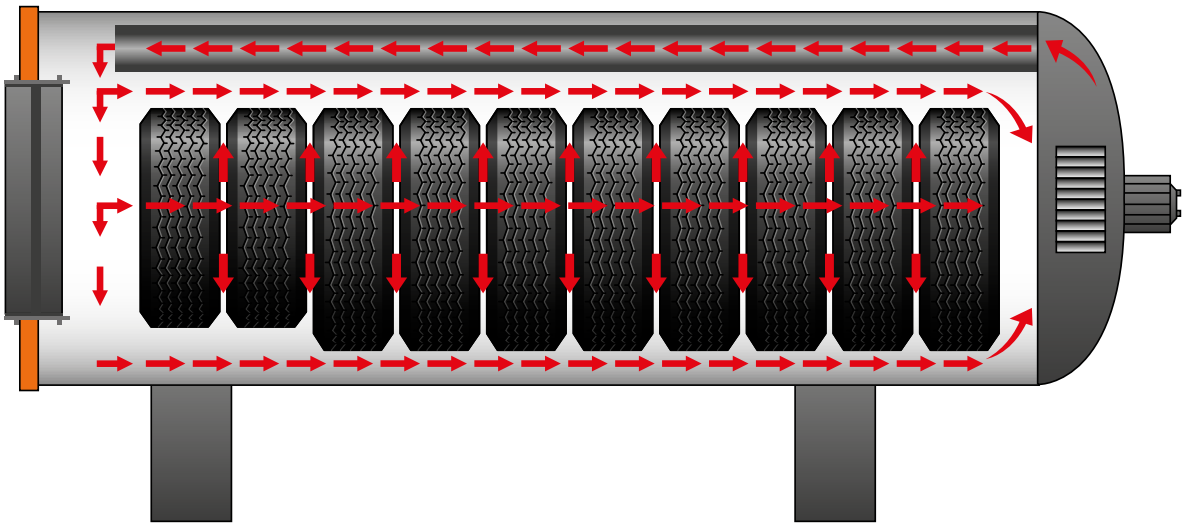
PROGRAMS FOR INNLOP (112°C)

Revenue	P5 - Cars	P6 - Half load	P7 - Load	P8 - OTR
Curing Tubes Pressure	-	-	-	-
Autoclave Pressure	45	75	75	75
Envelopes Pressure	30	60	60	60
Vulcanization Time	90	120	150	180
Operating Temperature	112°C	112°C	112°C	112°C
Precast with Incavo	≤ 7,5 mm	≤ 14 mm	≤ 19 mm	≥ 20 mm

MASTER SYSTEM PROGRAMS

PROGRAMS FOR INNLOP (120°C)

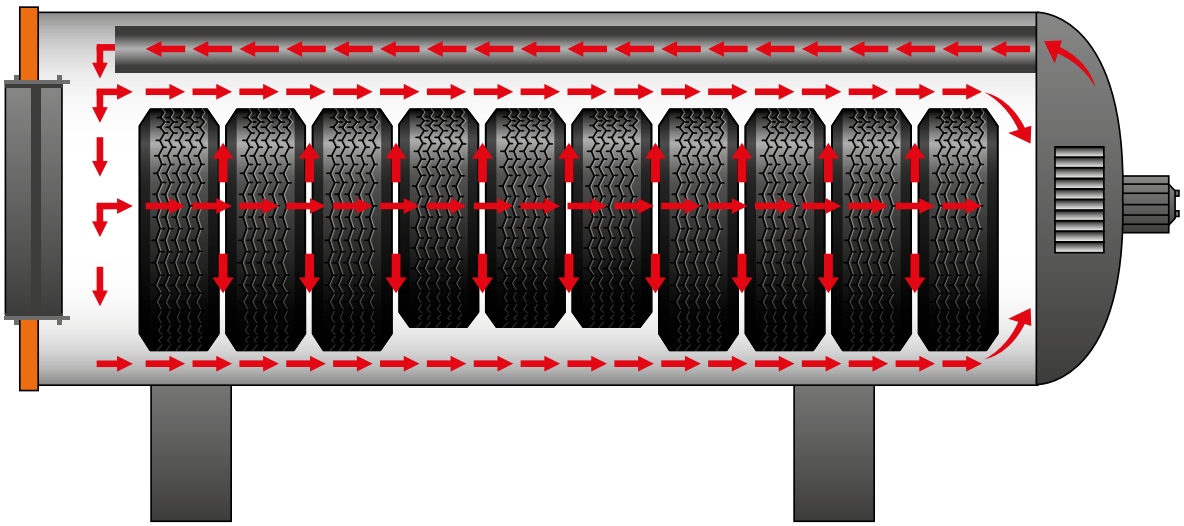
Revenue	P5 - Cars	P6 - Half load	P7 - Load	P8 - OTR
Curing Tubes Pressure	-	-	-	-
Autoclave Pressure	45	75	75	75
Envelopes Pressure	30	60	60	60
Vulcanization Time	60	90	120	150
Operating Temperature	120°C	120°C	120°C	120°C
Precast with Incavo	≤ 7,5 mm	≤ 14 mm	≤ 19 mm	≥ 20 mm



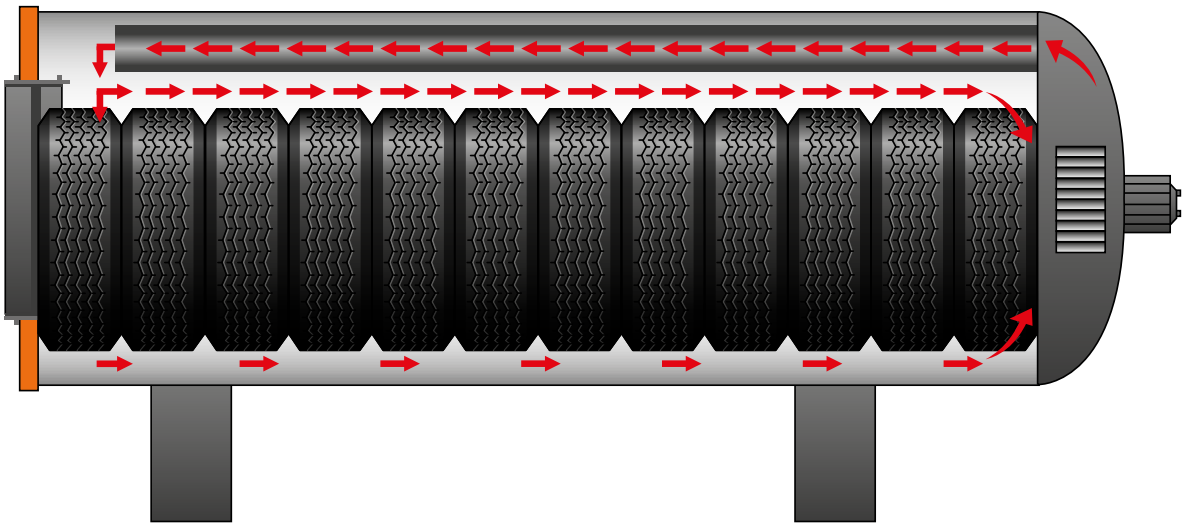
Observation:

Make sure that the space between the door and the last tyre is enough to allow adequate circulation of the heated air.

