

INDUSTRIAL TIRE

• RETREADING •

MANUAL



INTRODUCTION



Considering the importance of retreaded tires/tyres sold in the country having minimum safety requirements, this manual refers to the entire process of tire/tyre retreading, providing indications to Vipal Rubber customers, illustrating the use of the products and the retread application on industrial tires/tyres.

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TYPES OF TIRES/TYRES



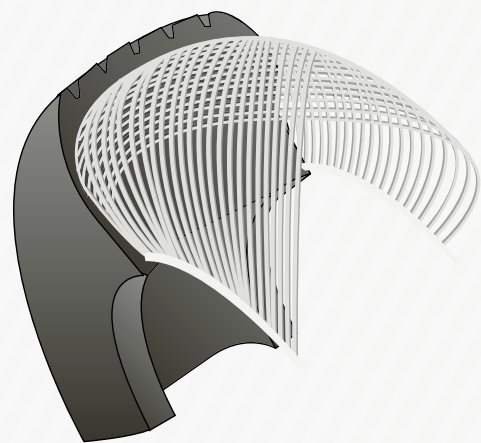
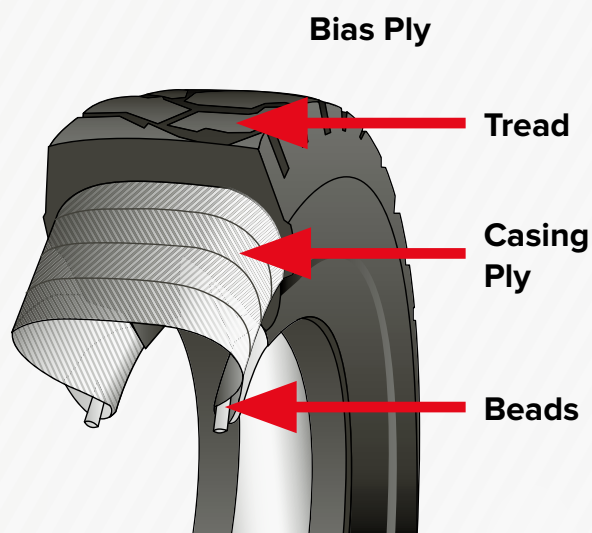
The main way of classifying the different tire/tyre constructions is by means of its casing's characteristics.

PNEUMATIC

These are tires/tyres that require air, so the casing can withstand the load being transported. Pneumatic tires/tyres are divided into two groups, according to their construction:

CONVENTIONAL OR BIAS PLY TIRES/TYRES:

This classification is characterized by the casing structure, composed of several crossed plies, tied to the lugs. They form angles of approximately 45 degrees to an imaginary line in the longitudinal direction of the tire/tyre.



Bias Ply Casing

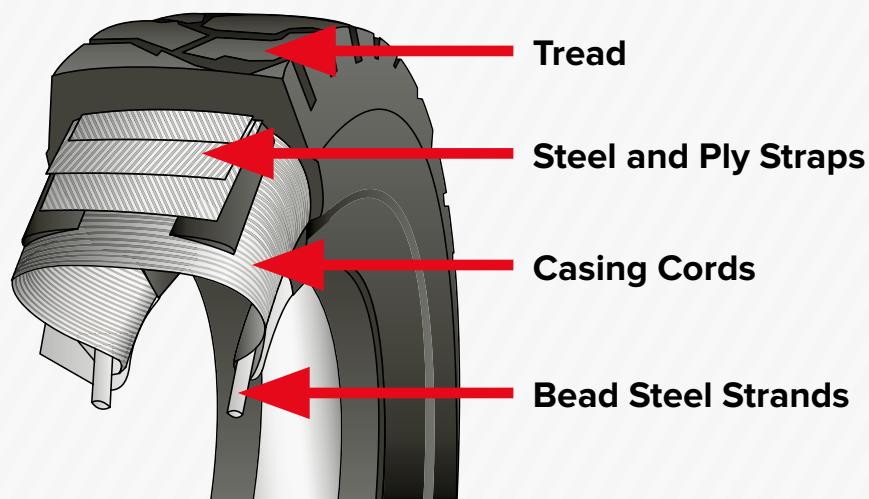
RADIAL TIRE/TYRE:

Radials are tires/tyres which casing is characterized by the existence of a body ply, represented by cords from bead to bead in the direction of the tire/tyre “radius”, forming an approximate angle of 90 degrees with an imaginary line in the longitudinal direction of the tire/tyre. Such cords are usually made of steel, but can also be made of textiles (rayon, polyester, nylon).

Another fundamental characteristic of this construction is the presence of steel stabilizing straps applied on the carcass ply (under the tread) at opposite angles and centered in the longitudinal direction of the tire/tyre.

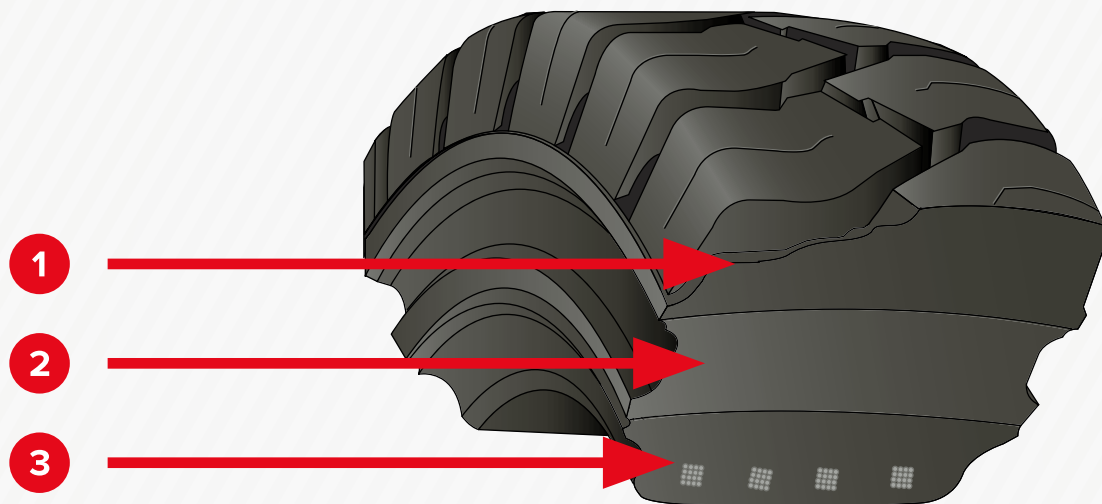
One of the advantages of this type of construction is that the impacts and deformations suffered on the tire/tyre side are not transferred to the tread.

This way, there is minimal loss of tread contact with the ground surface, resulting in greater drive and stability.



SOLID AND/OR SUPER-ELASTIC

The super-elastic and more rigid tires/tyres are those, generally, formed by three different rubber compounds, with specific characteristics and which totally complete the tires/tyres internal volume.



Tread and Sidewall Compound - Responsible for the tires/tyres service life, durability, and drive.

Intermediate Compound or “Filler” - Softer, it provides more comfort, low heat retention, and low rolling resistance to the operator.

Base Compound - Strictly speaking, the region which is in contact with the rim is characterized as being a compound with adequate hardness to provide maximum stability to the forklift. In this compound, the bead reinforcements are distributed to allow for a better tire/tyre fixation with the wheel.

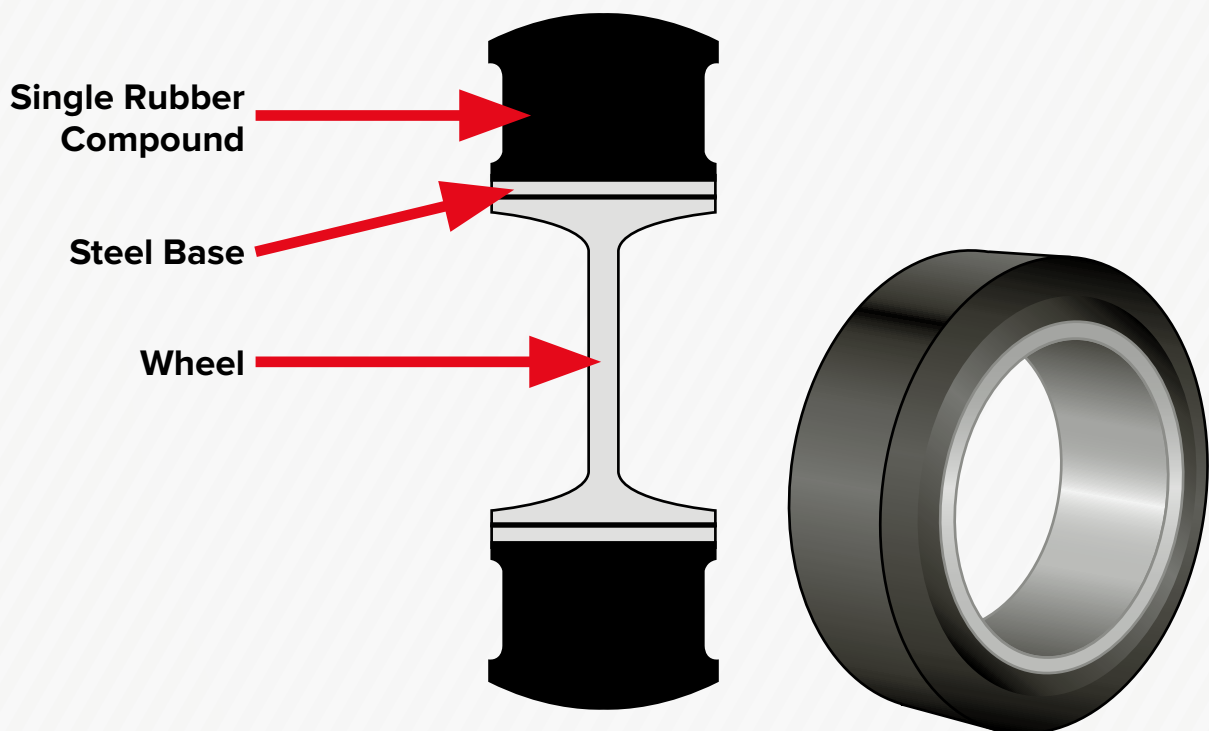
CUSHION OR PRESS-ON-BAND

The Cushion or “Press-on-Band” tire/tyre consists of a steel rim representing a unitary bead; on this base there is a vulcanized tread (generally with a single compound) forming a solid and ready-to-apply assembly.

The steel band provides easy installation and offers protection to the wheel and tire's/tyre's shoulder.

This structure also enables good heat dissipation through its steel base.

These tires/tyres are especially suitable for moving very high loads at low speeds. Used mainly in electric counterbalance forklifts, they become an economical and safe option. They have a tremendous service life even when they are demanded to the maximum, both in their load capacity and in speed.



TIRE/TYRE SIZES

There is a wide diversity of ways to inform the characteristics of an industrial tire/tyre, often making it difficult to identify the product.

To further deepen the analysis, it is important to mention the nomenclature of tire/tyre parts used by the industry, which will make it possible to understand the many ways of identifying the different measures.

