

DIAGNOSIS AND TESTING

WHEELS AND TIRES

Inspection and Verification

WARNING: A vehicle equipped with a Traction-Lok® differential will always have both wheels driving. If, while the vehicle is being serviced, only one wheel is raised off the ground and the rear axle is driven by the engine, the wheel on the ground could drive the vehicle off the stand or jack. Be sure both rear wheels are off the ground.

WARNING: Do not balance the wheels and tires while they are mounted on the vehicle. Possible tire disintegration or differential failure could result, causing personal injury and extensive component damage. Use off-vehicle wheel and tire balancer only.

Be sure to follow the warnings when carrying out the inspection and verification.

Road Test

Verify the customer concern by carrying out a road test on a smooth road. If any vibrations are apparent, go to **NOISE, VIBRATION & HARSHNESS** .

To maximize tire performance, inspect for signs of incorrect inflation and uneven wear, which may indicate a need for balancing, rotation, or front suspension alignment.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increases tire wear.

Tire Pressure Monitoring System (TPMS)

The optional tire pressure monitoring system (TPMS) has the ability to monitor the air pressure of the four road tires. The tire-mounted pressure sensors transmit signals to the TPMS module by using the valve stem as an antenna. These transmissions are sent approximately every 30 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPMS module compares each tire pressure sensor transmission against two pressure limits - low and high. If the TPMS module determines that the tire pressure has exceeded the low or high limit, the TPMS module communicates on the SCP network to the vehicle message center, which then displays a warning message.

Replacement tires must follow the recommended:

- tire sizes.
- speed rating.
- load range.
- tire construction type.

Use of any other tire size or type can seriously affect:

- ride.

- handling.
- speedometer/odometer calibration.
- vehicle ground clearance.
- tire clearance between the body and chassis.
- wheel bearing life.
- brake cooling.
- tire pressure sensors (if equipped with TPMS)

New wheels need to be installed when vehicle's wheels:

- are bent.
- are cracked.
- are dented.
- are heavily corroded.
- are leaking.
- have elongated wheel hub bolt holes.
- have excessive lateral or radial runout.

It is mandatory to use only the tire sizes recommended on the tire chart attached to the vehicle. Larger or smaller tires can damage the vehicle, affect durability, and require changing the speedometer calibration. Make sure wheel size and offsets match those recommended for the tire in use.

1. Inspect for signs of uneven wear that may indicate a need for balancing, rotation or front suspension alignment, a damaged tie-rod, or damaged steering components.
2. Check tires for:
 - cuts.
 - stone bruises.
 - abrasions
 - blisters.
 - embedded objects.
3. Tread wear indicators are molded into the bottom of the tread grooves. Install a new tire when the indicator bands become visible.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
<ul style="list-style-type: none"> • Tires show excess wear on edge of tread 	<ul style="list-style-type: none"> • Underinflated tires. • Vehicle overloaded. • High-speed cornering. <ul style="list-style-type: none"> • Incorrect wheel alignment. • Incorrect tire rotation 	<ul style="list-style-type: none"> • ADJUST air pressure in tires. • RETURN vehicle - NOTIFY customer of overloaded condition. • RETURN vehicle - NOTIFY customer of cause of condition. • CHECK the wheel alignment. ADJUST as necessary. REFER to <u>WHEEL ALIGNMENT</u>.

	intervals.	<ul style="list-style-type: none"> ADVISE customer of condition. ROTATE tires.
<ul style="list-style-type: none"> Tires show excess wear in center of tread 	<ul style="list-style-type: none"> Tires overinflated. 	<ul style="list-style-type: none"> ADJUST air pressure.
<ul style="list-style-type: none"> Other excessive tire wear problems 	<ul style="list-style-type: none"> Incorrect tire rotation intervals. Incorrect tire pressure. <ul style="list-style-type: none"> Loose or leaking shock absorbers. Incorrect wheel alignment. <ul style="list-style-type: none"> Loose, worn or damaged suspension components. Wheel and tire assembly out of balance. Excessive lateral or radial runout of wheel. 	<ul style="list-style-type: none"> ADVISE customer of condition. ROTATE tires. <ul style="list-style-type: none"> ADJUST pressure. TIGHTEN or INSTALL new shock absorbers as necessary. <ul style="list-style-type: none"> CHECK the wheel alignment. ADJUST as necessary. REFER to <u>WHEEL ALIGNMENT.</u> INSPECT the front suspension and REPAIR or INSTALL new suspension components as necessary. REFER to <u>WHEEL BEARING, HUB, KNUCKLE, UPPER ARM AND LOWER ARM - FRONT, SHOCK ABSORBER AND SPRING ASSEMBLY - FRONT</u> or <u>STABILIZER BAR AND LINK - FRONT.</u> <ul style="list-style-type: none"> BALANCE wheel and tire assembly. REFER to <u>NOISE, VIBRATION & HARSHNESS .</u>
<ul style="list-style-type: none"> Wobble or shimmy 	<ul style="list-style-type: none"> Damaged wheel bearings. Loose or damaged suspension components. <ul style="list-style-type: none"> Bent wheel. Damaged tire. Loose wheel nuts. 	<ul style="list-style-type: none"> REFER to <u>WHEEL BEARING INSPECTION</u> component test. INSPECT the front suspension and REPAIR or INSTALL new suspension components as necessary. REFER to <u>WHEEL BEARING, HUB, KNUCKLE, UPPER ARM AND LOWER ARM - FRONT, SHOCK ABSORBER AND SPRING ASSEMBLY - FRONT</u> or <u>STABILIZER BAR AND LINK - FRONT.</u> <ul style="list-style-type: none"> INSTALL a new wheel as necessary. <ul style="list-style-type: none"> INSTALL a new tire as necessary. TIGHTEN the wheel nuts. REFER to <u>WHEEL AND TIRE - FRONT</u> or <u>WHEEL AND TIRE - REAR.</u>
<ul style="list-style-type: none"> High-speed 	<ul style="list-style-type: none"> Wheel hub face/pilot/bolt circle runout. Tires/wheels. Wheel bearings. Suspension/steering 	<ul style="list-style-type: none"> REFER to <u>NOISE, VIBRATION &</u>

shake	linkage. <ul style="list-style-type: none">• Engine.• Transmission.• Brake discs/imbalance.	<u>HARSHNESS</u> .
<ul style="list-style-type: none">• Vehicle vibration	<ul style="list-style-type: none">• Driveline - engine.• Tires.	<ul style="list-style-type: none">• REFER to <u>NOISE, VIBRATION & HARSHNESS</u> .

TIRE PRESSURE MONITORING SYSTEM

Refer to SYSTEM WIRING DIAGRAMS for schematic and connector information.

Special Tool(s)

	Worldwide Diagnostic System (WDS) 418-F224 New Generation STAR (NGS) Tester 418-F052 or equivalent scan tool
	Rotunda 88 Digital Multimeter or equivalent 105-R0053
	Flex Probe Kit 418-F090 (105-R025B)
	Activation Tool, Tire Pressure Monitor 204-324
	Digital Tire Gauge 204-354

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Fig. 9: Identifying Special Tool
Courtesy of FORD MOTOR CO.

Principles of Operation

The tire pressure monitoring system (TPMS) monitors the air pressure of all four regular road tires. The tire-mounted pressure sensors transmit via radio frequency (RF) signals to the TPMS module, using the valve stem as an antenna. These transmissions are sent approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPMS module compares each tire pressure sensor transmission against a set

of low-pressure limits. If the TPMS module determines that the tire pressure has fallen below these limits, the TPMS module communicates this on the CAN network to the vehicle's instrument cluster which then illuminates the TPMS indicator and displays the appropriate message center message (if equipped).

