



Service Bulletin

WARRANTY ADMINISTRATION

Subject: Wheel Alignment Specifications, Requirements and Recommendations for GM Vehicles

Models: 2016 and Prior GM Passenger Cars and Light Duty Trucks

This Bulletin has been revised to update information in the Wheel Alignment Job Card Questionnaire and remove sections Mileage Policy and Warranty Documentation Requirements. Please discard Corporate Bulletin Number 05-03-07-009G.

Purpose

The purpose of this bulletin is to provide retail, wholesale and fleet personnel with General Motors' recommendations for customer concerns related to wheel alignment. For your convenience, this bulletin updates and centralizes all of GM's Standard Wheel Alignment Service Procedures, and bulletins on wheel alignment warranty service.

Important: PLEASE FAMILIARIZE YOURSELF WITH THESE UPDATES BEFORE PERFORMING YOUR NEXT GM WHEEL ALIGNMENT SERVICE.

The following key steps are a summary of this bulletin and are REQUIRED in completing a successful wheel alignment service.

1. **Verify the vehicle is in an Original Equipment condition** for curb weight, tires, wheels, suspension and steering configurations. Vehicles modified in any of these areas are not covered for wheel alignment warranty.
2. **Review the customer concern relative to "Normal Operation"** definitions.
3. **Document wheel alignment warranty claims** appropriately for labor operations 8070012 and 8070032. A copy of the alignment machine printout showing before and after alignment specifications must be attached to the job card. Please refer to Article 1.1.13 (1.4.19 Canada) of the Service Policies and Procedures for complete documentation requirements and labor operation restrictions for transactions involving wheel alignments, toe adjustments and wheel balancing.

Verify Original Equipment Condition of the Vehicle

- Verify that Original Equipment Tires and Wheels or Official GM Accessory Tires and Wheels are on the vehicle.
- Verify that aftermarket suspension "Lift" or "Lowering" Kits or other suspension alterations have NOT been done to the vehicle.
- Check for accidental damage to the vehicle; for example, severe pothole or curb impacts, collision damage that may have affected the wheel alignment of the vehicle; e.g., engine cradles, suspension control arms, axles, wheels, wheel covers, tires may show evidence of damage/impact.
- Check to be sure vehicle has seen "Normal Use" rather than abuse; e.g., very aggressive driving may show up by looking at the tires and condition of the vehicle.
- Check for other additional equipment items that may significantly affect vehicle mass such as large tool boxes, campers, snow plow packages (without the snowplow RPO), etc., especially in trucks and cutaway/incomplete vehicles. Significant additional mass can affect trim height and wheel alignment of the vehicle and may necessitate a customer pay wheel alignment when placed semi-permanently in the vehicle (Upfitter instructions are to realign the vehicle after placement of these types of items. (This typically applies to trucks and incomplete vehicles that can be upfit with equipment such as the above.)

Customer Concerns and "Normal Operation" Conditions

Possible Concerns

The following are typical conditions that may require wheel alignment warranty service:

1. **Lead/Pull:** defined as "at a constant highway speed on a typical straight road, the amount of effort required at the steering wheel to maintain the vehicle's straight heading."

Important: Please evaluate for the condition with hands-on the steering wheel. Follow the “Vehicle Leads/Pulls” diagnostic tree located in SI to determine the cause of a lead/pull concern. Lead/Pull concerns can be due to road crown or road slope, tires, wheel alignment or even in rare circumstances a steering gear issue. Lead/pull concerns due to road crown are considered “Normal Operation” and are NOT a warrantable condition -- the customer should be advised that this is “Normal Operation.”

Important: Some customers may comment on a “Lead/Pull” when they hold the steering wheel in a level condition. If so, this is more likely a “steering wheel angle” concern because the customer is “steering” the vehicle to obtain a “level” steering wheel.