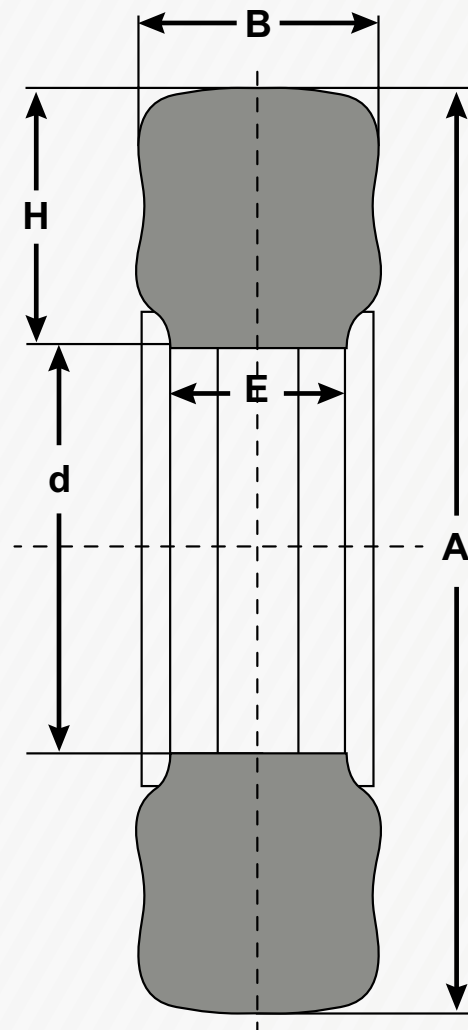
B = Section Nominal Width

H = Section Nominal Height

d = Rim Diameter

A = Tire/Tyre External Diameter

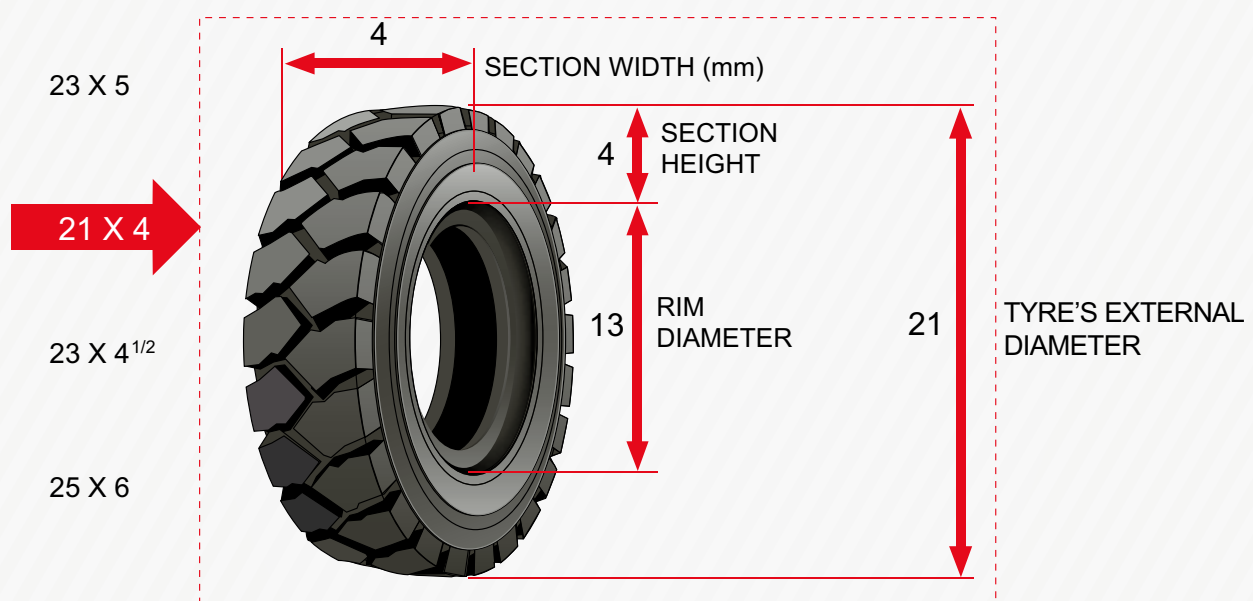
E = Rim Width

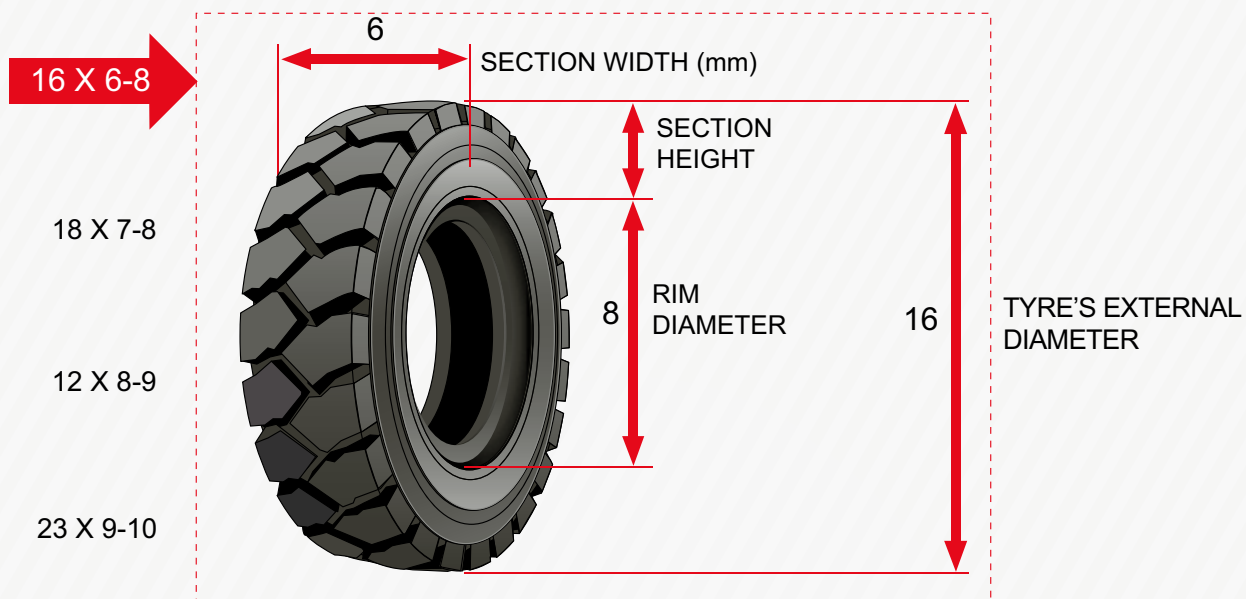


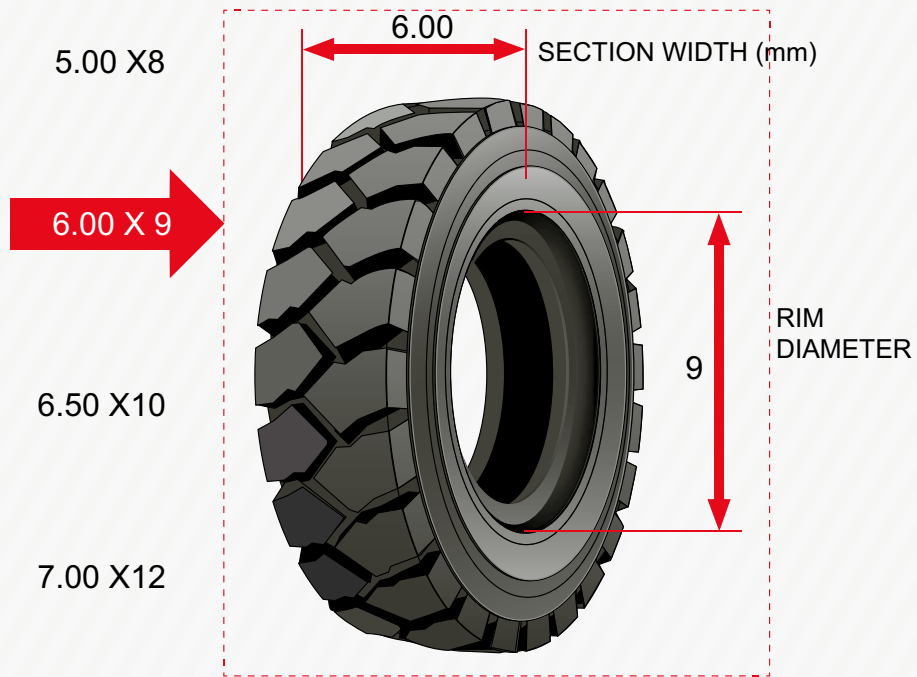
Observe the reading of the different tire/tyre sizes, as per the sheet below, for a better understanding, considering that the radial tires/tyres have the letter “R” in their measurements:

Size	External diameter	Section width	Height in % of width	Rim diameter
7.00 - 12	-	7 inches	-	12 inches
7.00 R12	-	7 inches	-	12 inches
23 X 5	23 inches	5 inches	-	-
18 X 7-8	18 inches	7 inches	-	8 inches
18 X 7 R8	18 inches	7 inches	-	8 inches
180/70 R8	-	180 millimeters	70	8 inches
250 - 15	-	250 millimeters	-	15 inches
355/65 - 15	-	355 millimeters	65	15 inches

Examples:







We can also observe that the same industrial tire/tyre size can be expressed in different ways, both in inches and millimeters:

Exemple:

$$180/70-8 = 18 \times 7-8$$

$$200/75-9 = 21 \times 8-9$$

$$29 \times 8-15 = 7.00-15$$

$$225/75-15 = 28 \times 9-15 = 8.15-15$$

LOAD INDEX AND SPEED SYMBOL

It is important to know the tires/tyres load capacity and the operation speed. Before, the tires/tyres load capacity was defined by the number of cotton plies with which the tire/tyre casing was built. With the raw materials improvement, the new fibers, much stronger and resistant, replaced the cotton ones using a smaller number of plies. This way, the term “Load Index” (CI) was created, which is a number, in a sheet corresponding to a value in kilos that the tire/tyre supports.

There is also a sheet that maintains a relationship between letters (SV - Speed Symbol) and the top speed indicated for the tire/tyre.

Conversion of 'plies capacity' to 'load capacity'

Cargo capacity.

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

It represents the maximum load that the tire/tyre can support in nominal use condition, identified by a load index or corresponding manner.

Abbreviation: LOAD CAP.

