# Motorcycle Industry Council

# Tire Guide

## All you need to know about street motorcycle tires

Motorcycle Industry Council®

The information in this booklet represents the collective knowledge of a number of motorcycle tire manufacturers and Motorcycle Industry Council staff and is intended to be a useful resource for motorcyclists. This booklet, however, cannot cover every possible example or aspect of tire usage. Consult the appropriate motorcycle or tire manufacturer for issues not addressed in this booklet.

## INTRODUCTION

Never underestimate the importance of having good, properly inflated tires on your motorcycle. The small contact patches provided by the front and rear tires are the motorcycle's only source of traction. Deterioration of your tires' condition can jeopardize this contact patch and bring a good ride to a quick end.

Safe riding depends on selecting the right tires, inspecting and maintaining them, and replacing them as necessary.

## INSPECTION AND MAINTENANCE

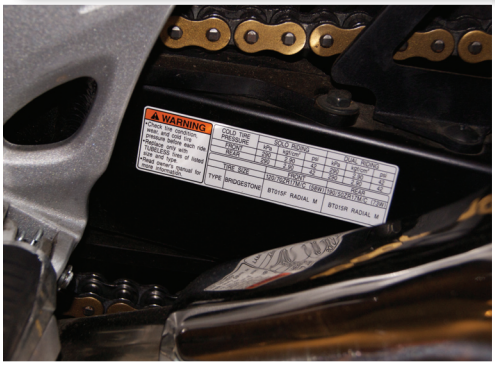
It's all about *inflation, inflation, inflation*. Proper air pressure is critical for tire performance and tire life. Under-inflation or overloading can cause sluggish handling, heavy steering, and internal damage due to over-flexing, and can cause the tire to separate from the rim. Over-inflation can reduce the contact area (and therefore available traction), and can make the motorcycle react harshly to bumps. Check

Tire Pressures

| LOAD | TIRE PRESSURE (COLD) | | | |
|---|---|---|---|---|
| | FRONT | | REAR | |
| | PSI | kPa | PSI | kPa |
| Solo rider | 36 | 248 | 36 | 248 |
| Rider and passenger | 36 | 248 | 40 | 276 |

| MOUNT | TYPE | SIZE | OPTION 1 | OPTION 2 |
|---|---|---|---|---|
| front | radial-ply, tubeless | 120/70 ZR17 | Brand X - F | Brand Y - F |
| rear | radial-ply, tubeless | 190/50 ZR17 | Brand X - R | Brand Y - R |

page 22 Specifications Owner's manual



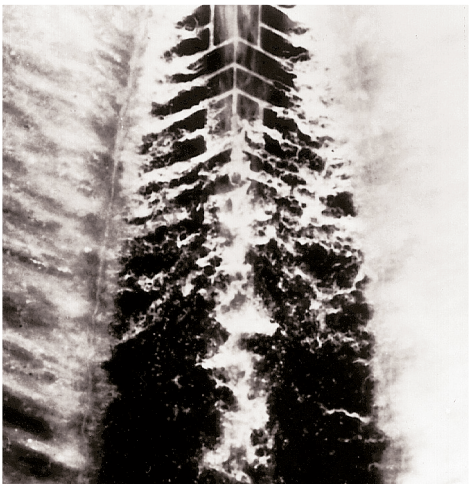

the air pressure when the tires are cold (at least three hours since the last ride), as part of your pre-ride "T-CLOCS" inspection (T-CLOCS means **T**ires and Wheels, **C**ontrols, **L**ights, **O**il, and **S**tands; see page 15 for a complete MSF T-CLOCS checklist), and adjust it according to your motorcycle's owner's manual or the tire information label on the chain guard, frame or swingarm. There may be two sets of recommendations for tire pressure (as well as suspension settings): one for solo riding and one for riding with a passenger and/or cargo. Do not exceed the maximum inflation pressure listed on the tire's sidewall. And never exceed the motorcycle's or tire's load limit (combined weight of operator, passenger, cargo, and accessories), since that can cause tire failure. (Refer to the Load Limit Calculator on page 18.)

