



TECHNICAL GUIDE

Solenoid Coil: Faults, Testing, Replacement and Maintenance

Understand how a solenoid coil works, spot open or shorted windings with a multimeter, replace it correctly and extend its service life on trucks.

When a vehicle does nothing with the ignition on, when the engine cranks but never fires, or when a valve command is given and nothing happens at all, the part most often blamed on the workshop ramp is the pump or the valve body. Yet in the field, what usually hides behind that picture is a winding no bigger than the palm of your hand: the solenoid coil. When this small part that converts an electrical command into mechanical movement burns out, the whole system attached to it does nothing, and the vehicle is stripped down needlessly until the fault is finally traced. This guide explains, through the eyes of a workshop foreman and a service technician, what the solenoid coil does, how it fails, how it is diagnosed with measurements, and which mistakes during replacement come straight back to the vehicle.

This document has been prepared by the VADEN technical team, based on heavy commercial vehicle fuel and pneumatic system service practice together with OE manufacturer documentation. The values given here are general reference figures; for exact data such as coil resistance, supply voltage and tightening torque, the current OE service manual matching the vehicle engine/chassis code is authoritative. Last updated: July 2026.

What Is a Solenoid Coil? Function and Operating Principle

A solenoid coil is an electromagnetic winding that generates a magnetic field when current passes through it and pulls the movable core (armature) inside the valve; on a heavy commercial vehicle it opens and closes fuel shut-off and fuel system valves on electrical command. In heavy commercial applications it is typically supplied with 24 V DC, draws 8–30 W and changes position within 10–60 ms. When the coil burns out, the system cannot carry out the given command even if the valve is mechanically sound.

The same part goes by several names in the field and in catalogues: **solenoid coil**, **magnetic coil**, **valve coil**, **electromagnet winding**, and in the fuel shut-off application **stop solenoid**. All of them do the same job: turning the current flowing through a copper winding into magnetic force. Whatever name it is searched under, the selection criteria stay the same: supply voltage, coil body form and OE reference number.

The operating principle is simple but the tolerance is narrow. The ignition switch or control unit applies voltage to the coil, current flows through the winding and the iron core in the middle of the coil becomes magnetised. The magnetic field pulls the movable armature inside the valve against spring force; as the armature shifts, the valve passage opens or closes. When the current is cut, the magnetic field collapses and the spring pushes the armature back to its initial position. In other words, the coil does not manage the fluid directly, it only moves the valve; the part in contact with the fluid is the valve body. This distinction is vital in diagnosis, because the valve may be jammed while the coil is healthy, or exactly the opposite may apply.

Two typical control methods are seen on heavy commercial vehicles. The first is *full voltage* (on/off) control: the coil is either given full supply or none at all. The second is *pulse width modulated* (PWM) control, where the control unit switches the coil at high frequency and thus reduces the average current. Some fuel shut-off applications also use a dual winding arrangement: the thick-wire **pull-in winding** pulls the armature strongly for a short period, while the thin-wire **hold winding** maintains the position at low current. If the pull-in winding is left

energised continuously, it heats up and burns within minutes; this is one of the most common coil burnout scenarios encountered in the field.

Division of work between the coil and the valve body

A solenoid coil represents the electrical side of the valve; hydraulic or pneumatic sealing is the job of the valve body. In most designs the coil slides onto the sleeve on top of the valve body and is secured with a single nut, which means the coil alone can be replaced without draining the system. From a service point of view this separation is a major advantage: in an electrical fault the valve is not removed, the fluid is not drained, only the winding is renewed.

Components and auxiliary elements

- **Copper winding and bobbin (coil body):** the enamelled wire that generates the magnetic field and the plastic carrier body.
- **Magnetic circuit parts:** core, sleeve, pole piece and outer magnetic frame.
- **Armature and return spring:** the movable core and the spring that pushes it back to its initial position.
- **Encapsulation resin:** the potting material that protects the winding against moisture, vibration and heat.
- **Connector and seal:** socket form, gasket/O-ring and cable entry sealing.
- **Retaining nut and washer:** the elements that position the coil on the sleeve.
- **Suppression (freewheeling) diode or varistor:** the protective element that damps the reverse voltage spike generated when the coil is switched off.
- **O-ring and sealing kit:** the elements supplied in the repair kit on the valve body side.