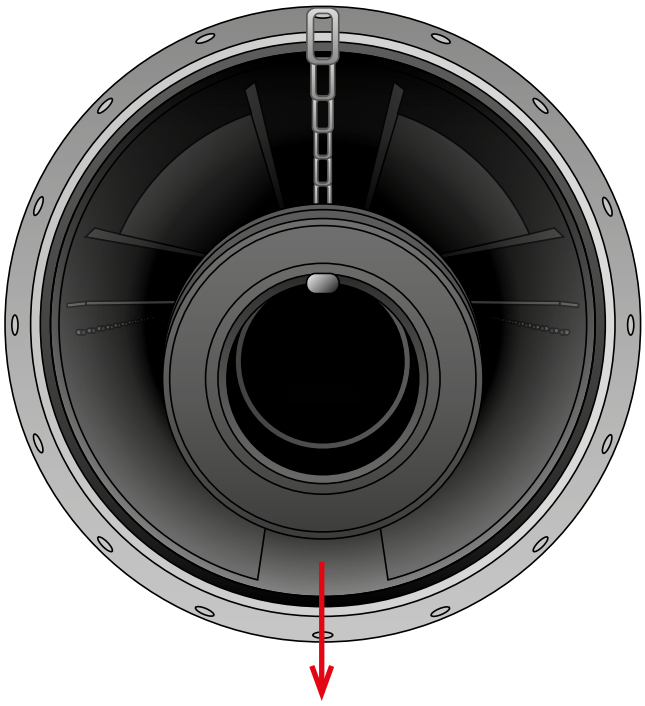
The red arrows in the image represent air circulation in the equipment's interior.



The smaller tyres are in the wrong position, they must be the last ones to be placed in the autoclave.



In case of tyres with larger section, it is not possible to work with the autoclave in its full capacity, since it hampers heat circulation and the vulcanizing process.



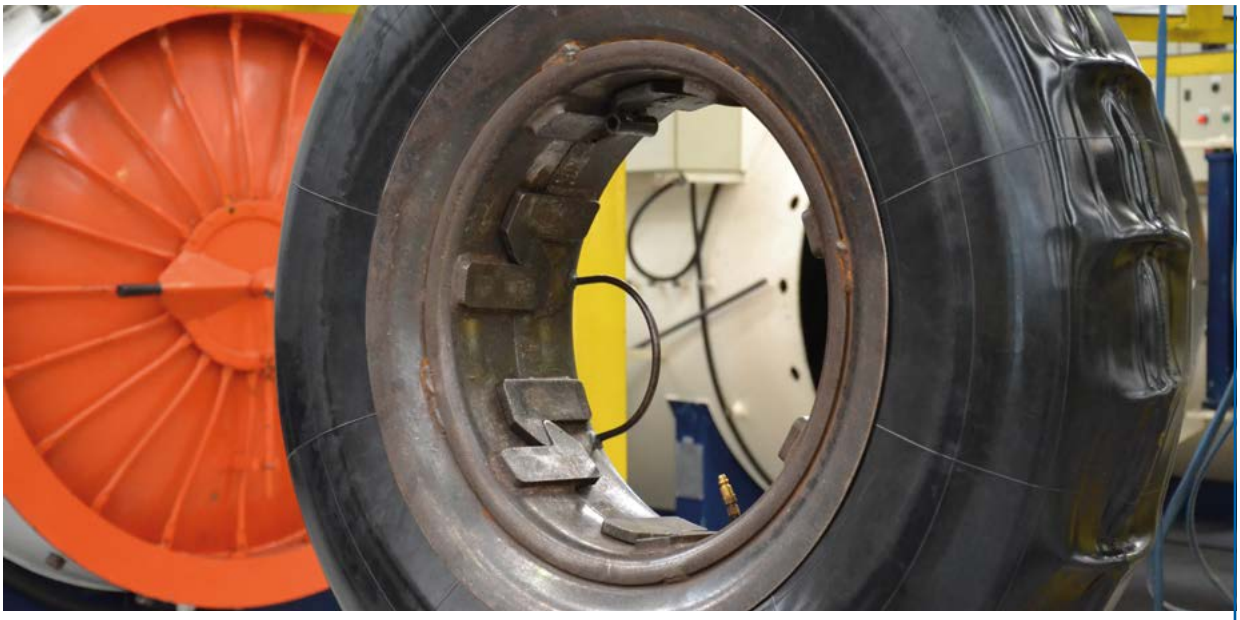
The space between the tyre and the floor of the autoclave must be at least 10cm.

Remove tyre from autoclave.

Conduct the tyre, through the monorail, until the dismounting equipment (pneumatic actuator or table).

IMPORTANT:

After finishing the process, the tyres should be removed from the autoclave and disassembled while still hot, avoiding damage to the accessories.



With wheel:

Using a pneumatic system, fix the tyre to the monorail; remove the hook.

Remove both parts of the wheel, the flap, the curing tube, and store it.

Replace the hook and conduct the tyre to the vertical envelope spreader.

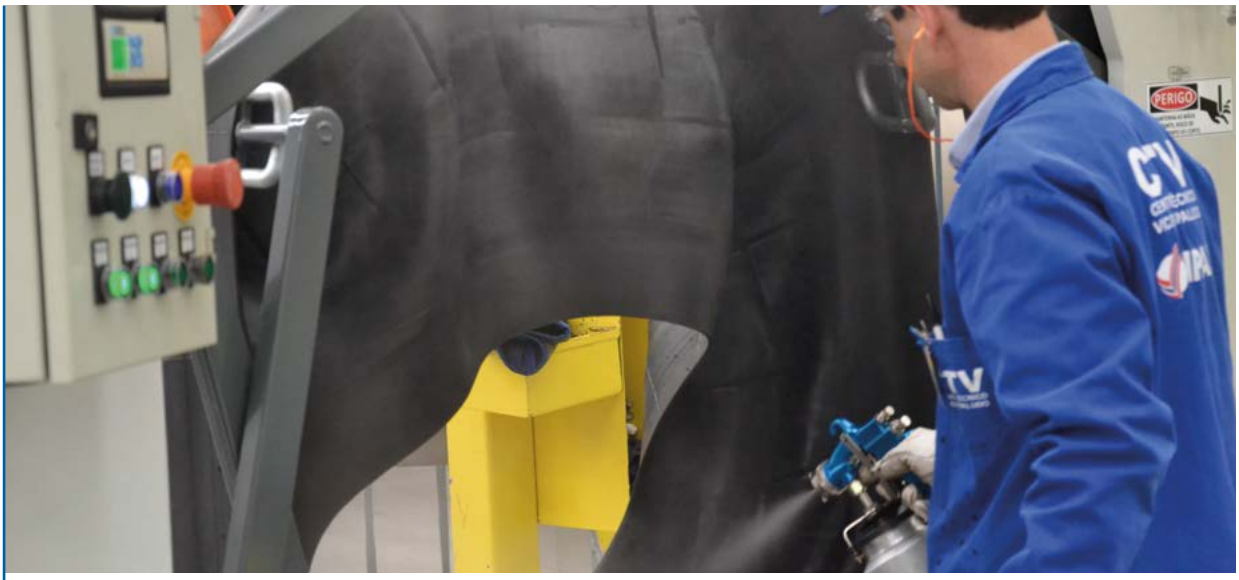
With INNLOP:

Vertically set the tyre with the pneumatic system and remove the saddle or the platform and store it.