Some riders eventually reduce the frequency of air pressure checks to at least once a week and before long trips, but will still visually inspect tires before each ride.

Regularly inspect the tire tread depth to ensure that adequate tread remains. Tires have small wear bars molded into the tread grooves. When the tread is worn down to the level of the wear bars (indicating 1/32 inches of tread remaining), the wear bars become exposed and the tire should be replaced. Some manufacturers recommend replacing the tire when there are 2/32 or 3/32 inches of tread remaining. Al-

though it may look like there is a sufficient amount, it may not be enough to maintain traction in wet conditions. The deep grooves in fresh tires help channel water away from the contact patch, and worn tires are thinner and easier to puncture. For a quick check, if you insert a penny into a groove in the center of your tire, 2/32 of an inch is right at the top of Lincoln's head.

In addition to tread depth, glance over the tires' surface for any evidence of uneven wear, cuts, embedded objects, bulges, or sidewall cracking.



This photograph shows how water is squeezed from the path of a tire.

Every time you ride, the tires go through a "heat cycle" as they go from ambient to operating temperature and back down again. Each successive heat cycle slowly hardens the tire. Similarly, as tires age, chemical reactions cause the rubber to harden, even during nonuse. Whether through heat cycles or aging, the tire's surface becomes less spongy and less able to interlock with the protrusions and pores in the road surface. (If you have an old tire and a new tire, you can press your fingernail into the surfaces of each to see the difference in how they react.) Tires can also absorb petroleum-based fluids from the road, which can further deteriorate the rubber. So, tires eventually have to be replaced, even if they have plenty of tread left. And don't

take a chance on buying used tires; you don't know how many heat cycles they've gone through. This also means that when you buy a used motorcycle, you should thoroughly inspect the tires, and replace them if their condition is questionable.

To clean your sidewalls, use a mild soap solution and rinse off with plain water. Do not use chemical cleaners or protectants, as they may degrade the rubber and cause cracks in the sidewalls.

If you'll be storing your motorcycle for more than a month, and it has a center stand, set the bike on its center stand to raise the rear tire off the ground and use blocks under the frame to lift the front tire slightly off the ground. If it doesn't have a center stand, periodically roll the bike forward or backward a few inches so the tires don't develop flat spots in the tread.

## THE RIDE


Rubber is harder when it's cold than when warmed up. Motorcycle tires are designed to provide maximum traction at specific temperatures. Riding moderately for the first few miles on the street will allow your tires to come up to proper operating temperature. Don't take the freeway on-ramp near your home at maximum lean angle and cornering speed before your tires come up to temperature. Tire temperature is so important that professional racers actually use electric tire blankets to preheat the tires so they'll have maximum grip when the green flag drops out on the track.

## SELECTING A TIRE

Your motorcycle was designed to work in harmony with a limited selection of tires. The owner's manual will specify tire size, construction (radial or bias, tube-type or tubeless), load range, and speed index, and may identify the brand installed as original equipment. In addition, tires are specifically designed for use only on the front or rear wheel – because each tire has a different function – and the front and rear tires should match each other by being from the same brand and model line. Tires must also be mounted so the sidewall arrows correspond to the direction of travel.

Motorcycle dealerships can recommend a variety of brands and types within brands that best match your motorcycle and style of riding, whether commuting, touring, sport riding, or on- and off-road adventure riding. Some tires even use two different rubber compounds in the tread: a harder compound in the center for extra life when riding in a straight line and a softer compound on the outer edges for extra traction while leaning through turns. Note, too, that different tread patterns can make a difference in how your bike handles. For example, some patterns will resist tracking on the rain grooves that are cut into some highways.

And never mount a passenger car tire on a motorcycle rim; the flat profile of a car tire is incompatible with the dynamics of a vehicle that leans as it corners, and the section of the tire in contact with the rim (the "bead") is incompatible with motorcycle rims.

## TIRE SIDEWALL INFORMATION

Every street-legal tire sold in the U.S. will have a Department of Transportation (DOT) serial number on the sidewall. The serial number begins with the letters "DOT" and ends with a four-digit date code (if there are only three numerals, the tire was made before 2000 and should be discarded). The four digits represent the week and year of production. For example, a date code of "4510" in the first photo means the tire was produced in the 45th week of 2010.




