19 – TIRES AND TUBES

ABOUT THIS CHAPTER

This chapter is about removing and installing tires and tubes, fixing a punctured inner tube, as well as installing a replacement tire and/or tube.

GENERAL INFORMATION

TERMINOLOGY

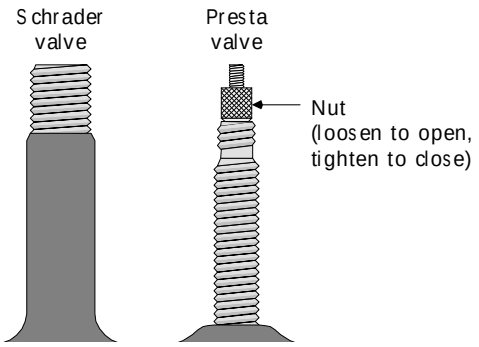
Tire: The rubber, cloth, and wire construction that touches the ground as you roll. A common misuse of the term is to use "tire" to refer to the entire wheel, including hub, spokes, rim, and tire.

Inner tube: The rubber air bladder that is inside the tire.

Valve: The stem on the inner tube that air is pumped through to fill the inner tube. When the inner tube is installed in the tire and the tire is installed on the rim, the valve may appear to be attached to the rim, as it is on automotive wheels, but it is always part of an inner tube.

Schrader valve: The correct name for the common bicycle inner-tube valve that is the same design as the one used on cars.

Presta valve: A valve that is narrower than a Schrader valve and has a built-in nut that must be loosened or tightened to open or close the valve. The Presta valve is sometimes called a "European valve" or "French valve."



19.1 *Schrader valve and Presta valve.*

Tread: The textured or smooth rubber on the outer perimeter of the tire where the tire contacts the road.

Sidewall: The portion of the tire that starts at the outer perimeter of the rim and ends where the tread begins. It may be fabric that is coated with so little rubber that the coating is not apparent, or it may be covered with an obvious layer of rubber such as: a natural gum color, black, or other assorted colors.

Carcass: The structural body of the tire. The carcass consists primarily of a fabric of cloth threads that stretch from one edge of the tire to the other. This fabric is generally impregnated with rubber.

Threads: The individual cloth fibers that make up the carcass.

Tire bead: The edge of the tire that attaches to the rim. The tire bead is usually metal wire, but could be a Kevlar cord. The wire or cord is wrapped in the hem of the tire carcass.

Seating line: About 1/4" to 3/8" above the bottom edge of the tire is the seating line. This is usually a molded rubber line, but may be nothing more than a color change between the edge of the carcass hem and the sidewall of the tire. The color change might be because a portion of the tire bead has been dyed, or because a coating on the sidewall of the tire begins or ends at this point.

Rim strip: The tape-like strip that mounts between the inner tube and the rim. The rim strip's function is to protect the inner tube from damage by the rim and the spokes. Rim strips come in many forms; they may be rubber, plastic, cloth, or an adhesive cloth tape.

Tire liner: This tape-like strip that inhibits punctures is an optional protective liner that goes between the inner tube and the tire. The tire liner is always plastic, and is approximately as wide as the tread.

PREREQUISITES

Wheel removal and installation

In order to replace or service a tire or a tube, the wheel should be removed from the bike. See the **WHEEL REMOVAL, REPLACEMENT, AND INSTALLATION** chapter, if unsure about wheel removal (page 18-6) and installation (page 18-15).

INDICATIONS

Flat-tire repair

The tire and tube will need to be removed and re-installed in order to fix a flat. It is important to keep in mind that all tires loose air gradually, even without a puncture. The fact that the tire has lost pressure does not always indicate that it is flat. Depending on the type and weight of rubber that the tube is made of, this loss could amount to just a few pounds a week, or as much as 20 pounds a day (lightweight latex tubes). Shops should have a policy of airing virtually all tires to the recommended pressure when a repair is checked in. This way, the mechanic can check for pressure loss when starting the job. However, there is little point in attempting to inflate a tire that has an obvious object sticking out of it.

There is another reason that tires might lose pressure and not be punctured. This is because some valves come loose from the factory, or develop looseness from age. In these cases, the valve just needs to be tightened. The ***TIRE AND TUBE REMOVAL*** procedure (page 19-3) starts with a check for a loose valve before going to the trouble of removing the wheel and tire.

Worn and damaged tires

The following list covers several of the symptoms that might be detected and would lead to replacing a tire:

- Tread on road-bike tires worn to the point that carcass threads are showing, or are about to show
- Knobs on off-road-bike tires worn to the point that they cause loss of traction
- Tread develops cracks from age and exposure to the elements
- Cuts in the tire that are through the rubber and have damaged threads in the carcass
- Abrasions in the tire's sidewall that have damaged threads in the carcass
- Bulges or distortions in the tire's shape (when inflated) that indicate hidden carcass damage

Wheel truing, replacement, and rebuilding

The tire needs to be removed and re-installed to do any wheel truing, wheel rebuilding, or wheel replacement.

TOOL CHOICES

The only tools required are tire levers, pump or compressor, and pressure gauges. All choices are adequate and any personal preference is fine.

TIME AND DIFFICULTY

Tire removal and re-installation is a 4–6 minute job of little difficulty. Patching a tube might take additional 1–3 minutes.

COMPLICATIONS

Difficult tire removal

Tires may be difficult to remove because of a tight fit or because of tire adhesion to the rim. If you are having trouble getting a tire off the rim, deflate the tube fully by squeezing the tire while the valve is open. Push the tire away from the rim bead all the way around on both sides to eliminate adhesion.

Difficult tire installation

Tires can be difficult to install for several reasons: the tire may simply be too tight a fit, there may be too much air in the tube, the tube or rim strip may be caught under the tire bead, the rim strip may be too bulky for a tight-fitting tire, or the tube may be too large for the tire cross-section.

Pinch flats on installation

Pinch flats can occur during installation when tire levers are used incorrectly.

Directional tread patterns

Many tires have directional tread designs. Look for directional arrows and notations to avoid installing the same tire twice.

High-seating bead section

Sometimes a portion of the tire bead seats higher on the rim than the rest of the tire. When you spin the wheel, you may see what appears to be a lump in the tire. Chances are this condition will lead to a blow-out. Newly-installed tires should be checked carefully for this condition. Causes may be the tube or rim strip caught under the tire bead, the valve-stem base caught under the tire bead, a damaged bead, poor fit, or a low-seating area elsewhere on the same side.

Low-seating bead section

When a portion of the tire bead sits too low on the rim, the tire has a flat spot. The low spot encourages a high spot elsewhere, which can lead to a blow-out. The causes usually are low inflation, or a high-seating area elsewhere.

Tire will not stay mounted

If the tire is seated properly at full inflation, and then develops high-seating areas or blows off the rim, the tire bead is probably damaged. Check for damage and replace the tire if the bead is damaged.

ABOUT THE REST OF THIS CHAPTER

The next part of this chapter assumes the most complex variation of the job being done, including removing a tire, patching an inner tube, replacing the tube (perhaps because the patch failed), solving problems with the rim strip, replacing the tire with a non-identical tire, installing a tire liner, and installing the tire. The following procedures for tire and tube service are divided into clear sections for each of these, so if doing a less complex job (removing and re-installing a tire in order to true a wheel, for example), then simply skip over the inappropriate sections.

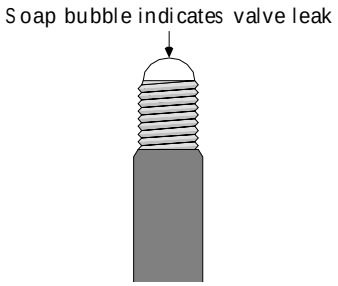
At the end of the chapter is a table of rim and tire sizes and a troubleshooting chart.

TIRE AND TUBE REMOVAL

PRE-REMOVAL INSPECTION

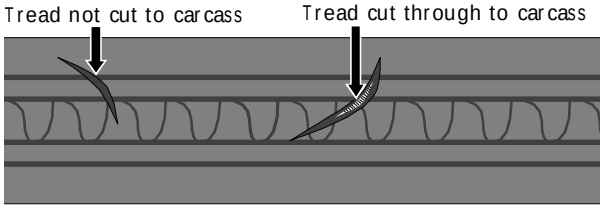
Inspecting for leaks, rubbing tires, and damaged tires

0a. [ ] If tire will hold air, inflate and inspect valve core for leaks. Tighten (Schrader valve only) if leaking.



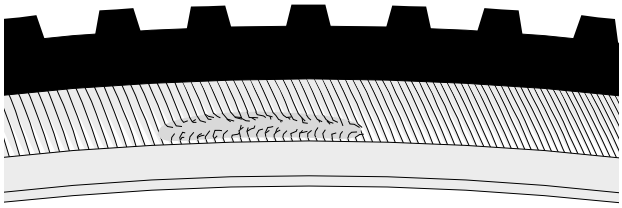
19.2 *Smear a liquid (liquid soap) on top of the valve. If it bubbles up, the valve core needs to be tightened.*

0b. [ ] If tire will hold air, inflate and inspect tread for cuts that have damaged threads in carcass. Replace tire if damaged threads are found.



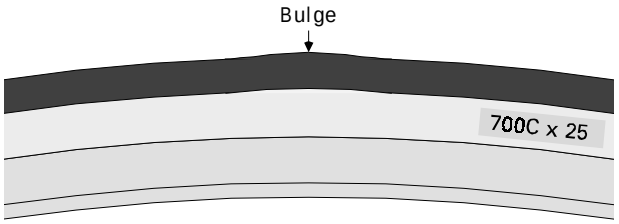
19.3 *Cuts in the rubber are no problem, but cuts that go through the rubber into carcass threads mean the tire should be replaced.*

0c. [ ] If tire will hold air, inflate and spin wheel to check for tire rubbing on brake pads or frame tubes. Replace tire if damaged threads are found.



19.4 *This sidewall was damaged by a brake pad.*

0d. [ ] If tire will hold air, inflate and check for bulges or deformations in tire's shape that would indicate there are cut or ruptured tire-carcass threads, hidden or not. Replace tire if damaged threads are found.