The system is not affected by wheel and tire rotation.

Ambient Temperature Change and Tire Pressure

CAUTION: Do not inflate tire higher than maximum pressure stamped on the tire sidewall.

As the ambient temperature decreases 12°C (10°F), tire pressure decreases 7 kPa (1 psi). Adjust the tire pressure by 7 kPa (1 psi) for each 12°C (10°F) ambient temperature drop as necessary to keep the tire at the specified vehicle placard pressure. For additional information, refer to the following figure.

Table 1. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature

**** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. ****
Table is based on a Garage Temperature of 70 °F. Max Pressure Adjustment is 7 psi.

Outside Temperature (°F)	Tire Placard Pressure (PSI)					
	30	31	32	33	34	35
70	30	31	32	33	34	35
60	31	32	33	34	35	36
50	32	33	34	35	36	37
40	33	34	35	36	37	38
30	34	35	36	37	38	39
20	35	36	37	38	39	40
10	36	37	38	39	40	41
0	37	38	39	40	41	42
-10	37	38	39	40	41	42
-20	37	38	39	40	41	42
-30	37	38	39	40	41	42
-40	37	38	39	40	41	42

Table 2. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature (Metric)

**** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. ****
Table is based on a Garage Temperature of 21 °C. Max Pressure Adjustment is 48 kPa

Outside Temperature (°C)	Tire Placard Pressure (kPa)					
	207	214	221	228	234	241
21	207	214	221	228	234	241
16	213	220	227	234	241	248
10	219	226	233	240	248	255
4	225	233	240	247	255	262
-1	232	239	247	254	262	269
-7	239	247	254	262	269	277
-12	246	254	262	270	277	285
-18	254	262	270	278	286	290
-23	255	262	269	276	283	290
-29	255	262	269	276	283	290
-34	255	262	269	276	283	290
-40	255	262	269	276	283	290

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Fig. 10: Ambient Temperature Change And Tire Pressure Chart
 Courtesy of FORD MOTOR CO.

TPMS Indicator and Vehicle Message Center Messages

The TPMS indicator and vehicle message center (if equipped) sometimes displays faults that cannot be resolved by the customer. Treat these messages as TPMS faults that must be serviced. GO to **SYMPTOM CHART** for the TPMS indicator operation and message center messages.

TPMS Indicator Illuminates Continuously

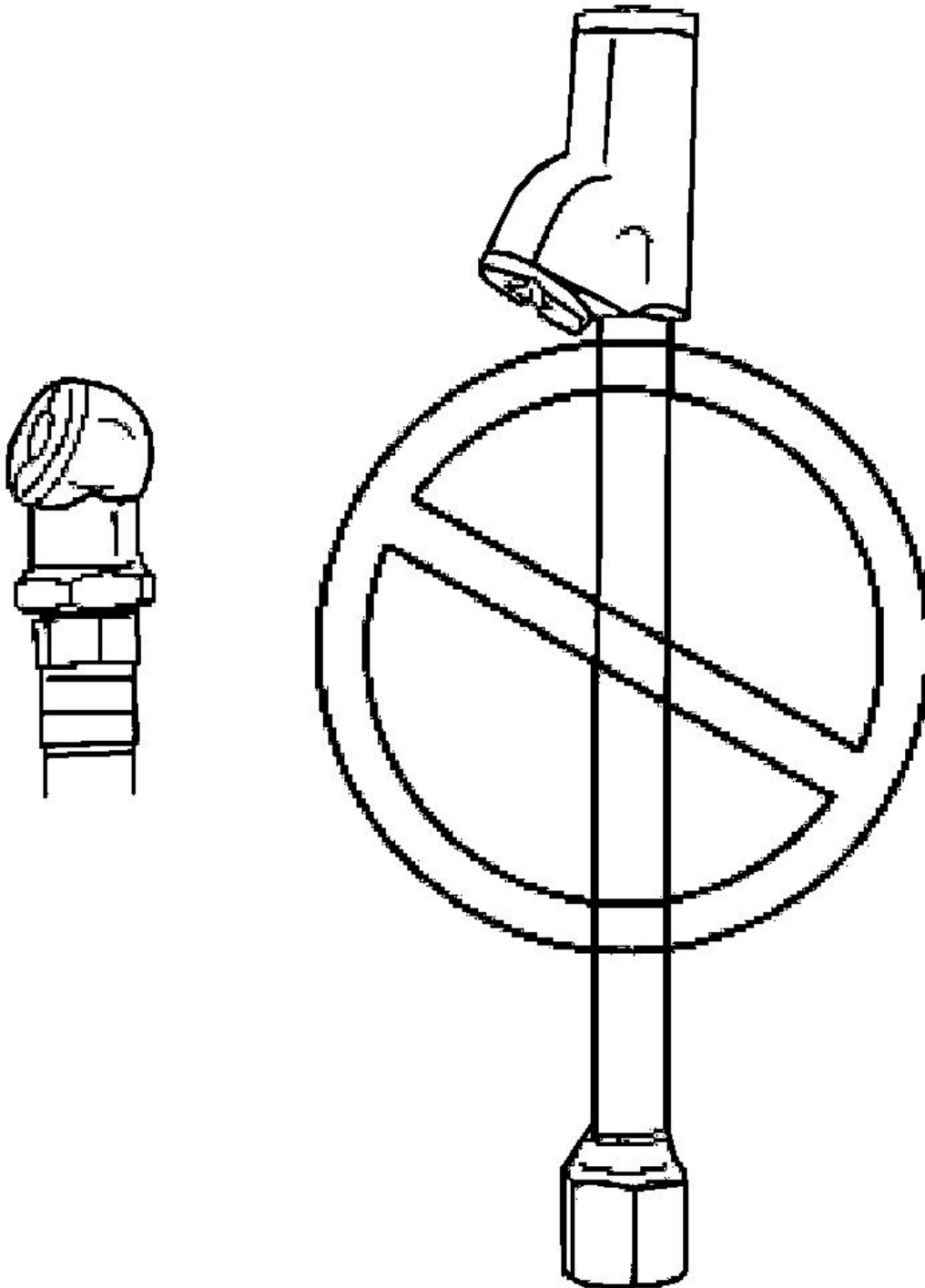
The TPMS indicator remains on continuously for the three following conditions:

CAUTION: Use only special tool 204-354 anytime tire pressures are measured to

be sure that accurate values are obtained.

CAUTION: Place the air chuck straight on the valve stem to inflate the tire. Do not cock the air chuck during the inflation cycle. Doing so can damage the valve stem and cause air leaks.

CAUTION: Ford recommends using a round head air chuck on tire pressure sensors; it is not recommended to use air chucks with long shanks. Doing so can cause tire pressure sensor valve stem damage and loss of tire pressure.



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Fig. 11: Caution For Not Using Air Chucks With Long Shanks
Courtesy of FORD MOTOR CO.

1. Low Tire Pressure - The TPMS indicator is illuminated solid and message center displays CHECK

TIRE PRESSURE (if equipped). This is displayed when any of the tire pressures are low. Tire pressure must be adjusted to the recommended cold placard pressure. ADJUST the air pressure in tires. DO NOT train the tire pressure sensors at this time.

