MOTORCYCLE TIRE GUIDE

What riders need to know about street motorcycle tires

MOTORCYCLE INDUSTRY COUNCIL®

U.S. TIRE MANUFACTURERS ASSOCIATION
Mobilizing the Future

The information in this booklet represents the collective knowledge of a number of motorcycle tire manufacturers, the U.S Tire Manufacturers Association, 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

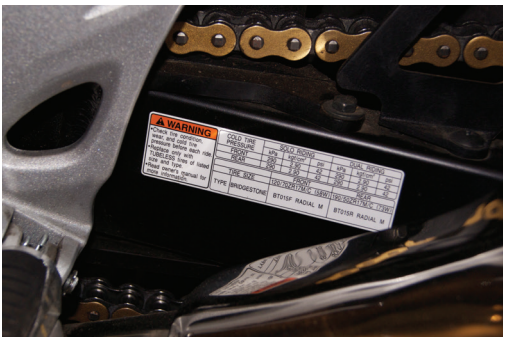
Inflation Pressure

It's all about *inflation, inflation, inflation.* Proper air pressure is critical for tire performance and tire life. Under-inflation or overloading can cause heavy steering, irregular wear, 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 the air pressure with a gauge when the tires are cold (at least three hours since the last ride), as part of your pre-ride "T-CLOCS" inspection (T-CLOCS

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

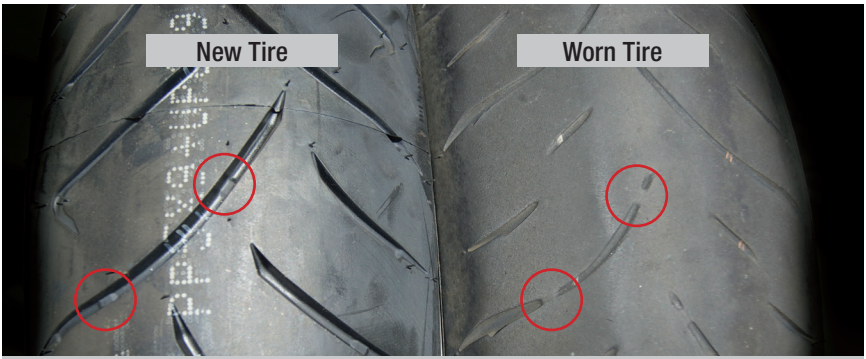
MOUNT	TYPE	SIZE	OPTION 1	OPTION 2
front	radial-ply, tubeless	120/70 ZR17	Brand X - F	Brand Y - F
rear	radial-ply, tubeless	190/50 ZR17	Brand X - R	Brand Y - R



means **T**ires and Wheels, **C**ontrols, **L**ights, **O**il, **C**hassis, and **S**tands; see page 14 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 17.)

At a minimum, check your tires' cold inflation pressures at least once a week and before long trips. Visually inspect tires for surface conditions before each ride. However, be aware that it is impossible to determine proper inflation by appearance alone. An accurate pressure gauge is needed, even if your motorcycle is equipped with a Tire Pressure Monitoring System that gives specific pressure readouts.

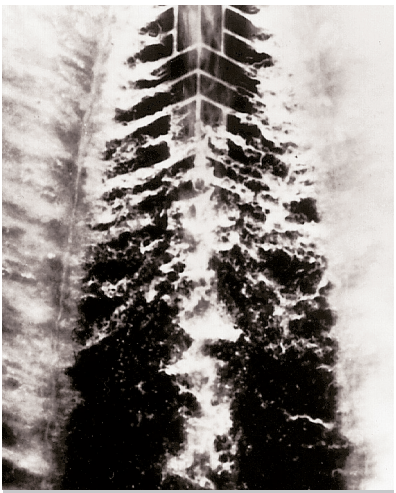
Regularly inspect the tire tread depth to ensure that adequate tread remains. Tires have small wear bars molded into the tread grooves. When the tread is worn down to the level of the wear bars (indicating 1/32 inches of tread remaining), the wear bars become exposed and the tire should be replaced.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



The circled areas show how the wear bars appear on a new tire and on a completely worn-out tire.

amount, it may not be enough to maintain traction in wet conditions. The deep grooves in new 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.

Heat Cycles and Tire Age

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 tread. Also, chemical reactions over time may cause the rubber to harden, even with 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, thereby decreasing maximum traction capability. (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.) So, tires eventually have to be replaced, even if they have plenty of tread left. However, tires don't have an "expiration date," since operating conditions, storage conditions, exposure to sunlight, number of heat cycles, and wear are the primary factors that determine

their usable tread life. Consult your motorcycle service professional or tire manufacturer for guidelines. We recommend against 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.

Cleaning

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, causing cracks in the sidewalls, and spread to the contact patch, causing loss of traction.