19.5 *The bulge in this tire indicates that the carcass threads are damaged and separating.*

Inspecting treadwear

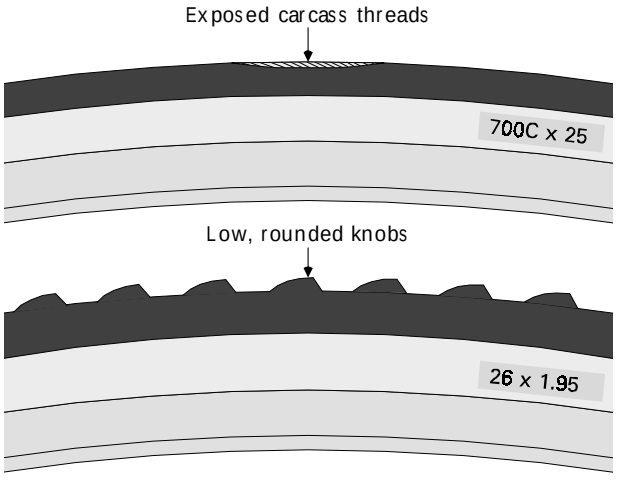
Determining if the tread is worn out is a subjective process. It differs for tires used on pavement and tires used off-road.

Road tires come with textured-tread and smooth-tread (bald or slick) designs. In either wet or dry conditions, the texture pattern is non-essential for traction, because bicycle tires do not hydroplane. The function of a tread pattern on an auto tire is to reduce hydroplaning. (Hydroplaning happens when a tire floats on the surface of the water; grooves in the tread allow the water to escape from under the tire. Automobile tires hydroplane because they have *less* load-per-square-inch of road contact than bicycle tires. This is not to say that a bicycle is not more likely to slide on wet pavement than on dry pavement; wet pavement causes bicycles to slide simply because the water changes the coefficient of friction of the pavement and the tire, not because of hydroplaning.) It is quite normal for a tire with a tread pattern to develop a smooth strip down the middle before the tire has seen many miles. The fact that the texture has worn off is not in itself an indication that the tire is shot. However, when the wear is getting bad, the bald section will become noticeably

wider. If the tire has an obvious "flat top" that covers the majority of the tread width (seen when looking in-line with the tire, sighting across the top of the tire), then it's time for a new tire. Looking for this wide "flat top" is the best way to determine whether a treadless tire is getting worn out. When the tire is off, feel the thickness and flexibility at the center of the tread. If the tire is obviously thinner and much more flexible in the center of the tread than at the edges, wear is advanced.

The issues are different with knobby off-road tires. The height and definition of the knobs create traction. When knobs are worn in the center of the tread, it affects braking and climbing traction. When knobs are worn on the outer portion of the tread, it affects cornering traction. Knobs wear two ways, they get shorter and they get rounded off. With the wheel on the bike and looking at the *top* of the wheel, check whether the center knobs are rounded on the front or back edges. If the tire shows wear on the leading edges (rear wheel only), climbing traction is affected. If worn on the trailing edges, braking traction is affected. If the center section knobs just appear short compared to the others, then they are simply worn out from miles, and all types of traction are affected. If the knobs on the outer portion of the tread appear worn, cornering traction is affected.

If the tread does not appear worn out, and there are no damaged carcass threads, it does not necessarily mean the tire is fine. Later, when the tire is removed, it should be inspected for age rot, one of the most common reasons for tire replacement.



19.6 *The exposed carcass threads indicate this road tire is worn out, and the rounded knobs indicate this MTB tire is worn out.*

0e. [ ] Rotate wheel slowly and inspect tread wear around whole tire.

0f. [ ] Inspect for and remove foreign objects in tread such as thorns, glass, tacks, wire, etc. Replace tire if damaged threads are found.

WHEEL REMOVAL

0g. [ ] See *WHEEL REMOVAL, RE-INSTALLATION, AND REPLACEMENT WORKSHEETS*: REMOVING A FRONT OR REAR WHEEL, steps 1–16.

TIRE REMOVAL

In the next step, mark the tire and valve in a specific way before removing them. By laying the tube on the tire in the orientation they had when both were mounted on the wheel, then it will be clear which section of the tire is likely to have the cause of the flat. Since a large part of successful flat repair is preventing the next flat, this localized cause-search is valuable in and of itself.

However, after searching the specific area of the tire, a thorough inspection of the tire is recommended. For example, if the reason for the flat was a piece of glass, then the rider probably ran through a patch of glass. It is quite likely that there are several pieces of glass in the tire, but only one has penetrated far enough to cause a flat, so far. A grease pencil/crayon or a regular ball-point pen can be used to mark on rubber.

1. [ ] Use a crayon or felt marker to mark tire sidewall on right side at valve and also mark valve stem on right side.

There are two basic valve types, Schrader (same as valve on car tires), and Presta (European style, narrower).

The Schrader valve has a small plunger in the top that must be depressed for air to escape. This plunger is pushed up by a spring (hidden beneath the plunger), which is what keeps the valve closed, even when there is no air pressure in the tube. This plunger, the spring, and the piece they are both built into are collectively called the valve core. The valve core can be threaded in and out of the valve stem, using a valve-core tool.

The Presta valve also has a little plunger, but no spring hidden inside to keep the valve closed. Instead, there is a small knurled nut on top of the plunger. When this nut is threaded down (with fingers), the plunger is pulled up and the valve is held closed. When the nut is threaded up, then the plunger can be pushed down with a finger to release air from the tube. Just below the plunger nut are the valve threads, which the valve cap screws onto. On rare occasions, there will be two wrench flats in these threads. In this case, the valve core

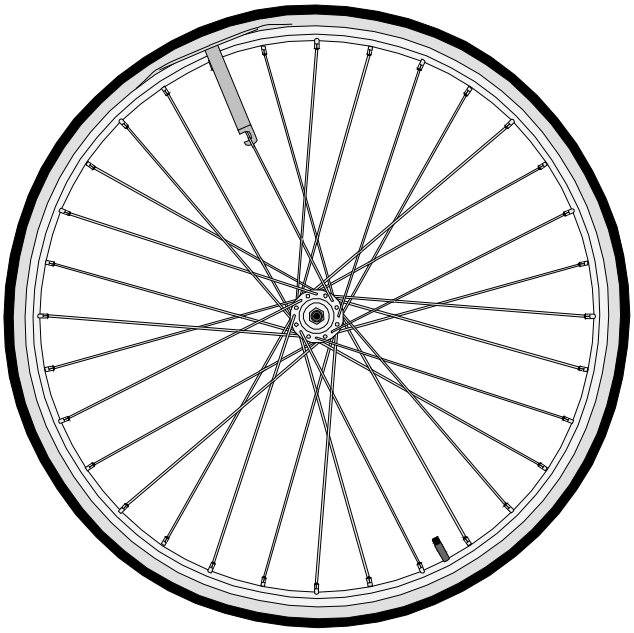
is removable, and it may need to be tightened to prevent the valve core from leaking. A small adjustable wrench is adequate to tighten a Presta-valve core.

Either valve type may be partially rubber coated, or either may be an exposed threaded metal shaft that is threaded all the way to the rim. When the valve is threaded, then a valve-retaining nut is often used. This nut is threaded (by fingers only) down against the rim. The only function of the valve-retaining nut is to keep the valve from escaping into the rim when trying to press a pump head onto the valve. Valve-retaining nuts are also reputed to prevent movement between the tire and tube under hard braking conditions (and thus prevent the valve from separating from the tube), but the real cause of this problem is under-inflation, and nothing will reduce the problem other than higher inflation pressures.

2. [ ] Remove valve cap (if any), valve-stem-retaining nut (if any), and loosen valve nut (if Presta valve).

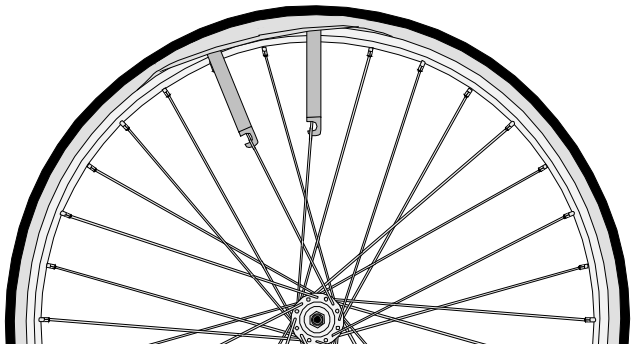
3. [ ] Deflate tire, if not already deflated.

4. [ ] On right side of wheel, 180° away from valve (at a point where a right-side spoke joins rim), insert tire lever under edge of tire and lever tire out of rim, hooking tire lever onto spoke.



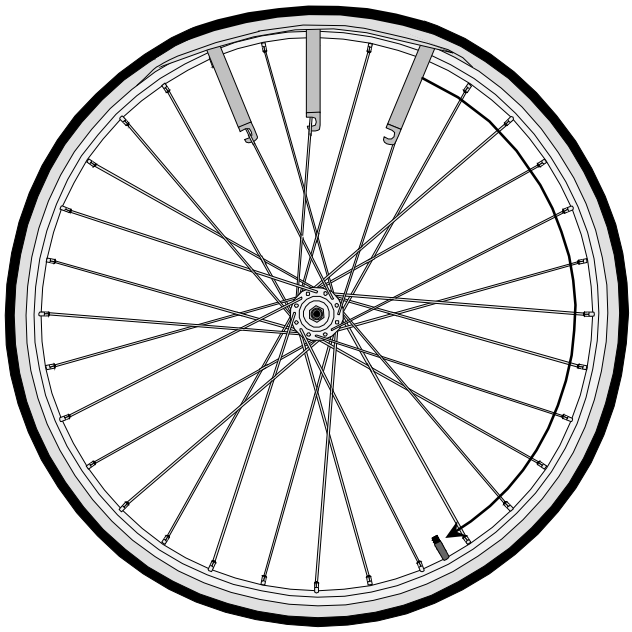
19.7 *Insert a tire lever under the right tire bead and lever down until the lever can be hooked onto a right-side spoke.*

5. [ ] Two spokes clockwise from first tire lever, insert second tire lever under edge of tire, lever tire out of rim, and hook tire lever onto spoke.