2. Very Low Tire Pressure - The TPMS indicator is illuminated solid and the message center displays WARNING-TIRE VERY LOW (if equipped). This is displayed when one or more tires have very low pressure. When this warning message is displayed, a warning chime sounds reminding you to stop the vehicle as soon as safely possible and check the tires for correct pressure, and for leaks or damage. Tire pressure must be adjusted to the recommended cold placard pressure. ADJUST the air pressure in tires. DO NOT train the tire pressure sensors at this time.
3. No Communication with the TPMS Module - The TPMS indicator is illuminated when the instrument cluster (IC) has received no signals from the TPMS module for more than 5 seconds. If equipped, the message center displays TIRE PRESSURE MONITOR FAULT. GO to **SYMPTOM CHART**

Refer to **MODULE COMMUNICATIONS NETWORK** for diagnosis of the SCP bus.

TPMS Indicator Flashes (flashes for 20 seconds at prove-out and every hour of operation)

The TPMS indicator flashes for the following reasons:

NOTE: **If the spare tire is in use, the damaged road tire must be repaired and installed on the vehicle to restore complete TPMS functionality.**

- Tire Pressure Sensor Fault - If equipped, the message center will display TIRE PRESSURE SENSOR FAULT when a tire pressure sensor is malfunctioning. GO to **SYMPTOM CHART**
- Tire Pressure Monitor Fault - If equipped, the message center will display TIRE PRESSURE MONITOR FAULT when the tire pressure monitoring system is malfunctioning. GO to **SYMPTOM CHART**

Inspection and Verification

1. Verify the customer concern by inspecting the vehicle and observing the message center (if equipped), the TPMS indicator and the tire pressure sensors.

NOTE: **If the tire pressure is adjusted to the cold placard pressure, the TPMS light may not immediately turn off. For additional information, Go To **PINPOINT TEST F**.**

2. Inspect to determine if one of the following mechanical or electrical concerns apply:

VISUAL INSPECTION CHART

Mechanical	Electrical
<ul style="list-style-type: none">• Tire pressure• Non-OEM wheels installed (aftermarket rims)• TPMS sensor damaged or missing• Spare tire installed as a road wheel	<ul style="list-style-type: none">• Power distribution box (PDB):<ul style="list-style-type: none">• fuse(s) 35 (10A)• 41 (15A)• Connectors or connections<ul style="list-style-type: none">• Ground integrity• Harness routing• Wire chafing

- Circuitry open/shorted
- TPMS module missing or damaged

3. If the inspection reveals an obvious concern(s) that can be readily identified, repair as required.
4. If the concern remains after the inspection, connect the scan tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the scan tool menu. If the scan tool does not communicate with the vehicle:
 - check the connections to the vehicle.
 - check the ignition switch position.
 - verify that the battery voltage is between 10 and 16 volts. Refer to **BATTERY & CHARGING SYSTEM**
5. If the scan tool still does not communicate with the vehicle, refer to the scan tool manual.
6. Carry out the DATA LINK DIAGNOSTIC TEST. If the scan tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to **MODULE COMMUNICATIONS NETWORK**.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out self-test diagnostics for the TPMS module.
7. If the DTCs retrieved are related to the concern, refer to **TIRE PRESSURE MONITOR MODULE DIAGNOSTIC TROUBLE CODE (DTC) INDEX** to continue diagnostics.
8. If no DTCs related to the concern are retrieved, GO to **SYMPTOM CHART** to continue diagnostics.

Tire Pressure Monitor System (TPMS) Module Diagnostic Trouble Code (DTC) Index

TIRE PRESSURE MONITOR SYSTEM (DTC) INDEX

DTC	Description	Source	Action
B1342	ECU is Defective	TPMS Module	INSTALL a new tire pressure monitor module. REFER to <u>TIRE PRESSURE MONITORING SYSTEM MODULE</u> .
B2477	Module Configuration Failure/ Mismatch	TPMS Module	REFER to <u>MODULE COMMUNICATIONS NETWORK</u> .
B2849	Horn Output Relay Circuit Open	TPMS Module	Go To <u>PINPOINT TEST D</u>
B2868	Left Front Tire Pressure Sensor Fault	TPMS Module	The module has not heard this sensor during the TPMS module removal and installation process. When programming or installing a new TPMS module, the tire pressure sensors must be manually trained. REFER to <u>TIRE PRESSURE MONITORING SYSTEM MODULE</u> .
B2869	Right Front Tire Pressure Sensor Fault	TPMS Module	The module has not heard this sensor during the TPMS module removal and installation process. When programming or installing a new TPMS module, the tire pressure sensors must be manually trained. REFER to <u>TIRE PRESSURE MONITORING SYSTEM MODULE</u> .
B2870	Right Rear Tire Pressure Sensor Fault	TPMS Module	The module has not heard this sensor during the TPMS module removal and installation process. When programming or installing a new TPMS module, the tire pressure sensors must be manually trained. REFER to <u>TIRE PRESSURE MONITORING SYSTEM MODULE</u> .

B2871	Left Rear Tire Pressure Sensor Fault	TPMS Module	The module has not heard this sensor during the TPMS module removal and installation process. When programming or installing a new TPMS module, the tire pressure sensors must be manually trained. REFER to <u>TIRE PRESSURE MONITORING SYSTEM MODULE</u> .
B2872	Tire Pressure Sensor Fault	TPMS Module	Go To <u>PINPOINT TEST E</u> .
C2780	ECU in Manufacturing Mode	TPMS Module	The TPMS module is in manufacturing mode and must undergo the removal and installation process. REFER to the steps in <u>TIRE PRESSURE MONITORING SYSTEM MODULE</u> .
U0073	Control Module Communication Bus Off	CAN Bus	REFER to <u>MODULE COMMUNICATIONS NETWORK</u>
U1900	Missing Message Timeout	CAN Bus	REFER to <u>MODULE COMMUNICATIONS NETWORK</u>

Symptom Chart

Failure of a tire pressure monitor system component may not cause the message center to display a system fault message or a DTC to be stored. The Symptom Chart is a starting point to begin diagnosis of these concerns.

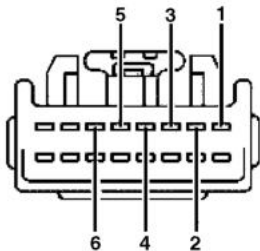
SYMPTOM CHART

Condition	Possible Sources	Action
<ul style="list-style-type: none"> Message center (if equipped) displays "CHECK TIRE PRESSURE". TPMS indicator ON continuously 	<ul style="list-style-type: none"> Air pressure not set to placard. Spare tire currently in use. <ul style="list-style-type: none"> TPMS module. TPMS sensor. 	<ul style="list-style-type: none"> Go To <u>PINPOINT TEST E</u>. EXCHANGE spare with repaired road wheel/tire. Go To <u>PINPOINT TEST E</u>.
<ul style="list-style-type: none"> Message center (if equipped) displays "CHECK PRESSURE" or "WARNING - TIRE VERY LOW". TPMS indicator ON continuously 	<ul style="list-style-type: none"> Air pressure not set to placard. Spare tire currently in use. <ul style="list-style-type: none"> TPMS module. TPMS sensor. 	<ul style="list-style-type: none"> Go To <u>PINPOINT TEST F</u>. EXCHANGE spare with repaired road wheel/tire. Go To <u>PINPOINT TEST F</u>.
<ul style="list-style-type: none"> Message center (if equipped) displays "TIRE PRESSURE MONITOR FAULT". TPMS indicator flashes 	<ul style="list-style-type: none"> TPMS module. All four TPMS sensors failed, missing, or incorrectly trained. 	<ul style="list-style-type: none"> Go To <u>PINPOINT TEST C</u>.
<ul style="list-style-type: none"> Message center (if equipped) displays "TIRE PRESSURE SENSOR FAULT". TPMS indicator flashes 	<ul style="list-style-type: none"> TPMS sensor. Spare tire currently in use. 	<ul style="list-style-type: none"> Go To <u>PINPOINT TEST E</u>. EXCHANGE spare with repaired road