The sidewall will also have a code indicating the size, plus a load index and a speed index as shown in these examples.

The examples use metric designations. The first number is the nominal tread width, in millimeters, 160 mm in the second photo, 120 mm in the third. The second number is the aspect ratio (ratio of tire height to tread width) which is a percentage, so for the 160/60 the tire height is 60 percent of the tread width, or 96 mm; for the 120/80 the tire height is 80 percent of the tread width, which also happens to be 96 mm. Some tires use letter or inch designations instead of millimeters, as shown in the chart on page 10.

In the second photo the "R" means radial-ply construction. In the third the "-" means bias construction. A "B" would mean bias-belted.

Next is rim diameter, in inches: 17 in the second photo, 18 in the third. The "M/C" means the tire was designed for motorcycles.

The next set of characters indicate load index and speed index. The "69" and "62" indicate the maximum load the tire can carry (see Load Index Rating chart below) at the speed indicated by the speed indexes "(W)" and "H," respectively (see Speed Index chart on the next page). In the chart, note that the W in parentheses has a different rating than a W without parentheses. Also note that tires with a "W" or "(W)" speed index are identified by a "Z" before the construction code in the tire size designation.

| Load Index Rating | | | | | |
|---|---|---|---|---|---|
| LI | lbs. | LI | lbs. | LI | lbs. |
| 33 | 254 | 51 | 430 | 69 | 716 |
| 34 | 260 | 52 | 441 | 70 | 739 |
| 35 | 267 | 53 | 454 | 71 | 761 |
| 36 | 276 | 54 | 467 | 72 | 783 |
| 37 | 282 | 55 | 481 | 73 | 805 |
| 38 | 291 | 56 | 494 | 74 | 827 |
| 39 | 300 | 57 | 507 | 75 | 853 |
| 40 | 309 | 58 | 520 | 76 | 882 |
| 41 | 320 | 59 | 536 | 77 | 908 |
| 42 | 331 | 60 | 551 | 78 | 937 |
| 43 | 342 | 61 | 567 | 79 | 963 |
| 44 | 353 | 62 | 584 | 80 | 992 |
| 45 | 364 | 63 | 600 | 81 | 1019 |
| 46 | 375 | 64 | 617 | 82 | 1047 |
| 47 | 386 | 65 | 639 | 83 | 1074 |
| 48 | 397 | 66 | 661 | 84 | 1102 |
| 49 | 408 | 67 | 677 | 85 | 1135 |
| 50 | 419 | 68 | 694 | 86 | 1168 |

As all street-legal tires are capable of handling the full range of posted speed limits nationwide, the higher maximum speeds shown in the Speed Index chart (page 10) are intended only for certain high-speed European road use applications and those participating in track days or other closed-course, sanctioned competition events.

Speed Index Chart

| Speed Index | Maximum Speed |
|---|---|
| P | 93 mph |
| Q | 99 mph |
| R | 106 mph |
| S | 112 mph |
| T | 118 mph |
| U | 124 mph |
| H | 130 mph |
| V | 149 mph* |
| W | 168 mph** |
| (W) | more than 168 mph** |

* At speeds above 130 mph, the maximum permissible load is reduced. Consult tire manufacturer for details.
** At speeds above 149 mph, the maximum permissible load is reduced. Consult tire manufacturer for details.

Cross-Reference Chart for Popular Tire Sizes

| FRONT TIRES | | |
|---|---|---|
| **Metric** | **Alpha** | **Inch** |
| 80/90 | MH90 | 2.50 to 2.75 |
| 90/90 | MJ90 | 2.75 to 3.00 |
| 100/90 | MM90 | 3.25 to 3.50 |
| 110/90 | MN90 | 3.75 to 4.00 |
| 120/80 | – | 4.25 to 4.50 |
| 120/90 | MR90 | 4.25 to 4.50 |
| 130/90 | MT90 | 5.00 to 5.10 |
| **REAR TIRES** | | |
| **Metric** | **Alpha** | **Inch** |
| 110/90 | MP85 | 4.00 to 4.25 |
| 120/90 | MR90 | 4.50 to 4.75 |
| 130/80 | – | 5.00 to 5.10 |
| 130/90 | MT90 | 5.00 to 5.10 |
| 140/80 | – | 5.50 to 6.00 |
| 140/90 | MU85/MU90 | 5.50 to 6.00 |
| 150/80 | MV85 | 6.00 to 6.25 |
| 150/90 | MV85 | 6.00 to 6.25 |