Remove the INNLOP and store it open, avoiding folds.

Conduct the tyre to the envelope spreader.

To remove the tyre, open the envelope enough.
Avoid opening too much the hot envelope.



With the envelope still open, apply a thin layer of Vipflex demoulding inside the envelope the spray system.

This process is only applicable to those not using the polyester/ polypropylene film or when Vipflex is applied while mounting.

Remove the envelope from the envelope spreader and store it open, avoiding folds.

Observation 1:
We recommend leaving the envelope to rest between cycles.

Observation 2:

We recommend that whenever the valve's pin (nozzle) of the envelope is not connected to the hose (quick hitch), it should remain protected by a lid.

Observation 3:

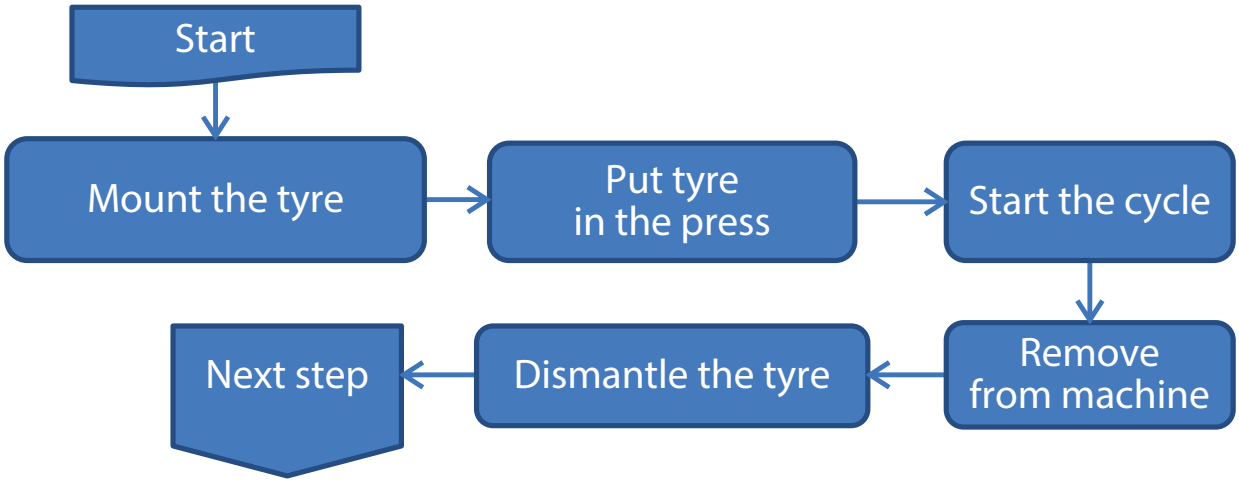
It is extremely important that the quick hitch, the pin (nozzle), the sealing disc, and the o'ring be from the same manufacturer and with code compatibility.

EQUIPAMENT:

- Autoclave;
- Vacuum pump;
- Dismounting table;
- Vertical envelope spreader;
- Pneumatic actuator (piston).

PRESS SYSTEM CURING

VULCANIZATION IN PRESS FLOWCHART



DIMENSIONAL TABLE OF CURING TUBES

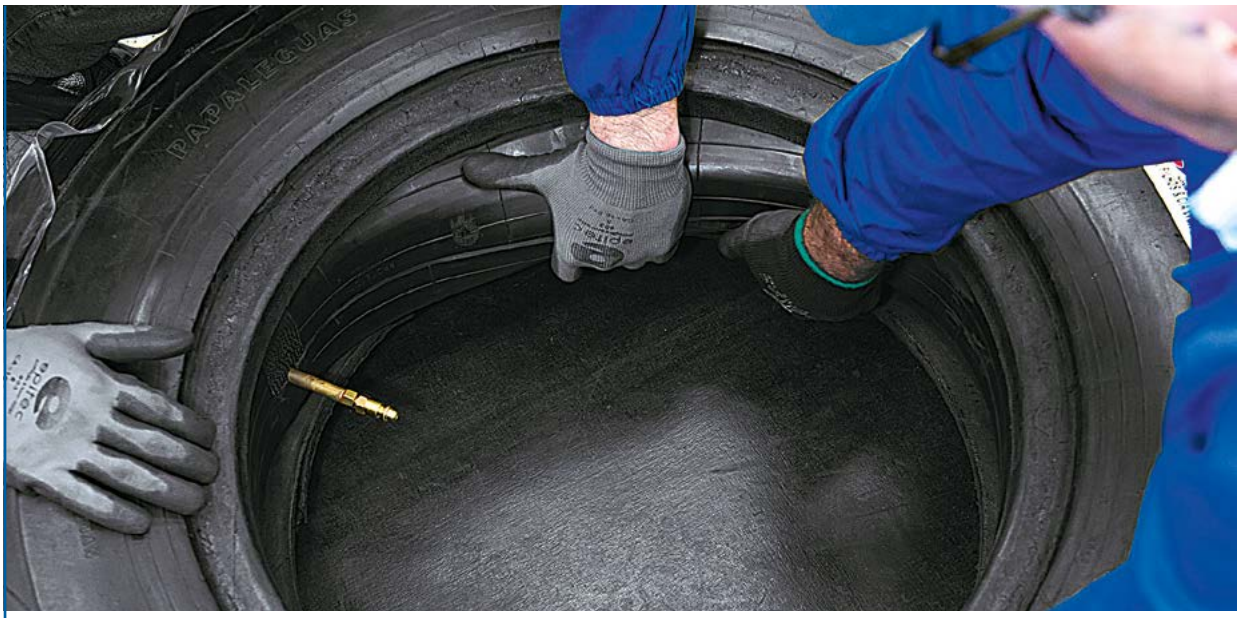
CURING TUBES	APPLICATION (TYRE)							
R 13	145R13	155R13	165R13	175R13	185R13	6.15-13		
R 14	175R14	185R14	195R14	5.90-14	6.45-14	6.95-14	7.35-14	
R 15	185R15	195R15	205R15	215R15	225R15	5.60-15		
R 16	205R16	215R16	225R16	235R16	6.50-16	7.00-16	7.50-16	
9.00-20	8.25-20	9.00-20	9.00R20					
10.00-20	10.00-20	10.00R20						
11.00-22	11.00-22	11.00R22	10R22,5	11R22,5	12R22,5	275R22,5	295R22,5	315R22,5

- Select the corresponding curing tube. Put it inside the tyre and inflate it until it is accommodated and there are no folds.

DIMENSIONAL TABLE OF PROTECTORS

PRESENTATION	Top cap	Top cap	Top cap	Top cap
RIM	16	20	22	24

- Select the corresponding flap



Put the flap over the curing tube. Slide your hands over the wings to check for folds.