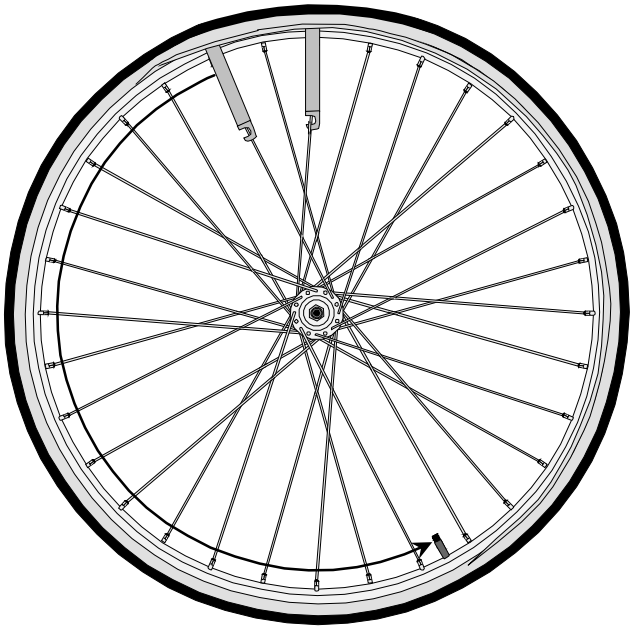
19.8 *Insert a second tire lever two spokes away from the first and hook it onto a spoke.*

6. [ ] Two spokes clockwise from second tire lever, insert third tire lever under edge of tire, lever tire out of rim, and slide tire lever clockwise around rim to unseat tire bead from rim. If tire lever will not slide, hook it to spoke, remove second tire lever, and insert second lever two spokes past third lever and try sliding it. Continue to leapfrog second and third levers in this fashion until a lever can be inserted and slid around rim.



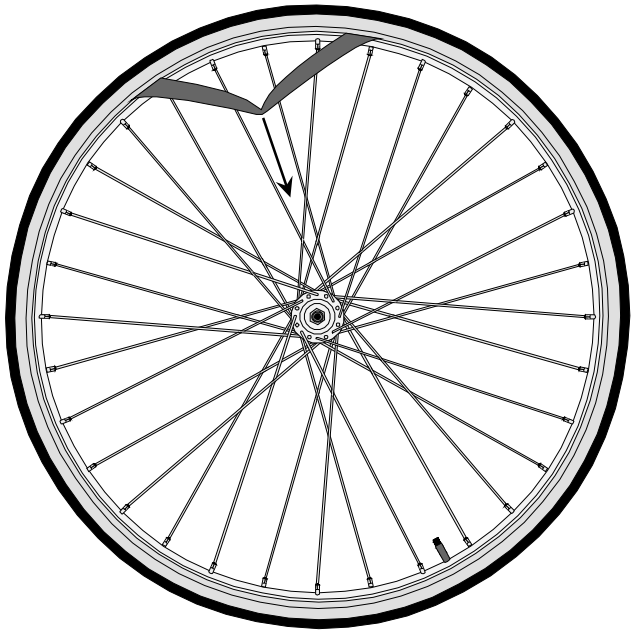
19.9 *Insert a third tire lever about two spokes away from the second, lever it down, and attempt to slide the tire lever around the rim away from the second tire lever, all the way to the valve.*

7. [ ] Unhook first tire lever from spoke and slide counterclockwise around rim back to valve.



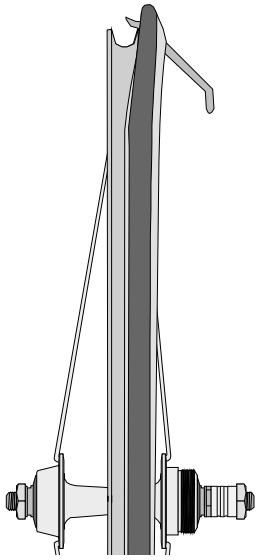
19.10 *Unhook the first tire lever from the spoke and slide it around the rim the opposite way back to the valve.*

8. [ ] 180° away from valve, pull inner tube out of tire and continue to pull until all of inner tube is out of tire. Finish by pulling valve out of rim.



19.11 *Opposite the valve, pull the tube out of the tire.*

9. [ ] Use tire lever to lift second bead over same side of rim as first bead.



19.12 *Use a tire lever to lift the second bead over the same side of the rim as the first bead.*

INSPECTION, REPAIR, AND FIT

TUBE INSPECTION

Many bike shops do not do tube repair. The reason they give is that it is more economical to just replace the tube. It is possible that they reach this conclusion by taking short cuts that should not be taken when installing a new tube. The process of putting a patch on a tube is not time consuming, in itself. It takes a mechanic that knows what to do less than 1 minute to apply the glue and the patch, and then inspect whether the patch is good. The real time that is required comes from searching for the hole in the tube. When shops don't patch tubes (citing the economy), it is a good bet that they don't inspect the old tube. Inspecting the old tube should *never* be skipped, because this is one of the best ways to determine the cause of the flat (and prevent its re-occurrence). Regardless of whether your shop does or doesn't patch tubes, don't skip inspecting the old tube. (While we are on this subject, patching tubes is a highly efficient form of recycling of a product made from a non-renewable resource.)

10. Perform following steps (in order) until leak is found, then ignore remaining steps:

[ ] Attempt to inflate tube and listen for leaking air to find hole.

[ ] If tube is holding air easily, over-inflate tube to enlarge puncture and make it easier to find. Tubes can easily be over-inflated until they are twice as fat as their inflated and un-expanded size.

[ ] If leak is not audible, rotate tube with outer perimeter close to cheek or tip of nose to feel for fine streams of air that cannot be heard.

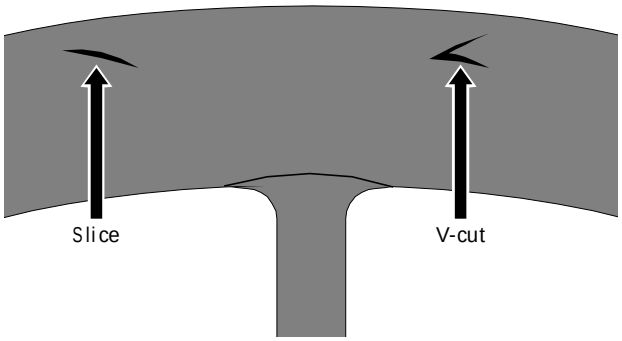
[ ] Submerge tube in water to look for bubbles rising from tube to find hole if all other techniques have failed to find hole.

11. [ ] Mark hole (with crayon or ball-point pen) with an X or cross that extends an inch in every direction from middle of hole.

12. Inspect hole and check off one or more of following choices to find and eliminate cause of puncture:

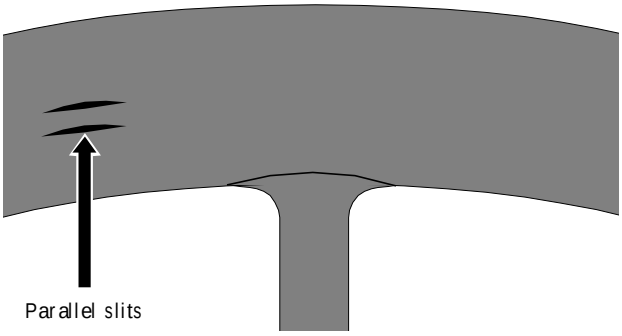
[ ] Puncture is a single or multiple pin hole in outer perimeter of tube. Inspect tire for thorns, tacks, or small wires.

[ ] Puncture is a cut or slit on outer perimeter. Inspect tire for glass, nail, or other large foreign objects.



19.13 *Cuts like these should mean inspect the tire for glass, a nail, or some other large foreign object.*

[ ] Puncture is a pair of horizontal, parallel slits on side of inner tube. Inspect for rim bead damage. Keep tires better inflated and avoid hitting obstacles on riding surface.



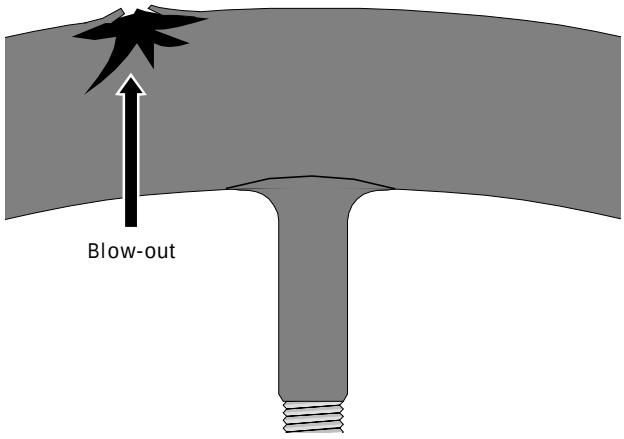
19.14 *Two parallel slits on the side of the tube indicate that the tire has been bottomed out and the tube has been pinched between the rim and the riding surface, or that a tire-removal tool has been used improperly.*

[ ] Puncture is a large shredded hole. Inspect tire for large holes and tire bead for damage from being blown off rim.

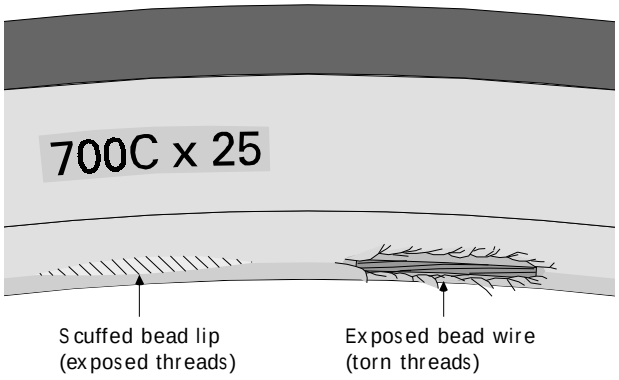
[ ] Puncture is a pin hole or slit on inner perimeter of tube. Inspect rim strip for position problem or failure. Inspect inside of rim for sharp burrs. Inspect spokes for protruding through nipple heads.

[ ] Puncture is a cut in rubber at base of valve. Install tube so valve is straight, and keep tire fully inflated to prevent tire creep around rim.