Solenoid coil types and typical application comparison (general reference; voltage V DC, power W)

Coil type	Typical supply	Typical power / current	Heavy commercial application example
Single winding on/off coil	24 V DC (12 V variant available)	8–20 W · 0.3–0.9 A	Fuel system solenoid valves, control valves
Dual winding (pull-in + hold) coil	24 V DC	High short-duration current on pull-in, low current on hold	Fuel shut-off (stop) solenoid applications
PWM controlled proportional coil	24 V DC, modulated	Average current set by the control unit	Proportional flow/pressure control valves
High protection class externally mounted coil	24 V DC	10–30 W	Under-chassis positions exposed to mud and salt
Coil/valve assembly renewed with a repair kit	Depends on the valve assembly	According to the assembly rating	Valves with fatigued sealing elements but a sound winding

On the electrical and environmental requirements side, solenoid coils are assessed against the **ISO 16750** family of environmental/electrical load conditions defined for road vehicle electrical equipment, against the **IEC 60529 (IP code)** definition in terms of protection class, and against **ECE R10** for electromagnetic compatibility. On coils using an industrial style connector, the socket

geometry often corresponds to the **DIN EN 175301-803** family. These standard families are given as guidance; which class a specific part falls into must be verified from the relevant OE catalogue.

A solenoid coil is a part that looks extremely similar from the outside: two coils of the same diameter, the same colour and held by the same nut may be 12 V and 24 V respectively, or they may differ in resistance and connector form. Do not select the part by eye or by vehicle model alone. Verify the OE number on the old coil, the voltage rating on the label and the connector form together. A coil of the wrong voltage burns the winding on the first run; a coil of the wrong resistance stresses the output stage of the control unit.

How do you recognise a solenoid coil fault?

Solenoid coil faults appear in three main forms: broken winding (open circuit), winding short circuit and leakage to the body. The most frequent picture in the field is an open-circuit winding after thermal fatigue, with the valve not moving at all. The table below matches typical symptoms with probable causes and verification methods.

Solenoid coil fault symptoms, probable causes and verification methods (field reference)

Symptom	Probable cause	Check / verification
Command is given but no click is heard from the valve	Broken winding (open circuit) or supply not reaching the coil	Voltage measurement at the connector; resistance measurement across the coil terminals (infinite reading means a broken winding)
Fuse blows or the control unit output protects itself	Short circuit inside the winding, harness contact with the body	Resistance measurement (clearly below the nominal value means a short circuit); the coil is disconnected and the circuit retried
Works when the vehicle is cold, fails to carry out the command once warm	Thermally fatigued winding; resistance rises when hot and pull-in force drops	Separate resistance measurements cold and hot; retest at operating temperature
Coil body overheats, plastic is deformed or there is a burnt smell	Coil of the wrong voltage, failure to switch to the hold winding on a dual winding system, remaining permanently energised	Comparison of the label voltage with the vehicle voltage; monitoring of the control signal with an oscilloscope or test lamp
Fault recurs in damp weather or after washing	Fatigued connector seal, cracked encapsulation, insulation leakage to the body	Insulation resistance measurement (coil terminal to body); drying the socket and retrying
Valve clicks but the system does not respond	Coil is sound, armature or valve body jammed, fluid side blocked	Magnetic field test with a screwdriver on the core with the coil removed; mechanical movement check of the valve
Fault is intermittent and appears when the vehicle is shaken	Loose connector pin, hairline break in the cable, slackened retaining nut	Measurement under vibration while loading the harness; check of pin tightness

Symptom	Probable cause	Check / verification
Open circuit or short circuit fault code in the control unit	Loss of continuity or leakage in the coil circuit	Reading the code together with its freeze frame data, then verifying the coil resistance by measurement

Quick differentiation by resistance measurement

Solenoid coil diagnosis centres on the ohm measurement. The socket is disconnected, the multimeter is set to the resistance range and connected to the two coil terminals, and the reading is compared with the label/catalogue value of the part. If the measurement is infinite the winding is broken; if it is clearly below the nominal value there is a short circuit inside the winding. Since the resistance of copper rises with temperature, take the measurement on as cold a part as possible and, in doubtful cases, compare a hot and a cold reading. The acceptance range is specific to the part; the binding value comes from the OE catalogue.