2. **Steering wheel angle to the left or right** (counter-clockwise or clockwise, respectively): Defined as the steering wheel angle (clocking) deviation from “level” while maintaining a straight heading on a typical straight road.
3. **Irregular or Premature tire wear:** Slight to very slight “feathering” or “edge” wear on the shoulders of tires is NOT considered unusual and should even out with a tire rotation; if the customer is concerned about a “feathering” condition of the tires, the customer could be advised to rotate the tires earlier than the next scheduled mileage/maintenance interval (but no later than the next interval). Be sure to understand the customer’s driving habits as this will also heavily influence the tire wear performance; tire wear from aggressive or abusive driving habits is NOT a warrantable condition.

Important: Slight or mild feathering, cupping, edge or heel/toe wear of tire tread shoulders is “normal” and can show up very early in a tire/vehicle service mileage; in fact, some new tires can show evidence of feathering from the factory. These issues do NOT affect the overall performance and tread life of the tire. Dealer personnel should always check the customer’s maintenance records to ensure that tire inflation pressure is being maintained to placard and that the tires are being rotated (modified-X pattern) at the proper mileage intervals. Wheel alignments are NOT to be performed for the types of “Normal” Tire Feathering shown in Figures 1-4 below.

Figure 1: Full Tread View – “NORMAL” Tire “Feathering” Wear on the Shoulder/Adjacent/Center Ribs



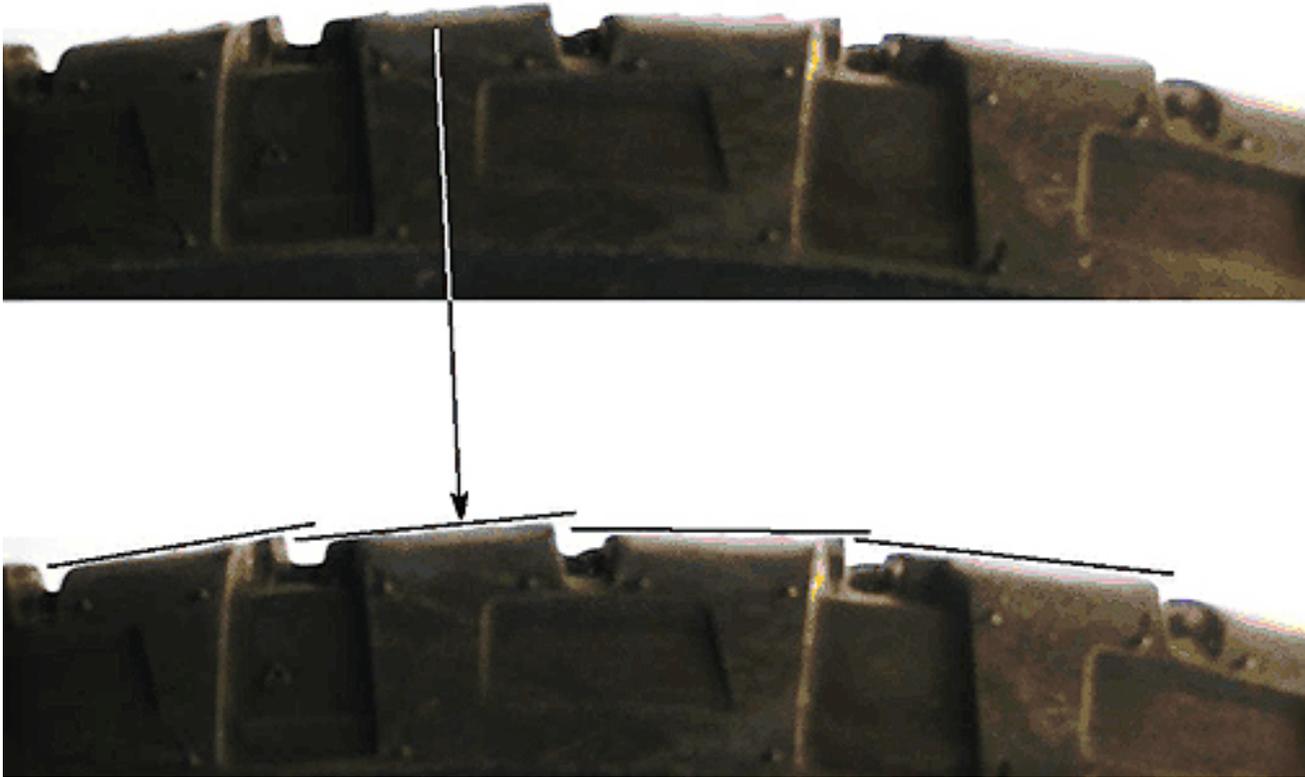
Figure 2: Tire Shoulder View Example 1 - “NORMAL” Tire “Feathering” Wear on the Shoulder