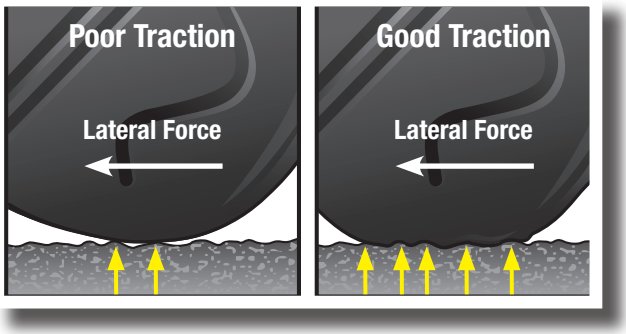
## MOUNTING THE TIRES

Tires should be replaced and balanced by a professional mechanic. Professionals have the right tools to prevent damage to the bead of the tire which must seat firmly against the rim to provide an airtight seal, and they have equipment that can perform dynamic, high-speed balancing to guard against wheel vibration. Valve stems (and tubes, for tube-type tires) should be replaced every time a tire is replaced.

New tires typically have a slippery surface. Take it easy on your first 100 miles as the tire's surface "scuffs in" and provides maximum grip. This break-in period also gives you time to adjust to the difference in how the new tires feel compared to the old, worn tires – like getting use to a new pair of shoes.

## HOW MOTORCYCLE TIRES WORK


Because a motorcycle is a single-track vehicle and leans as it turns, motorcycle tires are quite different than car tires. Whereas car tires have a fairly flat profile and a contact patch that varies little in size or shape, motorcycle tires have a U-shaped profile and a contact patch that changes size and shape during cornering. Motorcycle tires are also relatively narrow, which makes their gripping capability ("traction") a limited commodity. Plus, this limited amount of traction is divided up among multiple forces created when braking, cornering, and accelerating. The more you lean in a corner, for example, the less traction is available for braking; the quicker you accelerate, the less traction is available for turning. If any one of these actions uses an excessive share of available traction, you might lose control of the motorcycle. For more information on how motorcyclists can manage braking, cornering, and acceleration forces, please read the Motorcycle Safety Foundation's *Guide to Motorcycling Excellence* (Second Edition), or any number of in-depth books on the art and science of motorcycling.




Traction can be thought of as the mechanical adhesion between tires and road surface. Predictable traction is essential in all riding situations, especially cornering. To enable this connec-

tion to transmit as much force as possible, it is necessary for the tire's rubber surface to interlock at the microscopic level with the protrusions and pores of the road. That means there must be sufficient tread thickness, and it must be flexible (like a sponge).

There are several ways in which the adhesion between rubber and road can be compromised:

The tire surface has lost its elasticity, because of cold temperatures, aging, or other factors

The asphalt or concrete has been "polished" down and made smooth by automobile and truck tires

The interface between tire and road is "lubricated" or obstructed by any number of substances: rainwater, engine oil, leaves, gravel, sand, dirt, etc.

## TIRE FAILURE

A tire blowout can occur suddenly and without warning, and can induce panic even in experienced riders. You may feel a vibration or sluggish handling depending on the cause of failure. If a blowout should occur, keep a firm grip on the handlebars, steer smoothly, and gently ease off the throttle. Avoid downshifting or hard braking, as these actions can upset the now-unstable chassis. If traffic permits, slow gradually and move off to the side of the road. If you must brake, limit your braking to the wheel with the good tire. Applying the brake to the wheel with the bad tire can cause the tire to separate from the rim, leading to a loss of control.