Storage

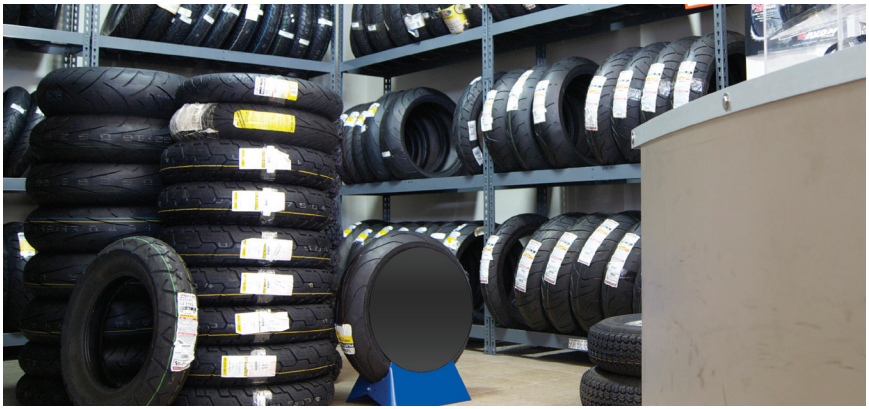
If you'll be storing your motorcycle for more than a month, and it has a center stand, set the bike on its center stand to raise the rear tire off the ground and use blocks under the frame or fork to lift the front tire slightly off the ground. If it doesn't have a center stand, periodically roll the bike forward or backward a few inches so the tires don't develop flat spots in the tread. Store the motorcycle in a dry, well-ventilated area, away from electric motors and generators, and ensure the tires do not come in contact with petroleum-based products or solvents.

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 and tire information label will specify tire size, construction (radial or bias, tube-type or tubeless), load range, and service description (load index and speed symbol), 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 directional arrows correspond to the direction of travel.

Motorcycle dealerships can recommend a variety of 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.

It is unsafe to install passenger car tires on motorcycle rims. The flat tread profile of a car tire is incompatible with the dynamics of a vehicle that leans as it corners. Plus, motorcycle tires and rims are designed with a different bead seat area than passenger car tires and rims. Ignoring this fact may cause inflation pressure loss while riding or the beads to break with explosive force resulting in possible serious injury or death.

TIRE SIDEWALL INFORMATION

Every street-legal tire sold in the U.S. will have a Department of Transportation (DOT) tire identification number (TIN) on the sidewall. The TIN begins with the letters “DOT” and ends with a four-digit date code. 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 symbol as shown in these examples.

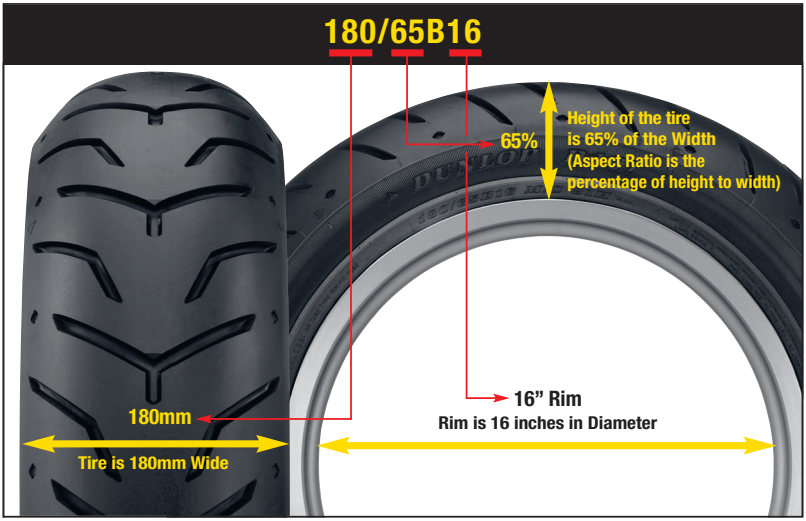
The examples use metric designations. The first number is the nominal section width, in millimeters: 160 mm in the second photo, 120 mm in the third. The second number is the aspect ratio (ratio of section height to section width) which is a percentage, so for the 160/60 the section height is 60 percent of the section width, or 96 mm; for the 120/80 the section height is 80 percent of the section width, which also happens to be 96 mm. Some tires use letter or inch designations instead of millimeters, as shown in the Cross-Reference Chart on page 9.

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 indicates load index and speed symbol. 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 symbols “(W)” and “H,” respectively (see Speed Symbol 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 symbol are identified by a “Z” before the construction code in the tire size designation.

Load Index Rating					
LI	lbs./kg.	LI	lbs./kg.	LI	lbs./kg.
33	254/115	51	454/206	73	805/365
34	260/118	52	467/212	74	827/375
35	267/121	53	481/218	75	853/387
36	276/125	54	494/224	76	882/400
37	282/128	55	507/230	77	908/412
38	291/132	56	520/236	78	937/425
39	300/136	57	536/243	79	963/437
40	309/140	58	551/250	80	992/450
41	320/145	59	567/257	81	1,019/462
42	331/150	60	584/265	82	1,047/475
43	342/155	61	600/272	83	1,074/487
44	353/160	62	617/280	84	1,102/500
45	364/165	63	639/290	85	1,135/515
46	375/170	64	661/300	86	1,168/530
47	386/175	65	677/307	87	1,201/545
48	397/180	66	694/315	88	1,235/560
49	408/185	67	716/325	89	1,279/580
50	419/190	68	739/335	90	1,323/600
51	430/195	71	761/345		
52	441/200	72	783/355		



Replacement tires must match or exceed the speed rating specified in the owner's manual and tire information label to maintain motorcycle speed and handling capabilities. However, tire speed ratings do not imply that any particular motorcycle can be safely ridden at the maximum speed for which the tire is rated. Consult the motorcycle manufacturer or tire manufacturer for recommendations.