Figure 3: Tire Shoulder View Example 2 - "NORMAL" Tire "Feathering" Wear



Figure 4: Detail Side View of Tire Shoulder Area - "NORMAL" Tire "Feathering" Wear



Important: When a wheel alignment is deemed necessary for tire wear, be sure to document on the repair order, in as much detail as possible, the severity and type of tire wear (e.g., severe center wear or severe inside or outside shoulder wear) and the position of the tire on the vehicle (RF, LF, LR, RR). Please note the customer's concern with the wear such as, noise, appearance, wear life, etc. A field product report with pictures of the tire wear condition is recommended. Refer to the latest version of Corporate Bulletin Numbers 02-00-89-002 (Canada, 10-00-89-006) and 07-00-89-036.

4. **Other repairs** that affect wheel alignment; e.g., certain component replacement such as suspension control arm replacement, engine cradle adjustment/replace, steering gear replacement, steering tie rod replace, suspension strut/shock, steering knuckle, etc. may require a wheel alignment.

Important: If other components or repairs are identified as affecting the wheel alignment, policy calls for the wheel alignment labor time to be charged to the replaced/repaired component's labor operation time rather than the wheel alignment labor operations.

Important: Vibration type customer concerns are generally NOT due to wheel alignment except in the rare cases; e.g., extreme diagonal wear across the tread. In general, wheel alignments are NOT to be performed as an investigation/correction for vibration concerns.

“Normal Operation” Conditions

Vehicle Lead/Pull Due to Road Crown or Slope:

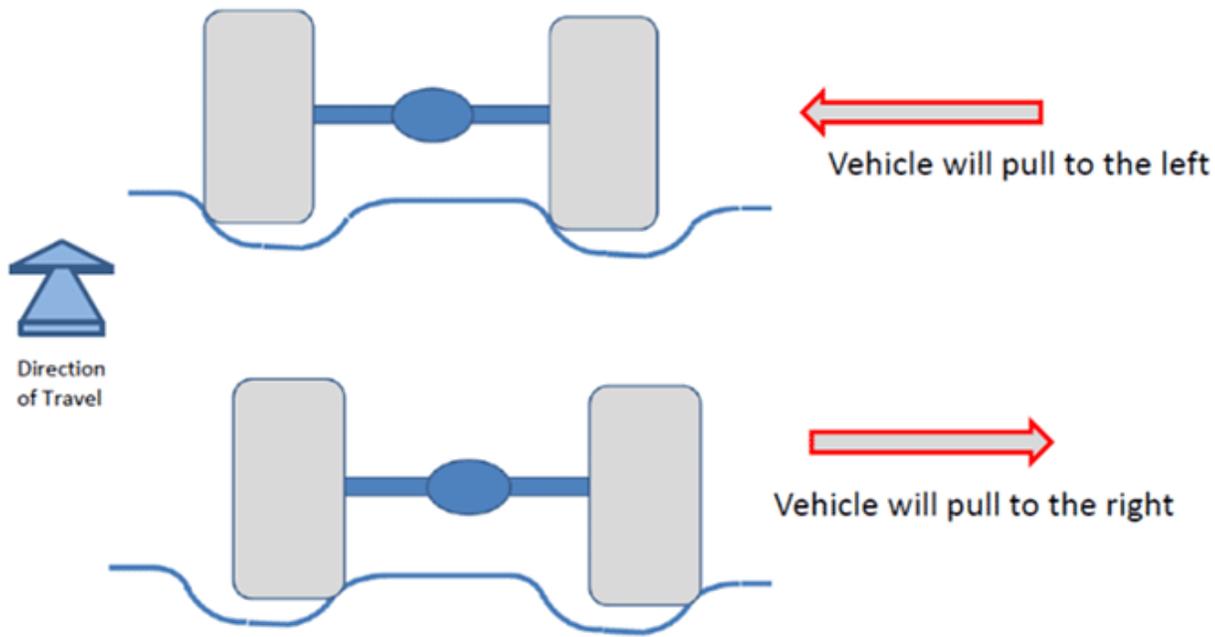
As part of “Normal Operation,” vehicles will follow side-to-side or left to right road crown or slope. Be sure to verify from the customer the types of roads they are driving as they may not recognize the influence of road crown on vehicle lead/pull and steering wheel angle. If a vehicle requires significant steering effort to prevent it from “climbing” the road crown there may be an issue to be looked into further.