Select the corresponding wheel, mount one side then turn the tyre to mount and close the other part of the wheel.

Observation:

To ensure safety for the operator and the equipment, we suggest that all the wheels have a safety pin.

Select the mould according to the tyre design and measure and put it in the press.

The press must be correctly assembled with the mould corresponding to the tyre (no space between sectors) and prepared (heated) using a temperature of 150°C +/- 2°C.

Tire curing press equipped for remolding/bead to bead retreading tires.

After the mould is heated, apply the demolding with the aid of the spray.

With the aid of equipment, put the tyre in the machine.

Close and lock the press after connecting the air hose.

Inflate the tyre to the pressure indicated by the manufacturer of the retreading product.

Adjust the previously stipulated vulcanization time.

For remould vulcanization, check the instructions and start the vulcanization process.

Note 1:

When inflating the tyre, the network needs to have a check valve, aiming at not losing any air in case of a loss of pressure in the compressed air network.

Note 2:

To determine the curing time, it is necessary to know the actual evolution of the temperature, in the most critical heating point through a calibrated pyrometer. Vipal has a specific methodology for this calculation, so contact our technical consultant.

Note 3:

In order to retread radial tyres in the machine (press), the retreader must have six or more sectors with a high-pressure line since the recommendation is of 200 to 250 lbs in the curing tube.

Remove tyre from press.

In appropriate place, remove both parts of the wheel, flap, curing tube, and store it.

Observation:
We recommend leaving the curing tube and the flap to rest one cycle time.

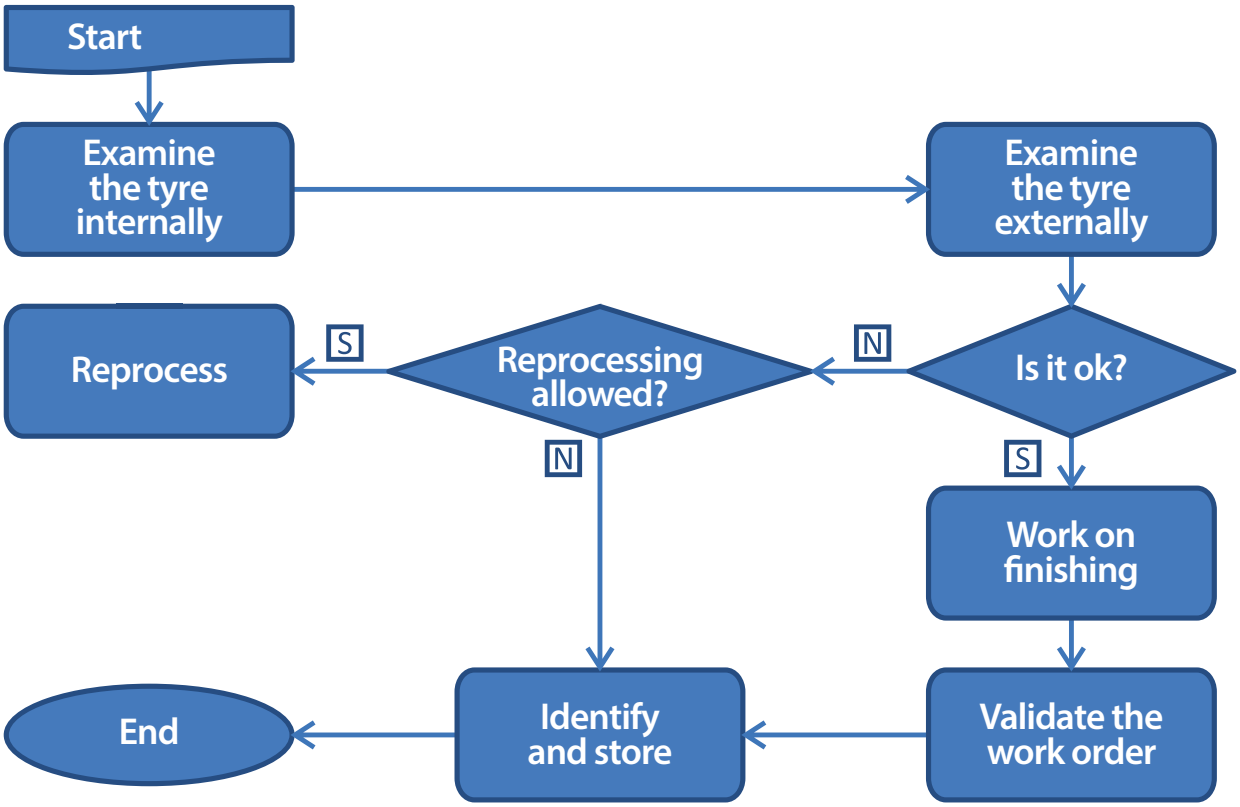
EQUIPAMENT:

- Wheel.
- Presses.

ACCESSORIES:

- Curing tubes.
- Flap.

FINAL INSPECTION FLOWCHART



GOAL:

Ensure that the retreaded tyre conforms to the order, quality standard and finish.

SECTOR:

Ideally wide, well-lit and allowing classifying the finished tyres by seller, client, or date.

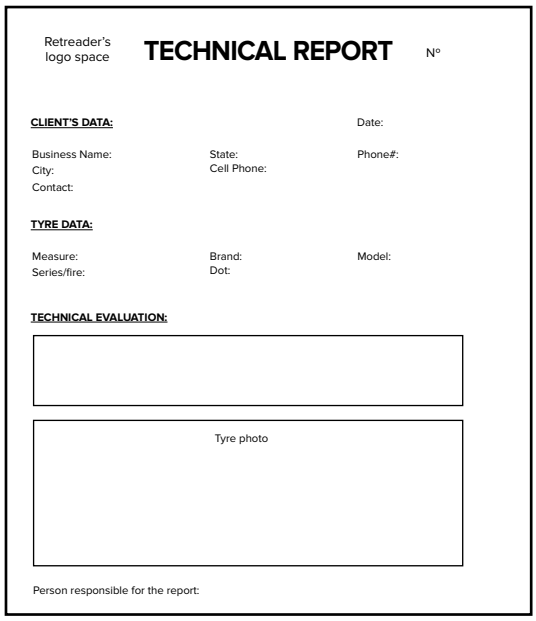
PROCEDURE:

Examine the tyre internally, making sure there are no separations between plies and/or components, repairs and liner with bubbles or separation.

Externally, check for dislocations, failures in vulcanization and finishing.

In case of defect, in any service, reprocess the tyre if possible. If not, buff the tread and remove the retreader´s identification label.

Put the tyre in the non-compliant material area, identify the problem and inform the client via technical report or tyre follow-up card with the appropriate occurrences.