		wheel/tire.
<ul style="list-style-type: none"> Message center (if equipped) displays "TIRE PRESSURE MONITOR FAULT". TPMS indicator ON continuously. No communication with TPMS module 	<ul style="list-style-type: none"> Fuse(s). Circuitry. Module. 	<ul style="list-style-type: none"> Go To <u>PINPOINT TEST A.</u>
<ul style="list-style-type: none"> No communication with the TPMS module 	<ul style="list-style-type: none"> Fuse(s). Circuitry. Module. 	<ul style="list-style-type: none"> Go To <u>PINPOINT TEST A.</u>
<ul style="list-style-type: none"> Unable to enter self-test 	<ul style="list-style-type: none"> TPMS module. Scan tool. 	<ul style="list-style-type: none"> Go To <u>PINPOINT TEST A.</u>
<ul style="list-style-type: none"> TPMS will not enter sensor training mode 	<ul style="list-style-type: none"> TPMS sensor. Message center. TPMS module. BOO switch. ABS/TC/IVD module. 	<ul style="list-style-type: none"> Go To <u>PINPOINT TEST B.</u> REFER to <u>ANTI-LOCK CONTROL</u>.

Connector Reference and Terminal Readings

Tire Pressure Monitoring System (TPMS) Connector C3183



Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
1	CKT 3126 (TN/YE) CAN Bus +	CAN communication high current when connected.
2	CKT 3125 (RD/YE) CAN Bus -	CAN communication low current when connected.
3	CKT 1003 (GY/YE) TPMS module memory power	B+ voltage at all times.
4	CKT 6 (LG/YE) Horn control relay signal to vehicle security module (VSM)	Five volts on activation.
5	CKT 1050 (LG/VT) TPMS ignition power	Twelve volts with ignition in START and RUN.
6	CKT 1205 (BK) TPMS module ground	Zero volts, less than five ohms to chassis ground.

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Fig. 12: Tire Pressure Monitoring System Connector Pinout (C3183)
Courtesy of FORD MOTOR CO.

Pinpoint Tests

Pinpoint Test A: No Communication With The TPMS Module/Unable To Enter Self-Test

Refer to SYSTEM WIRING DIAGRAMS for schematic and connector information.

Normal Operation

The TPMS module requires an operating voltage in a range between 10 and 17 volts.

Voltage is supplied by circuit 1050 (LG/VT) (ignition feed) and circuit 1003 (GY/YE) (B+ voltage at all times). Ground is provided through circuit 1205 (BK).

Possible Causes

- Power supply circuit 1050 (LG/VT) (ignition feed)
- Power circuit 1003 (GY/YE) (B+ voltage at all times)
- Ground circuit 1205 (BK)
- TPMS module
- Scan tool
- Data link connector (DLC) and wiring

Pinpoint Test A: No Communication With The TPMS Module/Unable To Enter Self-Test

CAUTION: The Flex Probe Kit must be used for all test connections. Use of standard multimeter probes may damage wiring terminals.

A1 CHECK CIRCUITS 1050 (LG/VT) AND 1003 (GY/YE) FOR AN OPEN

- Disconnect: TPMS Module C3183.
- Key in ON position.
- Measure the voltage between TPMS module connector C3183-5, circuit 1050 (LG/VT) harness side and ground and between C3183-3, circuit 1003 (GY/YE) harness side and ground.
- **Are the voltages greater than 10 volts?**

Yes GO to A2.

No REPAIR circuit 1050 (LG/VT) or circuit 1003 (GY/YE). TEST the system for normal operation.

A2 CHECK CIRCUIT 1205 (BK) FOR OPEN

- Measure the resistance between TPMS module harness connector C3183-6, circuit 1205 (BK) and ground.
- **Is the resistance greater than 5 ohms?**

Yes REPAIR circuit 1205 (BK) TEST the system for normal operation.

No CHECK the CAN communication circuits. REFER to **MODULE COMMUNICATIONS NETWORK**.

Pinpoint Test B: TPMS Will Not Enter Sensor Training Mode

Refer to SYSTEM WIRING DIAGRAMS for schematic and connector information.

Normal Operation

With the ignition on, the TPMS module enters the training mode when a combination of inputs are received from the brake pedal position (BPP) switch and the ignition status switch (from the instrument cluster).

The BPP signal and ignition status signal are sent to the TPMS module on the CAN network.

Possible Causes

- Circuit 1050 (LG/VT) ignition power
- BPP switch
- Ignition status (from instrument cluster)
- CAN network
- TPMS module

Pinpoint Test B: TPMS Will Not Enter Sensor Training Mode

CAUTION: The Flex Probe Kit must be used for all test connections. Use of standard multimeter probes may damage wiring terminals.

B1 CHECK CIRCUIT 1050 (LG/VT) FOR SHORT TO POWER

- Key in OFF position.
- Disconnect: TPMS Module C3183.
- Measure the voltage between TPMS module C3183-5, circuit 1050 (LG/VT) harness side and ground.
- **Is the voltage less than 0.3 volts?**

Yes GO to B2.

No REPAIR circuit 1050 (LG/VT). TEST the system for normal operation.

B2 CHECK THE BRAKE PEDAL POSITION SWITCH

- Using the scan tool menu, monitor the brake pedal position switch PID.
- Press and release the brake pedal while monitoring the PID.
- **Do the brake pedal PID values match with the brake pedal positions?**

Yes GO to B3.

No REFER to **ANTI-LOCK CONTROL** .

B3 CHECK THE INSTRUMENT CLUSTER

- Using the scan tool menu, monitor the instrument cluster ignition switch status PID.
- Cycle the ignition switch to the ON and OFF position while monitoring the PID.

- Does the ignition switch status PID values match with the ignition switch positions?

Yes INSTALL a new TPMS module. REFER to **TIRE PRESSURE MONITORING SYSTEM MODULE**. TEST the system for normal operation.

No CHECK the ignition switch and instrument cluster. REFER to **INFORMATION, GAUGES & WARNING DEVICES**

Pinpoint Test C: Message Center Displays "TIRE PRESSURE MONITOR FAULT"

Refer to SYSTEM WIRING DIAGRAMS for schematic and connector information.

Normal Operation

If there is a fault in the TPMS system, such as damaged sensor or module, DTCs are set in the TPMS module, the TPMS indicator will illuminate and the message center (if equipped), will display the appropriate message.

Possible Causes

- Tire pressure sensor(s)
- TPMS module DTC(s)

Pinpoint Test C: Message Center Displays "Tire Pressure Monitor Fault"

C1 CHECK FOR DTCs

- Connect the scan tool.
- Retrieve and document the continuous DTCs.
- **Are DTCs obtained?**

Yes REFER to **TPMS MODULE DIAGNOSTIC TROUBLE CODE (DTC) INDEX**. If DTC B2872 is retrieved, TRAIN the TPMS sensors. REFER to **SENSOR TRAINING**. If DTC B1342 is retrieved, INSTALL a new TPMS module. REFER to **TIRE PRESSURE MONITORING SYSTEM MODULE**. TEST the system for normal operation.

No GO to C2.