Important: A wheel alignment will generally NOT correct vehicles that follow the road crown since this is within “Normal Operation.”

Trough Wander/Tramlining:

Some customers may comment about their vehicle having a tendency to pull left or right depending on road conditions. Typical descriptions may refer to the vehicle not tracking properly or that the car wanders. Additional comments may include that the car follows grooves or inconsistencies in the road to the extent that the vehicle must be steered or directed with additional force to overcome these roadway characteristics.

Trough Wander / Tramlining



What is Tramlining?

"Tramlining" is an industry term used to describe a vehicle's tendency to follow the longitudinal ruts and/or grooves present in the road. (Also called "trough wander"). The name comes from the feeling on a tram or trolley as the vehicle follows along the tracks. Any vehicle can exhibit tramlining due to uneven pavement or severe rutting in the roads surface. All vehicles tramline to some degree, however vehicles equipped with low aspect ratio, wide tires tend to be more sensitive to this condition (e.g. Corvette, Camaro, CTS-V, Chevrolet SS).

Vehicles experiencing this condition can feel "pulled" in both directions depending on the positions of the tires in the trough (ruts).

If a similarly equipped vehicle experiences the same condition as the customer's car, the customer's car is most likely experiencing tramlining, which is a normal characteristic of a car with low aspect ratio, wide tires.

Important: It should be noted that adjusting alignment settings will NOT improve this condition.

Wheel Alignment Equipment and Process

Wheel alignments must be performed with a quality machine that will give accurate results when performing checks. "External Reference" (image-based camera technology) is preferred. Please refer to the latest version of Corporate Bulletin Number 05-00-89-029: General Motors Dealership Critical Equipment Requirements and Recommendations.

Requirements:

- Computerized four wheel alignment system.
- Computer capable of printing before and after alignment reports.
- Computer capable of time and date stamp printout.
- Racking system must have jacking capability.
- Racking system must be capable of level to 1.6 mm (1/16 in).
- Appropriate wheel stops and safety certification.
- Built-in turn plates and slip plates.
- Wheel clamps capable of attaching to 20" or larger wheels
- Racking capable of accepting any GM passenger car or light duty truck.
- Operator properly trained and ASE-certified (U.S. only) in wheel alignment.

Recommendations:

Racking should have front and rear jacking capability.

Equipment Maintenance and Calibration:

Alignment machines must be regularly calibrated in order to give correct information. Most manufacturers recommend the following:

- Alignment machines with "internal reference" sensors should be checked (and calibrated, if necessary) every six months.

- Alignment machines with "external reference" (image-based camera technology) should be checked (and calibrated, if necessary) once a year.
- Racks must be kept level to within 1.6 mm (1/16 in).
- If any instrument that is part of the alignment machine is dropped or damaged in some way, check the calibration immediately.