Retreader's logo space

TECHNICAL REPORT Nº

CLIENT'S DATA: Date:

Business Name: State: Phone#:
City: Cell Phone:
Contact:

TYRE DATA:

Measure: Brand: Model:
Series/fire: Dot:

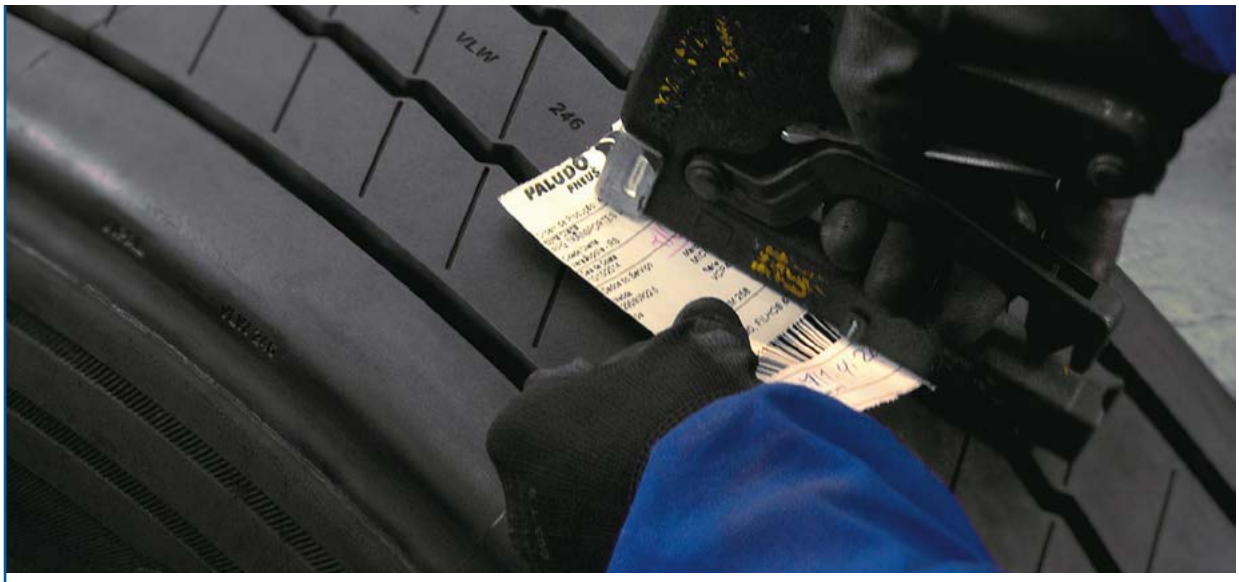
TECHNICAL EVALUATION:

Tyre photo

Person responsible for the report:

Trim the edges when the process used is hot cure. For both cases (hot and cold), paint the tyre, applying a thin and even layer, preferably with the tyre still warm.

If the retreader has a cleaning machine that provides good brushing, cleaning the sidewalls, the painting becomes optional.



Identify the tyre.

Store the tyres in a manner that allows classification by seller, client, or date.

Note:
It is crucial for the tyre to be cold before using.

EQUIPAMENT:

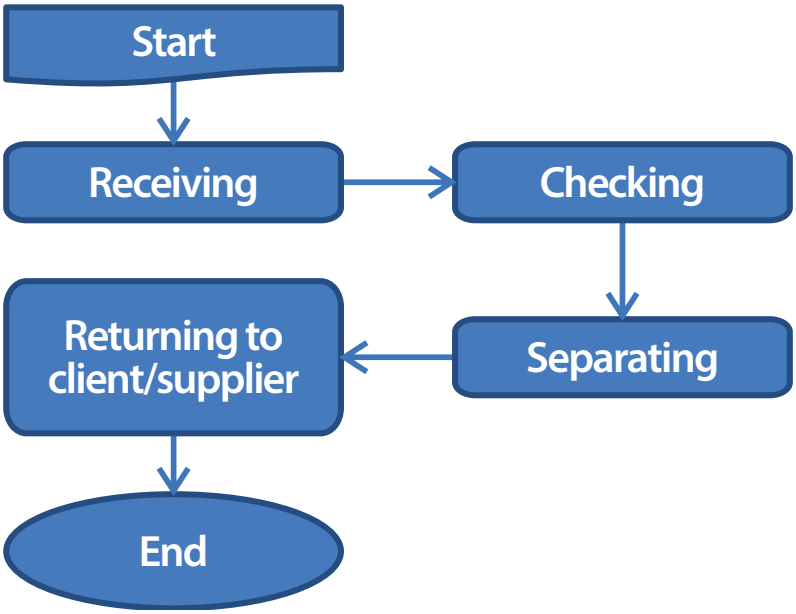
- Examining machine with lighting;
- Painting cabin.

TOOLS:

- Punch;
- Stapler;
- Trimmer;
- Knife.

DISPOSING OF NON-COMPLIANT MATERIALS

NON-COMPLIANT MATERIALS FLOWCHART



GOAL:

To establish the means to make sure the product that does not comply with specified requirements is prevented from inadvertent use.

SECTOR:

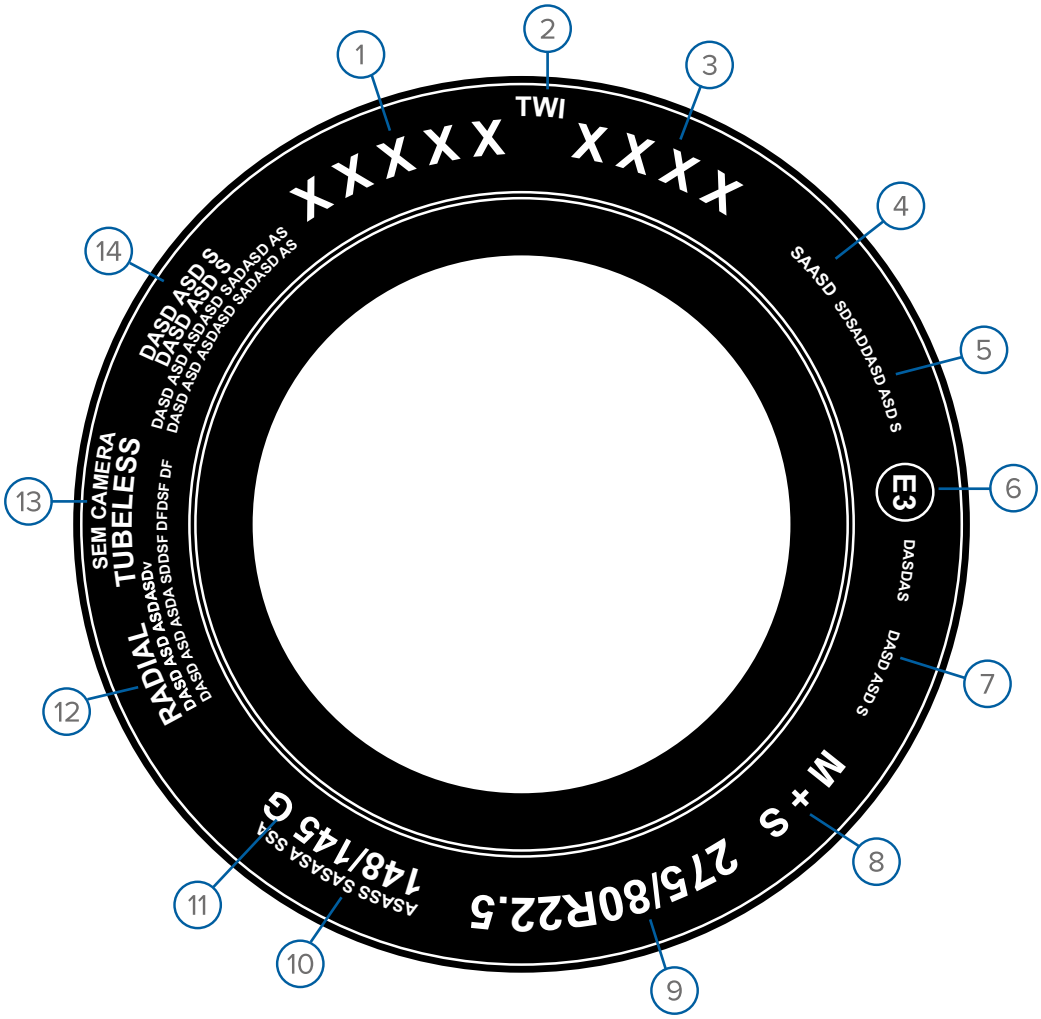
Appropriate place, identified, organized, and with easy dispatch.

