VADEN® ORIGINAL

TECHNİCAL GUİDE

Brake Pad Wear Sensor: Function, Faults & Replacement Guide

Truck brake pad wear sensors: how the wire or electronic sensor triggers the warning lamp, common wiring faults, and how to measure and replace one.

vaden.com.tr · **vadenoriginal.com** · Version: September 2026 · Heavy commercial vehicle (truck · tractor · bus)

A fleet vehicle comes in for routine service; the brake pad wear icon is flashing on the dashboard, yet the driver has not noticed any loss of braking performance. When the technician removes the caliper, the pad thickness is still above the usable limit — the problem is not the pad but the sensor cable, worn through by axle movement. The brake pad wear sensor is a small but critical safety component designed to flag exactly this kind of distinction early, for both driver and technician. When the pad material reaches a defined thickness, the circuit opens, a warning appears on the dashboard, and the pad replacement can be scheduled before braking performance drops. This guide covers the sensor's working principle, fault symptoms, the correct measurement method, and replacement steps from start to finish.

This document was prepared by the VADEN technical team for heavy commercial vehicle disc brake systems. The values given here are general reference only; for exact data, the current OE service manual matching the vehicle's engine and chassis code is authoritative. Last updated: September 2026.

What Is a Brake Pad Wear Sensor? Function and Working Principle

The brake pad wear sensor is a safety component that indirectly monitors the thickness of the friction material in a disc brake caliper and triggers a dashboard warning by generating an electrical signal once the pad drops below its usable limit. The sensor is built either as a wear wire embedded in the pad body or as an electronic sensor mounted on the caliper.

The sensor's job can be summed up in one sentence: warn the driver before the pad runs out. In heavy commercial vehicles, pad wear rate varies enormously with load, driving style, and route; a pad working on a hilly route in a loaded tractor unit wears out far faster than one on a vehicle running empty. A mileage-based maintenance schedule cannot capture that difference. Because the wear sensor measures the pad's physical condition directly, it signals the need for replacement based on actual wear, preventing both premature (unnecessary) and late (dangerous) replacement.

Two basic sensor concepts are found on the market. The first and most common is the wear wire, embedded in the pad material at a set depth; once the pad wears down to that depth, the disc physically abrades and severs the wire, opening the circuit. The second is an electronic (non-contact) sensor fitted to the caliper body in some systems; this type indirectly measures piston travel or the position of the pad backing plate, allowing it to track the wear level in gradual steps. Both types serve the same purpose: changing the circuit or signal characteristic as pad thickness decreases.

How does a wear wire (friction-type) sensor work?

In the wear wire type sensor, a thin conductive wire is embedded in the pad friction material at a depth matching the wear limit. When the pad is new, the wire does not touch the disc surface and the circuit is closed — resistance measured at the sensor connector is low. As the pad wears, the wire moves closer to the disc surface; once the pad reaches the defined limit, the disc physically abrades and severs the wire. The circuit opens, the control module behind the dashboard detects this open circuit, and it lights the warning lamp. This mechanism is simple,

inexpensive, and reliable; however, it produces a binary (present/absent) warning — it does not report "wear at X percent," only that "the limit has been reached."

How does an inductive (electronic) sensor work?

In some caliper and EBS-integrated brake systems, pad wear is monitored with a non-contact electronic sensor. This type indirectly calculates the wear amount by referencing the distance travelled by the caliper piston or the position of the pad backing plate. Unlike the wear wire type, it can produce a graduated signal instead of a single threshold; on some vehicles this information is shown on the dashboard as a percentage or an estimated remaining mileage. This type of sensor usually communicates with the EBS module and supplies data to the pad wear balancing function. The exact operating logic and signal characteristic vary by manufacturer; the vehicle's OE service documentation should be consulted for correct interpretation.

How does the sensor signal reach the dashboard?

The two-wire or single-wire line leaving the sensor runs along the axle inside a dedicated wiring harness to the chassis and connects to the vehicle wiring via a connector. The signal reaches either a control module that drives the dashboard directly, or the EBS/ABS electronic control unit; the module interprets whether the circuit is open or closed (wire type) or the signal level (electronic type) and drives the warning lamp accordingly. The components in this line are:

- **Wear wire or electronic sensor:** the element fitted to the pad or caliper that measures wear directly.
- **Sensor connector:** the usually waterproof plug-and-socket set that connects the sensor to the vehicle wiring.
- **Wiring harness:** the section that flexes with axle movement and is most exposed to friction and fatigue damage.
- **Dashboard/control module:** the unit that processes the circuit state or signal level and lights the lamp; on some vehicles this is shared with the EBS.
- **Warning lamp:** the only output visible to the driver, shown on the dashboard with a pad symbol.

Ignoring the wear sensor warning and running the pad completely out lets the steel pad backing plate rub directly against the disc. This permanently damages the disc surface and noticeably extends the braking distance. Metal-to-metal contact usually announces itself with a sharp, high-pitched squeal; once this sound is heard, the vehicle should be brought in for service as soon as possible.

