Electric Fuel Pumps
Models, Damages, Reasons
MSI Motor Service International GmbH. And what it stands for.

MSI Motor Service International GmbH is the sales organisation for the global aftermarket activities of Kolbenschmidt Pierburg AG. Under the premium brands KOLBENSCHMIDT, PIERBURG and TRW, we supply a comprehensive range of requirement-oriented products in and on the engine.

Repair shops and engine reconditioners have engine components for more than 2000 different engines at their disposal. All products meet high requirements on quality, economic efficiency and environmental protection.

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As a long-standing partner of the automotive manufacturers, the companies in the Kolbenschmidt Pierburg Group develop innovative components and system solutions with renowned competence in the fields of air supply and emission control, for oil, water and vacuum pumps, for pistons, engine blocks and engine bearings.

The products of Kolbenschmidt Pierburg Group comply with the high demands and quality standards of the automotive industry. Low emissions, reduced fuel consumption, reliability, quality and safety – there are the forces that drive innovation at Kolbenschmidt Pierburg.
# Electric Fuel Pumps

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1 Introduction

1.1 Foreword

The heart of the vehicle
The electric fuel pump is an important component in the vehicle.

If there is a malfunction in the fuel pump, or if it fails completely, it is often difficult for a workshop to determine the cause of the damage with absolute certainty.

After a new pump has been installed, damages and malfunctions often occur again within a brief period of time because although the damaged components were replaced, the actual cause of the damage was not remedied. Therefore a more comprehensive approach to the entire fuel system is required.

In the course of processing complaints concerning Pierburg fuel pumps we have discovered that the vast majority of electric fuel pumps that are returned are completely OK.

When an electric fuel pump malfunctions prematurely, this is almost always caused by fuel that is dirty or diluted with water, or of a poor quality.

The consequences of pumping contaminated fuel can be:
– Reduced delivery rate,
– Reduced pressure,
– Low performance,
– Misfires or even
– Complete failure of the electric fuel pump.

External appearances
In the workshop a defective or returned pump can be assessed only according to its outward appearance and delivery rate or pressure (please refer to Section 5.2 as well).

In many cases, the decision on whether a complaint is justified or not can be made only when the fuel pump is opened and the damage is viewed “from inside”.

The staff of a workshop may not open a fuel pump that is still under warranty or returned due to complaints on their own.

If the staff of a workshop or parts distributor opens a fuel pump that has been returned due to a complaint, the guarantee will expire automatically.

Views of hidden areas
An important concern of this brochure is to explain what could have been responsible for the failure of a fuel pump.

Therefore a host of pictures shows what it looks like inside the pumps that are returned due to complaints.

This brochure offers assistance in diagnosing and determining the causes. It is designed as a help for workshops and as information for distributors that handle defective or returned fuel pumps on a daily basis.

Based on common instances of damage, we show what it looks like inside defective or returned pumps, and what the causes of the damage could be.

This information will help you process damage claims with your customers in the workshop.

The content of this brochure is a compilation of findings gathered from service work by MSI Motor Service International, the Aftermarket Division of Kolbenschmidt Pierburg AG.

For this reason, this brochure concentrates on fuel pumps marketed by MSI Motor Service International.
1.2 General information on this brochure

– All illustrations and drawings in this publication are intended for general information.
– Certain details may not always match the current design of the construction.
– We reserve the right to make technical changes by further development without the necessity of changing this publication.

Please note:
This brochure was designed exclusively for technical personnel. Technical personnel are persons who, based on their professional training, experience and schooling, have adequate knowledge of
– Safety regulations,
– Accident prevention regulations and
– Directives and acknowledged technical rules (e.g. standards)

1.3 Pictograms and Symbols

The following general pictograms and symbols are used in this brochure:

⚠ Calls attention to dangerous situations in which personal injuries or damages to vehicle components are a possibility.

Information on environmental protection.

Information on useful advice, explanations and details on handling.

[...] Reference to sources and further reading (please refer to ➔ Section 6.1)

This type of damage cannot be detected from outside. The damage descriptions with this symbol are visible only by opening, and thus harming the fuel pump.

By necessity, many of the images used in this brochure are extreme close-ups of very small components. For a better understanding of the correlations, a pictogram of the model accompanies the illustrations of the pumping mechanisms. The individual models are explained in Section 2.2
1.4 Safety Instructions

- For safety reasons, only technical personnel may perform work on fuel systems and electric fuel pumps.
- The personnel charged with the work must have read and understood this publication before starting the job.
- Observe the applicable respective legal provisions specific to your country and the appropriate safety regulations.
- Safety devices must not be switched off or bypassed.
- Provide sufficient ventilation in the workplace.
- Wherever required or mandated by regulations, use personal safety equipment.
- In addition, the safety regulations specific to your country apply!
- Store parts that have been removed in a clean place and keep them covered.
- Keep the transportation seals on the new fuel pumps until you are ready to install them.
- Never use compressed air to clean an open fuel system.
- Dispose of used materials, cleaning agents and waste matter in an environmentally friendly manner.
- Observe the safety regulations governing the handling of fuel and fuel vapours. Fuel and fuel vapours are highly inflammable.

During work on fuel pumps
- smoking,
- open fires,
- open flames and
- sparking producing activities are strictly prohibited.

1.5 Liability

All information in this brochure has been carefully researched and compiled. Nevertheless, errors can occur, information can be translated incorrectly, information may be missing, or the information provided may have changed in the meantime.

Therefore, we cannot guarantee or accept legal responsibility for the correctness, completeness, update status or quality of the information provided.
We do not accept any liability for damages, especially direct or indirect and material and immaterial arising from the use or misuse of information or incomplete or erroneous information contained in this brochure unless caused by a deliberate act or gross negligence on our part.

Use of the information given is solely at the risk and responsibility of the workshop staff. Likewise, we shall not be liable for damages arising because the workshop staff do not have the necessary technical expertise, the required knowledge of, or experience in repairs.
2 Basic principles

2.1 Fuel system

To operate vehicles and machines with combustion engines, normally petrol or diesel fuel is required. The components used for this purpose are classified under the term “fuel system”.

The components of the fuel system have changed over the decades. The current state of today’s injection engines is explained in simplified form in Fig. 2.

The fuel pump suctions the fuel from the fuel tank and delivers it to the fuel supply system with the required pressure.

There is often a coarse filter (also “sieve filter”) in the fuel tank or in the suction pipe. A fine mesh filter on the suction side could damage the fuel pump by cavitation *).

There is also a risk of cavitation caused by other components installed on the suction side that constrict the width of the pipe.

The fuel filter on the pressure side of the pump protects the injection valves from impurities.

The pressure regulator regulates the pressure to the necessary level in the rail. It is often operated pneumatically by the vacuum in the intake manifold.

The fuel is fed from the rail to the individual injection valves.

All vehicle manufacturers offer injection systems in different versions. A more detailed explanation of the individual systems is beyond the scope of this brochure.

Surplus fuel is fed back into the fuel tank.