PROCEDURE:

Raw materials and inputs, as well as tyres in several stages of the manufacturing process that do not meet the specified requirements, must be identified as non-compliant products and separated in appropriate place.

INTERPRETING A CARGO TYRE

A tyre has marks to indicate dimensions, structure type, and main characteristics of its application, where a series of marks is adopted to allow identification of the tyre. In the illustrations, we present an example of the main marks that appear on the sides of the tyre.



1- Manufacturer;

2- Wear indicator;

3- Tyre model;

4- Certification;

5- DOT registration;

6- Compliance with ECE;

7- Manufacturing country;

8- Symbol of tyre adapted for use in mud and snow;

9- Characteristics of dimensions;

10- Cargo index for simple and double mounting;

11- Speed code;

12- Construction type;

13- Tubless tyre tubetype;

14- Indicates possibility of re-grooving the tread.

Source: Alapa – Latin American Tyres and Rims Association

Definitions:

1. **Tyre's external diameter:** Maximum diameter measured on the new tyre when mounted on its respective measuring rim and inflated with measuring pressure, without load.
2. **Settling diameter:** Equal to nominal diameter of the mounting rim, corresponding approximately to the tyre's internal diameter.
3. **Height of tyre section:** Half of the difference between the tyre's external diameter and the internal diameter.
4. **Width of tyre section:** Width of new tyre, mounted over measuring rim, not including the thickness of the protection or decorative bars and inscriptions.

Size designation

295/80R22.5

295 - Indicates the width of the tyre's section, equal to 295mm.

80 - Indicates the height of the tyre's section, equal to 80% of the width.

R - Indicates that the tyres is of radial construction.

22.5 - Indicates the tyre's internal diameter, equal to 22.5 inches.

Source: Alapa – Latin American Tyres and Rims Association

Observation:

Reinforced tyres have the additional mark 'Reinforced'.

Tyres 'Mud' and 'Snow' have the additional mark 'M+S' ('MS', 'M&S', and 'M-S' are also allowed).

Conversion of “plies capacity” to “load capacity”

C. Cargo capacity

Is the tyre capacity of supporting the maximum load allowed for it.

It represents the maximum load that the tyre can support in nominal use condition, identified by a load index or corresponding manner. Abbreviation: “LOAD CAP”.

The tyres’ load capacity can be indicated in one of the sides with the expressions and their respective abbreviations:

“PLIES CAPACITY” (“CAP. PLIES” or “PLIES CAP”’); “PLY RATING” (P.R.”); “LOAD RANGE,” and “LOAD CAPACITY”.

Load cap.	Replaces plies cap.	Load cap.	Replaces plies cap.
A	2	G	14
B	4	H	16
C	6	J	18
D	8	L	20
E	10	M	22
F	12	N	24

Source: Alapa – Latin American Tyres and Rims Association

Speed symbol

The 'Speed symbol' indicates the speed to which the tyre can be submitted, to the load corresponding to its load index, in the service condition specified by the tyre manufacturer, according to the image below.

Speed symbol	Speed (km/h)	Speed symbol	Speed (km/h)
A1	5	K	110
A2	10	L	120
A3	15	M	130
A4	20	N	140
A5	25	P	150
A6	30	Q	160
A7	35	R	170
A8	40	S	180
B	50	T	190
C	60	U	200
D	65	H	210
E	70	V	240
F	80	W	270
G	90	Y	300
J	100		

Source: Alapa – Latin American Tyres and Rims Association

Load index

The 'Load index' (L.I.) is a numeric code associated to the maximum load to which a tyre can be submitted, to the speed indicated by the Speed symbol in the service conditions specified by the tyre manufacturer.

IC	kg	IC	kg	IC	kg	IC	kg
0	45	40	140	80	450	120	1400
1	46,2	41	145	81	462	121	1450
2	47,5	42	150	82	475	122	1500
3	48,7	43	155	83	487	123	1550
4	50	44	160	84	500	124	1600
5	51,5	45	165	85	515	125	1650
6	53	46	170	86	530	126	1700
7	54,5	47	175	87	545	127	1750
8	56	48	180	88	560	128	1800
9	58	49	185	89	580	129	1850
10	60	50	190	90	600	130	1900
11	61,5	51	195	91	615	131	1950
12	63	52	200	92	630	132	2000
13	65	53	206	93	650	133	2060
14	67	54	212	94	670	134	2120
15	69	55	218	95	690	135	2180
16	71	56	224	96	710	136	2240
17	73	57	230	97	730	137	2300
18	75	58	236	98	750	138	2360
19	77,5	59	243	99	775	139	2430
20	80	60	250	100	800	140	2500
21	82,5	61	257	101	825	141	2575
22	85	62	265	102	850	142	2650
23	87,5	63	272	103	875	143	2725
24	90	64	280	104	900	144	2800
25	92,5	65	290	105	925	145	2900
26	95	66	300	106	950	146	3000
27	97,5	67	307	107	975	147	3075
28	100	68	315	108	1000	148	3150
29	103	69	325	109	1030	149	3250
30	106	70	335	110	1060	150	3350
31	109	71	345	111	1090	151	3450
32	112	72	355	112	1120	152	3550
33	115	73	365	113	1150	153	3650
34	118	74	375	114	1180	154	3750
35	121	75	387	115	1215	155	3875
36	125	76	400	116	1250	156	4000
37	128	77	412	117	1285	157	4125
38	132	78	425	118	1320	158	4250
39	136	79	437	119	1360	159	4375