C2 CHECK THE SYSTEM COMPONENTS

- Measure and record the tire pressures with an accurate tire gauge.
- Carry out the sensor training procedure. Refer to the **SENSOR TRAINING** procedure.
- Using the scan tool menu, enter the TPMS module function test for tire pressure status.
- Compare the recorded tire pressure values to the tire status values obtained by the function test.
- **Do the compared tire pressure values match within +/-3 psi?**

Yes INSTALL a new TPMS module. REFER to **TIRE PRESSURE MONITORING SYSTEM MODULE**. TEST the system for normal operation.

No INSTALL new tire pressure sensors for those with discrepancies.

Pinpoint Test D: DTC B2849 - Horn Output Relay Circuit Open

Refer to SYSTEM WIRING DIAGRAMS for schematic and connector information.

Normal Operation

The horn output relay circuit receives a signal from the TPMS module during the TPMS module training mode.

Voltage to the horn output relay circuit is carried through circuit 6 (YE/LG).

Possible Causes

- Horn circuitry
- Circuit 6 (YE/LG)
- TPMS module

Pinpoint Test D: DTC B2849 - Horn Output Relay Circuit Open

CAUTION: The Flex Probe Kit must be used for all test connections. Use of standard multimeter probes may damage wiring terminals.

D1 CHECK MANUAL HORN OPERATION

- Confirm horn operation.
- **Does the horn sound?**

Yes GO to D2.

No REPAIR the horn. REFER to **INFORMATION, GAUGES & WARNING DEVICES** . TEST the system for normal operation.

D2 CHECK HORN OPERATION USING ACTIVE COMMAND

- Using the scan tool active command menu, actuate the horn.
- **Does the horn sound?**

Yes CHECK the TPMS module connector C3183 for corroded, damaged or backed out pins. If no faults are found, INSTALL a new TPMS module. REFER to **TIRE PRESSURE MONITORING SYSTEM MODULE**. CLEAR the DTC. TEST the system for normal operation.

No GO to D3.

D3 CHECK CIRCUIT 6 (LG/YE) FOR AN OPEN

- Disconnect the battery ground cable. For additional information, refer to **BATTERY & CHARGING SYSTEM** .
- Disconnect: TPMS Module C3183.
- Disconnect: Battery Junction Box (BJB) Horn Relay.
- Measure the resistance between TPMS module C3183-4, circuit 6 (YE/LG) harness side and ground.

- Is the resistance greater than 5 ohms?

Yes INSTALL a new TPMS module. REFER to **TIRE PRESSURE MONITORING SYSTEM MODULE**. CLEAR the DTC. TEST the system for normal operation.

No REPAIR circuit 6 (YE/LG). Test the system for normal operation.

Pinpoint Test E: DTC B2872 - Tire Pressure Sensor Fault

Refer to SYSTEM WIRING DIAGRAMS for schematic and connector information.

Normal Operation

Each tire pressure sensor transmits a specific sensor ID (via radio signals) to the TPMS module.

The tire pressure sensor valve stem serves as an antenna which sends the radio signal to the TPMS module.

The tire pressure sensor is battery powered.

Possible Causes

- Tire pressure sensor
- Tire pressure sensor battery
- Spare tire in use

Pinpoint Test E: DTC B2872 - Tire Pressure Sensor Fault

E1 CHECK FOR FAULT REPEATABILITY

- Connect the scan tool.
- Carry out the tire pressure sensor training procedure. Refer to the **SENSOR TRAINING** procedure.
- Does the tire training procedure initiate?

Yes GO to E2.

No Go To **PINPOINT TEST B**.

E2 CHECK TIRE PRESSURE SENSOR TRANSMITTING ABILITY

- Continue to train the tire pressure sensors. REFER to the **SENSOR TRAINING** procedure.
- Do all of the tire pressure sensors transmit correctly and does the horn sound when each tire pressure sensor transmits to the TPMS module?

Yes GO to E3.

No INSTALL a new tire pressure sensor. REFER to **TIRE PRESSURE SENSOR**. CLEAR the DTC (s). REPEAT the self-test.

E3 CHECK THE TPMS MODULE

- Carry out the TPMS module On-Demand Self Test.

- Retrieve and document the DTCs.
- **Are any DTCs obtained?**

Yes REFER to the **TPMS MODULE DIAGNOSTIC TROUBLE CODE (DTC) INDEX**.

No If no DTCs are retrieved, the system is functioning normally.

Pinpoint Test F: Message Center Displays "CHECK TIRE PRESSURE" or "TIRE VERY LOW" and/or the TPMS Indicator On Continuously

Refer to SYSTEM WIRING DIAGRAMS for schematic and connector information.

Normal Operation

If there is a fault in the TPMS system, such as a damaged sensor or module, DTCs are sent to the TPMS module, the TPMS indicator will illuminate and the message center (if equipped), will display the appropriate message.

Possible Causes

- Low tire pressure(s)

Pinpoint Test F: Message Center Displays "Check Tire Pressure" Or "Tire Very Low" And/Or The TPMS Indicator On Continuously

NOTE: If a warranty case is opened for an actual TPMS fault, document and include the actual tire pressure data in all warranty communications.

F1 MEASURE AND RECORD TIRE PRESSURE WITH AN ACCURATE TIRE GAUGE

- For those found to be below the vehicle placard tire pressure, adjust and recheck.
- With key in RUN position, place the TPMS activation tool (204-324) on each valve stem for at least 7 seconds.
- **Does the TPMS indicator/message center warning (if equipped) go out?**

Yes The diagnosis is complete.

No GO to E2.

F2 CHECK FOR DTCs

- Using the scan tool, retrieve and document DTCs.
- **Are DTCs retrieved?**

Yes REFER to **TPMS MODULE DIAGNOSTIC TROUBLE CODE (DTC) INDEX**.

No GO to E3.

F3 CHECK THE SYSTEM COMPONENTS

- Measure and record the tire pressures with an accurate tire gauge.
- Carry out the Sensor Training procedure. Refer to **SENSOR TRAINING**.

- Using the scan tool menu, enter the TPMS module function test for tire pressure status.
- Compare the recorded tire pressure values to the tire status values obtained by the function test.
- **Do the compared tire pressure values match within +/-3 psi?**

Yes INSTALL a new TPMS module. REFER to **TIRE PRESSURE MONITORING SYSTEM MODULE**. TEST the system for normal operation.

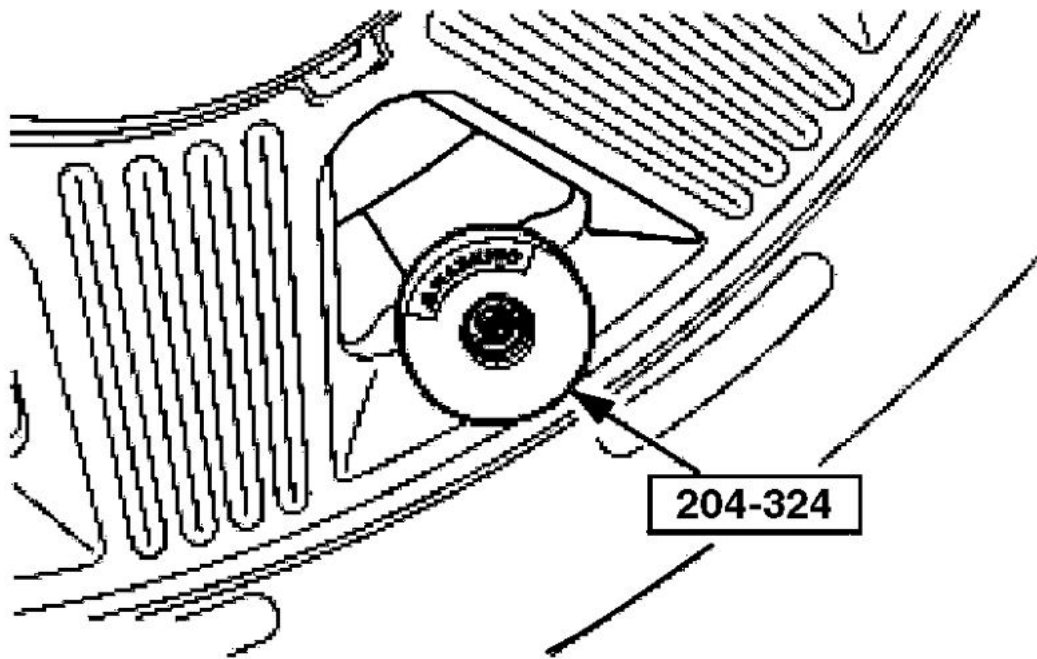
No INSTALL a new tire pressure sensors for those with discrepancies. REFER to **TIRE PRESSURE SENSORS** and the **SENSOR TRAINING** procedure. TEST the system for normal operation.