The tire's/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

Speed symbol

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

Speed symbol	Speed (km/h)
A1	5
A2	10
A3	15
A4	20

F. Load index

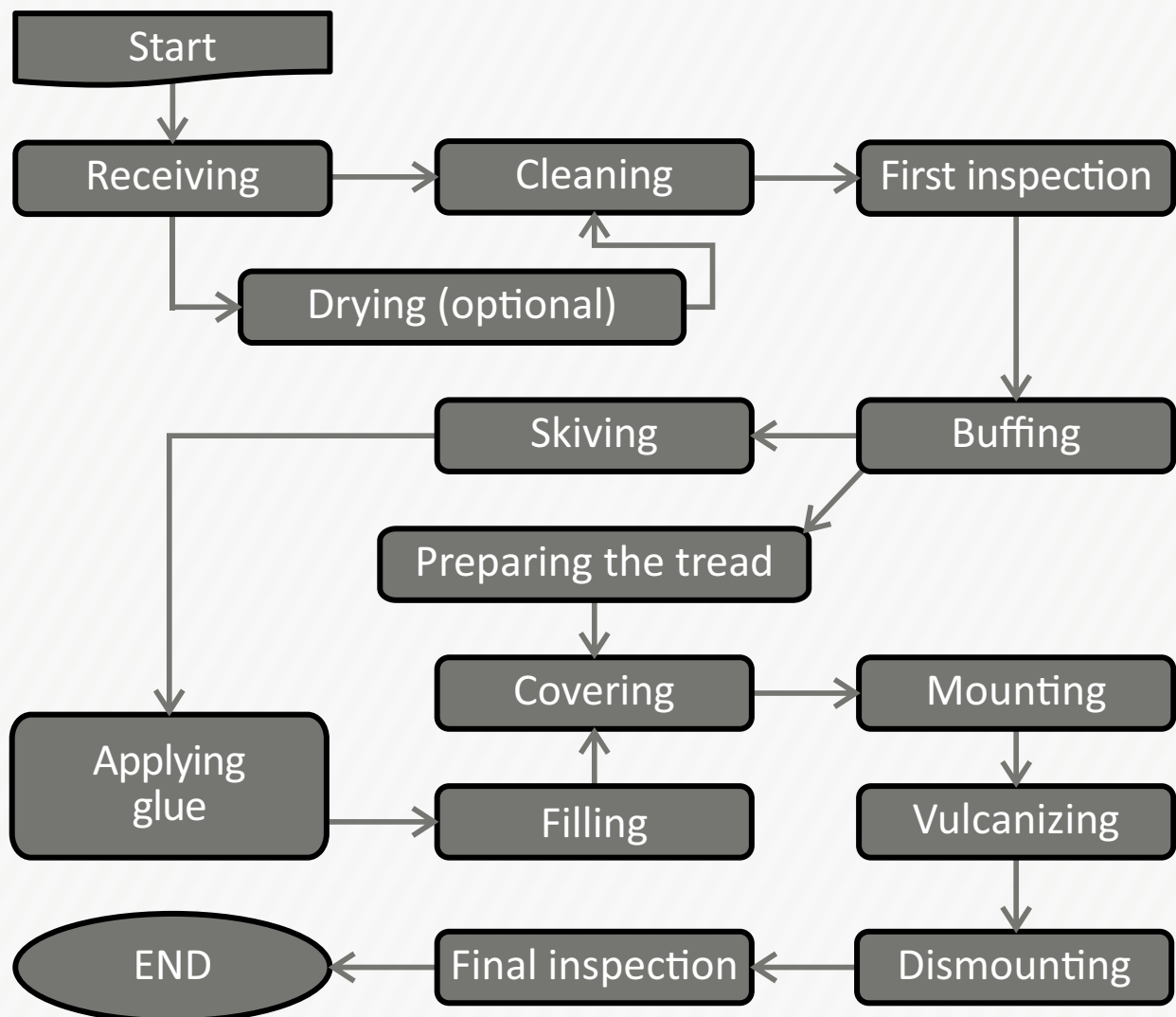
The 'Load index' (L.I.) is a numeric code associated to the maximum load to which a tire/tyre can be submitted, to the speed indicated by the Speed symbol in the service conditions specified by the tire/tyre manufacturer.

LI	kg	LI	kg	LI	kg	LI	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

LI	kg	LI	kg	LI	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

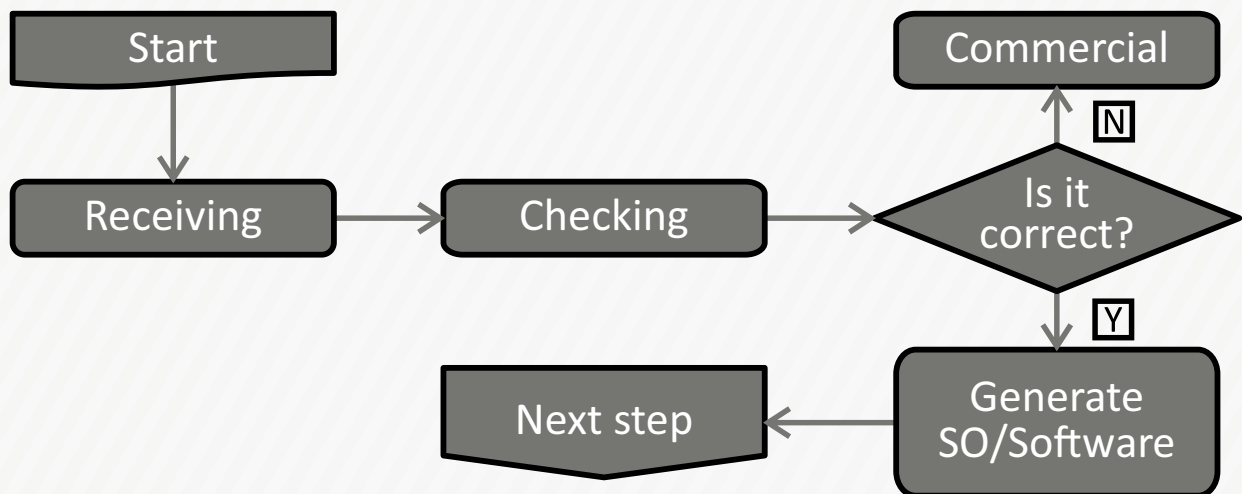
INDUSTRIAL TIRE/TYRE RETREADING STEPS

TIRE/TYRE RETREADING GENERAL FLOWCHART



RECEIVING AND CHECKING TIRES/TYRES

RECEIVING AND CHECKING TIRES/TYRES FLOWCHART



OBJECTIVE:

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

SECTOR:

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

PROCEDURE:

Perform preliminary tire/tyre analysis and check if the information in the incoming invoice is the same as the ones in the sidewall.



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



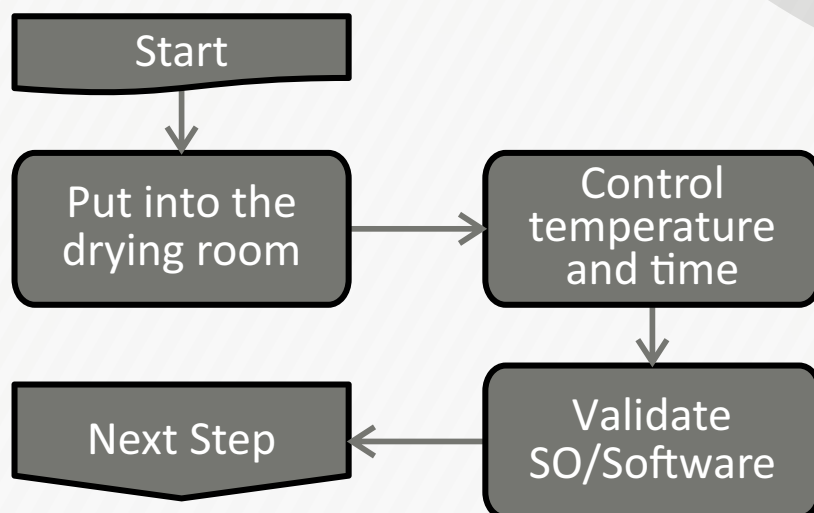
Store the tires/tyres in covered space, organizing them to facilitate handling.

TOOLS:

- Clipboard.
-

DRYING

DRYING FLOWCHART



OBJECTIVE:

Drying or eliminating humidity from tires/tyres.

SECTOR:

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

PROCEDURE:

Keep the drying room warm to a temperature of 60°C ($\pm 10^\circ\text{C}$).



Leave the tires/tyres in the drying process for at least 4 hours.

EQUIPMENT:

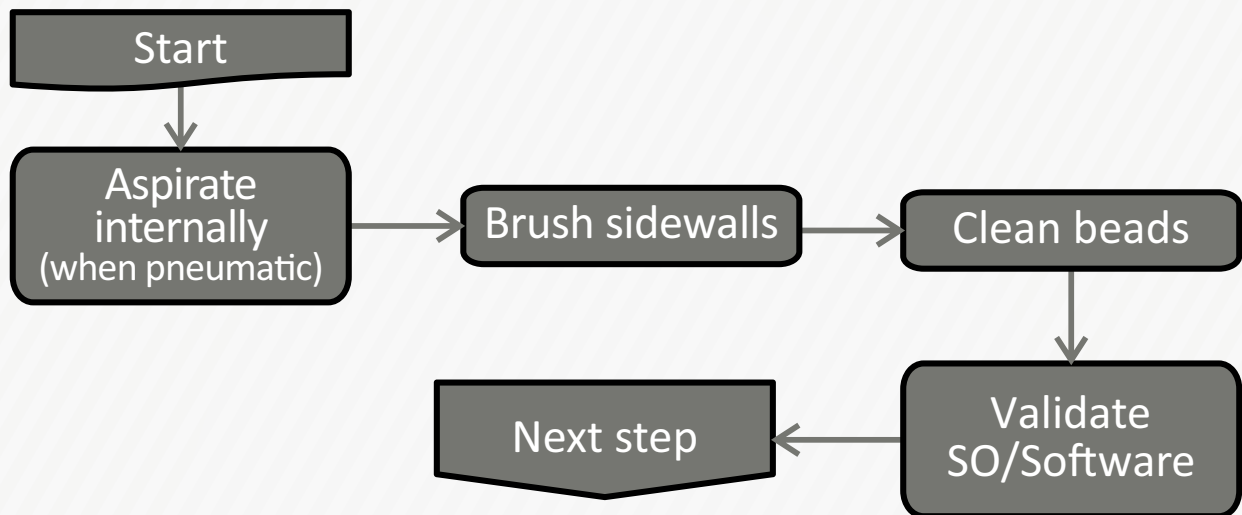
Drying room with moisture exhaustion, controller of temperature and time.

Note:

This stage is not mandatory in the process.

CLEANING

CLEANING FLOWCHART



OBJECTIVE:

Perform cleaning to facilitate initial tire/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, when pneumatic, 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.

EQUIPMENT:

- Cleaning machine;
 - Exhaust system.
-

TOOLS:

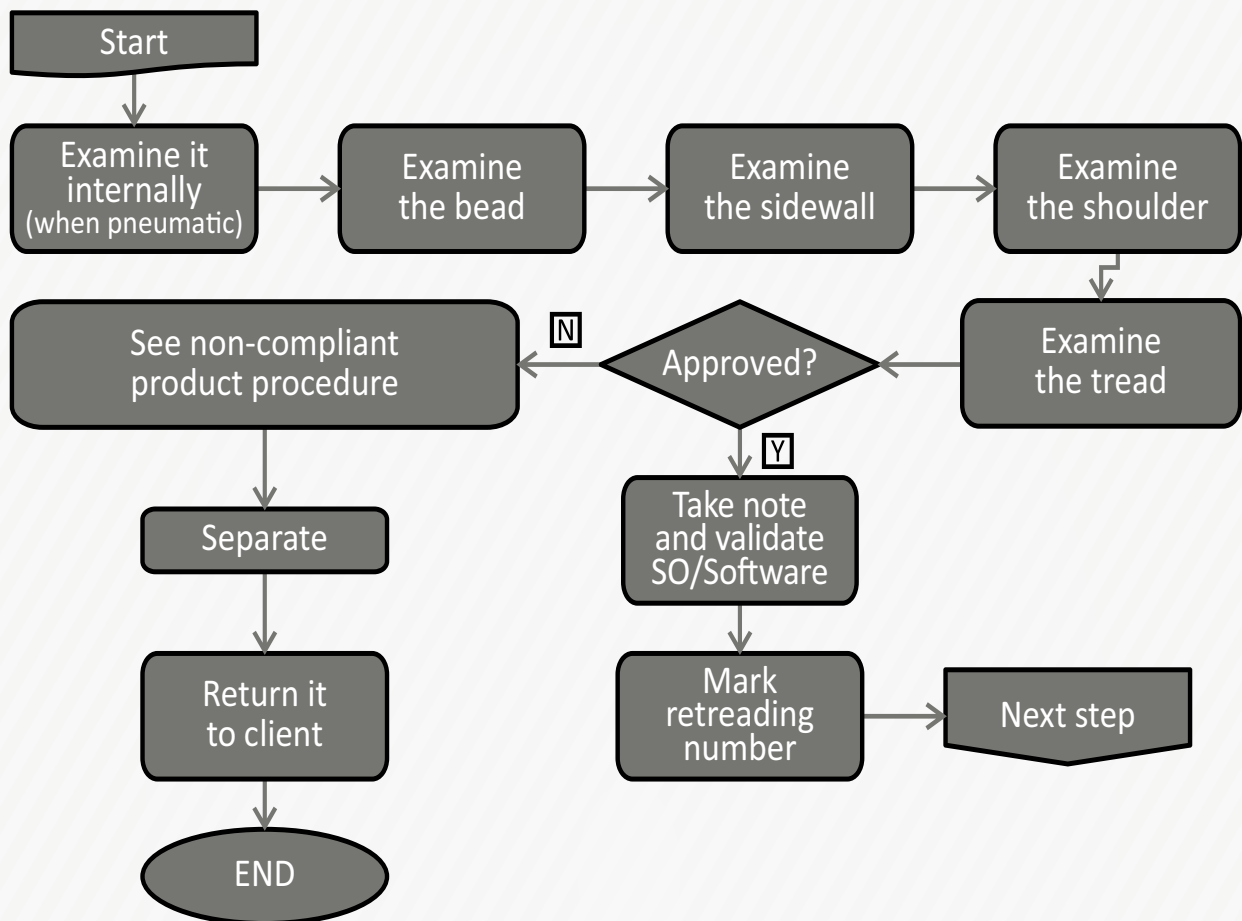
- Industrial vacuum and/or exhaust system;
 - Cloth or tow for cleaning/drying the tire/tyre.
-

Note:

In case of contamination by oil derivatives, reject the tire/tyre.