Source: Alapa – Latin American Tyres and Rims Association

IC	kg	IC	kg	IC	kg
160	4500	200	14000	240	45000
161	4625	201	14500	241	46250
162	4750	202	15000	242	47500
163	4875	203	15500	243	48750
164	5000	204	16000	244	50000
165	5150	205	16500	245	51500
166	5300	206	17000	246	53000
167	5450	207	17500	247	54500
168	5600	208	18000	248	56000
169	5800	209	18500	249	58000
170	6000	210	19000	250	60000
171	6150	211	19500	251	61500
172	6300	212	20000	252	63000
173	6500	213	20600	253	65000
174	6700	214	21200	254	67000
175	6900	215	21800	255	69000
176	7100	216	22400	256	71000
177	7300	217	23000	257	73000
178	7500	218	23600	258	75000
179	7750	219	24300	259	77500
180	8000	220	25000	260	80000
181	8250	221	25750	261	82500
182	8500	222	26500	262	85000
183	8750	223	27250	263	87500
184	9000	224	28000	264	90000
185	9250	225	29000	265	92500
186	9500	226	30000	266	95000
187	9750	227	30750	267	97500
188	10000	228	31500	268	100000
189	10300	229	32500	269	103000
190	10600	230	33500	270	106000
191	10900	231	34500	271	109000
192	11200	232	35500	272	112000
193	11500	233	36500	273	115000
194	11800	234	37500	274	118000
195	12150	235	38750	275	121000
196	12500	236	40000	276	125000
197	12850	237	41250	277	128500
198	13200	238	42500	278	132000
199	13600	239	43750	279	136000

Fonte: Alapa - Associação Latino Americana de Pneus e Aros

AVOIDING WASTE, OPTIMIZING RESOURCES, AND IMPROVING THE PROCESS

INTRODUCTION

There are many points that can be worked with so to save on products and resources.

Sustainability in the process (more with less), better operational result.

Make the exercise and account your profits.

RECEIVING

The tyres must arrive identified and unloading must be organized, divided by collection.

Types of gain:

Time hour/man.

CLEANING

The brushes' pressure must be regulated so the cleaning is done in one cycle only. It is important to point out the amount of clean tyres per set, of each accessories' brand (brush), so to check which accessory generates more productivity and thus establish buying interval.

Types of gain:

Time hour/man, economy of power and hour/machine, preservation of set, provisioning of stock.

FIRST INSPECTION

Measure the amount of refused tyres, generating refusal indicators, evaluating technical criteria used by seller and examiner in qualifying the tyre to be retreaded, minimizing the amount of tyres unfit for retreading.

Types of gain:

Production indicators for process analysis. Time hour/man.

BUFFING

Inverting the rotation direction of the saws the tyre allows the saws to self-sharpen and therefore increases the autonomy of the set.

Ex.: tyre in the clockwise direction and saws in the anti-clockwise direction. Ideally, invert it every 15 buffed tyres.

It is important to point out the amount of tyre buffed by each set, of each accessory's brand (saw) to check which saw generates more productivity and thus establish buying intervals.

Types of gain:

Preservation of set, time hour/man, time hour/machine, provisioning stock and service quality.

PREPARING THE TREAD

Before cutting the tread, it is important to check if the remaining piece of tread is equal or superior to 1m. If not, we recommend opening a new roll. This avoids pieces with less than 50cm from being left behind, since they cannot be used in the process.

Start applying the cushion to the precured tread by aligning the top of the end so that there is no waste, respecting the instructions of about 1mm.

When the application is finished, use a hot knife and cut close to the tread's border; thus, the cushion will always be aligned to begin the next application and it will generate less product waste.

Types of gain:

Economy in raw material.

SKIVING

It is important to point out the amount of skiving by each grinding stone used, be it pink or white, to check which accessory generates more productivity and thus establishing buying intervals.

This instruction applies to all accessories used in skiving.

Types of gain:

Tool performance, provisioning stock.

CEMENTING

Regulate the impeller's speed so that it is about 16 rpm, thus the amount of cement applied is smaller.

Remember that the spray must be activated after the tyre starts moving, to avoid wasting cement accumulated in the beginning of application.

It is important to make note of the amount of tyres made per litre of glue, before and after adjusting the equipment and process, to evaluate productivity of both to establish buying intervals.

Types of gain:

Economy in raw materials, time hour/machine, provisioning stock.

When turning the mini extruder, put a 15cm to 20cm piece of profile and begin the operation. Remove it and reinsert it in the extruder. Repeat the operation 2 or 3 times. Thus, the set will be heated immediately. This practice is recommended at every beginning of a cycle. Remember that the extruded material must be reused to perform the fillings.

When the extruder is not in operation, remove the material (Rope Rubber) completely from inside of it, avoiding pre-vulcanization. This material must also be reused for fillings.

In intervals of more than 60min, after performing the previous operation, turn the equipment off.

Important: calibrate the mini extruder's nozzles; if it is not possible, replace them.

This will make it so that only the necessary material is used.

At the end of the process, remove the rubber from the orbicushion applicator extruder, store it in an appropriate place to cool and it can be reused in the same process.

Types of gain:

Economy of raw material, economy of power, time hour/man, time hour/machine, preservation of equipment.

MOUNTING

In order to avoid damages/micro holes in the accessories, use a magnet to remove all metallic residues from inside the tyre. It is important to do this before placing in the Innlop or the curing tubes.

Application of alternate envelope/Innlop is 3x1. Set A in the interior of autoclave, set B mounted awaiting its turn in the autoclave, set C resting. Next, set A dismounted and resting, set B inside the autoclave, and set C awaiting its turn. Next, set C inside the autoclave, set B dismounted and resting, set A mounted and awaiting its turn. Restart the cycle.

Testing periodically the curing tubes avoids losses in the vulcanization process and in accessories.

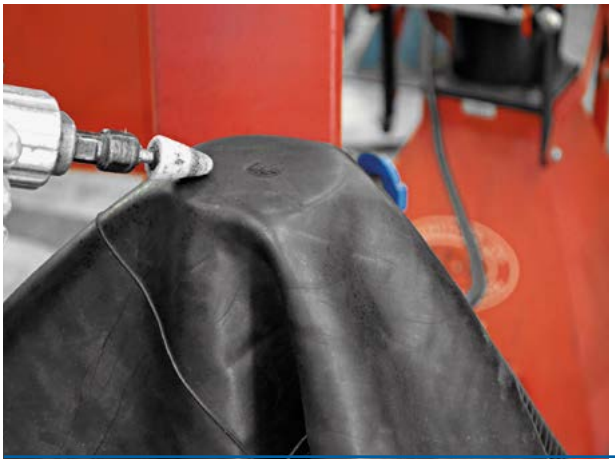
Repair envelopes, Innlops and curing tubes.

Types of gain:

Preservation of accessories, time hour/machine, gain in raw material.

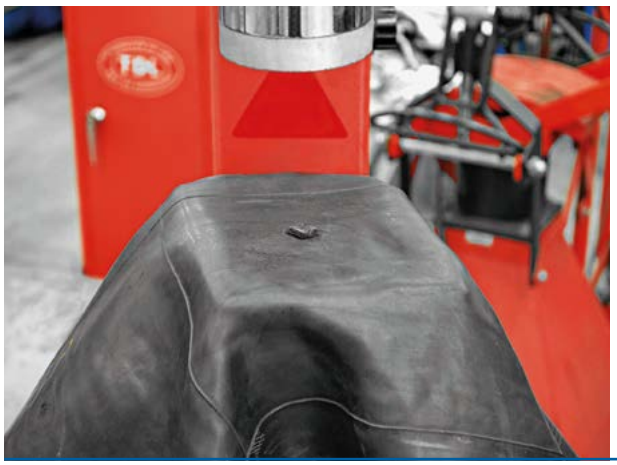
PROCESS FOR PREPARING ACCESSORIES

Clean the area to be repaired with the Bufpal surface activator.