Sensor Training

NOTE: **The tire pressure sensor training procedure must be done in an area without radio frequency (RF) noise.**

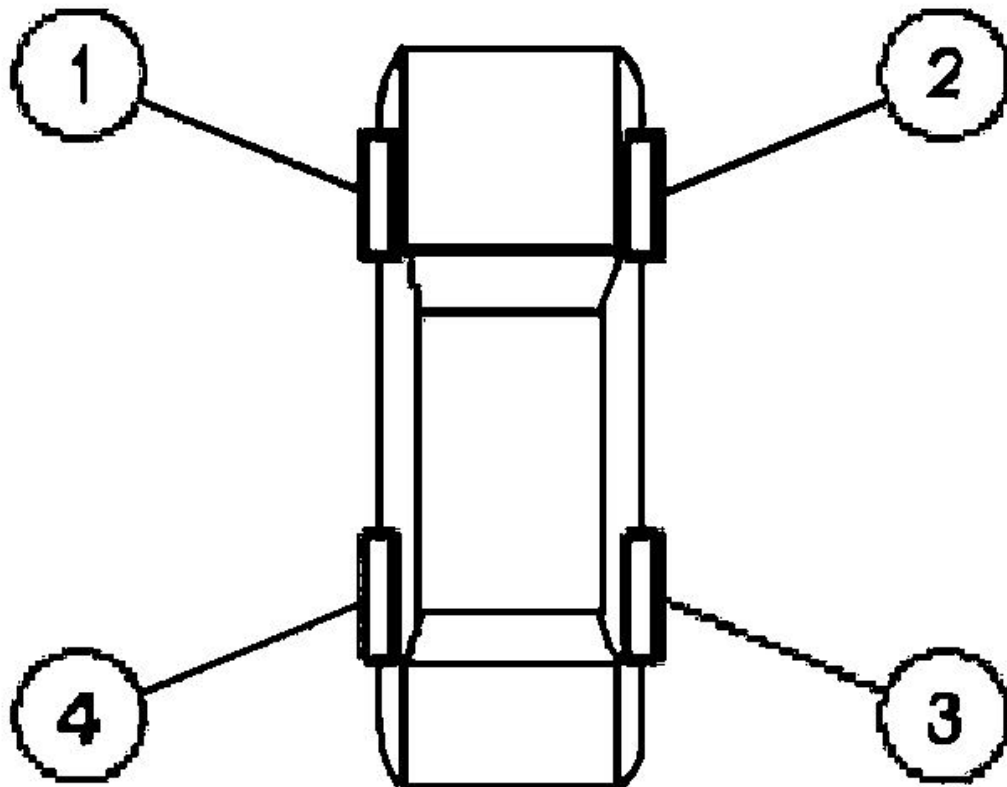
RF noise is generated by electrical motor and appliance operation, cellular telephones, and remote transmitters.

1. Turn the ignition switch to the OFF position.
2. Turn the ignition switch to the RUN position three times, ending in the RUN position. Do not wait more than two minutes between each key cycle.
3. Press and release the brake pedal.
4. Turn the ignition switch to the OFF position.
5. Turn the ignition switch from the OFF position to the RUN position three times, ending in the RUN position. Do not wait more than two minutes between each key cycle.



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Fig. 13: Identifying TPMS Activation Tool
Courtesy of FORD MOTOR CO.



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Fig. 14: Identifying TPMS Activation Tool Position Sequence
Courtesy of FORD MOTOR CO.

6. The horn will sound once and the TPMS indicator will flash if train mode has been entered successfully. If equipped, the message center displays "TRAIN LEFT FRONT TIRE". Place the magnet on the valve stem of the LF tire pressure sensor. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the TPMS module.
7. Within two minutes after the horn sounds, place the magnet on the valve stem of the RF tire pressure sensor.

NOTE: If the TPMS module does not recognize any one of the four tire pressure sensors during the tire training procedure, the horn will sound twice and the message center (if equipped) will display "TIRE TRAINING MODE INCOMPLETE". If this occurs, the entire procedure must be repeated from Step 1.

8. Repeat Step 7 for the RR and LR tires.

When the tire training procedure is complete, the horn will sound once and the message center (if equipped) will display "TIRE TRAINING MODE COMPLETE".

SUSPENSION SYSTEM

Inspection and Verification

- 1. Road test.
 - Verify the customer's concern by carrying out a road test on a smooth road. If any vibrations are apparent, refer to **NOISE, VIBRATION & HARSHNESS**
- 2. Inspect tires.
 - Check the tire pressure with all normal loads in the vehicle and the tires cold. Refer to the Vehicle Certification (VC) Label.
 - Verify that all tires are sized to specification. Refer to **SPECIFICATIONS**.
 - Inspect the tires for incorrect wear and damage. Install new tires as necessary.
- 3. Inspect chassis and underbody.
 - Remove any excessive accumulation of mud, dirt or road deposits from the chassis and underbody.
- 4. Inspect for aftermarket equipment.
 - Check for aftermarket changes to the steering, suspension, wheel and tire components (such as competition, heavy duty, etc.) The specifications shown in this manual do not apply to vehicles equipped with aftermarket equipment.

VISUAL INSPECTION CHART

Mechanical
<ul style="list-style-type: none">• Front wheel bearing(s)• Loose or damaged front or rear suspension components• Loose, damaged or missing suspension fastener(s)• Incorrect spring usage• Damaged or sagging spring(s)• Damaged or leaking shock absorber(s)• Worn or damaged suspension bushing(s)• Loose, worn or damaged steering system components• Damaged axle components

- 5. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the next step.
- 6. If the fault is not visually evident, determine the symptom. GO to **SYMPTOM CHART**

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
<ul style="list-style-type: none">• Dogtracking	<ul style="list-style-type: none">• Rear suspension components.	<ul style="list-style-type: none">• INSPECT the rear suspension system. REPAIR or INSTALL new suspension components as necessary. REFER to <u>WHEEL BEARING, HUB, KNUCKLE, UPPER ARM AND LOWER ARM -</u>