The fuel pump is the “heart” of the fuel system.

In every operating state, sufficient fuel must be supplied to the engine. If this does not occur, there will be malfunctions in the vehicle operation and the vehicle can even stop running.

The fuel pump is only one of many components in the fuel system, and as such, is only one possible source of faults.

For this reason, when there is a malfunction, the fuel system must be considered in its totality.

Because, as with a person with “heart problems” the actual cause can be somewhere else.

The vast majority of all malfunctions in the fuel system are due to impurities in the fuel.

The cause of these impurities can be due to many sources, as explained in Section 3.

* Cavitation is the formation of bubbles in liquids under low pressure. The resulting bubbles implode immediately, which can damage parts of the pumping mechanism.
2.2 Models

The way electric fuel pumps are designed today, the pumping mechanism sits directly on the shaft of the electric motor. They are flooded with fuel, which cools and “lubricates” them at the same time.

Advantages:
– Fewer moving parts
– Compact construction
– Low overall dimensions

There are different designs of pumping mechanisms. Roughly a distinction can be made between flow and displacement pumps.

- Flow pumps
  In flow pumps the fuel is conveyed by the centrifugal force of a rotor. They generate only low pressures (0.2 – 3 bar) and are used as the preliminary stage of a two-stage pump or as a pre-feeder pump.
  The fuel flows through the flow pump freely without throttles or valves. For this reason the fuel can flow back through the flow pump when the vehicle is stopped.
  Flow pumps are not self-priming, i.e., they must always be placed below the fuel level in the fuel tank (max. suction length 0 mm).
  “Side channel” pumps are flow pumps.

- Positive displacement pumps
  In positive displacement pumps the fuel is forced through enclosed chambers.
  They are used for higher system pressures (up to approx. 6.5 bar) such as those that dominate in conventional injection systems.
  Except for leaks due to the design, even when the vehicle is stopped, the fuel cannot flow back through the displacement pump in the opposite direction.
  Positive displacement pumps include the toothed ring, sliding vane, roller vane and screw pumps.
  Positive displacement pumps are self-priming only to a very limited extent, i.e., they should be installed below the fuel level of the fuel tank (max. suction length 500 mm).
  Fuel cannot be forced through a positive displacement pump!
  In other words, if such a fuel pump malfunctions, it must be replaced.
  It is useless to install an additional pump before or behind the existing pump (in a row).

A distinction is made between in-tank and in-line pumps, based on their location in the vehicle.

The trend is toward in-tank pumps, or complete fuel supply modules in which other components such as fuel level sensors or diagnostic systems are included in or attached to the fuel supply module.

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Motor size
(Pump Ø in mm)
1 = 38 mm
2 = 43 mm
3 = 43 mm increased power

**Fig. 3** Pierburg abbreviations for electric fuel pumps
**Electric Fuel Pumps**

**BASIC PRINCIPLES**

- **Sliding vane pump – E1F**
  - Prefilter
  - Sliding vane pumping mechanism
  - Electric connection
  - DC motor
  - Pressure holding valve
  - Suction side
  - Pressure side

*Fig. 4  Pumping principle and cross-section (schematic) of a sliding vane pump*

- **Side channel pump – E1S**
  - Side channel pumping mechanism
  - Electric connection
  - DC motor
  - Pressure holding valve
  - Suction side
  - Pressure side

*Fig. 5  Pumping principle and cross-section (schematic) of a side channel pump*

- **Screw pump – E3L**
  - Prefilter
  - Clutch
  - Pressure holding valve
  - Screw pumping mechanism
  - DC motor
  - Electric connection
  - Suction side
  - Pressure side

*Fig. 6  Pumping principle and cross-section (schematic) of a screw pump*

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1) The pressure holding valve maintains a holding pressure in the fuel system even when the ignition is OFF.
**Basic Principles**

- **Toothed ring pump – E2T/E3T**

  Fig. 7  Pumping principle and cross-section (schematic) of a toothed ring pump

- **Toothed ring pump with preliminary side channel stage – E3TS**

  Fig. 8  Pumping principle and cross-section (schematic) of a two-stage pump

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1. The pressure holding valve maintains a holding pressure in the fuel system even when the ignition is OFF.
2. The pressure limiting valve will open if the pressure inside the fuel pump increases to unacceptably high levels.
3) The ejector pump uses the Venturi effect: The fuel flowing back from the engine is forced through the nozzle of the ejector pump, which ejects the fuel out of the tank into the reservoir.
### 2.3 Block diagrams of examples of electric fuel pump installations

A distinction is made between in-tank and in-line fuel pumps, depending on the type of installation in the vehicle.

- In-line pumps are placed in the fuel line.
- In-tank pumps are placed in the fuel tank. In the case of in-tank pumps, other components such as fuel level sensors or diagnostic systems can be included directly in or attached to the fuel supply module.

Interim and special solutions such as half-in-tank pumps (e.g. Golf II) are not listed here.

One or two fuel pumps are connected one after another, depending on the requirements.

- A single fuel pump
- Two fuel pumps (pre-feeder and main pump)
  Pre-feeder pumps supply the fuel to the main pump at low pressure.
- A single, but two-stage fuel pump

These types of possible installations are shown in the adjoining illustrations.

**Fig. 10** Fuel pump in-line

**Fig. 11** Fuel pump in-tank

**Fig. 12** Pre-feeder pump in-line/main pump in-line

**Fig. 13** Pre-feeder pump in-tank/main pump in-line

**Fig. 14** Two-stage fuel pump in-line

**Fig. 15** Two-stage fuel pump in-tank
Fuel in reservoir (“swirl pot”); stages are sealed off from each other
3 Damages

3.1 Overview

The main cause of malfunctions or damages to electric fuel pumps are consequential damages caused by fuel that is dirty or diluted with water.

Other causes are poor quality fuel, impact damage or simply the incorrect arrangement or choice of fuel pumps.

In the following subsections you will find individual damages and an explanation of their possible causes. In order of frequency, they are:

- Damages caused by dirt (see ➔ Section 3.2.1)
- Damages caused by water (see ➔ Section 3.2.2)
- Wrong use or application (see ➔ Section 3.4)
- Poor fuel quality (see ➔ Sections 3.2.3 and 3.3)
- Mechanical damages/installation errors (see ➔ Sections 3.5 and 3.6)

Please note that the individual causes cannot always be clearly distinguished from each other. Thus “rust particles” that are a result of water in the fuel, strictly speaking must also be listed under the “damages caused by dirt” category. Likewise a frequent characteristic of poor quality fuel is too much water, which then can lead to corrosion and damages caused by dirt. Due to the frequency of “water damages” they will be dealt with in a separate subsection.

The content of this brochure is a compilation of findings gathered from service work by MSI Motor Service International, the Aftermarket Division of Kolbenschmidt Pierburg AG.

For this reason, this brochure concentrates on fuel pumps marketed by MSI. An important concern of this brochure is to explain what could have caused the damage because “from outside” it is generally impossible to tell by looking at a fuel pump why it is no longer working or why it isn’t performing adequately.