[ ] Puncture is a failure of seam where the ends of tube are joined together to make a circle. Inspect whether tube size is too small for fatness or diameter of tire.



19.15 *This blown-out tube was caused by either a large hole in the tire or a tire-mounting failure.*



19.16 *These abrasions and tears on the tire bead could lead to another blowout.*

NOTE: If tube will be replaced, go to CHECKING NEW INNER-TUBE FIT (page 19-8). If not repairing or replacing inner tube, go to TIRE INSPECTION (page 19-9). If not repairing or replacing inner tube, but installing a new tire, go to TIRE FIT AND COMPATIBILITY (page 19-10). If simply re-installing the original tube and tire, go to INSPECTING AND INSTALLING RIM STRIPS (page 19-12).

TUBE REPAIR

Many bike shops do not patch tubes. The usual excuse is that it is not financially sensible. Although this argument has some holes in it, there is a more important issue at stake. The variety of tubes out there in the real world usually exceeds the variety of stock of tubes that a bike shop has on hand. Given the choice between installing a tube that is not a good match, or patching a tube that has a minor puncture, it is preferable to patch the tube. For this reason, a mechanic should know how to patch tubes in a way that will make the patched tube as reliable as a replacement tube. A well-done patch job will successfully repair a simple puncture. Slits, tears, multiple punctures, and seam failures cannot be reliably patched.

There are several brands of good patch kits on the market, and they all have one thing in common: the patches have feathered edges. This is easy to see, because the perimeter of the patch will be a different color than the center of the patch. Feathered patches are not only better quality and more suited to lightweight bicycle tubes, they are a lot easier to use. This is because the patch is laminated between a layer of foil and a layer of cellophane. The foil protects the adhesive side of the patch and the cellophane provides something to hold onto without touching the adhesive once the foil has been peeled. The old standby brand is REMA, but several other companies now make feathered patches.

Keep these following tips in mind to insure a successful patch job:

Don't miss the hole. If the hole is well marked by an X or cross that is larger than the size of the patch, then it is less likely the hole will be near the edge of the patch.

Roughing the tube up eliminates surface contamination and creates a rough surface, which helps the glue adhere to the tube. Do a thorough job.

Gluing needs to be thorough, but don't overdue it. Use a *thin* layer that evenly extends slightly past the area the patch will cover. A lumpy buildup creates a greater likelihood of patch failure. Starting with plenty of glue and smearing it around quickly as far as necessary to get the covering thin will achieve the best result. Putting on a little, finding that it's not enough, then adding more after the first application has partially dried is asking for trouble.

13. [ ] Use emery cloth (usually comes with patch kit) to rough up an area around hole that is slightly larger than the patch.

14. [ ] Use rubber buffer to clean roughed area.

15. [ ] Put dime-sized blob of glue on hole and use finger to spread glue out thoroughly. Glued area must be at least slightly larger than patch to be applied.

16. [ ] To speed glue drying, inflate tube if possible until it is expanded.

17. [ ] Deflate tube if it was expanded in previous step.

18. [ ] When glue is dry, peel foil-back off patch, being careful not to touch exposed surface of patch, and apply to tube. Center patch over hole.

19. [ ] Roll a screwdriver handle back and forth over patch, or apply pressure in some other way to get patch to stick well. Cellophane on patch (if any) can be left in place, or may be removed.

20. With tube mostly inflated, check for:
- **[ ] Patch for security (edges not peeling up)**
- **[ ] Leaks coming from edge of patch**
- **[ ] Other leaks elsewhere in tube.**

21. [ ] Deflate tube just enough so that it still has shape, but is not expanded at all.

22. [ ] Optional: use talcum powder, tire talc, or cornstarch on patched area to neutralize glue past edges of patch, so tube will not stick to inside of tire.

NOTE: If inner tube has been patched, go to TIRE INSPECTION (page 19-9). If installing a new tire, go to TIRE FIT AND COMPATIBILITY (page 19-10). If simply re-installing the original tube and tire, go to INSPECTING AND INSTALLING RIM STRIPS (page 19-12).

CHECKING NEW INNER-TUBE FIT

It would seem that tube fit would simply be a matter of putting a tube inside a tire of the same nominal size. Because tire nominal sizes are not exact measurements, and because tire manufacturers "play" with reality for marketing reasons, the marking on the tire does not accurately say how wide the tire is. The size number (27", 700C, 26") is generally accurate, but there are several sizes that are easily confused and not interchangeable, and there are dissimilar-named sizes that are interchangeable. The 26"×1-3/8" size sounds similar to a tube that might be marked 26"×1.5" & 1.75", but these numbers come from completely different sizing systems and the two 26" are not at all the same. On the other hand 27" and 700C don't sound at all alike, but with regards to tube fit, they are fully interchangeable.

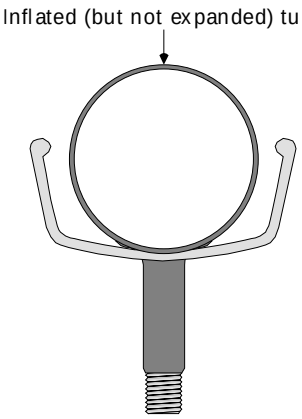
Another factor that further complicates tube fit is that tubes are simply inconsistent. I have seen two brands of tubes marked 700C×25 vary in width by as much as 50%. Use the marked designation of the tire to determine which tube to use, but then perform these simple tests to confirm that it is a good fit.

23. [ ] Inflate tube until it has shape *but is not expanded*.

24. Place tube on rim and check for following symptoms that tube is too small:

[ ] If tube needs to be stretched to fit on rim it is too small.

[ ] If tube is skinnier than inside width of rim, tube is too small.

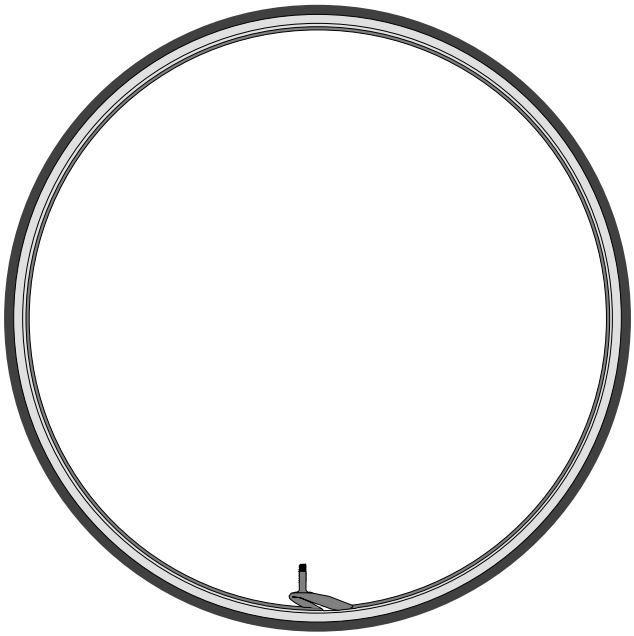


19.17 *The fact that the inflated tube is narrower than the inside width of the rim suggests it will be to small for the tire.*

If several fingers can fit between the tube and rim, it is normal. The tube should be installed in a tire, not the rim, to be checked for being too large.

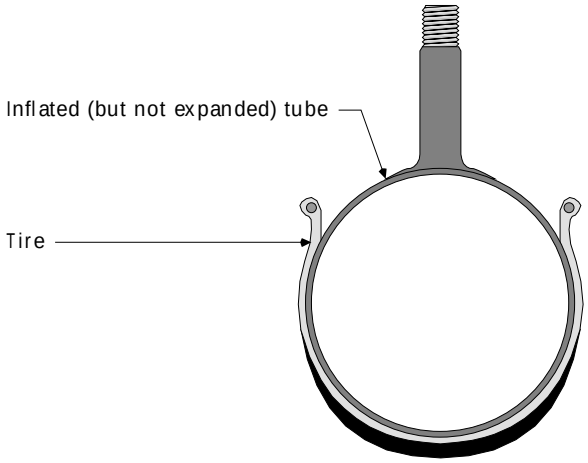
25. Place tube inside of tire and check for following symptoms that tube is too large:

[ ] If tube has doubled over itself to fit inside tire, diameter of tube is too large for tire.



19.18 *If the tube has doubled over to fit in the tire, it is too large.*

[ ] If tube is fatter than tire height (viewing tire from side, tube extends beyond inner perimeter of tire all way around tire), tube is too fat for tire.



19.19 *The inflated tube will not fit inside the tire. The tube is too fat.*

NOTE: If inner tube has been replaced, go to CHANGING VALVE TYPES (below). If inner tube has been replaced with one of same valve type, go to TIRE INSPECTION (page 19-9). If installing a new tire, go to TIRE FIT AND COMPATIBILITY (page 19-10). If simply re-installing the original tube and tire, go to INSPECTING AND INSTALLING RIM STRIPS (page 19-12).

CHANGING VALVE TYPES

26. [ ] If replacing Presta valve with Schrader valve, ream or drill rim hole to >9mm.

27. [ ] If replacing a Schrader valve with a Presta valve, valve grommet should be installed in rim to reduce hole size and restrict entry of dirt into rim.

TIRE INSPECTION

When the tire was still on the wheel, it was inspected for external damage and wear. Now it needs further inspections that are best done while the tire is off the rim.

The first of these inspections is for age rot. Rubber deteriorates with age, and it will show up in the tread of a tire as thousands of hairline cracks that appear more obviously when squeezing the tread. The tread is a primary factor in puncture resistance. Each of these cracks is like having an open door in a fortress wall. These cracks make the tire more vulnerable to punctures, particularly from glass. The tread also protects the carcass threads from exposure to the elements. With cracks

in the tread, there is a greater chance of these threads deteriorating, leading to more stone bruises (carcass threads ruptured by sharp stones) and blow outs.

28.[ ] Squeeze sides of tire together and inspect tread for hairline cracks that open up when tire is squeezed.

29.[ ] If tube was punctured, place tube on tire with valve lined up with mark (from step 1) on right sidewall and with sidewall and valve marks both facing up. Find the puncture and closely inspect the tire 3" either way from the puncture for foreign objects.

30.[ ] Visually inspect inside of tire for foreign objects (thorns, wire, glass, etc.) and remove them.