Buff the area to be repaired, avoiding increasing the damage.

Cut out the repair with enough size to fill in the damage.



Apply the repair to the damage, there is no need to go beyond the glued area.

Protect the repair and the envelope with polyester or polypropilen film so to avoid direct contact of the repair with the heated sheet of the thermo-press.

Vulcanize it in thermo-press according to the table.

Temperature (C°)	Time (min.)
150	25
160	15

Observation:

It is important to coat the equipment's lower resistance with vulcanized rubber.

HOW TO IMPROVE THE TYRE'S APPEARANCE

Retreading tyres is a process that aims at replacing the tread, offering safety, reliability, yield, and quality. In order to do that, it is essential to offer a service with quality combined with good appearance.

To ensure that the new tyre will have good appearance, Vipal Rubber lists some tips that will ensure better finishing:

- Always clean the tyres before inspection – besides avoiding contaminations and helping inspection, it will ensure better appearane;
- During the inspection process, it is fundamental to outline with chalk all damages on the sidewalls and beads (rubber only), allowing their repair;
- Buff the tyre allowing the correct centralization of the tread; avoid buffering the shoulder area, unless the tread has wings, or for the bead-to-bead molding process;
- Always use the buffing texture pattern 3 or 4;
- Select the tread according to the tread width;
- For treads with wings with a dimensional of 5 to 8mm less than the 'useful' length of the tread (do not consider the wings);
- Reaming the sidewall and shoulder damages must be done according to the damage's size;
- Prepare the area for the labels (retreader, QGR, and property) according to each label's dimension using the cleaning brushes;
- After selecting the repair, use the template to mark the dimension to be buffed;
- Adequately centralize the patches keeping the arrows in the bead's direction;
- Apply sealer to the borders of the repairs – besides ensuring better finishing, it prevents infiltrations;
- Apply Vulk Glue only to the buffed areas - glue applied to areas not buffed compromises the appearance, contaminates the accessories (curing tubes, envelope, INNLOP) and can reduce their service life;

- Uniformly fill in the reaming on the sidewalls, shoulders, and beads;
- Apply the finishing rubber only to the buffed area, avoiding stretching;
- During the application of the tread, check the tyre perimeter x tread length avoiding excessive stretching or shrinkage of the tread. If necessary carry out in sections every 90°;
- For treads with over 20mm of depth, make the contact from the base to the crown (top to bottom). During the closing of the seam, leave an extra of up to 15mm without contact with the cushion;
- Avid using staples – they can endanger accessories and compromise the finishing;
- For traction designs, cut the tread up to 30mm shorter than the tyre's perimeter. For other designs, cut the tread up to 30mm longer than the tyre's perimeter;
- Buff the borders of the tread uniformly, avoiding compromising the design sequence (buffing texture pattern 1 or 2);
- Whenever possible, cut the tread according to the sequence of the design (Vipal already provides indicators of where to cut on the tread);
- Apply MB/AC cushion gum with the same tread width, avoiding wastes and leftovers that compromise the finishing;
- On the joint, leave only one layer of MB/AC cushion gum or finishing rubber with an extra of up to 1mm from crown to tread;
- Remove the excess material that remains in the seam's grooves;
- Select the envelope size corresponding to the tyre; dilated parts can be used on larger tyres – using accessories that are too large makes operation difficult and causes folds that harm the finishing;
- Place the rubber wicking pad 90° to 180° from the seam;
- Avoid using damaged or leaking accessories (curing tubes, envelopes, and INNLOP);
- When performing the vacuum, carefully observe if the envelope is not under the tread (riskier for treads with wings);
- Treads with wings: after rolling, mount the tyre and immediately apply vacuum;
- Buff or treat the fillings on the sidewalls, shoulders, and beads with a thin tungsten saw (36); Paint the tyre with the appropriate Vipal paint when necessary;
- Allow the tyre to cool down horizontally, avoiding deformations.

Selective waste collection:

Separate scraps correctly, so they can be reused in an environmentally safe manner.

The Resolution CONAMA n.275 from 25/04/2001, established the color code for different types of residues:

Check local legislation.

Paper Cardboard | **Plastic** | **Glass** | **Metal** | **Wood**

Non-recoverable waste (dry) | **Medical and health services' waste** | **Radioactive waste** | **Organic waste** | **Dangerous waste**

- Cardboard core, cardboard, paper.

- Plastics, plastics from cushions.

- Paper, plastic, cloth, tows, and any other material contaminated with paint, glue, grease, oil, or solvent.

- Nylon cloth, adhesive labels, silicone paper, fax paper, carbon paper, disposable cups (tea and coffee), cookie packaging, polystyrene, candy wrappers.

• Metallic packaging of Vipal products, metals in general.

• Soil from tyres, fruit peel, residues of vegetables, residues of food, yerba mate, toilet paper, tissues, sanitary pads, coffee powder, cut leaves and grass, wood residues, branches, and bones.

Observation:

There is not a defined color to accommodate rubber residues, rubber powder, scraps of tread, of tyre, vulcanized rubber, treads, envelopes, dustings, and rubber originated from tyre matrix. The company must adopt a color different from the existing ones to identify such residues. At Vipal, the color adopted is **BEIGE**.

Residue	Destination
Paper	**Sale to recycling or donation.**
Plastic	**Sale to recycling or donation.**
Metal	**Sale to recycling or donation.**
Contaminated residue - dangerous	**Landfill or co-processing (generates costs).**
Scraps of rubber	**It can be used as raw materials in another company.**
Residues generated by cleaning	**Classified as organic residue.**

INDUSTRIAL PIPES

Colors of industrial pies according to the ABNT norm NBR 6493/1994.

Colors	Application
Red - Safety B 291	Saturated value - fire-fighting materials (water).
Yellow C 067	Non-liquefied gases.
Blue - Safety X 17J	Products under pressure - Compressed air.
Light Grey J 684	Vacuum.
White B 000	Vapor.
Aluminum	Inflammable and low viscosity fuels (diesel, gasoline, kerosene, lubricants, solvents).
Orange C 244	Acid.
Green N 541	Water - Except for fire-fighting water.
Brown - Pipes T 260	Color to other fluids (oil, fragmented materials – raw ore – crude petroleum).
Cream F 143	Intermediate or heavy products.
Dark Grey W 685	Conduits.
Black Y 999	Flammable and high viscosity fuels (fuel, asphalt, tar).
Lilac (purple) M 32T	Alkali - Bleach.

- Check local legislation.

REFERENCES

ABNT NBR NM 225:2000 - Minimum tire selection criteria for retreading and repair Inspection and Identification

ABNT NBR NM 224:2003 - Pneumatic set Terminology

Technical Manual ALAPA - Technical Standards Manual of the Latin American Tire Association

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