How Do You Recognize a Brake Pad Wear Sensor Fault?

A brake pad wear sensor fault is usually noticed through unexpected behavior of the dashboard lamp: either the lamp lights while the pad is still adequate, or it never lights even though the pad has genuinely worn out. The second case is riskier, because it gives the driver no warning at all. The table below summarizes the symptoms most commonly encountered in the field, their probable causes, and how to verify them.

Brake pad wear sensor fault symptoms and how to check them

Symptom	Probable cause	Check / verification
Dashboard lamp stays on, pad thickness is still adequate	Sensor cable is broken or the connector has lost contact	Measure the cable from the connector with an ohmmeter and check the pins for corrosion
Lamp never lights, pad is worn far beyond limit	Wear wire was never fitted, is at the wrong depth, or the sensor has been bypassed	Measure pad thickness with a caliper gauge or depth gauge and visually confirm the sensor is present
Lamp flickers intermittently, not steady	Wiring harness is rubbing due to axle movement, causing intermittent loss of contact	Trace the cable by hand along its full route, looking for chafing and pinch marks
Lamp does not go out after pad replacement	Sensor was not replaced together with the new pad, or the connector was not fully seated	Check that the connector clicks fully into place and measure circuit continuity
Lamp lights together with a metallic squeal	Pad is completely worn out, backing plate is contacting the disc	Inspect the disc immediately; if there are scores or grooves, disc inspection or replacement may be required
The two sides warn at different times	Caliper piston or guide pin is sticking, causing uneven pad wear	Check piston retraction and guide pin lubrication
Diagnostic tool shows a "sensor circuit open" code, but the bulb does not light	Dashboard lamp or supply fuse is faulty, sensor itself is sound	Test the lamp circuit and the relevant fuse separately

How is the wear sensor measured and checked?

Sensor checking starts by measuring the circuit at the connector with a multimeter. In the wear wire type, a sound sensor should give a resistance reading close to zero (closed circuit); infinite resistance (open circuit) indicates that the wire has broken — meaning the pad has reached its wear limit, or the cable has been physically damaged. For electronic sensors, the measurement depends on the signal characteristic; the vehicle's OE service manual should be consulted for the correct measurement procedure and expected value range. The second step is to measure pad thickness directly: the friction material thickness is measured with a caliper gauge or depth gauge and compared against the vehicle's minimum pad thickness reference. If the sensor signal and the physical measurement disagree, the problem lies with the sensor, not the pad.

Before replacing a sensor as "faulty," always trace the cable route by hand and physically measure the pad thickness. In a significant share of parts replaced in the field as a wear sensor fault, the real problem is a chafed or severed wiring harness; even after the sensor is replaced, the warning returns unless the cable itself is repaired.

Standards and further reading

This subject is governed by the equipment rules for air-braked commercial vehicles. In the United States the federal air brake standard, FMVSS 121 (49 CFR 571.121) defines the reservoirs, protection

and timing a compliant system must provide, and Europe applies the equivalent limits of UNECE Regulation No. 13. For further detail, see the on-road braking performance requirement in 49 CFR 393.52. Always confirm specific figures against the current regulation and the vehicle manufacturer service data.

Outside the United States the equivalent duties sit in national law. In the United Kingdom, regulation 18 of the Road Vehicles (Construction and Use) Regulations 1986 requires every part of the braking system to be maintained in good working order. In Canada, air brake systems fall under the Motor Vehicle Safety Regulations, which contain CMVSS 121.

How Is a Brake Pad Wear Sensor Replaced? Step by Step

1. Park the vehicle on level ground, apply the parking brake, and place wheel chocks.
2. Remove the relevant wheel to make the caliper visible and accessible.
3. Confirm the dashboard fault with a diagnostic tool and note the existing fault code record.
4. Disconnect the battery terminal if the ECU or dashboard connection is to be separated.
5. Disconnect the sensor connector; do not force the locking tab — if the pins bend, contact loss will persist even after fitting the new part.
6. Release the cable from its clips and note its original routing — the new cable must follow the same path through the same mounting points.
7. If the wear wire is embedded in the pad body, replace the sensor together with the pad set; do not pair the old worn wire with the new pad.
8. If the electronic sensor is mounted separately on the caliper, remove it from its housing and clean the seating surface.
9. Fit the new sensor/pad, seat the cable back into its original clips, and keep it clear of sharp edges and moving parts.
10. Seat the connector until it clicks audibly into place, then test circuit continuity with a multimeter.
11. Reconnect the battery, clear the fault memory, switch on the ignition to confirm the lamp goes out, and take a short test drive to confirm the warning does not return.