In many cases the fuel pump has to be opened, and thus irretrievably damaged, in order to determine the cause of the failure.

Even a reading of OBD fault codes in newer vehicles can only be considered a helpful tool. Because it is not always the component indicated by the OBD that actually caused the damage.

This requires the expertise of a specialist with knowledge of the system. This is the only way to ensure that the actual cause will be addressed and not just a symptom, so that the damage will not recur after a few hundred kilometres.

In the course of processing complaints we have discovered that the vast majority of electric fuel pumps that are returned meet the required specifications.

To avoid unnecessary work and additional costs, MSI Motor Service International has developed an easy-to-operate tester for wholesalers and importers (please refer to ➔ Section 5.2). It offers the ability to check the functioning of electric fuel pumps locally without damaging them.

This way unjustified complaints can be detected without a problem and unnecessary returns and costs can be avoided.
3.2 Contaminated fuel

3.2.1 Damages due to dirt

The most frequent cause of malfunctions in the fuel system or premature failure of fuel pumps is impurities with larger or smaller particles.

They produce different effects:
– Clogging of filters
– Reduction of fuel delivery rate
– Excessive noise in the fuel pump
– Dry running of the pump
– Blocking of the pumping mechanism

Possible causes can be:
– Rust or lime particles (for “water damages” see ➔ Section 3.2.2)
– Impurities in the fuel tank from outside (e.g. while filling the tank)
– Ageing of the fuel by long periods of disuse (formation of deposits)
– Failure to adhere to maintenance schedule (filter change)
– Poor fuel quality (see ➔ Section 3.2.3)
– Old, porous fuel hoses
– Impurities and water due to a frayed fuel tank vent hose or due to improper retrofitting of a fuel tank vent hose.
Clogging of filters
If fuel filters or sieves are clogged by impurities on the suction side, they will first show the following symptoms:
– Insufficient delivery rate
– Pressure not reached
– Excessive noise in the fuel pump
– Engine misfires (due to bubbles)
This can cause the fuel pump to fail and the vehicle to break down.

Most modern fuel pumps are rinsed thoroughly by the fuel, which also lubricates and cools them. If this does not occur to a sufficient degree, for example, if a prefILTER or sieve filter in a fuel pump intake is clogged, there is a danger of “dry running”. Dry running will cause damage to the pumping mechanism very fast.

E1F, E2T and E3T series fuel pumps have a sieve filter built in on the suction side. This small “prefilter” is a protection against impurities. Inspections of returned fuel pumps have revealed that this sieve filter is often clogged with dirt from the intake fuel.

When retrofitting with an E1F, please note:
In diesel operated vehicles the sieve filter must be removed because it can cause problems due to the higher viscosity of the diesel at low temperatures.
Electric Fuel Pumps

DAMAGES

- **Blocking of the pumping mechanism**
  If debris is sucked into the fuel pump, the rotating parts of the pumping mechanism will often become blocked. Usually this will cause the pump to fail immediately.

Debris gets into the fuel pump if either the fuel filter or sieve on the suction side is damaged or missing.

There is a danger of debris getting into the fuel tank while work is being done on it.

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**Fig. 24** Pumping mechanism of a sliding vane pump - damage due to debris
The upper right vane is severely damaged by debris.
For comparison purposes an undamaged vane was inserted on the bottom right-hand side.

**Fig. 25** Scratches made by debris
Fig. 26  E2T toothed ring pump - damaged by debris

Fig. 27  Debris that has caused damage (enlarged compared with a paper clip)

Fig. 28  Typical abrasions made by debris
Electric Fuel Pumps

DAMAGES

Fig. 29  Chips in the sieve filter
Here metal chips have landed in the fuel tank while work was being done on the fuel system. The sharp-edged chips have damaged the sieve filter. This way dirt can get into the pump and block the pumping mechanism.

Fig. 30  Dirty pumping mechanism of a sliding vane pump
The rotor is so dirty that the individual vanes (removed here) can no longer move. The pump still “runs” but no longer conveys fuel.

Figs. 31 and 32 show a case where liquid sealing compound got into the fuel tank while work was being done on the fuel system. The sieve filter was not able to stop this sealing compound. It jammed the pumping mechanism.

Fig. 31  Sealing compound in the sieve filter

Fig. 32  Sealing compound in the pumping mechanism (trochoid toothed wheel)
In-tank pumps often have a mesh filter on the suction side. During installation, make sure that the filter, and here especially any reinforcements that may be present in the filter, are not damaged (see also Section 3.6.2).

Figure 33: Damaged filter of an in-tank pump
Here dirt can enter easily or fractions of the reinforcement in the filter can block the pumping mechanism.

Figure 34:
The vanes of the pump fan of a type E1S side channel pump were damaged by a piece of debris (below). The fractions (right) ended up in the filter.

Figure 35:
For comparison: View of the suction side socket of a side channel pump with undamaged pump fan (below)
3.2.2 Water damage (corrosion)

A special form of damage due to dirt is damage from water in the fuel system.

Rust or lime particles that are a result of water in the fuel can clog filters and thus cause dry running. Lime and rust deposits on or in the fuel pump reduce the slackness between the components. This limited movement will increase the power consumption and reduce the delivery rate until the fuel pump is blocked.

The term “water damages” in the fuel pump may seem strange at first, but the fuel can become contaminated by water in many ways:

- **Water condensation in the tank**
  The ambient air, as well as the air above the fuel level in the tank, always contains a certain amount of water. The degree of this water quantity is referred to as the “relative humidity”. Cold air is able to hold less water than warm air, i.e., when the air cools, water can condense out of it. This can be a problem with “garage cars”. If vehicles with a relatively empty fuel tank are not driven for a longer period of time, the larger amount of air in the tank can also produce larger amounts of water condensation.

- **Improper use**
  Fuel pumps are designed to convey fuel (petrol, diesel). There are actually cases where a fuel pump was used as a “water pump”.

- **Fuel quality**
  Fuel can already contain water when it is pumped at the petrol station. Possible causes can be:
  - Different fuel qualities in some countries
  - Fuelling from moist drums, containers.
  - Poorly managed tank systems
  - Biodiesel (please refer to Section 3.3)
  - High alcohol content
  Alcohol attracts water. When a certain limit is reached, this water precipitates.

- **Leaks in the fuel system**
  Splashed water can get into the fuel system in many ways:
  - Filling the fuel tank in the rain
  - Leaky or missing fuel cap gasket
  - Missing fuel cap
  - By aeration holes of pneumatic valves that are exposed to splashed water, e.g. valves in the ACF system (activated carbon filter system).
  - Faulty assembly of the fuel filler neck after an accident or auto body repair.
  - Frayed or improperly retrofitted fuel tank vent hose

If a vehicle is going to remain standing for a longer period of time, make sure that the fuel tank is full.

The subject of “fuel quality” is discussed in greater detail in Section 3.2.3.
This is the way to determine whether there is water in the fuel:
Pour a little fuel from the deepest possible location into a fuel resistant test tube.
After a while the water will separate.