Speed Symbol Chart

Speed Symbol	Maximum Speed	
P	93 mph	150 km/h
Q	99 mph	160 km/h
R	106 mph	170 km/h
S	112 mph	180 km/h
T	118 mph	190 km/h
U	124 mph	200 km/h
H	130 mph	210 km/h
V	149 mph	240 km/h
W	168 mph	270 km/h
(W)	more than 168 mph	more than 270 km/h

Examples:

Tire Designation	**Maximum Speed**
160/70-17 M/C 72H	130 mph (210 km/h)
160/60ZR17 MC 72W	168 mph (270 km/h)
160/60ZR17 M/C (72W)	Above 168 mph (270 km/h); consult the tire and motorcycle manufacturers for the maximum rated speed.

Cross-Reference Chart for Popular Tire Sizes*

FRONT TIRES		
Metric	Alpha Numeric	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 Numeric	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
160/80	–	6.80 to 7.00
180/55	–	7.00 to 7.25
200/60	–	7.90 to 8.00
230/50	–	9.50

*Be aware of speed ratings, load index and dimensional differences when comparing tires with different size nomenclatures. For recommendations or additional information, consult the tire or motorcycle manufacturer.

NEW TIRE INSTALLATION AND PRECAUTIONS

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. Install a new tube every time a tube-type tire is replaced. If equipped with a rubber rim band, replace it with an equivalent band. For a tubeless rim, replace the rubber valve stem, or replace the valve core and rubber grommet in a metal valve assembly. For motorcycles equipped with a TPMS, consult the owner's manual or TPMS manufacturer for service recommendations.

Certain Harley-Davidson® motorcycles use spoked, tubeless-type rims identified as "MTM" which require a rim seal for proper tire-to-rim fitment. Consult your owner's manual.

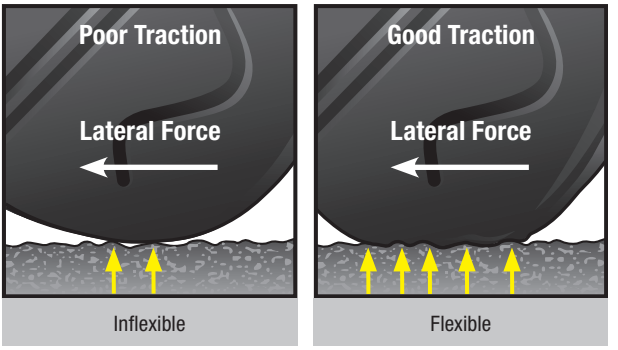
Take it easy on new tires for your first 100 miles. The tire's surface will be a bit smooth and needs to be "scuffed in" for maximum grip. Also, its cross-section shape will be more round than a worn tire, which likely has flattened out over time in the central tread area. This wear happens so gradually that you likely won't notice how sluggish (relatively speaking) your bike's handling has become until your first ride with new tires. The fresh tires may respond more quickly to cornering input, and during this break-in period you may have to re-adjust to this "restored" feeling.

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 connection 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 to provide adequate traction.

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.

SUDDEN AIR LOSS AND TIRE REPAIR

Fortunately, sudden air loss is uncommon and generally preventable by maintaining proper air pressure. Sudden air loss may occur due to a puncture, overloading, under-inflation, impact, etc. Sudden air loss may occur without warning and can induce panic even in experienced riders. The symptoms may include vibration or sluggish handling. If a sudden air loss 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.

If a tire is punctured, it might be possible to repair it. However, repairs should be considered a temporary measure at best, and speeds should be kept low. Repairs to the sidewall are not permitted. Some tire manufacturers do not recommend repairing motorcycle tires or using liquid sealants. If permissible, repairs should be limited to a combination plug/patch repair of tread punctures no larger than 1/4" in diameter on a demounted tire. Never perform an exterior repair and never use an inner tube as a substitute for a proper repair. 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 (not recommended to exceed the legal speed limit in any event). Remember, motorcycle tires experience tremendous sideways forces and deformation when cornering. For detailed information on repairing your tire, contact the specific tire manufacturer.

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, cracking, evenly seated, bulges, embedded objects.	Front	Rear
	Air Pressure	Check when cold, adjust to recommended pressure, considering total 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
	Valve Caps	Damaged, missing.	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
original tire size:_____ load index:_____ speed symbol:_____

Installation date	Odometer reading	Brand	Model	Size

REAR recommended pressure: _____PSI solo riding; _____PSI with passenger/cargo
original tire size:_____ load index:_____ speed symbol:_____

Installation date	Odometer reading	Brand	Model	Size

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 your 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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