

Tires 101

Tires 101 is specifically designed with dealers in mind. Our motorcycle tire experts have a remarkable background in tires ranging from racers to engineers. This handout is chock full of practical, useful information. It targets all areas of the dealership from sales, service, and parts with the latest training techniques.

Our experience has shown that the best customer service and sales come from knowledgeable staff. Please contact Avon if you would like a webinar, either for your customers or staff. The more you know the better you'll be able to sell tires. 800-624-7470 x 3135 or use the training PDFs www.avonmoto.com/downloads

The handout covers 8 areas:

Section 1 - Sizing

Sizing is confusing as there are 5 methods in use. There are three technical organizations that all manufacturers adhere to. The organizations that set the parameters/ranges for permissible ranges for all sizes are the European Tire & Rim Technical Organization, the Japanese Association of Tire Manufacturers and the US Tire & Rim Association.

The 3 most common ones are inch sizing, Alpha numeric and Metric. Metric sizing provides the most information, for example a 140/90H16 where the approximate width is 140 mm, the key word being approximate. Bear in mind that manufacturers are allowed approximately a 5% variance from standard. This is why no two tire measurements from manufacturers are the same. They may both be marked 140 but one width may be 134 mm and another 145 mm.

And the size ranges can overlap. One manufacturer's "140" can actually be narrower than another manufacturer's "130". It's important to check what the actual width of a replacement tire is with the manufacturer to determine if it will fit. Most tire manufacturers' literature will include overall widths in inches and/or mm and the rim size that each width is measured on. Take a size and check one manufacturer against another and you'll be able to see quite easily that there can be as much as a quarter to a half inch difference in width between the same sized tires. Be aware that this can cause fitment problems!

Okay, so now we go back to the 140/90H16 tire. The second set of digits, the "90" is the aspect ratio of the tire. The aspect ratio is the relationship of the height of the tire (from bead area to the top of the tire) to the width of the tire. The aspect ratio of a tire is always expressed as a percentage of height to width, so the "90" in a 140/90-16 means that this tire is 90% as high as it is wide or 126mm tall.

Over the years we have seen lower aspect ratio tires which help improve sport tire performance. There is a tradeoff however and when you sell these tires keep in mind there's a difference in handling.

As a 90% aspect ratio or lower tire reaches its maximum adhesion around a corner it will begin to slip. You will start to feel that it's slipping, but it will fall off on a relatively gradual basis.

On the other hand, lower aspect ratio tires have comparatively better grip, but when they reach their maximum adhesion, they drop off, or begin to slip, more rapidly. There is less warning.

So, low aspect ratio tires are better suited for the skilled rider. And when I say skilled rider, I don't just mean someone who has been riding for 10 or 15 years. I'm referring to an accomplished rider, who knows how to handle a high performance motorcycle and will be able to sense when he is reaching the maximum limits of his abilities and the machine's.

Most riders, and certainly all less experienced riders, should be sold higher-aspect ratio 90 series tires unless their bike has stock lower aspect tires. There is more forgiveness as the rider approaches maximum performance and the rider will appreciate that.

Again, let's go back to the 140/90H16. The letter "H" following the aspect ratio signifies the speed rating of the tire.

In the U.S. the Federal Motor Vehicle Department tests only at speeds up to 85 mph. So the tire manufacturers have borrowed the European speed rating system which goes higher. There are five levels in European system: N, S, H, V, W. The N rating is good for sustained speeds up to 93 mph, S is good up to 112 mph, H for speeds up to 130 mph, V 149 mph, W over 149 mph.

One problem with this system, however, is that there are no international standards for load and time at these speeds. It's strictly up to the integrity of the manufacturer of the tire as to how long and at what load, these sustained speeds will be tested.

One common error, regarding speed ratings, is to assume that the higher the speed rating, the better the tire. This is not necessarily true. Application is what determines what tire is best.

Touring riders are interested in smooth riding under heavy loads, over long distances. Sport riders carry light loads, and want high grip performance. The faster you want to go means less load you can carry and a firmer ride. Generally

sport tires are V and W rated, while most other street and touring tires are H rated.

In some cases, the speed rating appears at the end of the metric size. For example, 140/90-16 67H. The number code "67" preceding the "H" speed rating indicates the load carrying capacity. 67 signifies 675 pounds. But it's not important that you become familiar with load carrying capacity codes because manufacturers are also required to put the maximum load of the tire in pounds and kilograms directly on the sidewall.

Finally, the "16" at the end of the 140/90-16 is the diameter of the wheel on which the tire is to be mounted.