Check with the manufacturer of your specific equipment for their recommended service/calibration schedule.

Wheel Alignment Process

When performing wheel alignment measurement and/or adjustment, the following steps should be taken:

Preliminary Steps:

1. Verify that the vehicle has a full tank of fuel (compensate as necessary).
2. Inspect the wheels and the tires for damage.
3. Inspect the tires for the proper inflation and irregular tire wear.
4. Inspect the wheel bearings for excessive play.
5. Inspect all suspension and steering parts for looseness, wear, or damage.
6. Inspect the steering wheel for excessive drag or poor return due to stiff or rusted linkage or suspension components.
7. Inspect the vehicle trim height.
8. Compensate for frame angle on targeted vehicles (refer to Wheel Alignment Specifications in SI).

Satisfactory vehicle operation may occur over a wide range of alignment angles. However, if the wheel alignment angles are not within the range of specifications, adjust the wheel alignment to the specifications. Refer to Wheel Alignment Specifications in SI. Give consideration to excess loads, such as tool boxes, sample cases, etc. Follow the wheel alignment equipment manufacturer's instructions.

Measure/Adjust:

Important: Prior to making any adjustments to wheel alignment on a vehicle, technicians must verify that the wheel alignment specifications loaded into their wheel alignment machine are up-to-date by comparing these to the wheel alignment specifications for the appropriate model and model year in SI. Using incorrect and/or outdated specifications may result in unnecessary adjustments, irregular and/or premature tire wear and repeat customer concerns.

Important: When performing adjustments to vehicles requiring a 4-wheel alignment, set the rear wheel alignment angles first in order to obtain proper front wheel alignment angles.

Perform the following steps in order to measure the front and rear alignment angles:

1. Install the alignment equipment according to the manufacturer's instructions.
2. Jounce the front and the rear bumpers 3 times prior to checking the wheel alignment.
3. Measure the alignment angles and record the readings.

If necessary, adjust the wheel alignment to vehicle specification and record the before and after measurements. Refer to Wheel Alignment Specifications in SI.

Important: Technicians must refer to SI for the correct wheel alignment specifications. SI is the only source of GM wheel alignment specifications that is kept up-to-date throughout the year.

Test drive the vehicle to ensure a proper repair.

Understanding the Effects of Wheel Alignment on a Vehicle vs. Customer Complaints (Quick Reference Section)

Note: Refer to SI for complete alignment specifications.

- Prior to any measurement on the alignment machine, you must confirm the current specifications and tolerances as listed in GM's Service Information System. Do not assume that numbers in the alignment machine are correct, as it may not have been recently updated.
- Always use the correct specifications for that vehicle based on confirmed vehicle option content.
- It is important to always include as much information as possible in the RO – including the confirmed customer complaint and the complete before and after alignment measurements on the vehicle.

Steering Wheel Angle Complaints:

A true steering wheel angle complaint can be diagnosed as a vehicle that goes straight down the road without extra steering input, but the steering wheel angle is clocked to one side or the other. Make sure to always note which direction the steering wheel is clocked on the Repair Order ("Left/CCW" or "Right/CW").

If a steering wheel angle complaint has been verified, it should be noted that front and rear toes are the only alignment values that affect the angle of the steering wheel.

Vehicle Pull Complaints:

Prior to any adjusts, the vehicle must be driven to confirm the customer complaint. Use this drive to verify that the vehicle does have a pull and it is not a steering wheel angle issue. Try and use same stretch of road for all drives so that you understand the different characteristics of that specific road.

A true vehicle pull only complaint will have the vehicle pull to one side or the other regardless of steering wheel angle. It may require more than normal effort to keep the vehicle going straight.

Important: It is possible for customers to confuse a steering wheel off angle issue as a vehicle pull, as they may be trying to hold the wheel centered (level) on a straight road which would be adding a slight steering input to the wheels. If this is the case, please note this on the Repair Order, including the direction the vehicle is pulling.