INITIAL INSPECTION AND CLASSIFICATION

FIRST INSPECTION FLOWCHART



OBJECTIVE:

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

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 tire/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 tire's/tyre's internal area, the operator must check when pneumatic:

- Existence of perforation, tire/tyre casing displacement, radial cracks;
- Damages (breakdowns) on the casing structure;
- Indicators of tread with low pressure, presenting folds on the carcass ply or blisters perceived by touch;
- Variations of circumferential color or roughness in the bending area, indicating overheating;
- Tubeless tires/tyres presenting inner liner displacement or openings in the splice.



In order to check if there are displacement in the plies, put your hand in the tire's/ tyre's internal area corresponding to the tread and the shoulder and turn the tire/tyre. If there are blisters, make sure it is not a displacement.



2 - Bead:

- Check deformations due to incorrect mounting, folds, and broken wire;
- Check if the tire/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.



3 - Sidewall:

- Check if there are broken plies, displacement, blisters, marks (folds) that indicate run flat;
- Contaminations by hydrocarbons (oils and greases);
- Tire/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;
- If separation is suspected, confirm with the aid of an awl or by injecting air into the separate area.



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;



If the tire/tyre is approved, make a mark indicating the amount of retreads that it has undergone. Such marks must be made through vertical and successive bars, with maximum height of 10mm, positioned next to the tire's/tyre's tire/tyre measurement marking.

Fill in the data on the tire/tyre service order or software.

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

EQUIPMENT:

Inspection machine with good lighting, allowing opening (when pneumatic) and turning of the tire/tyre.

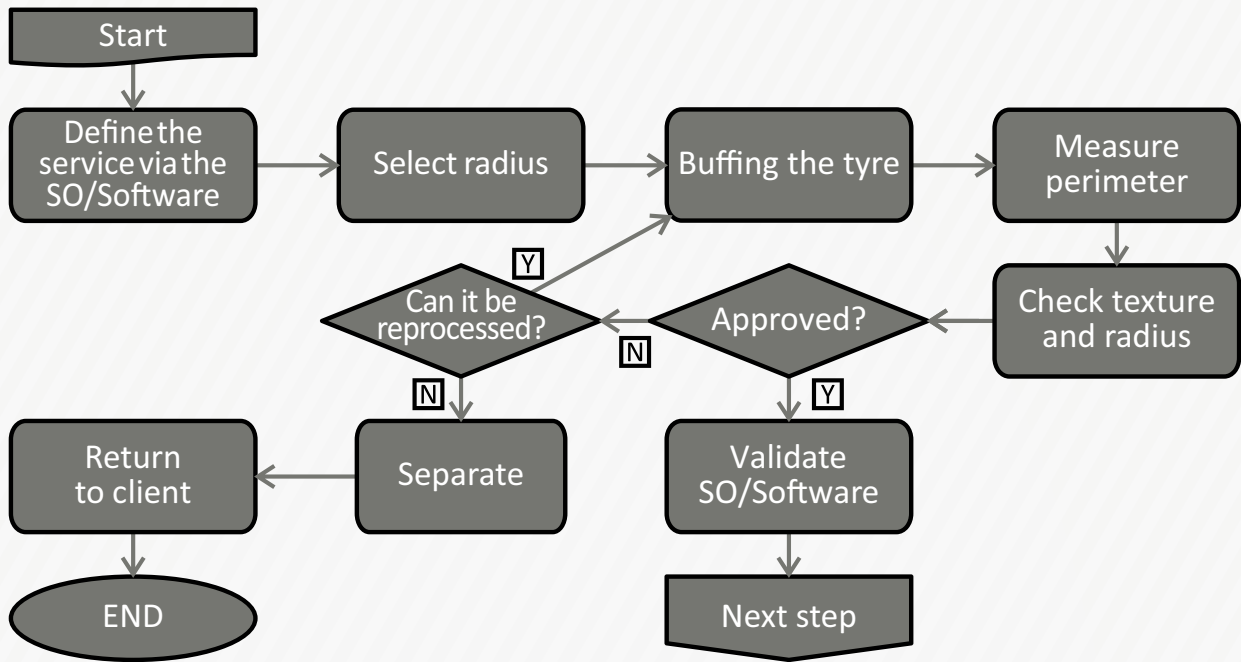
There are machine that use electrical current for detecting holes; others use high pressure or comparisons of images from the tire/tyre submitted to vacuum or not (shearography) so to evaluate the casing's structure.

TOOLS:

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

BUFFING

BUFFING FLOWCHART



OBJECTIVE:

Remove remaining tread, leaving the tire/tyre with the proper dimensions (base width, radius, and under tread) and texture to apply the new tread and sidewall.

SECTOR:

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

PROCEDURE:

Position the tire/tyre on the equipment, and when it is allowed, inflate the tire/tyre between 20 and 30 PSI..



Scrape the split tire/tyre from the hump, maintaining the original curvature of the tire/tyre (buffing radius). This is achieved by trimming the design of the original tread evenly. When the original design is scrapped, the process is complete.

Advance carefully with each advancing so that the rubber is not burned.

Excessive heating caused by great advances or older buffing blades cause superficial degradation of the rubber, which makes the adhesion of the cushion gum difficult.

Note:

For solid tires/tyres, the plies or second layer or rubber should not be hit, in case this occur, the tire/tyre should be discarded.



It is essential that the buffed surface be clean and with the correct texture to allow great adherence of the new tread. The ideal texture is the RMA3 and RMA4.



Note 1:

Measure the perimeter with a measuring tape, a mechanical measurer, or laser.

For cases when the measuring is done with a circumferential laser measurer, the tire/tyre must be in movement in the moment of measure. When the measuring is done with measuring tape or mechanical circumferential measurer, the tire/tyre must be stopped.

This will work for cutting the tread and for forming pairs when the tires/tyres are from the same client.



Use a tread gauge to adjust the trim on the side or metal ruler.



Write the perimeter of the buffed tire/tyre and floor width on the service order or register it in the software.

EQUIPMENT:

- Buffing machine;
 - Circumferential measurer.
-

TOOLS:

- | | |
|-----------------------|--------------------------------|
| • Tungsten discs; | • 1 kg rubber hammer; |
| • Buffing blades; | • Probing awl; |
| • Tread templates; | • Slip joint pliers; |
| • RMA table; | • Knife; |
| • 5 m measuring tape; | • Metal tape measure of 40 cm. |
-

Note 2:

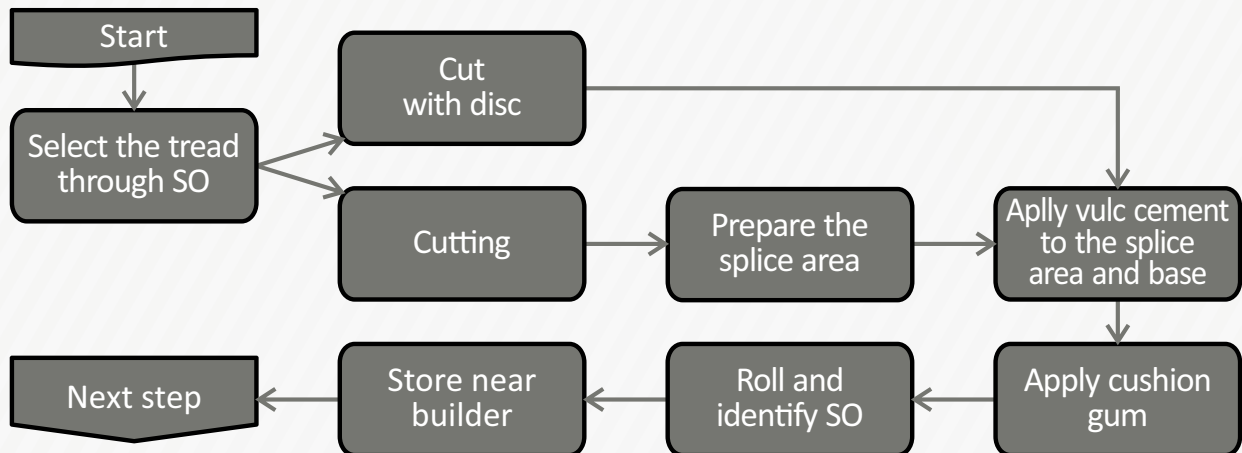
It is important that tires/tyres from the same client, with the same size and tire/tyre construction, must be buffed with the same radius and perimeter.

Note 3:

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

PREPARING THE PRECURED TREAD

TREAD PREPARATION FLOWCHART



OBJECTIVE:

Preparing the tread for application to the tire/tyre.

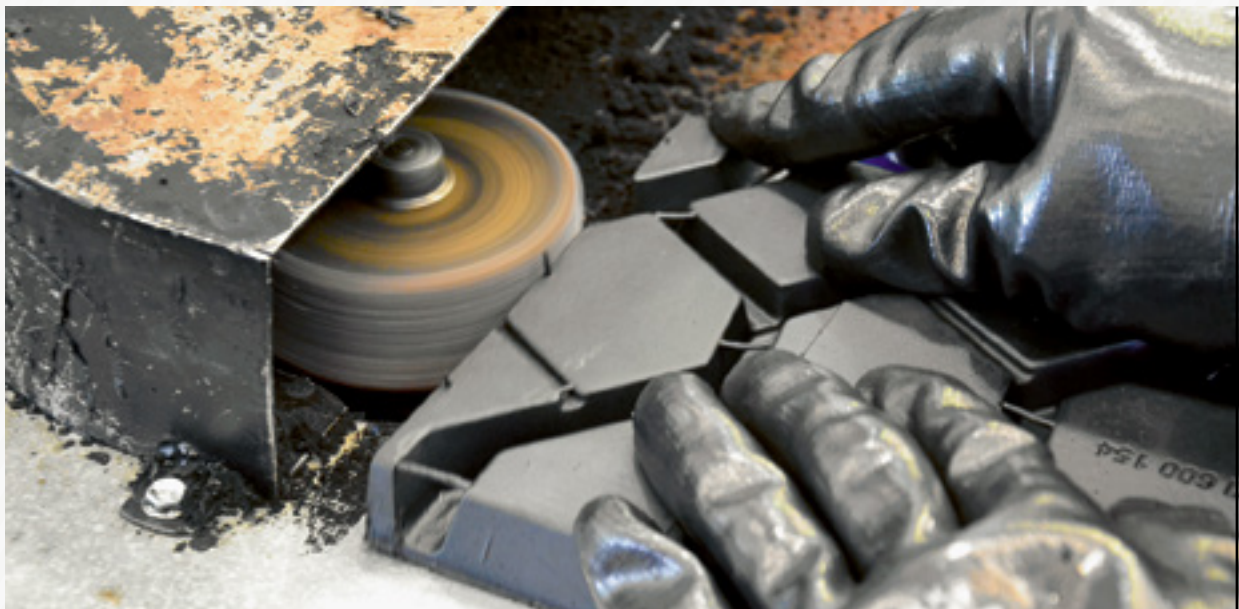
SECTOR:

Ideally wide, with adequate lighting and clean.