Alpha Numeric is a second, less often used system of sizing, for example – MT90-16. The "M" stands for motorcycle tire. The "T" is a code for the approximate width of the tire. "T" happens to be 130mm wide. The higher the letter, the wider the tire, with "T" being narrower than "U" for example.

The "90" in MT90-16 is the aspect ratio, width to height and the number "16" is of course the rim diameter. A speed rating is sometimes added to an alpha numeric size such as MT90S16, indicating an "S" speed rating.

Inch sizing is a system which is fading away as lower aspect ratios become more popular and also the inch sizing can be confusing. 4.00H18 is a good example of inch sizing. The "4.00" represents the approximate width of the tire, 4 inches; "H" is the speed rating and "18" is the rim diameter.

The confusing part concerns the last two digits in the width marking, "00" in the case of a "400". These digits tell you what the aspect ratio of the tire is. If the two digits are divisible by .25 as in the case of the 4.00-18 then the aspect ratio of the tire is greater than 95% or the tire is approximately 95% as high as it is wide.

But if the last two digits in the width marking are a 10 or a 60 as in 4.10-18 or 4.60-18 then the aspect ratio of the tire is between 80% and 94% - a low profile tire. So when you see a 4.10, 4.25, 5.10, 5.60 and so on it means the tires have a low aspect ratio.

The confusing part is that many people assume that a 4.00-18 is smaller than a 4.10-18, but that's not true. The 4.10 merely has a lower aspect ratio. You've probably had many people come into your shop and say, I want to put the biggest tire on the back of my bike that will fit between the swing arm. Now if you notice that he has a 4.00 and sell him a 4.10 you're actually going to be

selling him a smaller tire than he already has. It can be very confusing and a cross reference chart of all the various sizing methods will be very helpful.

A typical ATV marking is 22x11x8. The 22 is the approximate overall height in inches, 11 is the width and 8 is the rim diameter.

Section 2 – Directional Arrows

Before we can talk about directional arrows we must first understand a bit about tread patterns. There are many different tread patterns but there is one main reason to have any tread and that is to disperse water. (dust, dirt)

A tread pattern can be designed to disperse more water by making it rotate in only one direction. Thus, the need for directional arrows. The arrow tells you which way to mount a tire for maximum water dispersal. Another, less apparent reason for directional arrows is the tread splice.

What is a tread splice? When a tire is manufactured the tread portion of the tire starts out as a long flat strip. This strip is wrapped around the tire and the two ends are cut on an angle so one end overlaps the other rather than having square cut ends.

This overlapping point or splice offers a bigger surface area to bond together, rather than the small surface area provided by square cut ends. (Imagine gluing your fingertips together, as opposed to gluing along the entire length of your fingers laid on top of each other. Like an angled splice, the overlapping fingers result in a much stronger bond).

To further ensure the strength of this bond along the tread splice the directional arrow will show you which way to mount the tire so that when the rider is “on the gas”; the acceleration force on the rear tire is pressing the splice together, rather than peeling it back.

As for braking, 80 % of the braking should take place in the front on most bikes. Therefore, the front tread splice is run in the opposite direction than that of the rear, so when the rider is on the brakes, he’s not peeling the tread splice back.

If you are using a tire that has a directional arrow for rear rotation only and for some reason you want to put it on the front, make sure it is rotating in the opposite direction so you don’t aggravate the tread splice.

Section 3 – Design Profile

All motorcycle tires have what is called an optimum design profile. This refers to the optimum or proper shape the tire will take when under load. In other words, the tire will flex into a predictable shape at the contact patch. This shape, which

allows the tire to perform most effectively, is obtained when the correct designated rim size is used. If a rider uses a rim which is too wide or too narrow he will not get the proper design profile and thus not get the maximum performance and life from the tire.

So let's examine 3 examples of how design profile can be affected. The first is use of the recommended rim which gives the correct design profile. When mounted on the correct rim the tire will give its maximum traction, wear and load capacity. But if the rim being used is narrower than the recommended rim size, the beads of the tire would be squeezed together more than they are designed for. The contact patch would then be narrower, or sharper.

In addition to reducing the tire's traction and wear capabilities while cornering, a sharper contact patch causes the bike to flop unnaturally into a lean angle. So, if a customer wants to put an oversized tire on his bike, in order to get a larger contact patch and better wear, unless he also changes the rim, he could actually be getting a smaller contact patch and less tire life.