After a *thorough* visual inspection of the inside of the tire, use your finger tips to feel for foreign objects. The visual inspection should have detected anything that could cut fingers. The feel test will find small thorns, more than anything else. Out here in eastern Colorado, we have small cactus thorns that are as thin as hairs. They cannot be seen, but they certainly can be detected by feel. If you want to be cautious, use a rag instead of your fingers. Most thorns and staples will catch on a rag, but you're sure to miss a few that fingers would find.

31.[ ] Stroke inside of tire softly and carefully with finger tips to find thorns or other small foreign objects that might have missed by visual inspection and remove them.

32.[ ] Visually inspect inside of tire for damaged threads in the carcass. Replace tire if any threads are cut.

33.[ ] Inspect tire beads for abrasions and delaminations, especially if tube was blown out. Replace tire if problems are found.

NOTE: If installing a new tire, go to TIRE FIT AND COMPATIBILITY (page 19-10). If simply re-installing the original tube and tire, go to INSPECTING AND INSTALLING RIM STRIPS (page 19-12).

TIRE FIT AND COMPATIBILITY

Nothing is any more confusing on the bicycle than tire and rim sizes. The basic confusion is that the sizes consist of numbers that sound as though they might be measurements of the rim and tire. It would seem to make sense that these measurements relate to the dimensions of the rim and tire where these two parts attach to each other, but with the exception of the new and rarely-used ISO designations, the numbers have nothing to do with the measurements of the tire and rim where they attach to each other.

Traditional tire sizes were measurements of the outside diameter of the tread of the tire (size) and the fatness of the tire when mounted and inflated on the rim (width). Although these numbers might have been close to reality when they were created, tires have changed their shape and proportions without changing their dimensions at the interface to the rim many times since this system of categorization was created. Rims are named by the size of the tire that fits it, and this is why a 26" MTB rim measures approximately 22.5". To further complicate matters, sometimes there is more than one name for a size. The 700C size was developed in France, and is a metric size. Canadian companies copied the size, but gave it their own name, 28"×1-1/2". To further confuse matters, this is a smaller size than the familiar 27" (British in origin).

To solve this problem, there are now ISO (International Standards Organization) sizes, which are based on measurements of the tire and rim that relate to how these two parts fit together. These measurements are metric. Traditional tire sizes have always listed size followed by width, such as 27" (size) × 1-1/4" (width) or 700C (size) × 25 (width). So that ISO sizes will not be confused with traditional sizes, they list width, then size. The ISO equivalent of a 700C×25 tire would be 20-622. The ISO equivalent of a 26"×1.75" rim would be 20-559. In both cases, the second three-digit part of the number refers to the *bead diameter*. On the tire, this number is simply the diameter at the inside perimeter. On the rim, this number is the diameter at the point on the rim where the tire bead sits, in which case it is called the *bead-seat diameter*.

The first part of the ISO number refers to the width of the tire or rim. With regards to the rim, this is simply a measurement between the rim flanges. For the tire, the measurement is not so simple. Because tire fatness changes with rim size, inflation pressure, and whether the tire is installed or not, the ISO started its tire-width number by measuring the only constant there is in regard to tire width — its width when flattened. This flattened width is a very unfamiliar number (the very narrow 700C×21 tires have flattened widths of close to 50mm). The ISO chose to divide the flattened width by an arbitrary constant of 2.5 to convert flattened width to *ISO section width* so that ISO's width number might be a more familiar number.

The advantage of the ISO approach to tire and rim width is that whether a tire's width is compatible with a rim's width can easily be measured and calculated. For any given rim, the tire's *section width* can be between 1.4 and 2.0 (road bikes) or 1.4 and 3.0

(MTBs) times the rim's inside width. When the tire width is outside the range created by multiplying these factors times the rim's inside width, then handling may be compromised, tires may be damaged by the brake pads, the wheel may be difficult to remove, or the rim may be more vulnerable to damage. If the ISO width information is not used, and the mechanic relies on traditional size information alone, then all the problems listed above are risked.

In the following steps, "size" refers to the overall diameter of the wheel, and "width" refers to how fat the tire and rim are.

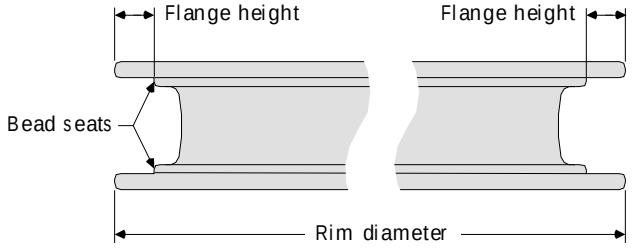
34. Determine rim size by one or all of following choices:

[ ] Look up rim size on sticker or engraved on rim. Enter here: _____

[ ] Convert ISO size marked on rim to conventional size by looking in ISO size column on the TIRE AND RIM SIZES table (page 19-16) and read across to Nominal size column. Enter here: _____

[ ] Determine ISO size of rim and convert to conventional size by measuring exact rim diameter and subtracting flange height twice to determine ISO size, then looking in ISO size column on the TIRE AND RIM SIZES table (page 19-16) and read across to Nominal size column. Enter here: _____

[ ] Measure outside diameter of rim and look up size by finding measurement on the TIRE AND RIM SIZES table (page 19-16) in the Approximate rim O.D. column and reading across to Nominal size column. Enter here: _____



19.20 *Measure the rim's diameter and subtract the flange height twice to calculate the ISO bead seat diameter.*

35. Determine size of new tire by one or all of following choices:

[ ] Look on sidewall of tire or molded in edge of tread for nominal size description. Enter here: _____

[ ] Look on sidewall of tire or molded in edge of tread for ISO size description. Enter here: _____

[ ] Use TIRE AND RIM SIZES table (page 19-16) to convert ISO size to Nominal size, or Nominal size to ISO size in order to compare tire's size to rim's size, whichever nomenclature is used. Enter here: _____

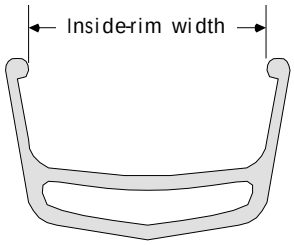
36. [ ] Check that tire size and rim size are compatible by comparing steps 34 and 35.

Assuming that the tire is being replaced with one of the same size category and the old rim will be reused, if the new tire is a different width, check if the tire is compatible with the rim width. In everyone's mind, tire selection should simply be a matter of matching the named width of the rim with the named width of the tire, and that all 26" MTB tires should be compatible with all 26" MTB rims. However, for any size (such as 26" MTB) there are a variety of rim widths and a variety of tire widths. To complicate matters further, the actual width for two rims that are named the same can be quite different. The same is true of tires. If combining the narrowest of rims with the widest of tires in a given size group, or vice versa, then there may be a problem. There are a few simple measurements that can be taken and calculations to make to determine whether the tire width is acceptable to use with the rim.

If the tire is too narrow for the rim, there are several consequences. The height profile of the tire will be too low, which can lead to more rim damage and more pinch flats. Also, the shape of the tire will be deformed in a way that reduces cornering performance (particularly on road bikes). If the tire is too wide for the rim, there may be different consequences. If the bike has cantilever brakes, a common occurrence with a tire that is too wide for the rim is that the brake pads end up rubbing on the tire, resulting in its premature demise. When a tire that is too wide is installed on a road bike, the brake pads may still not clear the tire, even with the quick release all the way open. Also on road bikes, when this rim and tire combination is used, there could be a squirmy feel in the handling, depending on the tire design and the air pressure.

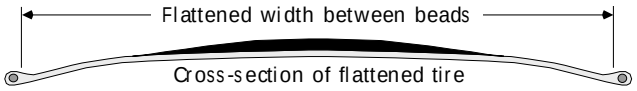
The following steps determine whether the new tire is within the range of widths that is acceptable on the rim.

37. [ ] Use caliper to measure inside width of rim. Record measurement here: _____



19.21 *Rim width is measured between the flanges.*

38. [ ] Measure width from bead-to-bead (edge-to-edge) of tire (flattened as best possible) and record width here: _____



19.22 *Flatten the tire and measure bead-to-bead to determine flattened width.*

39. [ ] Divide answer in step 38 by 2.5 to determine "section width" and record answer here: _____

40. [ ] Multiply rim inside width from step 37 by 1.4 to determine narrowest acceptable "section width" and record answer here: _____

41. [ ] Multiply rim inside width from step 37 by 2.0 (road bikes) or 3.0 (MTBs) to determine widest acceptable "section width" and record answer here: _____

42. Check one of following choices:

[ ] Step 39 is included in range of steps 40 and 41, so tire width is ideal for rim.

[ ] Step 39 is outside of range of steps 40 and 41, so tire width is potentially unacceptable for rim. (See preceding text for description of possible problems.)

INSTALLATION

INSTALLING A TIRE LINER (OPTIONAL)

43. [ ] Roll tire liner out on inside of tire.

44. [ ] Overlap the liner over itself and tape excess down, but do not cut off excess (sharp edge left by cut may cut tube).

45. [ ] Use masking tape to hold tire liner centered under tread (optional).

INSPECTING AND INSTALLING RIM STRIPS

The rim strip protects the tube from the rim, the spoke nipples, and the spokes. Problems with the rim strip are often the cause of "mystery" flats. There is a common type of rim called a "modular" or "double-wall" rim. The characteristic of this rim is that the tube rests on one wall of the rim, and holes are drilled in this wall for access to the spoke nipples. Sometimes these holes are filled with re-enforcing sockets called ferrules. The problem with this rim type is that the rim strip can appear to cover these holes adequately when the tire and tube is off, but when the tire and tube are installed and under pressure the rim strip sinks down into the nipple access hole, exposing the sharp edges of the hole to the tube.

Bicycle manufacturers are often ignorant of this and supply bikes with this rim type and include inexpensive black rubber rim strips that are too elastic. Other publications often mention using strapping tape as an alternative. Strapping tape is known to crack easily and allow the tube to go into the nipple-access holes (causing flats). Adhesive cloth rim strips and polyurethane rim strips do the best job. Polyurethane rim strips are thin and smooth (makes tire installation easier), elastic enough for easy installation and removal, resistant to cracking, and stiff enough that they do not deflect down into the nipple-access hole. In either case, the challenge is getting the correct-width rim strip. Too narrow and the slightest shift of the rim strip exposures the spoke access holes. Too wide and the rim strip overlaps the rim's bead seat, interfering with proper mounting of the tire.Polyurethane rim strips that are too wide can be cut down to size with scissors.