Fortunately, blowouts are uncommon and generally preventable, especially with modern, tubeless tire technology. If a tire is punctured, it might be possible to patch it, but repairs should be considered a temporary measure at best, and speeds should be kept low. Some manufacturers advise against repairing holes more than ¼" in diameter, repairing radial tires or any punctures in the sidewall, or using liquid sealants. Speeds should not exceed 50 mph for the first 24 hours after the repair and the repaired tire should never be used over 80 mph. Motorcycle tires experience tremendous sideways forces and deformation when cornering, which can cause patches to flex and fail.

## CONCLUSION

Buy the right tires, have them professionally installed, maintain proper air pressure, inspect them regularly, don't ride over sharp objects, and avoid slick surfaces. Treat your tires well and they'll treat you to many miles of safe, comfortable riding.

Danger lurks beyond the wear bars. Once the rubber is gone, so is your tire's ability to grip the road.

# MSF T-CLOCS[SM] Pre-Ride Inspection Checklist

| T-CLOCS ITEM | WHAT TO CHECK | WHAT TO LOOK FOR | CHECK-OFF | |
|---|---|---|---|---|
| **T-TIRES & WHEELS** | | | | |
| **Tires** | Condition | Tread depth, wear, weathering, evenly seated, bulges, embedded objects. | Front | Rear |
| | Air Pressure | Check when cold, adjust to load. | Front | Rear |
| **Wheels** | Spokes | Bent, broken, missing, tension, check at top of wheel: "ring" = OK — "thud" = loose spoke | Front | Rear |
| | Cast | Cracks, dents. | Front | Rear |
| | Rims | Out of round/true = 5mm. Spin wheel, index against stationary pointer. | Front | Rear |
| | Bearings | Grab top and bottom of tire and flex: No freeplay (click) between hub and axle, no growl when spinning. | Front | Rear |
| | Seals | Cracked, cut or torn, excessive grease on outside, reddish-brown around outside. | Front | Rear |
| **Brakes** | Function | Each brake alone keeps bike from rolling. | Front | Rear |
| **C-CONTROLS** | | | | |
| **Levers and Pedal** | Condition | Broken, bent, cracked, mounts tight, ball ends on handlebar levers, proper adjustment. | | |
| | Pivots | Lubricated. | | |
| **Cables** | Condition | Fraying, kinks, lubrication: ends and interior. | | |
| | Routing | No interference or pulling at steering head, suspension, no sharp angles, wire supports in place. | | |
| **Hoses** | Condition | Cuts, cracks, leaks, bulges, chafing, deterioration. | | |
| | Routing | No interference or pulling at steering head, suspension, no sharp angles, hose supports in place. | | |
| **Throttle** | Operation | Moves freely, snaps closed, no revving when handlebars are turned. | | |
| **L-LIGHTS** | | | | |
| **Battery** | Condition | Terminals clean and tight, electrolyte level, held down securely. | | |
| | Vent Tube | Not kinked, routed properly, not plugged. | | |
| **Headlamp** | Condition | Cracks, reflector, mounting and adjustment system. | | |
| | Aim | Height and right/left. | | |
| | Operation | Hi beam/low beam operation. | | |
| **Tail lamp/ brake lamp** | Condition | Cracks, clean and tight. | | |
| | Operation | Activates upon front brake/rear brake application. | | |
| **Turn signals** | Operation | Flashes correctly. | Front left | Front right |
| | | | Rear left | Rear right |
| **Mirrors** | Condition | Cracks, clean, tight mounts and swivel joints. | | |
| | Aim | Adjust when seated on bike. | | |
| **Lenses & Reflectors** | Condition | Cracked, broken, securely mounted, excessive condensation. | | |
| **Wiring** | Condition | Fraying, chafing, insulation. | | |
| | Routing | Pinched, no interference or pulling at steering head or suspension, wire looms and ties in place, connectors tight, clean. | | |