PROCEDURE:

After choosing the Vipal procured tread and width more adequate to the buffed casing, you must cut it with the guillotine or cutting tungsten disc to obtain the length corresponding to the perimeter of the buffed tire/tyre.



Buffing the tread's splice area, obtaining RMA1 or RMA2. If the cutting of the tread was done with a cutting disc, and that leaves a proper 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 reapplying the cement is necessary, remove the plastic; if not, remove it in the connection application.

Note:

When using non-tarnishing treads, it will always be necessary to apply glue to the base.



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



Select the MB/AC Vipal Cushion Gum according 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 tire/tyre, do not consider this stage.**



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

In the case of application of non-tarnishing treads, the following procedure must be followed:

- 1** - Cut the tread as far as the circumference of the trimmed tires/tyres;
- 2** - Remove protective fabric from base;
- 3** - Apply a layer of Vulk Cement, letting it dry;
- 4** - Apply the MB/AC Connection in the non-tarnishing tread;
- 5** - Allow the tread to rest for at least 30 minutes before applying it to the casing.

This procedure will provide adequate grip between the tread and the connection.

EQUIPMENT:

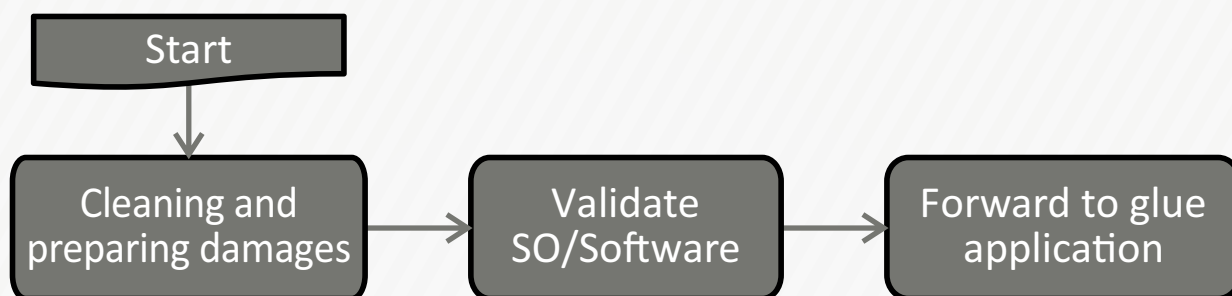
- Tread preparation table with guillotine or cutting machine;
 - Extruder air cylinder;
 - Tungsten grinding wheel;
 - Tread support for drying of glue.
-

TOOLS:

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

SKIVING

SKIVING FLOWCHART



OBJECTIVE:

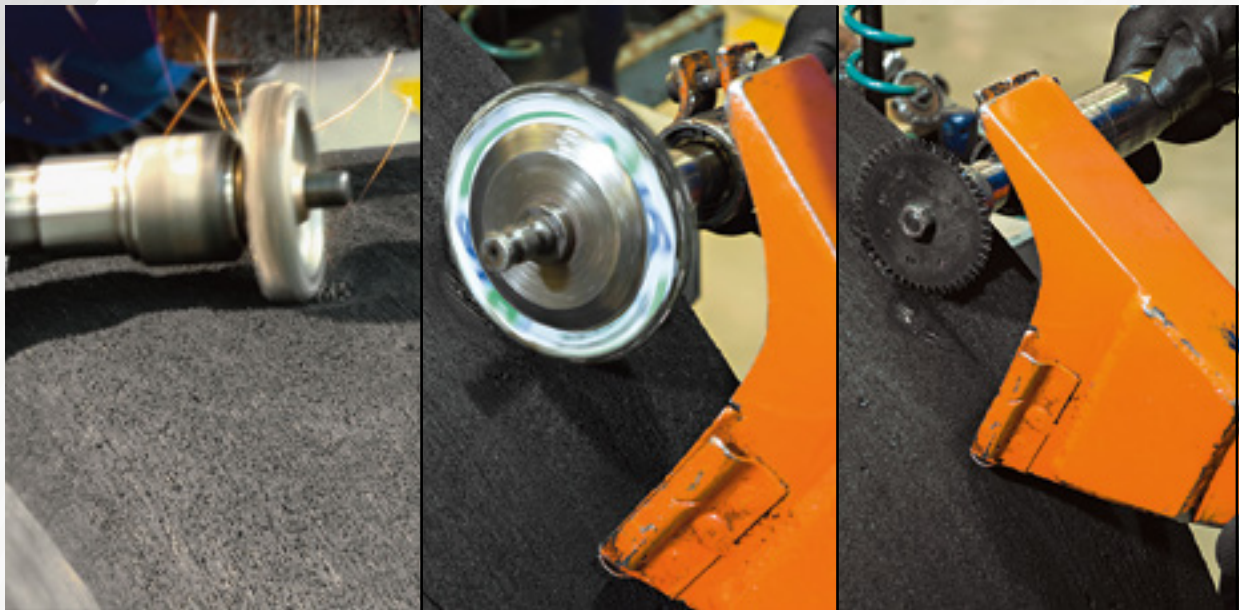
Cleaning and preparing the damages that compromise the retreading process and the casing's integrity, be it on the bead (rubber only), sidewall, shoulder, and/or tread.

SECTOR:

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

PROCEDURE:

Turn the tire/tyre and identify damages to be skived.



Skive the damage in a concave way, removing the loose rubber, preparing the damage so to avoid straight or too open angles that hamper the filling's anchorage. Remove the rubber and the loose plies/belts with a whip or a low rotation turbine with the help of a rubberized brush or tungsten disk or a circular saw. Tools with 2,500 rpm and 3,500 rpm are recommended.



Remove damaged cables with abrasive and/or tungsten blades mounted on a high-speed turbine or electric grinder, between 10,000 rpm and 25,000 rpm.



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



Clean the tire/tyre with a nylon brush or paintbrush.

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:

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

EQUIPMENT:

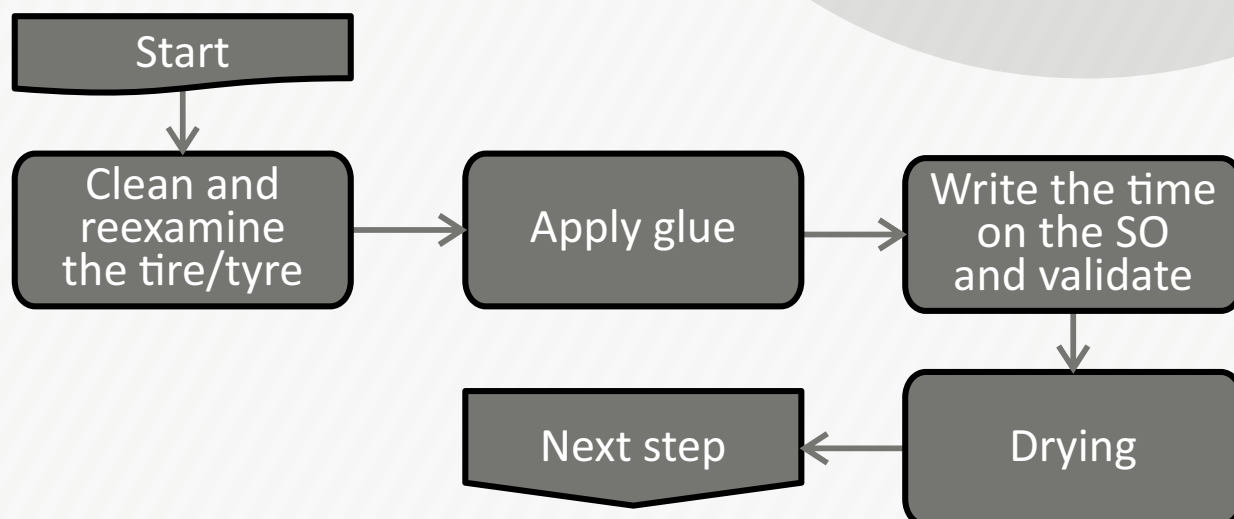
- Low rotation electrical grinder (2,500 to 3,500 rpm);
 - Pneumatic turbine or high rotation electrical grinder from 18,000 to 25,000 rpm;
 - Trestle for skiving.
-

TOOLS:

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

APPLYING THE GLUE

APPLYING THE GLUE FLOWCHART



OBJECTIVE:

To reexamine the previous steps. To ensure the necessary adhesion among tire/tyre, cushion, and tread so to allow their fixation until the set is vulcanized.

To protect the buffed area from oxidation and tire/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 tire/tyre internally, when pneumatic.



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



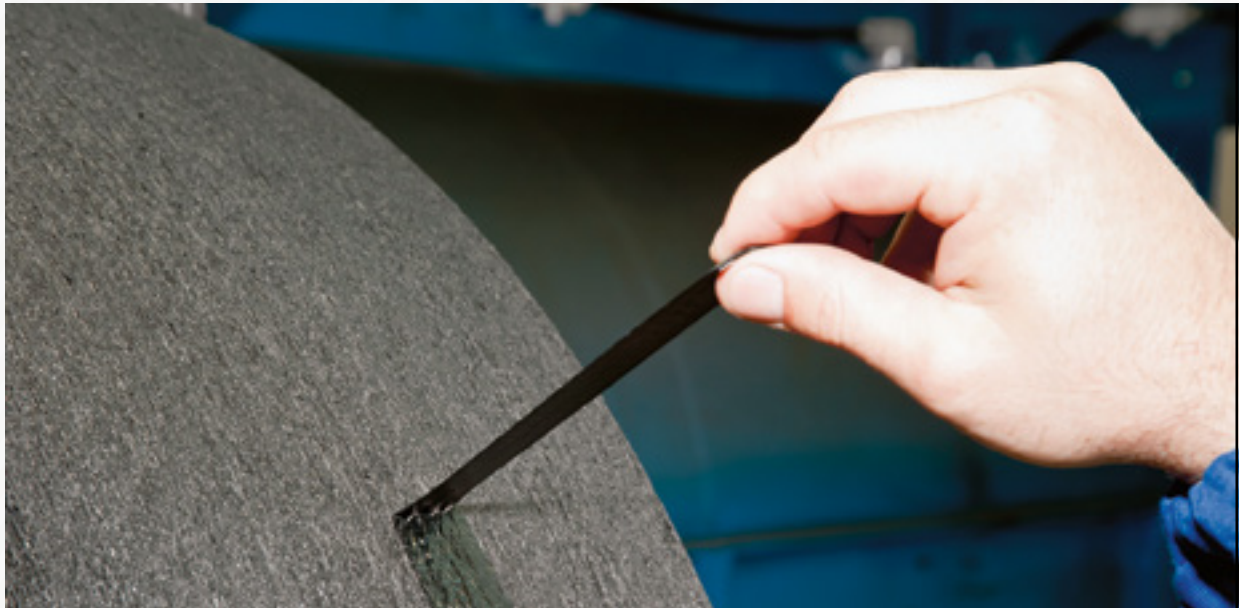
Then, with a spray gun, apply a thin and even layer of cement in all buffed area that will be covered.