Pay attention to the fire safety rules!
Electric Fuel Pumps

Fig. 40  Rusted intake of an E1F sliding vane pump
The outside cover of a fuel pump is usually made of aluminium.
Since aluminium cannot “rust”, in such a case the causes of the rusting should be questioned in the workshop.

Fig. 41
left: Sieve filter clogged by rust
right: New sieve filter
If the sieve filter on the suction side of a fuel pump shows rust or lime deposits, this is a sign of water in the fuel.

Fig. 42  left: Lime deposits in the filter of an in-tank pump right: For comparison, a new filter

Fig. 43  Lime deposits in the intake of this in-tank pump
Electric Fuel Pumps

Fig. 44 Water in a fuel pump
In this case, the water was “standing” properly in the pump. The pumping mechanism was so corroded that the water could no longer run out. This fuel pump was incorrectly used as a “water pump”.

Fig. 45 Rust and lime particles
If the rust or lime deposits grow to the extent that particles or grains form, these can block or damage the rotating parts of the pumping mechanism, as is the case with debris that is suctioned into the pump.

When this fuel pump was opened, proper “lime sand” that had damaged the vanes of the pump fan was discovered.

These particles could not have entered the pump through the undamaged sieve filter. They must have formed inside the pump.
**Fig. 46**  
Left: Corroded electric contacts  
Right: New

**Fig. 47**  
Trochoid toothed ring blocked by rust particles (microscopic enlargement)
Fig. 48  Left:  Heavily rusted trochoid toothed ring  
Right:  New

Fig. 49  Trochoid toothed wheel with lime deposits

Fig. 50  Calcified outside bearing of a fuel pump

Fig. 51  Trochoid toothed ring  
(on the left with lime deposits and on the right, new)
It is easy to test the smooth running of a trochoid pumping mechanism:
If the pumping mechanism is rolled over an even surface, as shown here,
the toothed ring and the toothed wheel must roll smoothly as they engage.

Fig. 52 The parts of the trochoid pumping mechanism must be able to roll smoothly as they engage

Fig. 53 For comparison: A rusted trochoid pumping mechanism
Here, nothing can move any more.

Fig. 54 Screw pump (on the left, rusted, and on the right, new)
3.2.3 Fuel quality

- **Standards that are not maintained**
  Problems with fuel quality have indeed become less, but cannot be ruled out completely. This can still be a problem in countries outside Europe in particular. Reports and rumours of poor quality, contaminated fuel in foreign countries continue to surface in the news media from time to time.

- **Fuelling from drums/containers**
  Another cause of water and dirt getting into the fuel can be the use of a container that was previously rinsed or cleaned with water and not sufficiently dried, to fill the tank.

- **Poorly managed tank systems**
  Under some circumstances, failure to follow the prescribed operating instructions when building or operating fuel tank systems can be responsible for water and dirt entering the fuel.

- **Ageing fuel**
  If a vehicle is not operated for longer periods of time, the air in the tank can cause oxidation of the fuel. The chemical reaction of the fuel with the oxygen in the air produces a resin-like “gum” [3] that can cause the entire fuel system and the pump to be stuck or clogged.

Fig. 55  Sticking due to prohibited medium

The illustration shows the pumping mechanism of a type E3L screw pump. The rest of a green liquid runs out of the housing that was cut open for evaluation. This “fuel” gummed up the pumping mechanism. The place where both screws of the pump were stuck together can be clearly recognised by the deposits on the screw (arrow).

Fig. 56  Film from poor quality fuel
3.2.4 Dissolved substances

A special case of dirt is the formation of impurities from dissolved chemical substances.

If poor quality materials are used to retrofit fuel systems (e.g. changing fuel lines, filters), substances such as vulcanisation accelerators, additives or softeners can dissolve into the fuel.

Such a case is shown in ➔ Fig. 57. Here all the pump components were covered with a yellow film. The substance that stuck to the surface of the components was crystalline, which is insoluble in water and fuel. The commutators were not corroded or tarnished, but the nonconductive properties of the film produced an insulation between the commutator and the brushes.

Fig. 57  Insulating film from softener in the fuel

Fig. 58  For comparison: The same type of pump without a film
3.2.5 What to do with impurities in the fuel?

As explained in the preceding sections, the causes of impurities can be many.

Find the source of the impurities!

If you only remedy the symptoms (e.g. by replacing a defective fuel pump), you will not be eliminating the source of the problem. Sooner or later the damage will recur.

– Use clean, quality fuel to rinse out the fuel system.
   To do this, you may have to remove the fuel tank.

– Change the fuel filter regularly.

– Use only fuel resistant material for components that are exposed to fuel (e.g. rubber gaskets).

– Use quality materials.

– Please adhere to the maintenance intervals specified by the vehicle manufacturer.

– If a vehicle is going to remain standing for a longer period of time, make sure that the fuel tank is full.

– Store parts that have been removed in a clean place and keep them covered.

– Keep the transportation seals on the new fuel pumps until you are ready to install them.

– Never use compressed air to clean an open fuel system.
3.3 Biodiesel/vegetable oil

In the past, mostly RME (rapeseed oil methyl ester) was used as “biodiesel”. Since November 2003 the new DIN EN 14214 standard for fatty acid methyl ester (FAME) is in effect. It allows other admixtures such as soy oil, sunflower oil and old cooking fats (animal fats, fish oil, etc.) to be used in addition to RME.

The use of biodiesel can produce damages and malfunctions faster than the other (“fossil”) fuels [2].

– In vehicles that have not been specially authorised by the manufacturer for operation with biodiesel, gaskets and plastic parts can become corroded.
– Biodiesel reacts hygroscopically, i.e., it draws water out of the ambient air. In addition to corrosion, this can also lead to an increase in bacteria.
– Oxidation processes occur in biodiesel that can cause fat molecules to lump together and clog filters and injection nozzles.
– Along with the good biodegradability of biodiesel there is also poor durability. This can cause filters to be clogged by sedimentary particles.

Biodiesel may be used only if it has been approved by the vehicle manufacturer.

---

**Fig. 59** Stuck pumping mechanism
The boundary disk was stuck completely to a trochoid pumping mechanism. The pumping mechanism was removed to take this picture, but its outline can still be made out easily in the sticky mass.

**Fig. 60** Damages from biodiesel
In this case, RME (rapeseed oil methyl ester) had already caused the carbon brushes to disintegrate after about 3 hours operation and a varnish-like, insulating layer was formed on the commutator (“pole changer”). The pump broke down.
Checks made in the course of quality management at Pierburg have revealed that when biodiesel is used, especially poor quality biofuels, the following malfunctions and damages can occur after a brief operating time:
- Deposits clog up filters and block pumping mechanisms
- Deposits on commutators have an insulating effect
- Gaskets and plastic parts become corroded
- Carbon brushes burn out after a brief run time (“brush fire”)
- Corrosion damages metals parts

“Brush fire” refers to the generation of sparks in the commutator (pole changer) of electric motors. The carbon brushes make contact with the rotating part of the pump (rotor). In the brief moments in which the brushes short circuit two differently charged commutators, electrostatic discharges, which can be seen as sparks, are produced. An insulating film on the glide path generates multiple discharges that can burn the brushes prematurely.
3.4 Incorrect use/application

- Incorrect selection
With recurring frequency the wrong fuel pumps are selected from catalogues or electronic media for replacement or retrofitting purposes.