Also remember that going the other way can be just as bad. Some riders will want to put a tire on too wide a rim, to make it appear wider than it actually is. By doing this the beads are spread wider than intended. The tire now takes on more of a square profile. This profile does allow for a larger contact patch but the handling is much worse, because of the squared off tread.

Another example of design profile is back in the late sixties, early seventies when British bikes were more popular and the tire shape was trigonic. Trigonic meant for a sharper, narrower contact patch. Back then the motorcycles didn't have the superior brakes and horsepower of today's machines. A rider could get away with a smaller contact patch and handle the noticeable flop into the corners. As bikes progressed with more horsepower and heavier motorcycles, the disadvantages of the trigonic profile became more obvious.

The last example: Another old look was the square profile which was original equipment of older Harley-Davidsons. This profile allows a relatively large contact patch for improved acceleration, braking, and mileage, but produces poor handling. Today's premium tires have a more rounded profile offering the advantages of a large contact patch with smoother cornering. So for best performance use the right tire on the recommended rim size, although it is permissible in most cases to go up or down one size from the recommended rim.

Section 4 – Tire Growth & Inflation Pressure

The first thing a mechanic should do, after mounting a new tire, is to turn the tire to make sure it doesn't rub against anything. But this may not be enough of a test because in the first 100 to 200 miles of use a tire is going to go through a

break in period. During this time, most tires will grow or enlarge slightly anywhere from 3 to 7%. Radials can grow by 1-2 mm.

So if a mechanic mounts a tire and notices it's just barely clearing the driveshaft, fender mounts of whatever, he must keep in mind the tire is going to grow a little during the break in period. There's another good reason to take note of this growth phenomenon and it has to do with air pressure.

Every customer should be told that during a new tire's 200 mile break in period, the tire will grow by as much as 7% causing the air pressure to decrease as much as 7%. If a mechanic puts 40 pounds of air pressure in the new tires of a fully loaded Gold Wing, 200 miles down the road the air pressure could be as low as 37 lbs. That's going to detract from the tires' mileage and certainly from their load carrying capacity. So in the first 100 to miles of a new tire the rider should be checking the tires' cold pressure frequently, with an accurate gauge.

Maximum tire inflation pressure is printed on the sidewall of every tire. Keep in mind: These are cold pressures. We say cold, meaning before the bike has been ridden. As the tires start to heat up pressure will increase. The difference between cold and hot tire pressures should be about 4-6 lbs. or about 10%.

Another factor relating to inflation pressure is load. Obviously a fully loaded GL1800 Gold Wing with two 250 pound riders is going to require more inflation than that the same motorcycle with a 170 pound rider. But the owner's manual doesn't account for that. The owner's manual just makes one general recommendation. You should encourage customers to adjust the pressure of their tires to accommodate their particular riding style and load.

Here's what to do: After a 200 mile break in period the rider should load the bike the way it's most likely to be normally loaded. She should then set the cold inflation pressure at the recommended level by the tire manufacturer and ride for 45 minutes to an hour. Then she should measure the hot pressure. If the hot pressure has increased more the 4-6 lbs. the tire is doing too much work. It's flexing too much and overheating.

After letting the tire cool down, the rider should increase air pressure about 2 lbs. and repeat the above testing procedure until the hot tire pressure increase is into that 4-6 pounds. No matter what the outcome I would suggest keeping the cold pressure no lower than the owner's manual inflation pressure recommendation and no higher than the maximum pressure listed on the sidewall.

If the rider is running the tire at the maximum pressure shown on the sidewall, and still getting more than a 4-6 lb. increase after heating the tire, then she has

to remove some weight from the bike or slow down. Under no circumstances should the rider exceed the maximum pressure on the sidewall, while cold. To do so will distort the profile of the tire and reduce its overall performance. High inflation pressures also increase the risk of damaging the tire if the rider should hit a pothole or similar hazard.

It should be mentioned here that most tire pressure gauges are not accurate. I've seen them off by as much as 7 lbs. An important service you can do for your gauge is to take a good pressure gauge like AccuGage and calibrate your own stick pencil gauge. Then you will see how many pounds it is off.

Section 5: Tubeless versus Tube type tires

A tubeless tire is of basically the same construction as a tube type tire, except that the tubeless tire has an added inner liner of soft, unstressed rubber. If a tubeless tire is penetrated by a nail, this soft inner liner wraps itself around the nail to help slow the air leak. The idea is that the rider will become aware of the air loss but have time to slow down and if necessary come to a safe stop. Hopefully she'll be able to ride home before the tire goes completely flat.