		<u>REAR.</u>
<ul style="list-style-type: none"> • Drift/pull 	<ul style="list-style-type: none"> • Unequal tire pressure. • Caster total split is not within specification. • Camber total split is not within specification. • Tire forces. • Unevenly loaded or overloaded vehicle. <ul style="list-style-type: none"> • Steering components. • Brake drag. 	<ul style="list-style-type: none"> • ADJUST tire pressure. • CHECK the wheel alignment. ADJUST as necessary. • CHECK the wheel alignment. ADJUST as necessary. • ROTATE tires front to rear. • NOTIFY the customer of incorrect vehicle loading. • REFER to <u>STEERING SYSTEM</u> • REFER to <u>BRAKE SYSTEM-GENERAL INFORMATION</u>
<ul style="list-style-type: none"> • Front bottoming or riding low 	<ul style="list-style-type: none"> • Incorrect springs. • Front shock absorber(s). 	<ul style="list-style-type: none"> • INSTALL new springs as necessary. REFER to <u>SHOCK ABSORBER AND SPRING ASSEMBLY - FRONT.</u> • INSTALL new shock absorber(s) as necessary. REFER to <u>SHOCK ABSORBER AND SPRING ASSEMBLY - FRONT.</u>
<ul style="list-style-type: none"> • Incorrect tire wear 	<ul style="list-style-type: none"> • Incorrect tire pressure (rapid center rib or inner and outer edge wear). • Excessive front or rear toe (rapid inner or outer edge wear). • Excessive negative or positive camber (rapid inner or outer edge wear). • Front or rear suspension components. • Tires out of balance (tires cupped or dished). 	<ul style="list-style-type: none"> • ADJUST tire pressure. • CHECK the wheel alignment. ADJUST as necessary. • CHECK the wheel alignment. ADJUST as necessary. • INSPECT the front and rear suspension system. REPAIR or INSTALL new suspension components as necessary. REFER to <u>WHEEL BEARING, HUB, KNUCKLE, UPPER ARM AND LOWER ARM - REAR.</u> • BALANCE tires.
<ul style="list-style-type: none"> • Rough ride 	<ul style="list-style-type: none"> • High tire pressure. • Shock absorber(s). • Spring(s). 	<ul style="list-style-type: none"> • ADJUST tire pressure. • INSTALL new shock absorbers as necessary. REFER to <u>SHOCK ABSORBER AND SPRING ASSEMBLY - FRONT.</u> • INSTALL new spring(s) as necessary.

		REFER to <u>SHOCK ABSORBER AND SPRING ASSEMBLY - FRONT</u> or <u>SHOCK ABSORBER AND SPRING ASSEMBLY - REAR.</u>
<ul style="list-style-type: none"> Shimmy or wheel tramp 	<ul style="list-style-type: none"> Loose wheel nut(s). <ul style="list-style-type: none"> Loose front suspension fasteners. Front wheel bearing. Wheel or tire concerns. Shock absorber(s). <ul style="list-style-type: none"> Loose, worn or damaged ball joint (s). Loose, worn or damaged steering components. Front wheel alignment. 	<ul style="list-style-type: none"> TIGHTEN to specification. REFER to <u>SPECIFICATIONS.</u> TIGHTEN to specification. REFER to <u>SPECIFICATIONS.</u> <ul style="list-style-type: none"> REFER to <u>WHEEL BEARING INSPECTION</u> component test. REFER to <u>WHEELS AND TIRES.</u> INSTALL new shock absorber(s) as necessary. REFER to <u>SHOCK ABSORBER AND SPRING ASSEMBLY - FRONT</u> or <u>SHOCK ABSORBER AND SPRING ASSEMBLY - REAR.</u> <ul style="list-style-type: none"> REFER to the <u>BALL JOINT INSPECTION</u> component test. REFER to <u>STEERING SYSTEM</u> CHECK the wheel alignment. ADJUST as necessary.
<ul style="list-style-type: none"> Sticky steering, poor returnability 	<ul style="list-style-type: none"> Ball joints. Steering components. Caster out of specification. 	<ul style="list-style-type: none"> REFER to the <u>BALL JOINT INSPECTION</u> component test. REFER to <u>STEERING SYSTEM</u> . CHECK the wheel alignment. ADJUST as necessary.
<ul style="list-style-type: none"> Steering wheel off-center 	<ul style="list-style-type: none"> Unequal front toe setting (side-to-side). Steering components. 	<ul style="list-style-type: none"> CHECK the wheel alignment. ADJUST as necessary. REFER to <u>STEERING SYSTEM</u> .
<ul style="list-style-type: none"> Sway or roll 	<ul style="list-style-type: none"> Overloaded, unevenly or incorrectly loaded vehicle. Loose wheel nut(s). Shock absorber(s). Loose stabilizer bracket-to-frame bolts. Worn bar bushings 	<ul style="list-style-type: none"> NOTIFY the customer of incorrect vehicle loading. TIGHTEN to specification. REFER to <u>SPECIFICATIONS.</u> <ul style="list-style-type: none"> INSTALL new shock absorbers as necessary. REFER to <u>SHOCK ABSORBER AND SPRING ASSEMBLY - FRONT</u> or <u>SHOCK ABSORBER AND SPRING ASSEMBLY - REAR.</u> TIGHTEN to specification. REFER to <u>SPECIFICATIONS.</u> INSTALL new stabilizer bar bushings or links as necessary. REFER to <u>STABILIZER BAR AND LINK - FRONT</u> or <u>STABILIZER BAR AND</u>

	or links. <ul style="list-style-type: none"> Worn spring(s) 	<u>LINK - REAR.</u> <ul style="list-style-type: none"> INSTALL new spring(s) as necessary. REFER to <u>SHOCK ABSORBER AND SPRING ASSEMBLY - FRONT</u> or <u>SHOCK ABSORBER AND SPRING ASSEMBLY - REAR.</u>
<ul style="list-style-type: none"> Vehicle leans to one side 	<ul style="list-style-type: none"> Unevenly loaded or overloaded vehicle. <ul style="list-style-type: none"> Front or rear suspension components. Spring(s). Incorrect drive axle (s) ride height. Lateral tilt out of specification. 	<ul style="list-style-type: none"> NOTIFY the customer of incorrect vehicle loading. INSPECT the front and rear suspension systems. INSTALL new suspension components as necessary. INSTALL new spring(s) as necessary. REFER to <u>SHOCK ABSORBER AND SPRING ASSEMBLY - FRONT</u> or <u>SHOCK ABSORBER AND SPRING ASSEMBLY - REAR.</u> INSPECT the front and rear suspension systems. ADJUST, REPAIR or INSTALL new suspension components as necessary.
<ul style="list-style-type: none"> Vibration/noise 	<ul style="list-style-type: none"> Tire and wheel concerns. Wheel bearings. Brake components. <ul style="list-style-type: none"> Suspension components. Steering components. 	<ul style="list-style-type: none"> REFER to <u>NOISE, VIBRATION & HARSHNESS</u>.
<ul style="list-style-type: none"> Wander 	<ul style="list-style-type: none"> Unevenly loaded or overloaded vehicle. <ul style="list-style-type: none"> Ball joint(s). Loose, worn or damaged front wheel bearing(s). Loose, worn or damaged suspension component(s). Loose suspension fasteners. <ul style="list-style-type: none"> Steering components. Wheel alignment (excessive total front toe out). 	<ul style="list-style-type: none"> NOTIFY the customer of incorrect vehicle loading. <ul style="list-style-type: none"> REFER to the <u>BALL JOINT INSPECTION</u> component test. REFER to <u>WHEEL BEARING INSPECTION</u> component test. INSTALL new suspension component(s) as necessary. INSPECT and TIGHTEN to specification. REFER to <u>SPECIFICATIONS.</u> REFER to <u>STEERING SYSTEM</u> <ul style="list-style-type: none"> ADJUST as necessary.