As a result they produce pressure that is either too high or too low.

- Improper use
It is even worse to use a fuel pump in a manner for which it is not intended.

Fuel pumps are designed to convey fuel (petrol, diesel).

This may seem obvious to most people. Yet again and again fuel pumps that have been used to convey other liquids (water, oil, battery acid) are returned due to malfunctioning.

In Fig. 68, for example, a type E3T in-line pump, i.e., a fuel pump that is used in the fuel line outside the fuel tank, was placed in the tank. The rubber sleeve surrounding the fuel pump was dissolved by the fuel and plugged up the fuel pump and the rest of the fuel system.

Rubber sleeve
This rubber sleeve is used to adapt larger models made by competitors so that the fuel pumps sold by MSI will fit into the existing mountings (see ➔ Fig. 66).

An additional advantage of this rubber sleeve is that vibrations are not transferred to the auto body.

You will find further information in the Pierburg Product Information PI 0027/A.
Precisely when an electric fuel pump is being retrofitted, certain points must be observed because otherwise malfunctions can occur in the fuel system or damages can be caused in the fuel pump.

- Types E1F and E3L pumps are in-line pumps. They may be placed only in the fuel line. Maximum suction height: 500 mm

- As an in-tank pump, the E1S may be installed only in the tank. Maximum suction height: 0 mm

- All modern pumps are driven by an electric motor. Fuel flows through the drive unit, where it also serves as a coolant. For proper functioning/cooling a flow must always be present.

- The pump circuits designed to produce a constant flow when they are energised. When there is little flow or none at all, the power consumption will increase but no cooling will occur. The consequences will be gas forming in the pump, problems with the engine fuel supply and subsequent wear on the pump. This can be prevented by a return fuel line, for example.

- Install fuel pumps where they will be protected from dirt and splashing water.

- For type E1F electric fuel pumps, a sieve filter must be placed in the fuel line on the suction side upstream from the pump to prevent damages from dirt. This filter should have a large enough filter surface (based on the application) and a mesh width of 60–100 µm (microns). Paper filter is not suitable because the mesh width is too narrow.

- For use in diesel engines the sieve filter must be removed from the suction side socket.

- For type E1F fuel pumps Pierburg offers the fuel sieve filter 4.00030.80.0 that protects the fuel pump from dirt and other debris dependably, thus preventing premature failure (please refer to Fig. 67). The sieve filter should be changed at the same maintenance interval as the fuel filter.

- Select a location where the fuel pump will not be exposed to excessive heat (near engine or exhaust pipe) or vibrations (rigid lines, tight installation).
Electric Fuel Pumps

DAMAGES

– When retrofitting an electric fuel pump, a safety shut-off must be installed according to § 46 of the German road traffic licensing regulations.

As long as the ignition is ON, the pump will convey fuel. Installation of the safety shut-off 4.05288.50.0 (please refer to ➔ Service Information “SI 0016/A”) is mandatory so that the carburettor will not overflow or fuel will not run uncontrollably out of separated fuel lines when the engine is stopped with the ignition ON (engine stalled, accident)! The safety shut-off will switch the fuel pump OFF “when the engine is OFF”.

– Dry running will cause damage to the pumping mechanism very fast. To prevent this, the pumps must be installed far down (“wet”, below the level of the liquid) near the tank. Here narrow areas (“tight spots”) must be avoided on the suction side. If this is not possible, a type E1S sliding vane pump should be placed in the tank as a pre-feeder pump.

– Only fuel resistant material should be used for components that are exposed to fuel (e.g. rubber gaskets).

– Make sure that no combination of materials is used that would trigger a contact corrosion. Thus the pump housing (aluminium) must not come into contact with zinc plated surfaces, for example (please refer to ➔ Fig. 72).

– Depending on where an electric fuel pump is retrofitted, resonance can cause noises that will make the fuel pump sound like it is defective.

– Also fuel lines that are laid under tension can cause excessive noises to develop.

You will find further information on this subject in the brochure Fuel Systems – Components and solutions for universal applications [6].
3.6 Mechanical damages

3.6.1 Installation errors

When a fuel pump is installed or removed incorrectly, the gasket, housing and connections (electric, fuel) can be damaged.

- **Fastening without locking**
  In the case of types E2T and E3T toothed ring pumps when the fuel connection line is tightened, often the counterpiece on the pump housing is not locked in place. Therefore the entire pump cover with the connections is twisted in the housing. This crushes the sealing ring that lies under the cover. By twisting the pumping mechanism, the O ring that seals off the housing from the cover is often displaced or damaged. The pump then leaks at the flanging.

**Important installation instructions:**

When the connection line is being tightened, the lower hexagonal bolt of the fuel pump must be locked because otherwise this could cause the fuel pump to leak.

Leaky fuel pumps increase the danger of fire!

Before delivery, all fuel pumps undergo a quality and function check in the plant. Such damages can occur subsequently due to improper handling.
Electric Fuel Pumps

DAMAGES

- **Contact corrosion**
  When an installation or retrofit is performed improperly, materials can be combined that trigger contact corrosion. Thus the pump housing (aluminium) must not come into contact with zinc plated surfaces, for example.

If steel conduit clamps with zinc plating are mounted directly on the aluminium body of the pump without insulation, for example, and electrolyte (splashed water) is present, a contact corrosion can occur. This can even produce pitting which will make the pump body leak.

⚠️ Leaky fuel pumps increase the danger of fire!

3.6.2 **Heavy damage**

- **Housing damaged**
  Improper handling (e.g. dropping) can cause damages to the fuel pump housing.
  For example, dropping the pump during installation can produce cracks in the plastic, which will make the fuel pump leak (please refer to ➔ Fig. 73).

⚠️ Leaky fuel pumps increase the danger of fire!

Fig. 72 Contact corrosion by incorrect combination of materials

Fig. 73 Severe damage to the housing
**Damaged connections**

An improper installation/removal can cause the connections to be damaged or broken off (please refer to Fig. 74 and 75).

⚠️ There will be extreme danger of fire if the fuel connection leaks!

---

**Fig. 74** Broken off hose connection

**Fig. 75** Heavy damage to the electric contacts

Before delivery, all fuel pumps undergo a quality and function check in the plant. Such damages can occur subsequently due to improper handling.
Damage to filters
In-tank pumps often have a mesh filter on the suction side. Some filters have reinforcements for stabilisation. In the case of an improper installation, the filter and any reinforcements that may be present in the filter can be damaged (please refer to ➔ Fig. 76).

Here dirt can enter or fractions of the reinforcements in the filter can block the pumping mechanism.