46. [ ] Inspect that rim strip completely covers all spoke-nipple heads, or all access holes to spoke nipples. Adjust or replace as necessary.

47. [ ] Inspect that rim strip has no tears, cuts, or splits. Replace rim strip if damaged.

48. [ ] Inspect that rim strip is not twisted. Adjust as necessary.

49. [ ] Inspect that rim strip does not overlap rim bead seat (part of rim on which tire bead sits). Adjust or replace as necessary.

50. [ ] If replacing rim strip, insert valve, pencil, or #2 Phillips screwdriver through rim-strip valve hole and rim valve hole to keep holes aligned, then stretch rim strip around rest of rim. Check that rim strip is correctly positioned.

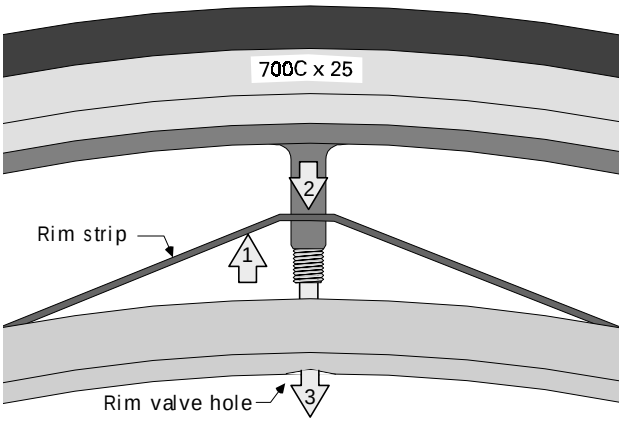
INSTALLING THE TIRE AND TUBE

51. [ ] Inflate tube so that it has shape but is not expanded.

52. [ ] Place tube inside tire with valve adjacent to pressure rating on side of tire.

53. [ ] Stand wheel on table or floor with valve hole at 12:00, with wheel's right side facing you.

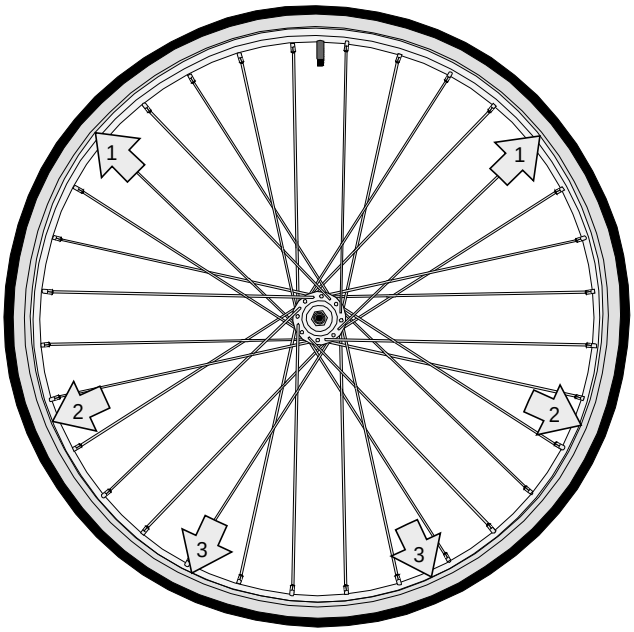
In the next step, be careful not to jam the rim strip through the rim hole with the valve. If necessary, lift the rim strip up, insert the valve through the rim strip, then put the valve (with rim strip already on it) into the valve hole in the rim (see figure 19-23).



19.23 *1) Lift the rim strip out of the rim. 2) Insert the valve through the rim strip. 3) Insert the valve into the valve hole.*

54. [ ] Place valve into valve hole (being careful not to jam the rim strip through the valve hole). Tire should have directional arrow (if any) pointing in the direction of rotation. If unsure, put tire's label on right side.

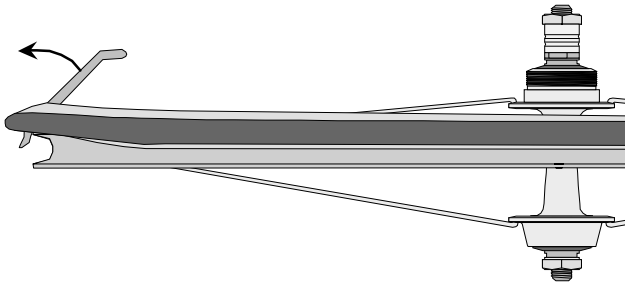
55. [ ] Starting at valve, work back-bead into rim with both hands simultaneously, working down toward 6:00 position.



19.24 *Use your hands to work the back-bead into the rim at the valve, then at the #1 positions, then at the #2 positions, and then at the #3 positions.*

56. [ ] When bead gets difficult to install, turn wheel over so that valve is at 6:00 and remaining uninstalled portion of back-bead is near 12:00.

57. [ ] Holding tire bead firmly to rim with one hand, use a tire lever from one end of the uninstalled portion to lever bead of tire over rim until bead is completely installed between rim flanges.



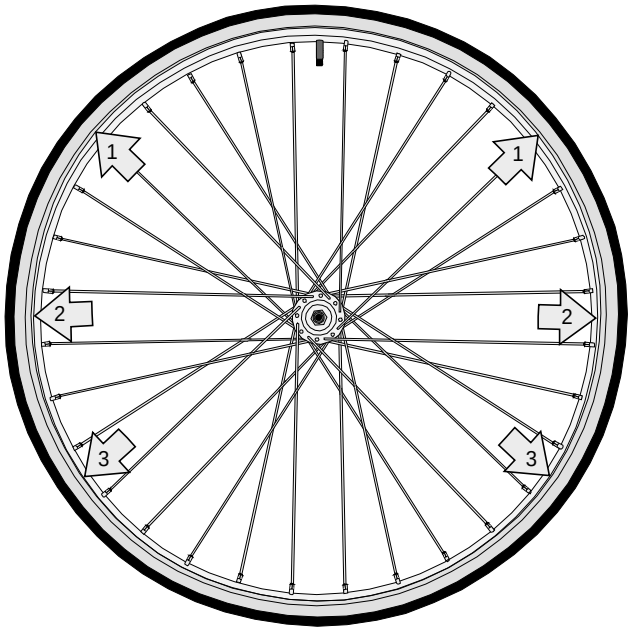
19.25 *Lever the bead onto the rim, using the tire lever in the same orientation as when bead was removed.*

58. [ ] Deflecting tire towards center of rim, inspect all around wheel for rim strip that has been pushed out of place, or section of tube caught under installed bead of tire.

59. [ ] With wheel horizontal, use fingers to work tube between rim flanges all around wheel. Deflate tube slightly if necessary to get it between rim flanges.

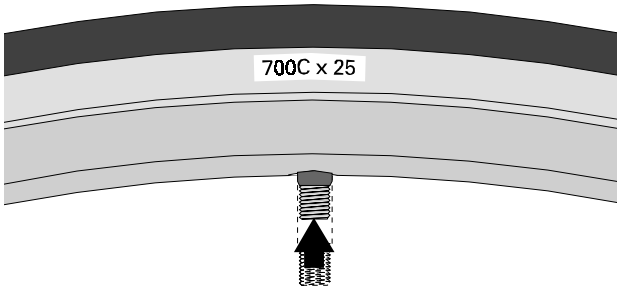
60. [ ] Stand wheel up, face wheel's right and rotate so valve is at 12:00.

61. [ ] Starting at valve, use fingers to work second bead over rim flange both ways away from valve until half or more of bead is in place.



19.26 *Use your hands to work the bead into the rim at the valve, then at the #1 positions, then at the #2 positions, and then at the #3 positions.*

62. [ ] Seat valve by pushing it as far as it will go into tire to prevent valve base from becoming lodged under tire beads.



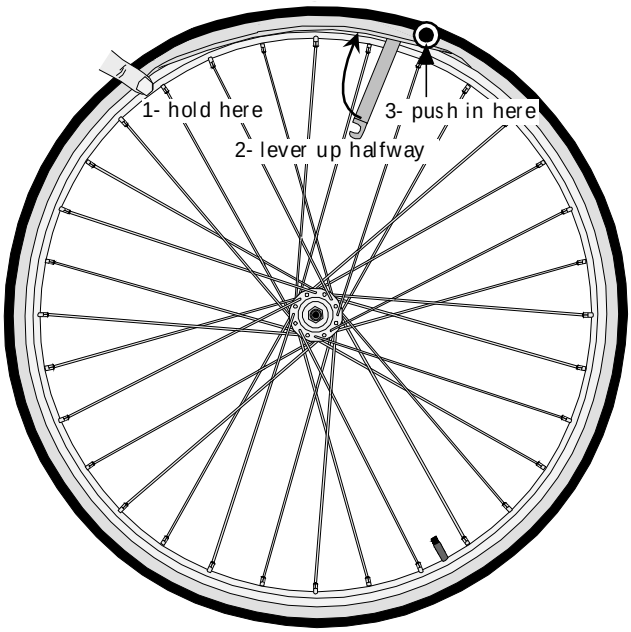
19.27 *When the second bead is mostly in the rim, stop to press the valve into the tire.*

63. [ ] Turn wheel over so that valve is at 6:00 position, and continue to work bead into rim with fingers until it becomes too difficult.

A common problem when installing tires is to pinch the tube with the tire lever when installing the second bead. For this reason, a lot of "authorities" say never to use a tire lever to install a tire, insisting that a "real" mechanic can always install a tire with fingers alone. There is no reason not to try using just fingers, but when this method doesn't work, it is important to know how to use a tire tool without pinching a tube.