Insulation and body leakage check

A solenoid coil winding that leaks to the body produces the most intermittent and most frustrating type of fault: the vehicle works flawlessly when dry and fails to carry out the command after washing or rain. To check this, the insulation resistance between either coil terminal and the metal body is measured; on a sound coil this value must be very high (in practice in the megaohm range). A low reading points to a crack in the encapsulation or to moisture ingress, and the coil is renewed.

Magnetic field test and audible verification

The fastest field test for a solenoid coil without removing it is to bring a small steel screwdriver close to the coil body at the moment the command is given: if the winding is working, a clear magnetic pull is felt at the tip. The second method is to listen; a crisp click at the moment of command shows that the armature has moved. If there is a click but the system does not respond, the culprit is not the coil but the valve body or the fluid side. These two simple tests are the cheapest barrier against unnecessary part replacement.

Further reading

For a plain-language technical overview of this subject, see the reference article on [Wikipedia](#). Always confirm specific figures and procedures against the vehicle manufacturer service data.

How is a solenoid coil replaced? Step by step

Solenoid coil replacement is a short job that in most designs can be carried out without draining the system; the real risk lies on the electrical side and in assembly discipline.

Before starting work, disconnect the battery isolator or the negative terminal. The coil body may be very hot after operation; do not handle it without gloves. When working on fuel system valves there must be no open flame or source of sparks nearby, and a fire extinguisher must be within reach. Personal protective equipment is essential: impact-resistant goggles, fuel-resistant gloves

and work clothing. If the valve body is to be removed on a pressurised system, the system pressure must first be released according to the procedure.

- 1 Secure the vehicle:** Stop the engine, apply the parking brake, chock the wheels and disconnect the battery isolator/negative terminal. Do not start work on a hot engine or a pressurised system.
- 2 Verify the fault by measurement:** Before removing the coil, measure the supply voltage at the connector and then the coil resistance. If there is no supply, the problem is not in the coil but in the circuit; replacing the coil will not solve the fault.
- 3 Clean the area:** Free the coil and the area around the valve of dust, mud and oil with compressed air and a clean cloth. Dirt that falls during removal is carried into the valve seat and the connector.
- 4 Disconnect the connector correctly:** Release the locking tab of the socket and pull it by its body; never pull on the cable. Sockets pulled by the cable develop hairline breaks that come back as intermittent faults weeks after assembly.
- 5 Mark the fitting position:** Note or photograph the cable exit direction of the coil and any orientation mark. The cable of a coil fitted at the wrong angle becomes taut and rubs against the neighbouring part.
- 6 Undo the retaining nut:** Loosen the nut holding the coil on the sleeve with a correctly sized spanner and do not lose the washer. Pull the coil off the sleeve straight along its axis without rocking it; if it is tight, work it off with a slight rotation and do not use a lever.
- 7 Inspect the removed part:** Burn marks, a swollen plastic body, a blackened connector pin or cracked encapsulation reveal the root cause of the fault. If you find a burnt coil, also investigate the possibility of excess current or permanent energising in the circuit; otherwise the new one will burn for the same reason.
- 8 Verify the new coil:** Compare the voltage rating on the label, the inner diameter, the length, the connector form and the OE reference with the old part side by side. Measuring and recording the resistance of the new coil before fitting creates a reference for future services.
- 9 Renew the seals, seat the coil and torque it:** If the valve body has also been removed, always renew the O-ring and sealing elements from the repair kit; an O-ring that is removed and reused starts to leak on the first thermal cycle. Then slide the new coil onto the sleeve without forcing it, fit its washer and tighten the retaining nut with a torque wrench to the low value specified by the manufacturer. Overtightening cracks the plastic body, while undertightening allows the coil to move on the sleeve under vibration and reduces magnetic efficiency.
- 10 Arrange the socket and the cable:** Seat the connector fully until the lock clicks, verify that its seal is in place and clip the cable along its original route without tension. The cable must not touch a hot surface or a moving part.