continued on next page

# MSF T-CLOCS[SM] Pre-Ride Inspection Checklist

| T-CLOCS ITEM | WHAT TO CHECK | WHAT TO LOOK FOR | CHECK-OFF | |
|---|---|---|---|---|
| **O-OIL** | | | | |
| **Levels** | Engine Oil | Check level per owner's manual. | | |
| | Hypoid Gear Oil, Shaft Drive | Transmission, rear drive, shaft. | | |
| | Hydraulic Fluid | Brakes, clutch, reservoir or sight glass. | | |
| | Coolant | Reservoir and/or coolant recovery tank — check only when cool. | | |
| | Fuel | Tank or gauge. | | |
| **Leaks** | Engine Oil | Gaskets, housings, seals. | | |
| | Hypoid Gear Oil, Shaft Drive | Gaskets, seals, breathers. | | |
| | Hydraulic Fluid | Hoses, master cylinders, calipers. | | |
| | Coolant | Radiator, hoses, tanks, fittings, pipes. | | |
| | Fuel | Lines, fuel valve, carbs. | | |
| **C-CHASSIS** | | | | |
| **Frame** | Condition | Cracks at gussets, accessory mounts, look for paint lifting. | | |
| | Steering-Head Bearings | No detent or tight spots through full travel, raise front wheel, check for play by pulling/pushing forks. | | |
| | Swingarm Bushings/ Bearings | Raise rear wheel, check for play by pushing/pulling swingarm. | | |
| **Suspension** | Front Forks | Smooth travel, equal air pressure/damping, anti-dive settings. | Left | Right |
| | Rear Shock(s) | Smooth travel, equal pre-load/air pressure/damping settings, linkage moves freely and is lubricated. | Left | Right |
| **Chain or Belt** | Tension | Check at tightest point. | | |
| | Lubrication | Side plates when hot. Note: do not lubricate belts. | | |
| | Sprockets | Teeth not hooked, securely mounted. | | |
| **Fasteners** | Threaded | Tight, missing bolts, nuts. | | |
| | Clips | Broken, missing. | | |
| | Cotter Pins | Broken, missing. | | |
| **S-STANDS** | | | | |
| **Center stand** | Condition | Cracks, bent. | | |
| | Retention | Springs in place, tension to hold position. | | |
| **Side stand** | Condition | Cracks, bent (safety cut-out switch or pad equipped). | | |
| | Retention | Springs in place, tension to hold position. | | |

T-CLOCS checklist used by permission of the Motorcycle Safety Foundation.

## Tire Replacement Log

| **FRONT** recommended pressure: ____PSI solo riding; ____PSI with passenger/cargo | | | | |
|---|---|---|---|---|
| Installation date | Odometer reading | Brand | Model | Size |
| | | | | |
| | | | | |
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| | | | | |
| | | | | |
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| | | | | |
| | | | | |
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| **REAR** recommended pressure: ____PSI solo riding; ____PSI with passenger/cargo | | | | |
|---|---|---|---|---|
| Installation date | Odometer reading | Brand | Model | Size |
| | | | | |
| | | | | |
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# Load Limit Calculator

## AVAILABLE LOAD CAPACITY

1. Enter GVWR (Gross Vehicle Weight Rating).
   Check owner's manual or Vehicle Identification Number (VIN) plate. 1. _____lbs.

2. Enter dry weight of motorcycle.
   Check owner's manual. minus 2. _____lbs.

3. Average weight of fluids (gas and oil). minus 3. 40 lbs.

**4. Available load capacity of our motorcycle.**
   (Line 1 - Line 2 - Line 3) **4. _____lbs.**

## LOADING OF YOUR MOTORCYCLE

5. Enter total weight of rider and passenger.
   Include helmets, boots and clothing. 5. _____lbs.

6. Enter weight of accessories.
   Accessories you have added, including chrome, windshield, saddlebags, etc. plus 6. _____lbs.

7. Enter weight of any cargo/luggage you are carrying. plus 7. _____lbs.

**8. This is the load you are adding to your motorcycle.**
   (Line 5 + Line 6 + Line 7) **8. _____lbs.**

If line 8 is greater than line 4, **YOUR MOTORCYCLE IS OVERLOADED.**

Overloading your motorcycle could lead to tire failure, accident, injury or death.

# TIRE TIPS

- Maintain proper air pressure
- Regularly inspect your tires
- Buy the right tires for your bike
- Have your tires professionally installed
- Avoid sharp objects and slick surfaces



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