Follow the instructions correctly, according to the package and make sure there is no buildup of glue on the trimmed surface.

Note:

When not in use, keep the gun's nozzle inside the solvent to avoid clogging, and keep the paintbrush inside the cement recipient to avoid hardening the bristles.

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 establish 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 Vipal shoulder stripping gum of about 4 cm wide by 10 cm of length, observing the following procedure:

- Stitch 50% of the length of the Cushion MB/AC or Vipal shoulder stripping gum over the buffed surface with cement;
- Remove the protective plastic. In a 90° angle, pull the Cushion MB/AC or Vipal Shoulder veneer, if it offers resistance and stretches, it is ready for next stages;
- If, when pulling, the Cushion MB/AC or Vipal shoulder veneer detaches itself easily, drying time must be longer.

Note:

- 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 tire/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 ($\pm 5^\circ\text{C}$).

Permanence time of the tire/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.
-

COVERAGE

OBJECTIVE:

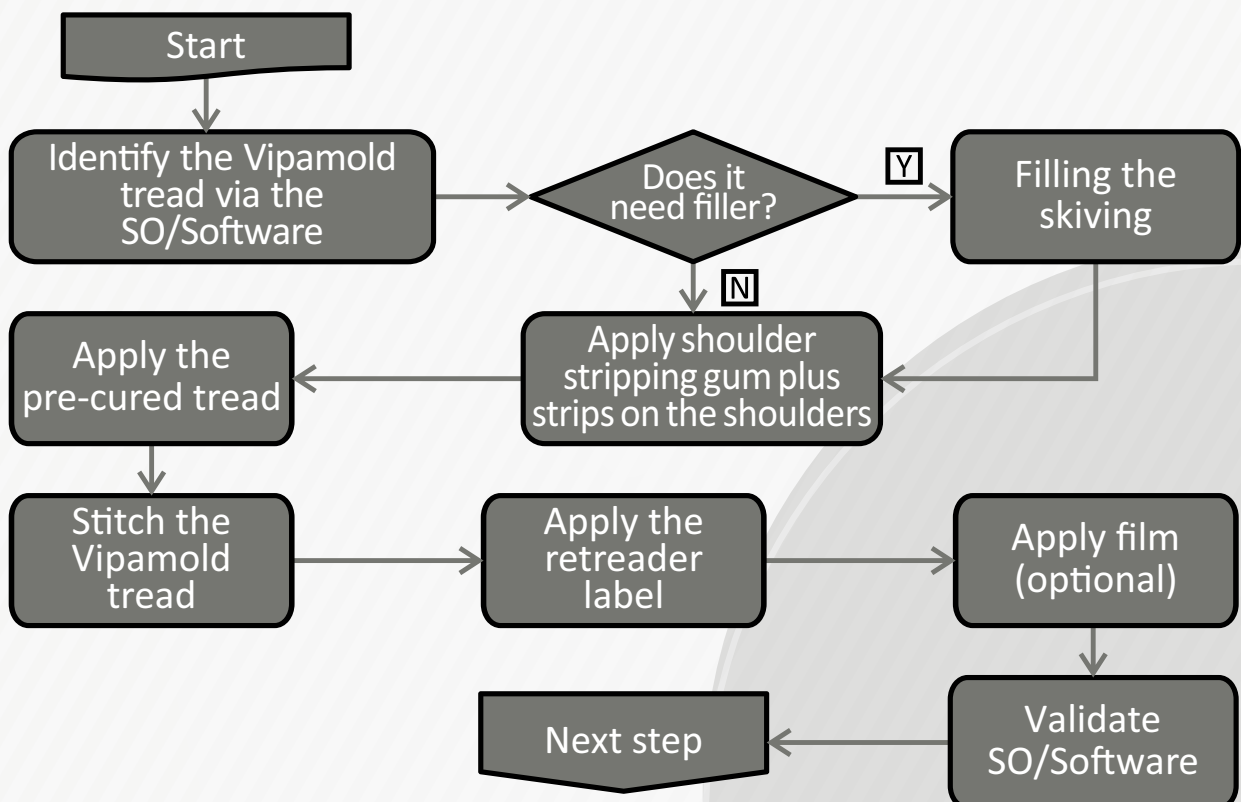
To replace a new tread in the tire/tyre.

SETOR:

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 or software.



Fill in the skiving with mini extruder heated to $75^{\circ}\text{C} (\pm 5^{\circ}\text{C})$, leaving an excess of maximum 1mm above the tire's/tyre's level.



Apply a strip of shoulder veneer to the tire's/tyre's shoulders, keeping the plastic.
Stitch manually and then remove the plastic.



Applying tread with MB/AC cushion gum.

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

Note:

When buffing still shows on the covering, apply shoulder veneer for better finishing.

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

Mend joint



For a correct and perfect joining of the Vipalmold preformed, with the help of a metal ruler, position the ends observing the design order.



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.



Apply the retreader's label or complying with local legislation. Check local legislation.



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

Note 1:

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

Note 2:

The rollers' pressure must be of at least 4 kgf/cm^2 and not over 4.5 kgf/cm^2 . We recommend that this pressure be certified in the equipment specification.

EQUIPMENT:

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

TOOLS:

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

TIRE/TYRE ASSEMBLY

This step can be in two ways:

- **Set with wheels**

Tire/tyre + envelope + curing tubes + flap + wheel (Applied when pneumatic).

- **Flange assembly**

Tire/tyre + envelope + special wheel (Applies only to solid tire/tyre).

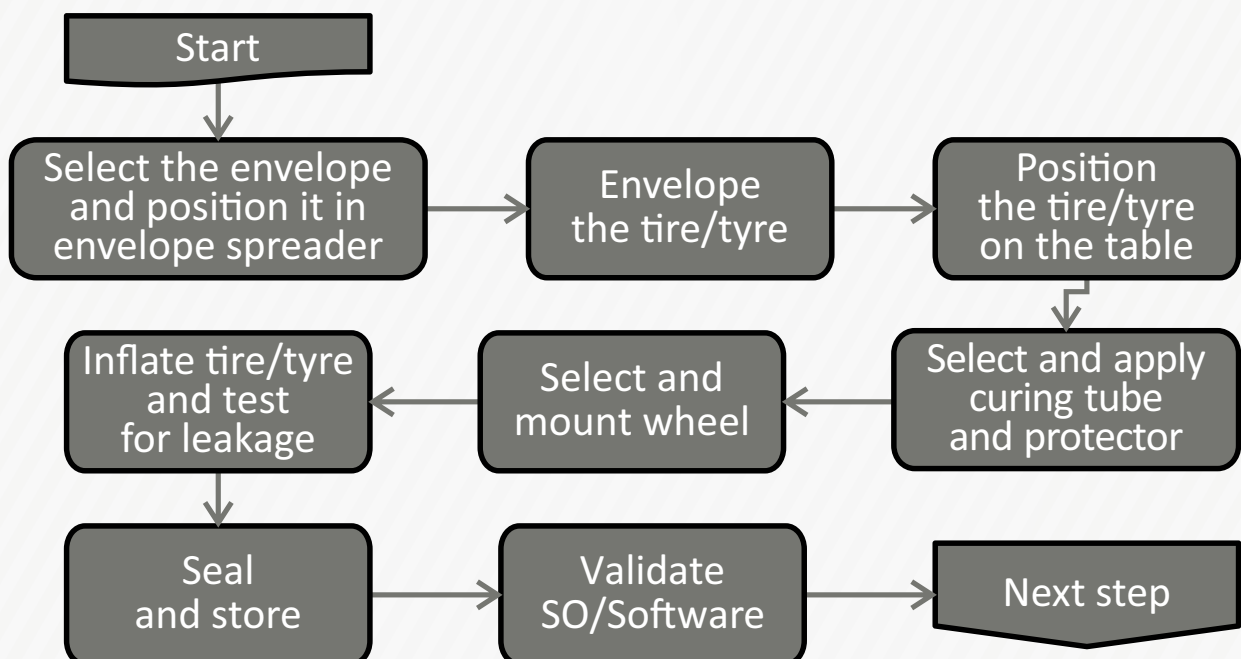
OBJECTIVE:

To prepare the tire/tyre for vulcanization in autoclave.

SECTOR:

Well-lit and ideally wide to allow distribution of equipment and accessories.

MOUNTING THE TIRE/TYRE WITH WHEEL IN AUTOCLAVE SYSTEM FLOWCHART



DIMENSIONAL TABLE OF ENVELOPES

ENVELOPES	APPLICATION
Assembled	
13	Rim 13 and smaller
14	Rim 13 e 14
15	Rim 14 e 15
16	Rim 15 e 16

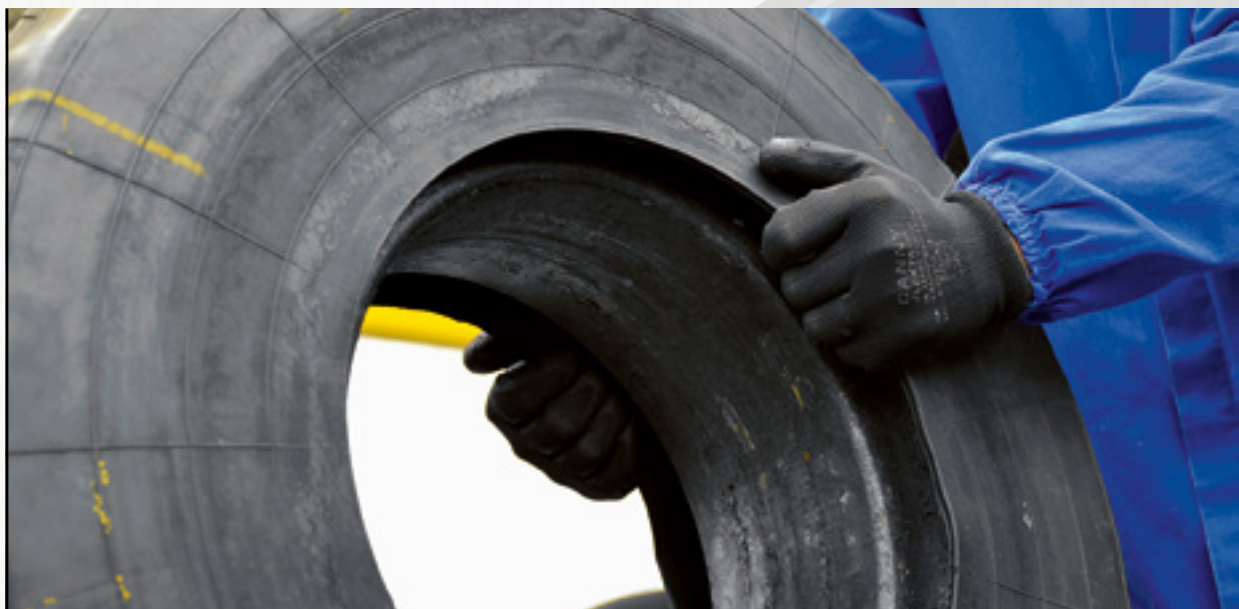
- Select the external envelope corresponding to the tire's/tyre's size.