- 11** **Test and clear the codes:** Reconnect the battery, give the command and verify the click and the expected system response. Clear the fault codes, then read them again after a short test drive or operating cycle; also check the temperature of the coil body by hand. Abnormal heating means the problem in the circuit is still present.

What are the common mistakes in solenoid coil replacement?

Most mistakes in solenoid coil replacement stem not from the part itself but from a failure to investigate the root cause of the fault.

Replacing a burnt coil with a new one without investigating the root cause brings the same fault back in a short time. A coil does not burn by itself; the cause is usually a part of the wrong voltage, failure to switch to the hold position on a dual winding system, a control unit output that stays permanently energised, or a suppression diode that is out of circuit. Always measure the supply voltage and the duration of the control signal before fitting the new coil.

Tightening the retaining nut of the coil like an ordinary bolt "to be on the safe side" cracks the plastic body and the encapsulation resin. Moisture entering through the crack comes back months later as insulation leakage to the body, and the fault turns into an intermittent error that appears after washing. This nut is tightened at low torque, preferably with a torque wrench.

- **Replacing parts without measuring:** Changing the coil when no supply voltage is present at all is a waste of time and money; voltage is measured at the socket first.
- **Voltage mismatch:** Fitting a 12 V coil to a 24 V system burns the winding within minutes; the label value is always verified.
- **Pulling the connector by the cable:** Removal without releasing the locking tab loosens the pins and creates hairline breaks.
- **Striking the encapsulation surface:** Forcing a stuck coil with a hammer or a lever deforms the magnetic circuit and the winding.
- **Reusing seals:** When the valve body is removed, the O-ring and sealing elements from the repair kit must be renewed.
- **Changing the cable route:** A cable not fitted into its original clips moves closer to the exhaust, chafes under vibration and breaks in time.
- **Fitting the coil onto a dirty sleeve:** Rust and deposits on the sleeve surface prevent the coil from seating fully and reduce magnetic efficiency.
- **Ignoring the suppression diode:** In a circuit where the protective element is not working, the voltage spike at switch-off wears out both the coil and the control output.
- **Skipping the mechanical condition of the valve:** If only the coil is changed while the armature is jammed, the fault continues unchanged.
- **Handing the vehicle over without testing:** A single trial on a system that has not reached operating temperature will not catch thermal faults.

Solenoid coil technical values and check points

The values given below for the solenoid coil are general reference ranges commonly encountered in heavy commercial vehicle fuel and control systems. The application, winding design and year of manufacture change these ranges; the binding data is always the OE catalogue of the part and the service manual of the vehicle.

Solenoid coil technical values (general reference)

Parameter	Typical range (general reference)	Note
Nominal supply voltage	24 V DC (12 V DC in some applications)	The label value must match the vehicle system exactly
Operating voltage range	Approximately 85–110 percent of nominal	At low voltage the pull-in force drops and the valve may not open fully
Coil resistance (20 °C)	Approximately 15–70 ohm	Varies with the power class; the acceptance range is specific to the part
Current draw	0.3–1.2 A	Briefly higher on pull-in with the dual winding type
Power consumption	8–30 W	Selected close to the lower band on continuously energised types
Response (switching) time	10–60 ms	Spring force and fluid pressure affect the time
Operating temperature range	Approximately –40 °C to +120 °C	Runs close to the upper limit in an engine bay position
Winding insulation class	Class F or H (approximately 155–180 °C)	The higher class is preferred in continuously energised applications
Protection class (IEC 60529)	IP65–IP69K range	The higher class is required in under-chassis positions exposed to washing
Insulation resistance to body	High, in the megaohm range when sound	A low reading means moisture ingress or a crack in the encapsulation
Operating pressure of the driven valve	Fuel side 0.5–10 bar · pneumatic side 8–12.5 bar	Pressure is data of the valve body, not of the coil