Fig. 76 Broken reinforcement in the filter of an in-tank pump

Fig. 77 Damaged sieve filter of an E1F sliding vane pump
Electric Fuel Pumps

Breaking off the fuel level sensor in the fuel supply model

Some fuel supply modules have a fuel level sensor that operates mechanically using a damper. Moving the fuel level sensor with your hand can break it (please refer to ➔ Fig. 78).

Never move the arm of the fuel level sensor with your hand (please refer to ➔ Fig. 79). Danger of breaking!

Bending of the fuel level sensor in the fuel supply model

The arm of the fuel level sensor can be bent by improper installation. This can cause the fuel gauge to indicate an incorrect fuel quantity.

Before delivery, all fuel pumps undergo a quality and function check in the plant. Such damages can occur subsequently due to improper handling.
3.6.3 Transportation damages

Transportation damages are usually easy to detect. Outer signs are:
– Buckling and dents in the pump housing
– Broken off connections or attachments
– Dirty suction side or pressure side sockets

Pay special attention to damaged packaging to ensure that there are no transportation damages to the fuel pump itself.

Remove packaging and transportation seals, e.g. plugs in new fuel pumps, only immediately prior to installation.

Fuel pumps that have been dropped or damaged during installation must not be installed.

Before delivery, all fuel pumps undergo a quality and function check in the plant. Such damages can occur subsequently due to improper handling.
4 Diagnostic instructions

**Symptoms**
When there are damages to the fuel system, almost always the same symptoms occur:
- Fuel pump does not run
- Fuel pump makes noises
- Fuel pump delivery rate is too low
- Delivery pressure too low
- Smell of fuel
- Fuel escape/leak
- Engine misfire
- Reduced engine power

**Reasons**
The reason is often dirty or watery fuel and often poor quality fuel itself (please refer to ➔ Section 3).

**Causes**
As already described in the preceding sections, these impurities can have many causes.
For this reason you will find the possible causes summarised again in this section.

**Legal note:**
The staff of a workshop may not open a fuel pump that is still under warranty or returned due to complaints on their own.
If you, as an employee of a workshop or parts distributor, open a fuel pump that has been returned due to a complaint, the guarantee will expire automatically.

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**Damages due to dirt**

<table>
<thead>
<tr>
<th>Claim/complaint</th>
<th>Appearance of damage</th>
<th>Possible causes</th>
<th>Remedies/remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>– Pressure not reached</td>
<td>– Plugged prefilter, filter or sieve</td>
<td>– Impurities in the fuel tank from outside (e.g. while filling the tank)</td>
<td>– Measure pressure and delivery rate</td>
</tr>
<tr>
<td>– Insufficient delivery rate</td>
<td>– Pumping mechanism scorched by dry running</td>
<td>– Ageing of the fuel by long periods of disuse (formation of deposits)</td>
<td>– Clean/replace plugged sieve filter on suction side</td>
</tr>
<tr>
<td>– Excessive noise in the fuel pump</td>
<td>– Debris in the pump</td>
<td>– Failure to adhere to maintenance schedule (filter change)</td>
<td>– Install prefilter</td>
</tr>
<tr>
<td>– Pump breaks down</td>
<td>– Debris in the pump</td>
<td>– Old, porous fuel hoses</td>
<td>– Replace fuel pump</td>
</tr>
<tr>
<td>– Water damages</td>
<td></td>
<td>– Water damages</td>
<td>– Use quality fuel</td>
</tr>
<tr>
<td>– Impurities and water due to a frayed</td>
<td></td>
<td>– Impurities and water due to a frayed fuel tank vent hose or due to improper</td>
<td>– Possible installation of an additional filter/sieve in the filter neck</td>
</tr>
<tr>
<td>fuel tank vent hose or due to improper</td>
<td></td>
<td>retrofitting of a fuel tank vent hose.</td>
<td>– Adhere to maintenance intervals (filter change)</td>
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<tr>
<td>retrofitting of a fuel tank vent hose</td>
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<tr>
<td>– Pump breaks down.</td>
<td>– Debris in the pump</td>
<td>– Damaged prefilter, filter or sieve</td>
<td>– Replace pump and fuel filter;</td>
</tr>
<tr>
<td></td>
<td>– Scrapping/scratch marks in the moving parts of the pump</td>
<td>– Dirty prefilter, filter or sieve</td>
<td>– Clean fuel system before installing new pump;</td>
</tr>
<tr>
<td></td>
<td>– Debris in the pump</td>
<td></td>
<td>– Replace filter basically according to the information given by the vehicle</td>
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<td>manufacturer; (Observe arrow for flow direction)</td>
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<tr>
<td>– Pressure not reached</td>
<td>– Film in the pump</td>
<td>– Use of poor quality materials from which vulcanisation accelerator, additives</td>
<td>– Use quality material</td>
</tr>
<tr>
<td>– Insufficient delivery rate</td>
<td></td>
<td>or softeners can dissolve</td>
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<tr>
<td>– Excessive noise in the fuel pump</td>
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<tr>
<td>– Engine misfire</td>
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<td>– Use of poor quality materials from which vulcanisation accelerator, additives</td>
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<tr>
<td>– Engine misfire</td>
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<td>– Use of poor quality materials from which vulcanisation accelerator, additives</td>
<td>– Use quality material</td>
</tr>
<tr>
<td>– Insufficient delivery rate</td>
<td></td>
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<tr>
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<tr>
<td>– Engine misfire</td>
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<td></td>
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<tr>
<td>– Pump breaks down</td>
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## Water damages

<table>
<thead>
<tr>
<th>Claim/complaint</th>
<th>Appearance of damage</th>
<th>Possible causes</th>
<th>Remedies/remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>– Pressure not reached</td>
<td>– Lime and rust deposits on the fuel pump</td>
<td>– Leaks in the fuel system</td>
<td>– Rinse entire fuel system with clean quality fuel</td>
</tr>
<tr>
<td>– Insufficient delivery rate</td>
<td>– <em>Lime and rust deposits in the fuel pump</em></td>
<td>– Filling the fuel tank in the rain</td>
<td>– Remedy leaks in the fuel system</td>
</tr>
<tr>
<td>– Excessive noise in the fuel pump</td>
<td>– Plugged prefilter, filter or sieve</td>
<td>– Leaky or missing fuel cap gasket</td>
<td>– Replace fuel pump</td>
</tr>
<tr>
<td>– Engine misfire</td>
<td>– <em>Pumping mechanism scorched by dry running</em></td>
<td>– Missing fuel cap</td>
<td>– Use quality fuel</td>
</tr>
<tr>
<td>– Pump breaks down</td>
<td>– <em>corrosion</em></td>
<td>– By aeration holes of pneumatic valves that are exposed to splashed water, e.g. valves in the ACF system.</td>
<td>– Fill the fuel tank when the vehicle is not going to be used for longer periods of time</td>
</tr>
<tr>
<td>– Lime and rust deposits on the fuel pump</td>
<td></td>
<td>– Water condensation in the tank:</td>
<td></td>
</tr>
<tr>
<td>– Lime and rust deposits in the fuel pump</td>
<td></td>
<td>– Garage vehicles</td>
<td></td>
</tr>
<tr>
<td>– Plugged prefilter, filter or sieve</td>
<td></td>
<td>– Fuel quality</td>
<td></td>
</tr>
<tr>
<td>– <em>Pumping mechanism scorched by dry running</em></td>
<td></td>
<td>– Quality standards not maintained</td>
<td></td>
</tr>
<tr>
<td>– <em>corrosion</em></td>
<td></td>
<td>– Fuelling from drums/containers</td>
<td></td>
</tr>
<tr>
<td>– Resin-like sticking or blockages in the fuel system</td>
<td></td>
<td>– Poorly managed tank systems</td>
<td></td>
</tr>
<tr>
<td>– Corroded gaskets and plastic parts</td>
<td></td>
<td>– Biodiesel</td>
<td></td>
</tr>
<tr>
<td>– <em>Burnt carbon brushes</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Deposits on commutators have an insulating effect</td>
<td></td>
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</tbody>
</table>