Sometimes you can pick up a nail and nothing will happen to the tire's inflation pressure. You may not even notice the puncture until you make a visual check, which illustrates the importance of eyeballing your tires as often as possible. There's an experiment you can try that will demonstrate the properties and puncture response of the tubeless tire. Take an ordinary rubber balloon. Before you inflate it, securely attach a strip of duct tape to it. When the balloon is inflated, what's beneath is a section of unstressed rubber. Now, if you stick a pin through the tape and into the balloon, the soft unstressed rubber will wrap around the pin (just like the tire's inner liner wrapped around the nail) and the balloon won't burst.

The problem with tube type tires is that when the tube is punctured the air often exits in a big hurry leaving the rider with precious little time to slow down and retain control.

Because of the advantages afforded by tubeless tires and in order to reduce the number of line items a dealer has to carry many manufacturers sell only tubeless tires. Tubeless tires can also take tubes. There are certain rims which can only take tube type tires – contre pointe CP,CM.

Remember under no circumstances should you use a tube to repair a tubeless tire. A tire that is damaged enough to require a tube it is no longer a safe motorcycle tire. Also tubeless repair should only be attempted in the tread section of the tire. And do not attempt to fix any hole larger than ¼ inch. Only a combination plug/patch (special plug required for radials?) should be used to repair a motorcycle tire. The patch seals the hole inside the tire while the plug

stops moisture from getting between the tire's plies. Also avoid excessive speeds on tires that have been repaired. Plugs are fine for roadside repair but a rider should not exceed speeds of 50 mph with only a plug in the tire.

One other thing; remember that motorcycle tires are subject to far greater stress than car tires. And if a tube is installed in a tubeless tire be careful not to get air trapped between the tube and the tire. To help avoid this first inflate the tire, then deflate it and inflate it again.

To reiterate, inflation pressure should be checked often, during the break in period, to discover loss of air and tire growth.

Section 6: Mounting & Balancing

When mounting a new tire begin by making certain the rim has been thoroughly cleaned. It may require a wire brush. If you leave the speck of old rubber, rust or dirt (even as little as .04 of an inch) the result may be a variation force of 11 lbs. And this may cause motorcycle tires to wobble. Next, lubricate the tire and rim to allow the new tire to seat itself. Lubricating the tire is not done just to help you get the tire on the rim. Lubrication allows the tire to seat itself.

Trying to mount a tire without cleaning the rim and lubricating the beads is like trying to put on a dry sock over a wet leg; you can't get the darn thing straight; it doesn't line up; all the ribs are crooked. Now some people don't care if the ribs on their socks are crooked. I happen to like mine straight.

If you try to mount a motorcycle tire without thoroughly lubricating both beads you stand a good chance of mounting it "tweaked". This is because when the beads first come in contact with the rim, there's tension. If the beads don't slide back and become comfortably seated they will be straining to get straight for the rest of the tire's life. This may cause wobbling and lower mileage so make sure that both beads are thoroughly lubricated with a good commercial lubricant. Soap and water may also be used but be careful in applying so you avoid getting soapy water inside the tire. This may cause the tire to become imbalanced and may also promote the rusting of steel rims.

Also water trapped inside the tire will turn to steam when riding, affecting tire pressure and performance. I strongly recommend against putting sealant and/or balancing fluids in a tubeless motorcycle tire. They tend to mask damage done to a tire by a penetrating object. These fluids continue to fill puncture holes until the object may suddenly be thrown out which may lead to a dangerous blow out. And with the kinds of heavy loading we're getting these days on motorcycles the risk is of concern.

Balancing new tires is also very important. 1.8 ounces of imbalance will result in 110 lbs. of variation force at 80 mph. That may cause a lot of wobble and 1.8 ounces of imbalance is not so uncommon with some manufacturers' tires.

Always have tires balanced at a dealership. Computer balancers are state of the art and you should take tires to places that have them. All tire manufacturers mold a thin line around the sides of each tire close to where the tire meets the rim. This rim line is to help the mechanic determine if the tire is properly seated. Be sure this line is parallel to the rim all the way around on both sides of the tire. If it is not, you must relubricate the beads and try again. After mounting any new tire, remember that most new tires are coated with a compound to help release the tire from the mold during production. Since this may cause slight traction problems, take it easy until the compound is worn off.

Section 7: Wear Patterns

As you look at different tread patterns you will find that essentially all of them can be broken down into blocks of rubber, rather than straight grooves all the way around. The idea behind these blocks is that they stagger the grooves so the tire is less likely to react to rain grooves, bridge grates and road seams. The problem arises when the rider grabs the brakes. The rubber in the blocks moves slightly to the rear under the force of braking. This wears the front, the braking edge, (or leading edge) slightly more than it does the rear edge. And this is the beginning of what's known as cupping.