There are two tricks to not pinching inner tubes. When using a tire lever to remove a tire, the tool faces out, so the hook on the handle end can be attached to a spoke. To many people, it seems that the tool should be turned around when installing the tire because the curve or hook on the business end of the tool catches nicely on the edge of the rim. Well, this same hook catches nicely on the tube. So use the tire lever for tire installation in the same orientation used for removal. The other trick has to do with how far the tire is levered with the tire lever. Start with the tip of the tool under the bead and the handle pointing in towards the hub. Lever up only 90°, so that the tool ends up perpendicular to the rim face, and use fingers to push the tire over the top of the rim if necessary. When the lever is moved a full 180° so that the tire lever points up above the tire, the tip of the tire lever can catch on the tube and pinch it. To do this correctly, place a thumb on top of the tire lever while it is against the tire in that 90° position, and push in on the tire while pulling out on the lever. If you just pull out on the lever, the tire will probably come out with it. An alternate technique is to not remove the tire lever at all, but let it drop down after levering up, slide it a few inches over, lever up again, let it drop again, then slide over again and repeat the process. (See figure 19.28.)

64. [ ] Holding tire bead firmly to rim at one end of uninstalled portion, use tire lever (approximately 2" from other end of uninstalled portion) to lever tire bead over rim flange. (Tire lever should be oriented same as it is for tire removal, with spoke hook facing towards spokes.)



19.28 *Holding the tire bead firmly at the end where it enters the rim, use a tire lever at the other end to lever the tire halfway to push it over the rim with fingers.*

65. [ ] Remove tire lever and re-insert 2" closer to the hand holding tire bead firmly to rim, levering in tire again. Moving 2" at a time, repeat until all of tire bead is levered over rim flange.

66. [ ] Deflate tube fully as possible.

67. [ ] Squeezing sides of tire together, inspect all around wheel for rim strip out of place and tube caught under bead of tire. Correct any problems detected.

68. [ ] Check that valve is straight, and strike tire obliquely with hand to force it around rim if necessary to straighten valve.

69. [ ] Install valve stem retaining nut, if any.

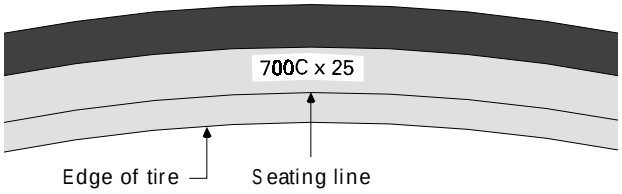
INFLATION AND SEATING OF TIRE

Different techniques and fittings are needed to inflate Schrader and Presta valves. To inflate a Schrader valve, simply remove the valve cap (if any), and place a standard air chuck or pump with a Schrader head on the valve. To inflate a Presta valve, first loosen the

valve nut on the top end of the valve. Presta valves require a fitting with a smaller aperture than Schrader valves. The air line or the pump needs to be equipped with a Presta head or air chuck. There are inexpensive adapters that fit on Presta valves so that a Schrader chuck or pump head may be used.

70. [ ] Inflate tire to approximately half final pressure.

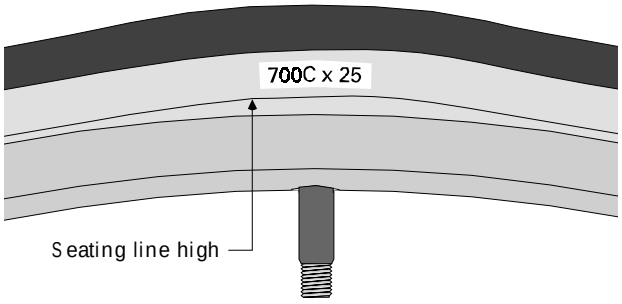
71. [ ] Find molded rubber line (seating line) in tire sidewall just above top of rim flange. Do not confuse color change from sidewall to bead area with molded rubber seating line.



19.29 *The seating line is the line about 1/4"–3/8" above the edge of the tire.*

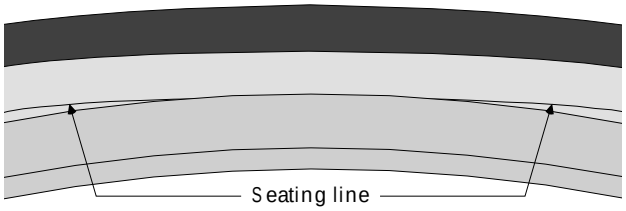
72. Spin wheel and inspect seating line on both sides of tire and check one or both of following choices:

[ ] Seating line periodically rises noticeably above edge of rim in places.



19.30 *Here the seating line rises too high above the edge of the rim for a few inches.*

[ ] Seating line periodically dips below edge of rim in places.



19.31 *Here the seating line sinks too low below the edge of the rim for a few inches.*

[ ] Seating line maintains a relatively uniform position just above edge of rim.

If seating line periodically rises noticeably above edge of rim in places:

73. [ ] Deflate tire and inspect in places where seating line rises for rim strip or inner tube caught between tire bead and rim. Correct any problems found.

74. [ ] Re-inflate tire to half pressure and fully inspect both seating lines again.

75. [ ] If seating line is too high where there is nothing caught under tire bead, deflate and try holding that section of tire firmly down into rim while re-inflating.

If seating line periodically dips below edge of rim:

76. [ ] Deflate and use a soapy solution or liquid soap to lubricate section of bead where seating line is dipping low, then re-inflate.

77. [ ] If seating line remains low after lubricating with soap, full inflation may be required to get bead to pop up.

If seating line maintains a relatively uniform position just above edge of rim:

78. [ ] Inflate tire to full pressure and immediately inspect for sections where seating line is too high. (Deflate immediately if seating line is high and repeat steps 73–75.)

79. [ ] Inspect both seating lines for section where seating line is below rim edge. If bead is already soaped in these areas, over-inflate 10psi and check again. Continue over-inflating 10psi at a time until tire is 50% over maximum, if necessary. Return tire to desired pressure.

80. [ ] Tighten valve nut (if Presta valve) and install valve cap (if any).

WHEEL INSTALLATION

81. [ ] See *WHEEL REMOVAL, REPLACEMENT, AND REINSTALLATION* procedure: FITTING WHEELS, ORIGINAL AND REPLACEMENT (page 18-8) steps 1–10 and INSTALLING THE WHEEL (page 18-15) steps 1–8 (front wheels) or steps 9–20 (rear wheels).

TIRE AND RIM SIZES

The following table is a selection of popular tire and rim sizes found on adult and juvenile road bikes and off-road bikes. The common practice is that rims are named by the tire that they fit.

The **Nominal size** column includes the most popular name for a size. The reason that these numbers are called nominal sizes is that they are not actual measurements. The diameter (27", 700, 26") is the approximate diameter of the tire at the tread. Tire profiles have changed dramatically since the sizes were created and it is rare that a tire actually measures the same as its name size. Rims are named by the tire they fit, rather than by the dimension where they fit the rim. Check a 26"×1.75" rim; it measures approximately 22.5" in diameter. The second part of the nominal size is the tire's inflated width. This number is based on the width of the tire when mounted on the rim, and it changes with the rim width and the tire pressure. Furthermore, tires have historically shrunk without the widths being renamed. A typical 1-1/4" tire is usually closer to 1-1/8".

The **Alternate names** column covers both vernacular names, and names used by another country for the same size tire. An example of a vernacular name would be to say "MTB tire" instead of 26"×1.75".

The **Bead-seat diameter/tire-bead diameter** column is the dimension that is most important in regard to tire fit. Bead diameter is the diameter of the tire at its inner perimeter. Bead-seat diameter is the diameter of the rim at the point the tire bead sits. The procedures in this chapter describes how to measure and calculate rim-bead-seat diameter. Tire-bead diameter can only be determined by looking up the tire's nominal size on this table and reading across to the **Bead-seat diameter/tire-bead diameter** column, unless the tire has an ISO marking.

The **ISO size** column is an alternate sizing system based on actual dimensions of tires and rims where they attach to each other. ISO stands for International Standards Organization. The two digit number before the dash is the tire's *section width*. Section width is described fully in the portion of this chapter about tire fit and compatibility (page 19-10). For each size in the table, the smallest and largest known section widths are shown. The three-digit number after the dash is the tire's bead diameter and the rim's bead-seat diameter. The table does not provide ISO rim-width information, which can be obtained easily by measuring the width between the inside faces of the two rim flanges. This number is expressed in millimeters.

The **Approximate rim O.D.** column is useful for identifying unmarked rims. It is expressed as a range for two reasons: one is that two rims of the same size have to have the same bead seat diameter, but their outside diameters (O.D.) can vary because their flange heights can be different without affecting fit; the other reason is that when measuring a rim with a hub already built in, the tape measure will have to deflect somewhat around the hub. Even if the measurement is slightly outside one of the ranges, it should be safe to assume the size of the rim. No two common sizes come closer than 3mm.

The **Typical use** column describes types of bikes where the size is most likely to be encountered, but other types occur. The suggestions are not a complete or limiting list of the types of bikes that use a particular size.

There are literally dozens of sizes that exist but are not listed. Most of the other sizes are a once-in-a-lifetime encounter for a shop mechanic and will probably never be encountered (other than a few juvenile sizes smaller than 24"). For a comprehensive listing of tire and rim sizes, see *Sutherland's Handbook for Bicycle Mechanics*.