Positioned the envelope in the envelope spreader, making sure that the valve position remains the same.



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



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

DIMENSIONAL TABLE OF CURING TUBES AND PROTECTORS

CURING TUBES	APPLICATION (TIRE/TYRE)
R 13	Rim 13 and smaller
R 14	Rim 14
R 15	Rim 15
R 16	Rim 16

- For rim 16 tires/tyres use the rim protector 16, for smaller rim tires/tyres, cut the rim protector 16 and use it open.



Select the corresponding curing tube and put it inside the tire/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.



Select the corresponding wheel, place the tire/tyre on the wheel with the notch turned to the valve, making sure that it is seated in the notch, then assemble the other wheel part.



With the tire/tyre laid on the mounting table, connect the spiral hose for air drainage (form vacuum). Inflate the air bag with a maximum of 30psi.

Check for leakages using the vacuum gauge. After forming the vacuum, close the valve and wait for the vacuum gauge to stabilize. If it does not stabilize, there is a leakage.

In this case, check the origin and eliminate leakage through repairs to the envelope or adjustment to the equipment.



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

Note:

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.

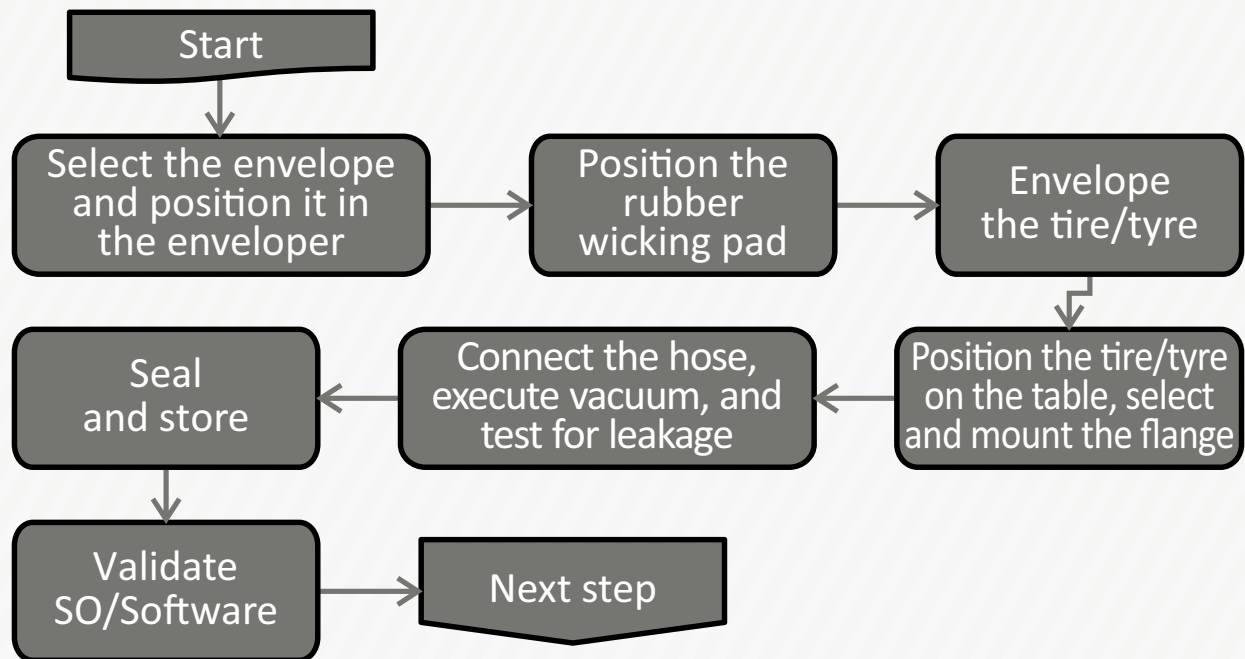
EQUIPMENT:

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

ACCESSORIES:

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

MOUNTING THE TIRE/TYRE WITH FLANGE AUTOCLAVE SYSTEM FLOWCHAR



PROCEDURE:

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



Apply the rubber wicking pad 90° to 180° from the precured tread's seam. If a polyester film is used, it is necessary to make cuts in the circumferential direction where it will be applied.



Select the corresponding flange, place the tire/tyre on one of the flange parts, and then mount the other part of the flange.



With the tire/tyre laid on the mounting table or on the table, connect the spiral hose for air drainage (form vacuum).

Check for leakages using the vacuum gauge. After forming the vacuum, close the valve and wait for the vacuum gauge to stabilize. If it does not stabilize, there is a leakage.

In this case, check the origin and scrapped leakages through repairs to the envelope or adjustment to the equipment.

IMPORTANT:

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

EQUIPMENT:

- Envelope spreader;
 - Mounting table;
 - Hooks;
 - Vacuum pump;
 - Vacuum's surge tank;
 - Vacuum gauge;
 - Vacuum sensor.
-

ACCESSORIES:

- Rubber wicking pad;
 - Rubber lid for the valves;
 - Envelope;
 - Mounting flange.
-

VULCANIZATION IN AUTOCLAVE

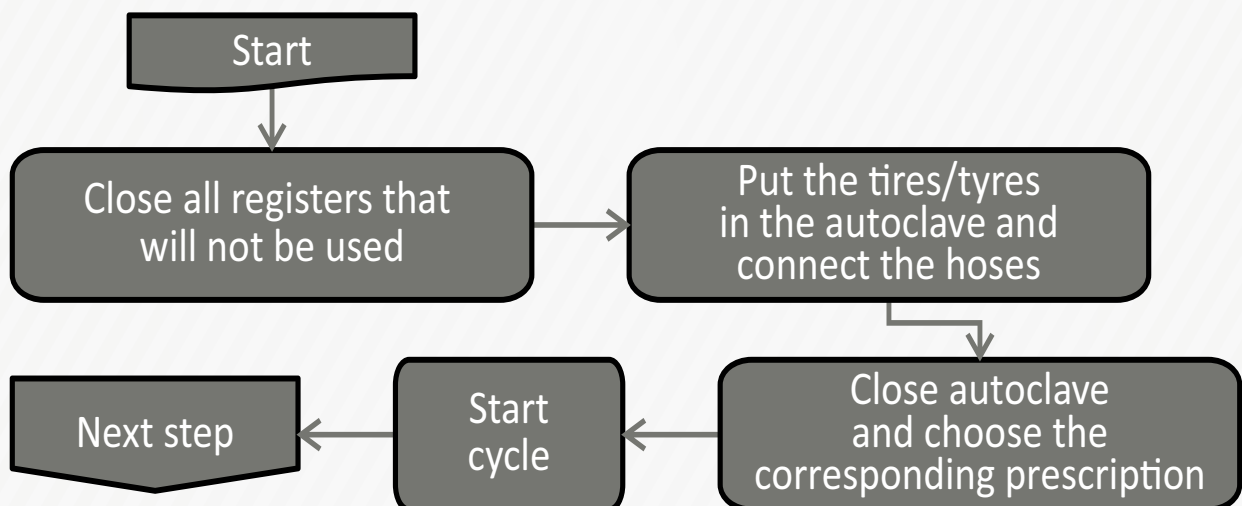
OBJECTIVE:

This stage has the function of changing the physical properties of the rubber from a plastic state to an elastic state, by means of time, temperature and pressure, so that the tread properly adheres to the tire/tyre.

SECTOR:

Ideally wide to allow handling of the mounted tires/tyres.

VULCANIZATION IN AUTOCLAVE FLOWCHART





PROCEDURE:

Close the hoses' registers that will not be used, that will not have tire/tyres connected to them.



Set of wheel: Put tires/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 flange: Put tires/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.

WHEEL MOUNTED TIRES/TYRES PROGRAMS

	Industrial load	OTR Industrial
Time	120 min.	180 min.
Temperature	120°C	120°C
Curing tubes pressure	105 psi	105 psi
Autoclave(curing chamber) pressure	75 psi	75 psi
Envelope pressure	60 psi	60 psi

Note: For pneumatic industrial tires/tyres

INNLOP MOUNTED TIRE/TYRE PROGRAMS 112°C - 120°C

	Industrial Light	Industrial load	OTR Industrial
Time	120 / 90 min.	150 / 120 min.	180 / 150 min.
Temperature	112 / 120°C	112 / 120°C	112 / 120°C
Autoclave (curing chamber) pressure	75 psi	75 psi	75 psi
Envelope pressure	60 psi	60 psi	60 psi
		For drawings up to 20 mm	For drawings over 21 mm

Note: For pneumatic industrial tires/tyres

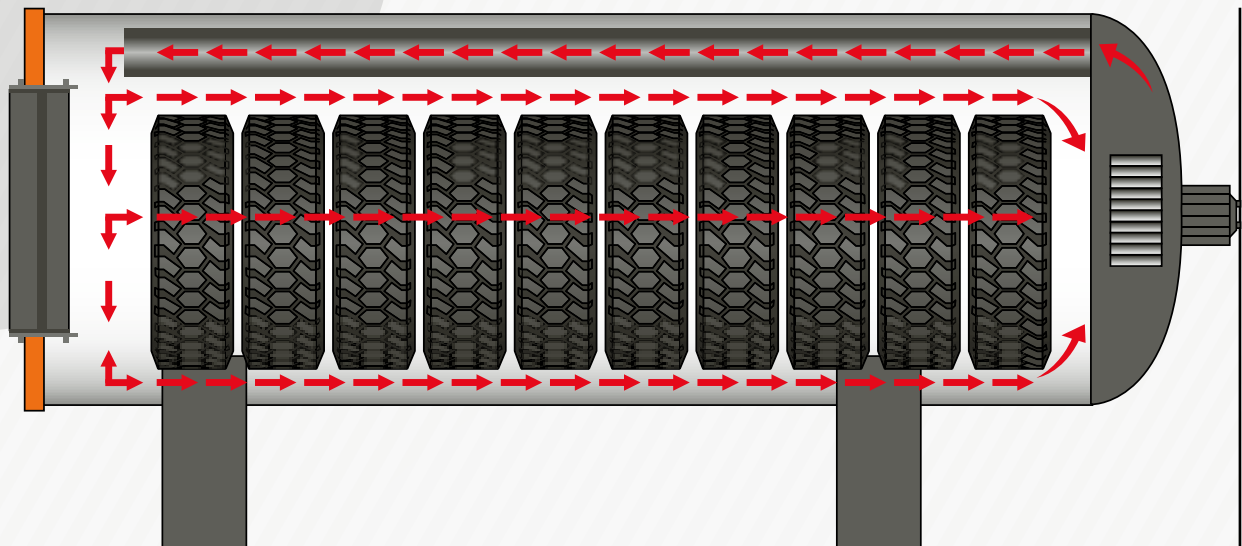
SOLID TIRE/TYRES PROGRAMS 125°C

	Industrial Solid Light	Industrial Solid Load	Industrial Solid OTR
Time	150 min.	180 min.	210 min.
Temperature	125°C	125°C	125°C
Autoclave (curing chamber) pressure	75 psi	75 psi	75 psi
Envelope pressure	60 psi	60 psi	60 psi

Note: For massive industrial tires/tyres

Note:

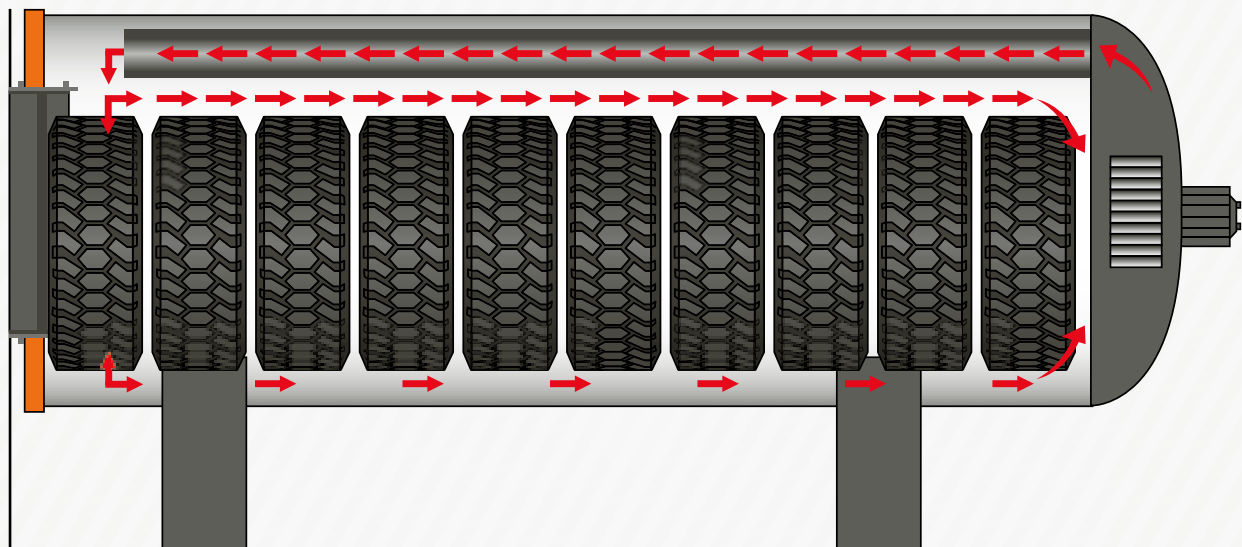
To better define the programs, it is imperative that the DIV - Vulcanization Index Determination is done, by a Vipal Rubber technician to evaluate which recipes best fit the equipment, tire/tyre, process, and design used by each retreader.



Note:

Make sure that the space between the door and the last tire/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..



It is essential to have air circulation between the tires/tyres, otherwise, it compromises the vulcanization process.

In case of tires/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.

EQUIPMENT:

- Autoclave;
- Vacuum pump.

DISMOUNTING THE TIRE/TYRE

OBJECTIVE:

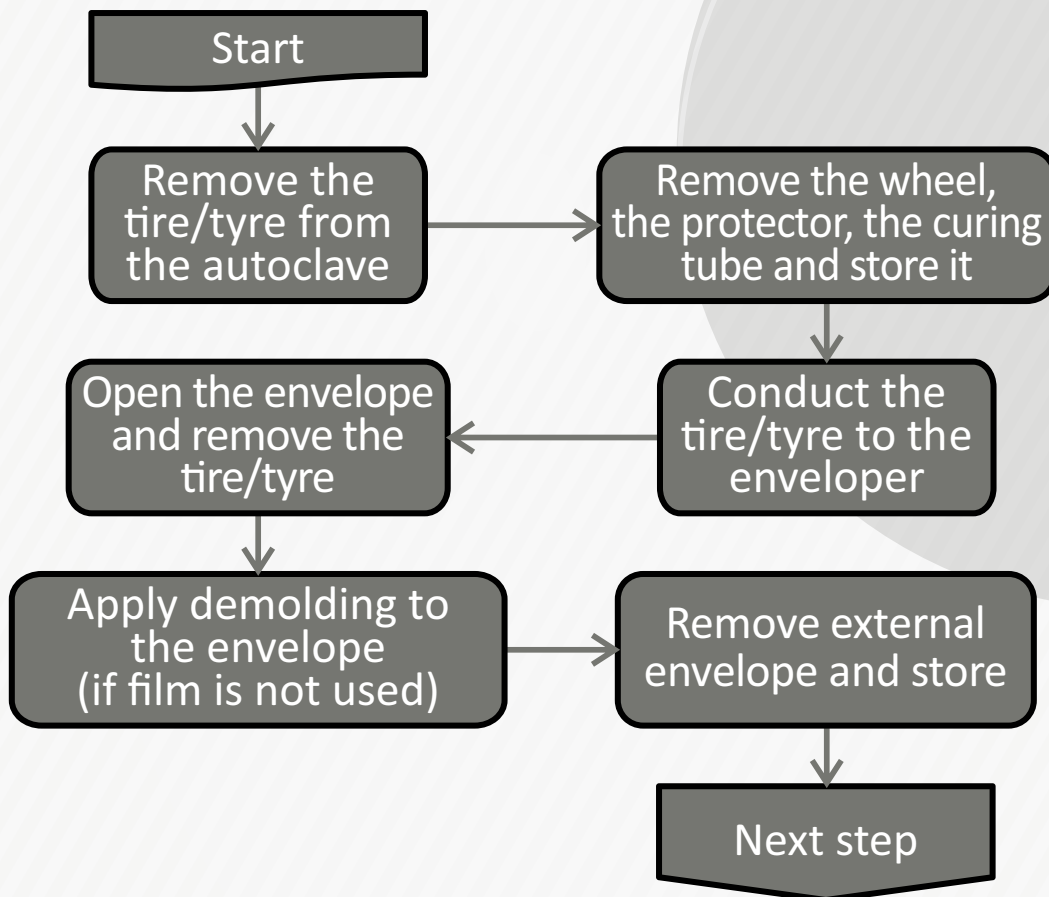
Dismounting the tire/tyre after vulcanization.

SECTOR:

This should ideally be extensive to allow for classifying and storing accessories such as wheels, flanges, flaps, air bags and envelopes.

Dismounting the tire/tyre with precured tread with wheel and Innop systems

DISMOUNTING THE TIRE/TYRE WITH WHEEL FLOWCHART





PROCEDURE:

Remove tire/tyre from autoclave
Conduct the tire/tyre, through the monorail, until the dismounting equipment
(pneumatic actuator or table).



Position the tire/tyre on the table and remove the accessories in the reverse order they were placed.



To remove the tire/tyre, open the envelope enough.



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

To feed the compressed air in the gun, it is necessary to regulate the pressure from 3.5kgf/cm² to 4kgf/cm².

This process is only applicable to those not using the polyester or polypropylene film.



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

Note 1:

We recommend leaving the envelope to rest between cycles.

EQUIPMENT:

- Dismounting table;
 - Envelope spreader;
 - Pneumatic actuator (piston).
-



Note 2:

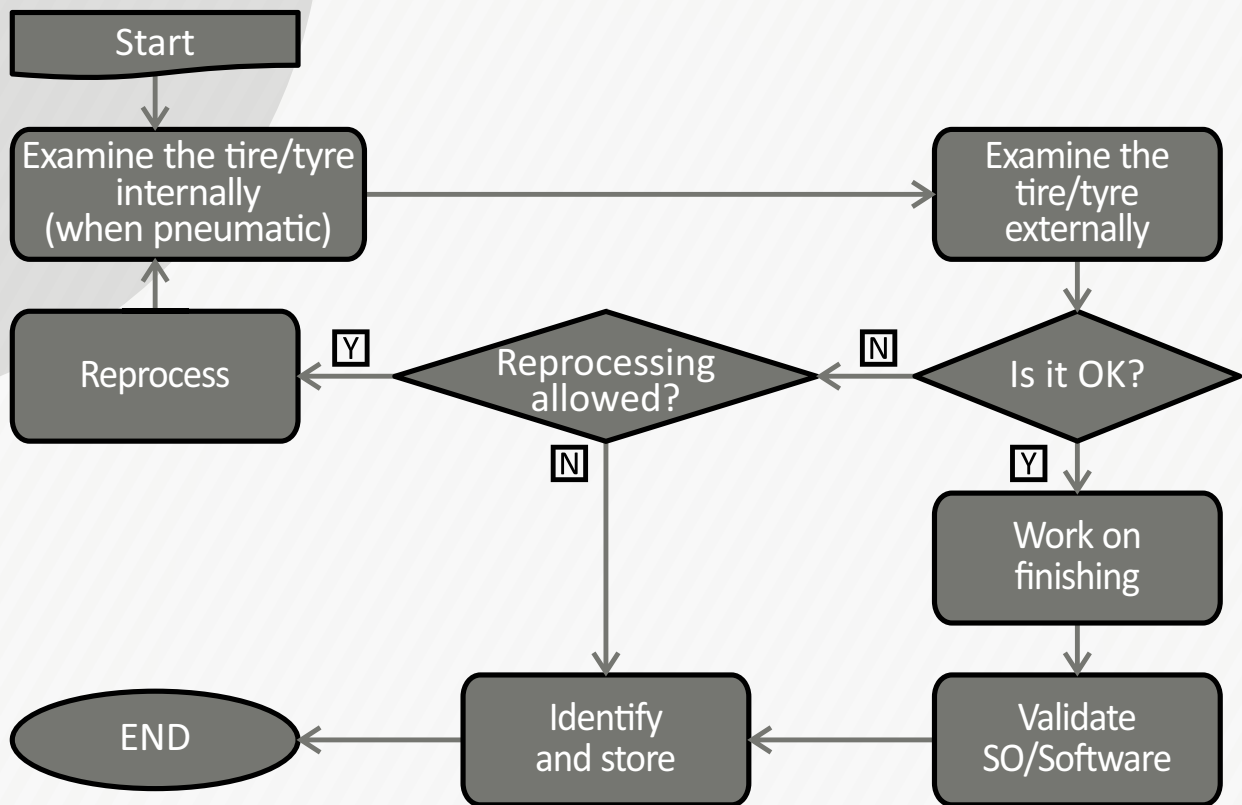
We recommend that whenever the valve's pin (nozzle) of the envelope is not connected to the hose (quick hitch), it should remain protected by a lid.

Note 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.

FINAL INSPECTION

FINAL INSPECTION FLOWCHART



OBJECTIVE:

To ensure that retreaded tires/tyre is in accordance with the critical analysis of the order and of the quality and finishing standards.

SECTOR:

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



PROCEDURE:

Examine the tire/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 tire/tyre if possible. If not, buff the tread and remove the retreader identification label. Put the tire/tyre in the non-compliant material area, identify the problem and inform the client via technical report.

Paint the tire/tyre, applying a thin, even layer, preferably with a still warm tire/tyre. In cases where the retreader has a cleaning machine that provides a good brushing and leaves the blades clean, painting the tires/tyres becomes optional.



Identify the tire/tyre. Store the tires/tyres in a manner that allows classification by seller, client, or date.

EQUIPMENT:

- Examining machine with lighting;
 - Painting cabin.
-

TOOLS:

- Probing awl;
 - Knife.
 - Stapler;
-

NOTES

RESIDUES

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



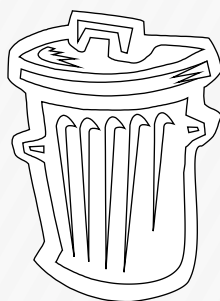
Metal



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, towels, 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 tires/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.



Note:

There is not a defined color to accommodate rubber residues, rubber powder, scraps of tread, of tire/tyre, vulcanized rubber, treads, envelopes, dustings, and rubber originated from tire/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	Sale to recycling or donation. It can be used as raw materials in another company.
Residues Generated by Cleaning	Classified as organic residue.

INDUSTRIAL PIPES

Colors of industrial pipes 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.

NOTES

[illegible]

Blank lined area for notes.

Vipal Borrachas

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