Points to Watch: Common Mistakes

- **Skipping the sensor at pad replacement:** a worn or near-limit wear wire that is not renewed together with the new pad triggers a fresh warning very quickly.
- **Routing the cable differently from its original path:** a cable left near a sharp edge or a moving part chafes through and breaks in a short time.

- **Leaving the connector not fully seated:** a half-fitted connector lets in water and dirt, causing intermittent loss of contact.
- **Aiming a high-pressure washer directly at the connector:** water can enter even a sealed connector and cause a fault that only shows up days later.
- **Ignoring the warning lamp and continuing to drive:** delaying replacement until the pad is fully worn directly raises the risk of disc damage and a longer braking distance.
- **Choosing the part by brand name:** the correct sensor is selected by the vehicle's engine and chassis code and the OE reference number on the existing part, not by brand name.
- **Checking only one side and skipping the other:** the two sides of the same axle can wear differently; the opposite side must also be checked when one side is replaced.
- **Clearing the code and driving off without a physical check:** if the physical cause of the fault has not been fixed, the code returns quickly, and the warning function is disabled the whole time.

Technical Values and Check Points

The table below summarizes the main points checked during brake pad wear sensor inspection and their general reference ranges. Values vary by vehicle, caliper family, and sensor type; the exact value should always be taken from the vehicle's current OE service manual.

Brake pad wear sensor check points (general reference)

Check point	General reference	What a deviation indicates
Wear wire circuit resistance (sound pad)	Close to zero, closed circuit	Infinite/open circuit: wire broken or pad has reached the limit
Minimum pad friction material thickness	In the range of a few millimeters (OE value is authoritative)	Below this, the risk of metal-to-metal contact and disc damage arises
Installation depth of the wear wire in the pad	Set to match the wear limit (OE value is authoritative)	Wrong depth: early or delayed warning
Wiring harness insulation integrity	No chafing marks, pinching, or cracking	Insulation damage: intermittent loss of contact and false warnings
Connector contact resistance	Low, corrosion-free contact	High resistance: false or delayed warning
Dashboard lamp behavior	Brief test illumination at ignition-on, then goes out (if no fault)	Stays on continuously: circuit open or pad has reached the limit
Electronic sensor signal range	Manufacturer-specific, narrow band (OE value is authoritative)	If the signal is lost or fixed, the sensor or connection is faulty

Monitoring the pad wear warning is one of the brake safety elements assessed under the **ECE R13** regulation, which forms the general type-approval and periodic inspection framework for commercial vehicle brake systems. The category and annex under which a given vehicle falls is defined in its type-approval documentation; in practice, the vehicle's current OE service document and the applicable inspection regulations should be treated as authoritative.

Brake Pad Wear Sensor Maintenance and Service Life

The service life of a brake pad wear sensor differs by sensor type. The wear wire type embedded in the pad is, by nature, a consumable part that "expires" together with the pad — once the wire breaks, it has already done its job and needs no further maintenance. The electronic type mounted on the caliper, on the other hand, can serve through several pad replacement cycles as long as it is not physically damaged; for this type, the deciding factor for service life is not pad wear but the soundness of the connector and wiring harness.

The factors that most shorten sensor life concentrate at the electrical connection points: moisture and corrosion in the connector, friction fatigue in the wiring harness caused by axle movement, and water ingress during high-pressure washing. On vehicles operating in salty, damp winter road conditions, applying a suitable electrical contact protectant to the connector area noticeably reduces faults caused by intermittent loss of contact. Keeping the original clips and clamps in place wherever the wiring harness could contact axle movement is also the cheapest way to prevent chafing damage.

Fleet operations are advised to add wear sensor circuit continuity measurement to their periodic maintenance plan. Even if the dashboard lamp has not yet lit, a stored (inactive) code may already be present in the diagnostic tool's memory; this code can be an early sign of fatigue starting in the wiring harness and allows it to be caught before a breakdown occurs. Sensor checking should be included as a standard routine at every service, alongside the pad replacement interval.

VADEN ORIGINAL Brake Pad Wear Sensors

VADEN ORIGINAL manufactures brake caliper sensor covers and sensor repair kits to OE dimensions for heavy commercial vehicle disc brake systems. The product range covers the sensor types used on the SB5, SN5, SB6, SB7, SL7, SM7, ST7, SN6, SN7 and SK7 caliper families; the same caliper group also includes pad holder repair kits, pad plates and brake lining retaining kits. To find the correct part, using the engine and chassis code together with the OE reference number on the existing part — rather than your vehicle's make and model — eliminates the risk of the wrong sensor type or an incompatible fitment.

The wear sensor does not operate in isolation from the rest of the disc brake system; it is one link in a chain that includes the caliper piston retracting properly, the guide pins moving freely, and the pad wearing evenly. A problem anywhere in this chain also affects the sensor's correct operation. The VADEN technical guide library includes separate fault, replacement, and maintenance guides for the disc brake caliper, the caliper pins and bushings, the pad holder, the ABS sensor, and the EBS modulator.