Please note the following on what can cause a vehicle pull:

- Tires
- Alignment settings

Tires: If a pull complaint has been verified but all the alignment settings all are within specifications, the issue may be in the tires. Certain tire differences left to right may cause a vehicle pull. Swapping the front tires left to right and re-evaluating is a simple way to verify a tire issue.

Important: Always ensure tire pressures are set to correct specifications before and after evaluating a vehicle.

Important: Always note if tires are directional and not able to be permanently swapped side to side.

Alignment Information

Alignment Settings:	Positive Value	Negative Value
Front Cross Camber (LH minus RH)	Pulls Left	Pulls Right
Front Cross Caster (LH minus RH)	Pulls Right	Pulls Left
Front and Rear Toe	Does Not Cause Vehicle Pulls	Does Not Cause Vehicle Pulls

Important: Front or rear toe values being out of specifications do not cause a true vehicle pull. If only front or rear toe values are out of specification on a confirmed vehicle pull issue, something else is causing the pull.

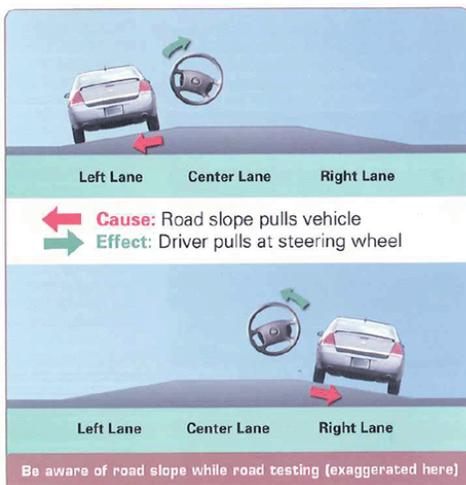
Important: If Cross Camber and Cross Caster are within GM specifications listed in the Service Information System, it generally means they are not the reason for a vehicle pull complaint.

Note: Although not normally an adjustable setting on many vehicles, you should always verify the caster repair procedure in GM's Service Information System.

Road Slope:

It is important to always note road slope during a drive, high angles can cause a vehicle to drift one way or the other. As flat of road as possible should be used for evaluations.