Component Tests

Wheel Bearing Inspection

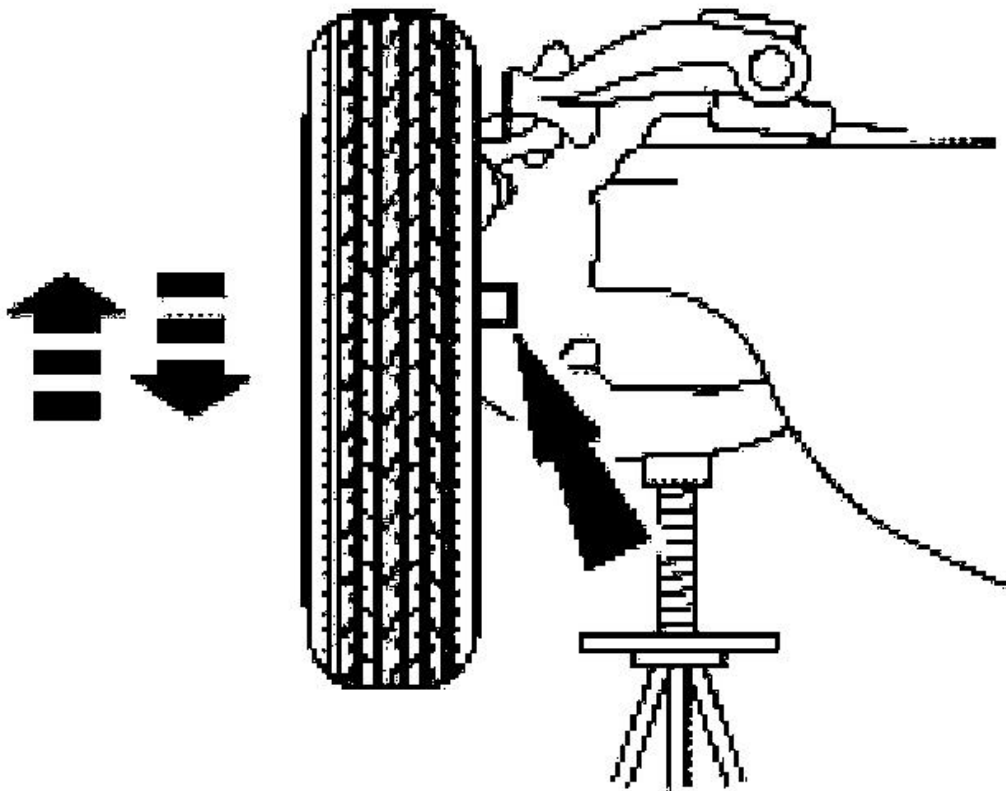
1. Raise the vehicle until the tires are off of the ground. Refer to **JACKING & LIFTING**

NOTE: Make sure the wheel rotates freely and the brake pads are retracted sufficiently to allow movement of the wheel and tire assembly.

2. Grasp the tire at the top and bottom and move the wheel inward and outward while lifting the weight of the tire from the front wheel bearings. If movement exists, a new bearing must be installed. Refer to **WHEEL BEARING, HUB, KNUCKLE, UPPER ARM AND LOWER ARM - FRONT** or **WHEEL BEARING, HUB, KNUCKLE, UPPER ARM AND LOWER ARM - REAR.**

Ball Joint Inspection

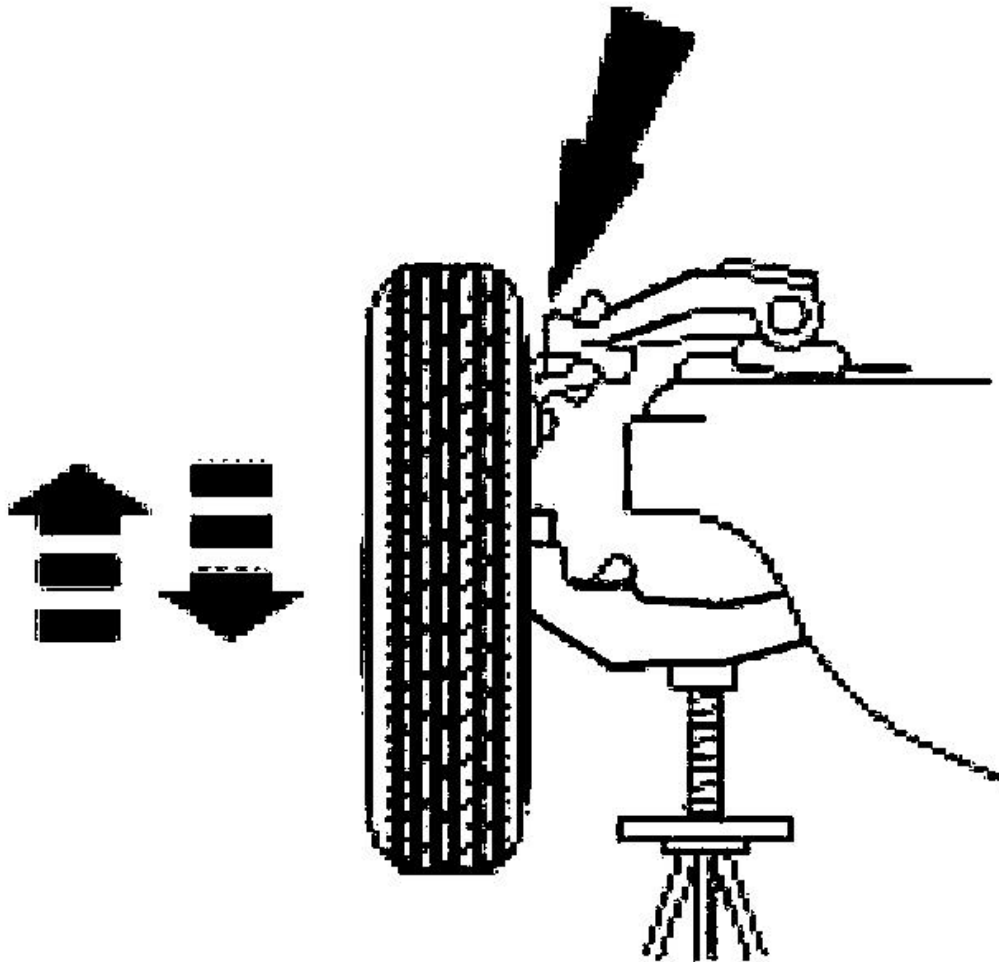
1. Raise and support the vehicle. Refer to **JACKING & LIFTING**
2. Prior to carrying out any inspection of the ball joints, inspect the front wheel bearings.
3. Position a safety stand beneath the front suspension lower arm to be tested.



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Fig. 15: Inspecting Lower Ball Joint
Courtesy of FORD MOTOR CO.

4. While an assistant pries upward on the bottom of the tire, observe the relative movement between the spindle and the lower arm ball joint. Any movement at or exceeding the specification indicates a worn or damaged lower ball joint. Install a new ball joint as necessary. Refer to **BALL JOINT - LOWER, 2WD** or **BALL JOINT - LOWER, 4WD**.



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Fig. 16: Inspecting Upper Ball Joint
Courtesy of FORD MOTOR CO.

5. While an assistant pries upward on the bottom of the tire, observe the relative movement between the spindle and the upper arm ball joint. Movement at or exceeding the specification indicates a worn or damaged upper ball joint. Install a new upper arm as necessary. Refer to **WHEEL BEARING, HUB, KNUCKLE, UPPER ARM AND LOWER ARM - REAR**.