Typical tightening torques for the solenoid coil and valve assembly (general reference, Nm)

Connection point	Typical torque band (general reference)	Application note
Coil retaining nut (on the sleeve)	3–8 Nm	Low torque; overtightening cracks the plastic body
Valve body connection to the block/manifold	15–35 Nm	With a new sealing element
Mounting bracket bolt	8–12 Nm	Keeps the vibration load away from the coil
Screwed electrical terminal connection (if fitted)	1–3 Nm	Overtightening deforms the pin housing

Torque and resistance values are guidance ranges only. Two coils of different power classes on the same vehicle show different resistance, and some manufacturers define separate acceptance bands for cold and hot measurement. In practice the authority is the current service manual specific to the vehicle manufacturer's engine/chassis code and the OE data sheet of the part.

- Is the coil resistance within the catalogue band on a cold measurement?
- Is the insulation resistance between the coil terminal and the metal body high?
- Are the connector pins bright, or is there blackening or green corrosion?
- Is the socket seal in place and flexible, and is the locking tab intact?
- Are there cracks, swelling or burn marks on the coil body?
- Is the retaining nut at the correct torque, or does the coil move on the sleeve?
- Is the cable on its original route and clipped, or does it touch a hot surface?
- Is the coil temperature at a normal level after operation?
- Is the control signal cut off within the expected time, or does it stay permanently energised?

How is solenoid coil maintenance carried out and its service life extended?

A solenoid coil has no declared replacement interval; three factors determine its service life: heat, moisture and vibration. A coil supplied with the correct voltage, kept dry and seated properly on its sleeve is one of the long-lived parts of the vehicle and can work faultlessly for hundreds of thousands of kilometres. A coil with a leaking socket, a taut cable or a permanently energised circuit, by contrast, can burn out before a single season is over. The most common cause of early failure in the field is not the part itself but a poor mounting position where heat and moisture act together.

- **Connector care:** On every electrical job, verify that the socket seal is in place; clean blackened pins and use a suitable contact protector.
- **Washing discipline:** Do not aim the high-pressure washer lance directly at the coil and the socket; even with a high IP class, a hot water jet from close range shortens seal life.
- **Cable routing:** Fit the cable into its original clips at every service; a cable that is taut, chafing or passing close to a hot surface fails before the coil does.
- **Vibration check:** A slack bracket and a loosened retaining nut let the coil move on the sleeve; this must be checked by hand at every periodic service.
- **Voltage quality:** A weak battery, an oxidised earth point or a fatigued alternator delivers low voltage to the coil; at low voltage the armature does not pull in fully and the coil heats up needlessly.
- **Energised duration:** Not leaving the vehicle on the ignition unnecessarily directly reduces the thermal load on continuously energised coils.
- **Not neglecting the valve side:** Dirty fluid jams the armature; a coil trying to pull a jammed armature draws more current and becomes fatigued. Filter maintenance also extends coil life.

- **Spare stock logic:** In fleet operations, keeping one suitable spare coil in stock per vehicle reduces roadside downtime from hours to minutes.

On the fleet side, the most efficient approach is to think of the coil not on its own but together with the valve assembly. Renewing the sealing elements with a repair kit while the valve body is already off is far more economical than the cost of bringing the vehicle back into the workshop a few months later. And the five-minute temperature and click check carried out after coil replacement is the cheapest insurance against a repeat fault.

This document is for information only; in practice the vehicle manufacturer's current service manual and safety instructions apply. Values are general references for common heavy-duty systems; use the relevant OE service document for model-specific figures. © VADEN Otomotiv San. Tic. A.Ş. · vadenoriginal.com