Cupping is a perfectly normal tread wear pattern. Still there are things you can do to help reduce the amount of cupping and one of those things is maintaining proper inflation pressure. Inflation pressure will affect how much cupping occurs because it affects the flexing of the tire as it goes into and out of the contact patch. If proper inflation pressure is maintained cupping may be reduced considerably.

With some front tires without directional arrows it's possible to remove the tire and reverse its direction to even the wear.

When all is said and done a cupped tire is the sign of a rider who knows how to ride a motorcycle. If a rider tells you he has 20,000 miles on his front tire and it's not cupped at all he's probably not been braking properly. His was either a very slow or a very scary 20,000 miles since about 80% of a motorcycle's braking should be on the front wheel.

Rotation of the tires helps even wear patterns on automobile tires but because of the differing tire sizes on front and rear and directional patterns rotating motorcycle tires is generally not possible.

There are some other wear problems. If you notice the two outside edges of the tires worn more than the middle the tire has been run under inflated. As the tire comes into the contact patch it will depress in the middle and will wear more heavily on the outside edges.

Over inflation will of course cause rapid wear down the middle though this wear pattern may also be caused by high speed burnouts. You may also see more motorcycle tires worn on the left side than the right side. This is due to the rider traveling on crowned roads where more pressure is put on the left side of the tire than the right.

Left side wear can be caused by crown of the road, offset motor or the fact that in this country when you initiate a left hand turn it is a further distance than when you make a right hand turn.

Another wear problem that is prevalent in the heavy touring market is channel cracking. This shows in the grooves of the tread where it looks like somebody has had little razor cuts into the tire. Overloading and under inflation are chief causes of channel cracking.

Channel cracking may be dangerous. You should inspect both tires for this. It is a common problem. One other common cause of channel cracking in motorcycle tires is weakened rear suspension under the stress of pulling a trailer. If the rider hits a pothole, the suspension may bottom out causing an unusually heavy shock load. So suspension and inflation pressure checks become especially critical on heavily loaded touring bikes.

Suspension system and fork and shock oil levels also have a big bearing on tire life.

Section 8: Displaying Tires

Tires have always been number one or two in best selling aftermarket accessories. They can and should be a major profit center and drawing card for most dealerships. To effectively sell tires a dealer must look as if he is in the motorcycle tire business. Too often dealers have tire inventories hidden away in back rooms. Start merchandising your motorcycle tires by moving them into an attractive display in plain sight. The display should be organized to help customers select the tires he needs. Separate tires into touring, sport, dirt and general groups. They may be spread throughout the store or placed in one tire section. Be sure each tire is labeled to assist the consumer. The label should include the price, application, size, and other pertinent data – tubeless, wide white wall, type of terrain it's designed for.

Group the tires by size, application, or manufacturer but have a system and keep it neat and clean. Tire manufacturers spend a lot of money every year to provide dealers with banners, tire stands, application charts and point of purchase materials. In most cases these materials are available at no charge. Ask your distributor to provide you with these materials and use them.

Signs advertising mounting and balancing service should be prominently displayed. Show the consumer you're interested in getting his tire business and it will surely come your way. And don't forget about selling and promoting tire related items: tubes, rim strips, tubeless valves, mounting lubricants, tire irons, flat repair kits, rim locks, pressure gauges. These all belong in your store's tire area.

Keep the names and addresses of all tire customers for your mailing list. Take the time to inform your customers about tire care, break in procedures, inflation pressures, dry rot, and winter storage. This show of knowledge and concern for your customer's satisfaction will surely help to keep them coming in.

Check List

The following questions will help you determine whether you are really in the motorcycle tire business

1. Are my tires displayed for the consumer?
2. Are my tires labeled?
3. Is there a system to my display?
4. Do I have a tire knowledgeable staff, offering accurate, helpful advice?
5. Do I have tire changing and balancing equipment?
6. Is my inventory sufficient?
7. Are tire related items available for sale?
8. Are tire literature, application charts and point of purchase materials prominently displayed?
9. Am I getting my fair share of the local motorcycle tire business?
10. Do I have a workable system of tire inventory control and am I rotating my stock expeditiously?

Motorcycle tires can be an important profit center in any dealership. Look, sound and act as if you're in the motorcycle tire business and you'll find business coming your way.