## Poor fuel quality

<table>
<thead>
<tr>
<th>Claim/complaint</th>
<th>Appearance of damage</th>
<th>Possible causes</th>
<th>Remedies/remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>– Pressure not reached</td>
<td>– Lime and rust deposits on the fuel pump</td>
<td>– Poorly managed tank systems</td>
<td>– Visual inspection, odour check</td>
</tr>
<tr>
<td>– Excessive noise in the fuel pump</td>
<td>– Plugged prefilter, filter or sieve</td>
<td>– Defective fuel quality</td>
<td>– Clean/replace plugged sieve filter on suction side</td>
</tr>
<tr>
<td>– Engine misfire</td>
<td>– <em>Pumping mechanism scorched by dry running</em></td>
<td>– Biodiesel</td>
<td>– Replace fuel pump</td>
</tr>
<tr>
<td>– Pump breaks down</td>
<td>– <em>corrosion</em></td>
<td></td>
<td>– Use quality fuel that meets the applicable standards</td>
</tr>
<tr>
<td>– Lime and rust deposits on the fuel pump</td>
<td></td>
<td></td>
<td>– Replace the fuel filter and possibly the injection valves</td>
</tr>
</tbody>
</table>
## Incorrect use

<table>
<thead>
<tr>
<th>Claim/complaint</th>
<th>Appearance of damage</th>
<th>Possible causes</th>
<th>Remedies/remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>– Pressure too high or too low</td>
<td>– none</td>
<td>– Incorrect selection</td>
<td>– Select correct pump</td>
</tr>
<tr>
<td>– Pressure not reached</td>
<td>– Dissolved rubber parts</td>
<td>– Improper use</td>
<td>– Proper use</td>
</tr>
<tr>
<td>– Insufficient delivery rate</td>
<td>– Lime and rust deposits on the fuel pump</td>
<td>– Pumping of improper liquids (e.g. water)</td>
<td>– Proper use</td>
</tr>
<tr>
<td>– Excessive noise in the fuel pump</td>
<td>– Lime and rust deposits in the fuel pump</td>
<td>– Proper use</td>
<td>– Proper use</td>
</tr>
<tr>
<td>– Engine misfire</td>
<td>– Pump leaks at cover</td>
<td>– Improper installation/Removal/Improper installation/Removal</td>
<td>– Adhere to installation conditions</td>
</tr>
<tr>
<td>– Pump breaks down</td>
<td>– Pumping mechanism scorched by dry running</td>
<td>– Pump installed too high</td>
<td>– Select a proper, protected installation location</td>
</tr>
<tr>
<td></td>
<td>– Pump leaks</td>
<td>– Fuel connection leaky/damaged</td>
<td>– Replace pump</td>
</tr>
<tr>
<td></td>
<td>– Electric connections damaged</td>
<td>– Improper installation/Removal/Improper installation/Removal</td>
<td>– Replace pump</td>
</tr>
<tr>
<td></td>
<td>– Decreasing delivery rate</td>
<td>– Improper installation/Removal/Improper installation/Removal</td>
<td>– Reo replace pellet mounting clamps</td>
</tr>
<tr>
<td></td>
<td>– Reduction of delivery rate</td>
<td>– Improper installation/Removal/Improper installation/Removal</td>
<td>– Adhere to tightening torques</td>
</tr>
<tr>
<td></td>
<td>– Smell of fuel</td>
<td>– Improper installation/Removal/Improper installation/Removal</td>
<td>– Adhere to tightening torques</td>
</tr>
<tr>
<td></td>
<td>– Leakage in the pump</td>
<td>– Improper installation/Removal/Improper installation/Removal</td>
<td>– Adhere to tightening torques</td>
</tr>
</tbody>
</table>

## Mechanical damages/installation errors

<table>
<thead>
<tr>
<th>Claim/complaint</th>
<th>Appearance of damage</th>
<th>Possible causes</th>
<th>Remedies/remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>– Decreasing delivery rate</td>
<td>– Pump leaks at cover</td>
<td>– Improper installation/Removal/Improper installation/Removal</td>
<td>– Replace pump</td>
</tr>
<tr>
<td>– Leakage in the pump</td>
<td>– Pump leaks</td>
<td>– Improper installation/Removal/Improper installation/Removal</td>
<td>– Replace pump</td>
</tr>
<tr>
<td></td>
<td>– Pitting</td>
<td>– Improper installation/Removal/Improper installation/Removal</td>
<td>– Avoid zinc platted mounting clamps</td>
</tr>
</tbody>
</table>
## Further malfunctions with similar symptoms

<table>
<thead>
<tr>
<th>Possible causes</th>
<th>Remedies/remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure regulator defective</td>
<td>– Check pressure and regulation function</td>
</tr>
<tr>
<td></td>
<td>– Replace faulty pressure regulator</td>
</tr>
<tr>
<td></td>
<td>– Check fuel system</td>
</tr>
<tr>
<td>Fuel tank aeration/ventilation not OK</td>
<td>– Check and clean or repair if necessary</td>
</tr>
<tr>
<td>ACF filter or lines filled with fuel</td>
<td>– Check lines (pay attention to information given by vehicle manufacturer)</td>
</tr>
<tr>
<td></td>
<td>– Check ACF regeneration valve for functioning</td>
</tr>
<tr>
<td>Voltage supply to EFP faulty</td>
<td>– Visual inspection</td>
</tr>
<tr>
<td>– Fuse defective</td>
<td>– Measure the voltage supply</td>
</tr>
<tr>
<td>– Line interruption</td>
<td>– Check and replace if necessary</td>
</tr>
<tr>
<td>– Pump relay defective</td>
<td>– Check and correct any errors</td>
</tr>
<tr>
<td></td>
<td>– Check and replace if necessary</td>
</tr>
<tr>
<td>Error in injection valve functioning</td>
<td>– When the engine is off use a suitable instrument to check the HC value in the intake manifold.</td>
</tr>
<tr>
<td>– Incorrect injection times</td>
<td>– Check Injection times, injection signal and impermeability</td>
</tr>
<tr>
<td>– Incorrect injection direction</td>
<td>– Clean valves or replace if necessary</td>
</tr>
<tr>
<td>– Leaky injection valves</td>
<td></td>
</tr>
<tr>
<td>The lambda probe is dirty or has deposits due to bad combustion or leaded fuel</td>
<td>– Check lambda probe and contacts</td>
</tr>
<tr>
<td>– The lambda probe responds too sluggishly, i.e., the lambda control tends to be too “rich”.</td>
<td></td>
</tr>
<tr>
<td>– The lambda probe is damaged by exhaust gas temperatures that are too high as a result of a faulty mixture formation or ignition misfires</td>
<td></td>
</tr>
<tr>
<td>– The electric earth connection is not OK</td>
<td></td>
</tr>
<tr>
<td>The fuel system has two fuel pumps connected one after another, one</td>
<td>– Check both fuel pumps for functioning</td>
</tr>
<tr>
<td>of which is defective</td>
<td></td>
</tr>
</tbody>
</table>