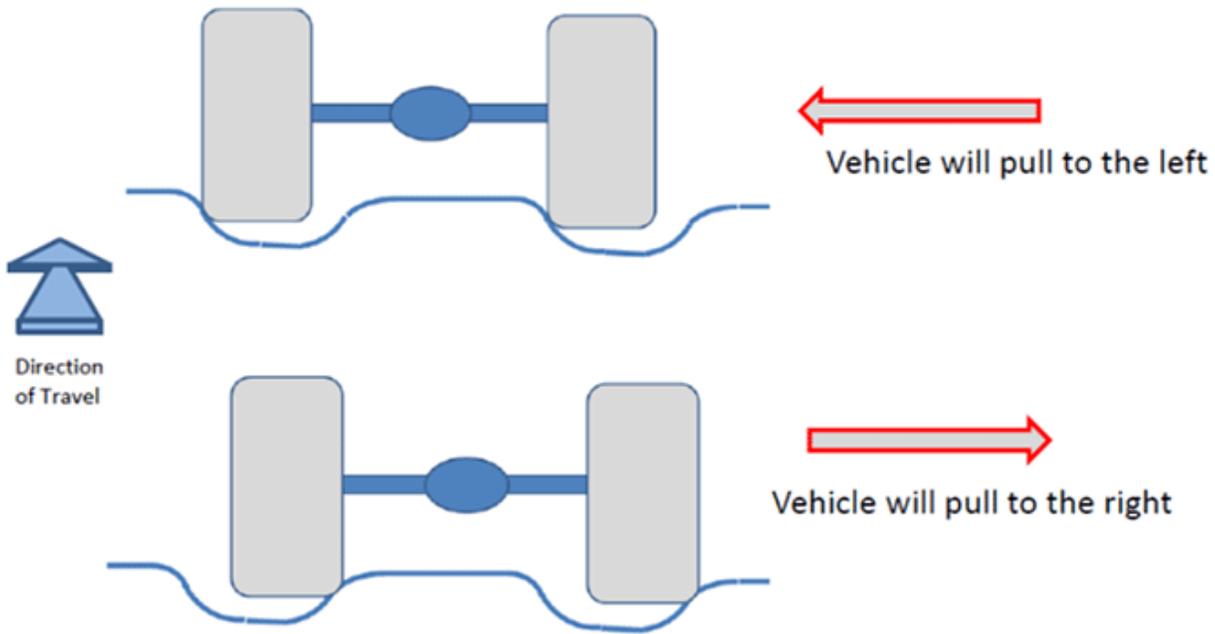
Effect of Road Slope



Trough Wander / Tramlining

Troughs or grooves in the road can pull a vehicle to either side depending on where in the groove the tire is. The tires will always want to pull the vehicle up the wall of the trough.

Trough Wander / Tramlining



Wheel Alignment Job Card Questionnaire

Note: For vehicles with less than 500 miles (800 km) on the odometer, please fill in the blanks. Additional help can be found in the "Vehicle Lead/Pull Diagnostics" located in SI under Suspension – General Diagnosis. It is also recommended that the dealership complete a Field Product Report to notify GM of this condition. Refer to Bulletin Numbers 02-00-89-002 (Canada: 10-00-89-006) and 07-00-89-036 for more information on Field Product Reporting.

TAC Case # if applicable:

Vehicle Concern Information

Customer Concern:

Tire Wear ___ Steering Wheel Off-Angle ___

Lead/Pull ___ Other _____

Was the customer concern duplicated? Yes ___ No ___

Is the tire pressure within +/- 3 psi (+/- 20 kPa) of the tire placard? Yes ___ No ___

If No, record the tire pressures (psi):

LF ___ RF ___ LR ___ RR ___

Tire Wear (If Applicable)

Please check all boxes that apply:

Left Front Tire:

Even Wear ___ Inside Shoulder ___

Center ___ Outside Shoulder ___ Cupping/Feathering ___

Right Front Tire:

Even Wear ___ Inside Shoulder ___

Center ___ Outside Shoulder ___ Cupping/Feathering ___

Customer Concern:

Tire Wear___ Steering Wheel Off-Angle___

Lead/Pull___ Other _____

Was the customer concern duplicated? Yes___ No___

Is the tire pressure within +/- 3 psi (+/- 20 kPa) of the tire placard? Yes___ No___

If No, record the tire pressures (psi):

LF___ RF___ LR___ RR___

Tire Wear (If Applicable)

Please check all boxes that apply:

Left Front Tire:

Even Wear___ Inside Shoulder___

Center___ Outside Shoulder___ Cupping/Feathering___

Right Front Tire:

Even Wear___ Inside Shoulder___

Center___ Outside Shoulder___ Cupping/Feathering___

Left Rear Tire:

Even Wear___ Inside Shoulder___

Center___ Outside Shoulder___ Cupping/Feathering___

Right Rear Tire:

Even Wear___ Inside Shoulder___

Wheel Alignment Job Card Questionnaire

Center___ Outside Shoulder___ Cupping/Feathering___

Steering Wheel Off-Angle (If Applicable)

Which way was the steering wheel off angle?

Lead/Pull (If Applicable)

Which way does the vehicle lead or pull? Right___ Left___

Were the front tires swapped side to side? Yes___ No___

Was the vehicle checked for brake drag? Yes___ No___

GM bulletins are intended for use by professional technicians, NOT a "do-it-yourselfer". They are written to inform these technicians of conditions that may occur on some vehicles, or to provide information that could assist in the proper service of a vehicle. Properly trained technicians have the equipment, tools, safety instructions, and know-how to do a job properly and safely. If a condition is described, DO NOT assume that the bulletin applies to your vehicle, or that your vehicle will have that condition. See your GM dealer for information on whether your vehicle may benefit from the information.



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