TIRE AND RIM SIZES (table 19-1)

Nominal size, rim or tire (common name)	Alternate names (country/name)	Bead-seat diameter/ tire-bead diameter	ISO size (tire section width[1]/rim or tire diameter)	Approximate rim O.D.	Typical use
27"×1-1/4" other widths are 1, 1-1/8, 1-3/8	British/K2	630mm	20-630 through 30-630	640-644mm	Recreational-level road bikes, touring road bikes
700C[2] widths are all sizes 18mm through 47mm	French/28×1-5/8 Canada/28×1-1/2	622mm	20-622 through 47-622	632-636mm	Performance road bikes, "cross" bikes, "hybrid" bikes

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TIRE AND RIM SIZES (table 19-1 continued)

Nominal size, rim or tire (common name)	Alternate names (country/name)	Bead-seat diameter/ tire-bead diameter	ISO size (tire section width[1]/rim or tire diameter)	Approximate rim O.D.	Typical use
26"×1-3/8" (tire to fit S-5 or S-6)	British/26×1-1/4 to fit EA1 rim	597mm	32-597 through 37-597	607-611mm	Older Schwinn 3-speeds, 5- & 10- speed "heavy" bikes
26"×1-3/8" (to fit EA3 or E3 rims) other widths are 1 and 1-1/4	French/650A	590mm	28-590 through 40-590	600-604mm	American made dept. store "12-speeds," narrow widths on some performance road bikes with small frames
26"×1-1/2" (to fit S4 rim)	French/650B	584mm	32-584 through 47-584	597-601mm	Schwinn MTB/cross bike size, rare French touring bikes
650C	USA/26"	571mm	20-571 through 47-571	583-587mm	Triathlon bikes with compact, high-performance wheels
26"×1-3/4"[3]	Schwinn S-7	571mm		583-587mm	Beach cruisers, old balloon-tire Schwinns
26"×1.75"[4] other widths are all sizes 1"–2.5"	26" MTB	559mm	20-559 through 54-559	571-575mm	MTBs, ATBs, "Cross" bikes
24"×1-1/4" other width is 1-1/8	Schwinn/ 24×1-3/8 (to fit S5 or S6 rim)	547mm	20-547 through 37-547	557-561mm	Narrow sizes on "proportional" performance road bikes, 24×1-3/8 on juvenile Schwinn derailleur bikes
24"×1-3/8" (to fit E5 or F3 rim)		540mm	32-540 through 37-540	550-554mm	Juvenile, department-store 12-speeds by USA manufacturers
24"×1.75" other widths are 1"–2.125"	BMX cruiser class	507mm	44-507 through 54-507	521-525mm	Juvenile MTBs, BMX cruiser class
20"×1.75" other widths are 1.5"–2.125"	BMX	406mm	44-406 through 54-406	420-424mm	BMX bikes, all qualities, other juvenile 20" wheel bikes

[1] ISO rim width is a measurement of the width between the rim flanges. A 20-622 tire might fit a 14-622 rim.

[2] The "C" is sometimes omitted, which is wrong since 700, 700A, 700B, and 700C are completely different sizes. The "C" sometimes appears after the width (example: 700×25C) which is also wrong as the "C" qualifies the size, not the width.

[3] Do not confuse this with 26×1.75 MTB size. They do not interchange.

[4] Do not confuse this with beach-cruiser and balloon-tire classic size, 26"×1-3/4". They do not interchange.

TIRE AND TUBE TROUBLESHOOTING

Cause	Solution
SYMPTOM: *Bead-seat line is too high at the valve.*	
Tube around base of valve is caught under rim bead.	Deflate tire and push valve into tire and then pull out again.
Rim strip is too wide for rim.	Inspect rim strip and replace it if against bottom edge of rim-bead lip.
SYMPTOM: *Bead-seat line is too high at points other than the valve.*	
Tube is caught under bead of tire.	Deflate, inspect, and reposition tube.
Rim strip is too wide or out of position so that it is against lip of rim bead seat.	Reposition or replace rim strip as necessary.
Tire fits rim loosely. High-seated areas are probably caused by low-seated areas elsewhere on the rim.	With tire at a pressure of approximately 10–15 psi, manipulate the tire by pulling out at low points while pushing in at high points. Add pressure once bead is more evenly seated.
SYMPTOM: *Bead-seat line will not pop out above the rim bead at one or more points.*	
Bead is too high at other points due to rim strip or tube caught under tire bead.	Check and fix high-seating problems.
Tire fits the rim loosely and high-seated areas elsewhere are probably keeping the tire bead in at this point.	With tire at a pressure of approximately 10–15 psi, manipulate the tire by pulling out at low points while pushing in at high points. Add pressure once bead is more evenly seated.
Tire is a tight fit.	– Deflate tire, lubricate tire bead with liquid soap or lanolin hand cream and re-inflate. – If bead is lubricated and there are no high-seating areas, inflate past recommended pressure until bead pops out.
SYMPTOM: *Tire seats correctly initially, then blows off of rim.*	
Tire was over-inflated.	Inspect for bead damage, then re-install.
Tire bead is damaged.	Inspect for damage and replace.
SYMPTOM: *Tire is extremely difficult to install.*	
Tire is wrong size.	Check tire fit.
Tube is over-inflated.	Remove air from tube.
Tube is too fat for tire.	Check tube fit.
Rim strip is too wide, interfering with bead seat area of rim.	Inspect and replace rim strip if it is jamming against bead lip on either side of rim.
Rim strip is too bulky for tight fitting rim/tire combination.	Avoid using thick black rubber and cloth rim strips.
Tire and rim are an unusually tight combination.	Lube complete tire beads with liquid soap or lanolin hand cream.
SYMPTOM: *Tire fabric has numerous ruptures all the way around both sides below the tread, but not just above the rim. There are no rub marks.*	
Tire has been ridden while punctured or virtually flat. Tire sidewalls have been rubbing on riding surface.	Replace tire and avoid riding with extremely low air pressure or no air pressure.

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TIRE AND TUBE TROUBLESHOOTING (Continued)

Cause	Solution
SYMPTOM: *Tire is extremely difficult to remove.*	
Tube needs additional deflation.	Squeezing tire, deflate tube further.
Tire has adhered to rim sidewall.	Run tire lever between tire and rim all the way around both sides to break free adhesion. Smear as much liquid soap or lanolin hand cream as possible between tire bead and rim.
Tire and rim are an unusually tight combination.	Lube complete tire beads with liquid soap or lanolin hand cream.
SYMPTOM: *Valve was in straight initially, but is now at an angle.*	
Hard braking has rotated tire around rim, probably because bike has been ridden with inadequate air pressure.	Deflate tire, rotate it in a direction that straightens the valve, and maintain correct pressure when riding.
SYMPTOM: *Rim strip is broken at valve hole.*	
Incorrect procedure was used when installing tube valve into rim strip and rim hole.	– Replace rim strip. – Avoid reoccurrence by lifting rim strip up at valve hole and installing valve through rim strip first and then drop rim strip and valve together into rim.
SYMPTOM: *Tire is flatting repeatedly from simple punctures on the outside perimeter of the tube.*	
Tire tread has worn thin.	Inspect tire tread and replace tire if worn.
Tire is full of cracks from aging.	Inspect for cracks and replace tire if needed.
Flat-causing object still stuck in tire.	Inspect more thoroughly for cause of flat.
SYMPTOM: *Tire has flatted from blowing off the rim.*	
Tire was over-inflated.	Inspect for bead damage and adhere to manufacturer's recommendations.
If tire was properly inflated, the tire probably was not mounted correctly.	Inspect for bead damage, and inspect tires for mounting problems before inflating fully.
Tire bead is damaged.	Remove and inspect tire, and replace tire if bead is damaged.
SYMPTOM: *Tire has flatted shortly after installation due to parallel slits in the sidewall of the inner tube.*	
Improper tool use during tire installation has damaged the tube.	Replace the tube, use only tire levers for tire installation, and avoid using the tire levers to lever the tire up any further than necessary to push the tire over the top of the rim with fingers.
SYMPTOM: *Tire has flatted in mid-ride due to parallel slits in the sidewall of the inner tube.*	
Tire has bottomed out, and tube was pinched between rim bead and riding surface.	– Avoiding riding with under-inflated tires. – Un-weight when hitting obstacles that cannot be avoided. – Use wider tires.
SYMPTOM: *Tire has a slow leak but inspection reveals no holes.*	
Valve is leaking because valve core is loose or bad.	Use bubble test to check for leaking valve with tire installed and fully inflated. Secure valve and replace if leaking continues.

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TIRE AND TUBE TROUBLESHOOTING (Continued)

Cause	Solution
SYMPTOM: *Holes found on "rim side" of tube.*	
Rim strip is out of position, exposing nipple heads or nipple access holes.	Inspect and reposition rim strip.
Elastic rubber rim strip appears to be covering nipple access holes when inspected, but is deflecting to expose holes when tire is fully inflated.	Use polyurethane rim strips on rims with nipple-access holes.
Spokes are too long and are protruding out of nipple heads and poking through the rim strip.	Remove rim strip and use edge of a file to file down excess spoke length.
Particularly at rim seam, rim has raw unfinished material that is puncturing or abrading the tube.	Inspect rim and file off any sharp protrusions.
SYMPTOM: *Tube has leak at edge of the oval mounting base of the valve.*	
Tube cross section is too narrow for tire and is being stretched too far to fill tire.	Replace with fatter tube.
SYMPTOM: *Tube has failed at the seam where two ends of tube were joined during manufacture to create a circle.*	
Tube is wrong size for rim (must be stretched to reach around rim) and is pulling on seam too much.	Replace with proper-size tube.
Tube cross section is too narrow for tire and is being stretched too far to fill tire.	Replace with fatter tube.
SYMPTOM: *Tire bead is damaged, evidenced by torn fabric wrapped around bead wire or scuffed rubber coating at bead wire, over a distance of approximately 1/2".*	
Improper tools or technique when levering tire off of rim.	Use plastic tire levers and find ways to solve problem if tire is difficult to remove or install.
SYMPTOM: *Wire bead in tire is broken, or rubber lip molded on at wire bead is scuffed off for several inches.*	
Over-inflation caused tire to blow off rim, which damages the beads.	Replace tire and avoid over-inflation.
SYMPTOM: *Tire sidewall has wear marks and frayed fabric most of the way around, just above the rim.*	
Brake pads are rubbing on tire because pads are out of position.	Replace tire and adjust brake-pad height.
Brake pads cannot be adjusted to correct height without rubbing on tire.	Replace tire with narrower size. Tire is too fat for rim width, and either rim or tire should be changed.
SYMPTOM: *Tire sidewall has rub marks and frayed fabric over a short distance just above the rim.*	
Rim is out of round, causing the brake pads to rub against tire intermittently.	Replace tire and correct out-of-round error. Replace rim/wheel if necessary.
SYMPTOM: *Tire tread or sidewall rubber is full of countless little cracks.*	
Rubber has hardened due to aging.	Replace tire and avoid unnecessary exposure to sunlight and/or water.
SYMPTOM: *Tire fabric is ruptured in tread area. Tread may or may not be damaged.*	
Fabric has rotted due to age.	Replace tire and inspect more frequently for cracks in the rubber.
Tire has been damaged by sharp stone.	Replace tire.