You will find further installation and diagnostic instructions, especially with respect to retrofitting electric fuel pumps, in the brochure Service Tips & Info Fuel systems – components and solutions for universal applications [6].
5 Tools and testing instruments

MSI Motor Service International offers a series of tools and instruments as required for work on fuel systems.

You will find further tools and testers in the catalogue “Tools and Testing Instruments” [7] and in the online-shop on our web site: www.msi-motor-service.com

5.1 Fuel pressure tester

With this tester a precise check can be made of the fuel pump and system pressure regulator, and all common injection systems can be checked for leaks.

– Calibrated manometer dual scale bar/psi
  0–2 bar (0–30 psi), special for central injections;
  0–10 bar (0–150 psi) for all other systems.
– Different connections and a 3-way adapter suitable for the most common injection systems
– Compact quick release couplings on all adapters and hoses.
– Supplied in a special case with comprehensive instructions for measuring the different systems.

For further information, please refer to ➔ Product Information PI 0005, PI 0007 and Service, Tips and Info Fuel Supply for Injection Engines [5].

Fig. 82 Fuel pressure tester 4.07360.51.0

Fig. 83 Application of fuel pressure tester 4.07360.51.0
5.2 Fuel pump tester

With this instrument electric fuel pumps can be tested for functioning and leaks regardless of the vehicle in a simple way.

For shops, service and workshops.

Power supply: 12 V DC, from vehicle battery or separate power supply.

Scope of delivery:
– Tester complete (without test liquid or power supply),
– Connection cable,
– Accessories and
– Operating instructions.

For further information please refer to → Product Information PI 0014

The instrument consists of
– a display unit and
– a lower part for test liquid (test oil) and sample.

The following are integrated into the display unit
– a voltmeter,
– an ammeter,
– a manometer and
– a flowmeter

The instrument is suitable for the following measurements:
– Delivery rate (volume flow) for system pressures from 0.2–6.5 bar
– Static pressure (for E1F pump series)
– Holding pressure (leak test) (not for E1F pump series)
– Power consumption

Technical data

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Designation</th>
<th>Dimensions/remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuel pump tester</td>
<td>HxWxD 590 x 405 x 350 mm</td>
</tr>
<tr>
<td>1</td>
<td>Operating instructions</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Connection cable</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket screws</td>
<td>To lock the upper part of the instrument into position</td>
</tr>
<tr>
<td>1</td>
<td>Accessory kit consisting of:</td>
<td>Article no. 4.07370.14.0</td>
</tr>
<tr>
<td>1</td>
<td>Screw connection M10 x 1; M12 x 1.5</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cap nut M12 x 1.5</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Screw connection M12 x 1.0; 8 mm connection</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Conical nipples 10.2 x 14 x 1.2 mm</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Conical nipples 12.2 x 16 x 1.5 mm</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Reducer Ø 8 – 6 mm; plastic</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Fuel hose approx. 15 cm long</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Hollow-core screw M12 x 1.0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Ring connection Ø 12 mm; 8 mm connection</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Hose clips Ø 14</td>
<td></td>
</tr>
</tbody>
</table>

*) To operate, the instrument must be connected to an external power source (stabilised DC).
### Test procedure

The test is taken according to Fig. 85 “Test procedure”. The fuel pump must be checked according to the test steps for the respective system pressure:
- 0.2–1 bar,
- 1.1–3 bar and
- 3.1–6.5 bar.

The instrument may be operated only with test liquid in accordance with ISO 4113.

In the operating instructions you will find a list of source addresses.

There you will receive the corresponding safety datasheet according to 91/155/EEC. Combustible fuels may not be used.

---

#### Table: Test procedure

<table>
<thead>
<tr>
<th>Test steps</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close V1</td>
<td></td>
</tr>
<tr>
<td>Open V1 (2 turns)</td>
<td></td>
</tr>
<tr>
<td>Close V2</td>
<td></td>
</tr>
<tr>
<td>Switch pump on (at switch 9, Fig. 1)</td>
<td></td>
</tr>
<tr>
<td>Read off static pressure</td>
<td>Compare with nominal value</td>
</tr>
<tr>
<td>Set up system pressure through V1</td>
<td>If not possible, then the pump is faulty.</td>
</tr>
<tr>
<td>Set up system pressure through V2</td>
<td>If not possible, then the pump is faulty.</td>
</tr>
<tr>
<td>Read off volume flow (at flow meter 2, Fig. 1)</td>
<td>Compare with nominal value, read off the flowmeter in l/h.</td>
</tr>
<tr>
<td>Read off current consumption and nominal voltage</td>
<td>Compare current consumption with nominal value. Pressure should amount to about 12 V and depends on the power source.</td>
</tr>
<tr>
<td>Close V2</td>
<td>Pressure increases</td>
</tr>
</tbody>
</table>
| Switch pump off                                                           | Due to the test unit, pressures > 43.5 psi (> 3.0 bar) will drop rapidly to about 3.0 bar and need to be main-
| Observe pressure drop                                                      | tained at this level. Pressures < 43.5 psi (< 3.0 bar) must be main-
|                                                                           | tained immediately. Permissible pressure drop < 0.3 psi/min (< 20 mbar/min). |
| Switch pump off (at switch 8, Fig. 1)                                     | In order to reduce the pressure in the pump and the test unit.          |
| Open V1 and V2                                                            |                                                                         |
| Empty the pump                                                             |                                                                         |

**Fig. 85  Test procedure for fuel pump tester (excerpt from the operating instructions)**
5.3 Special tool for electric fuel pumps

For removing and installing in-tank fuel pumps.
For many Audi vehicles (80/100/200/Avant/Quattro/A6) built from 08/1984 onward.
For further technical information and applications, please refer to Pierburg Service Information SI 0008/B and SI 0032/A.

5.4 Mounting tool for fuel pump (BMW 5 and 6 series models)

This is a tool for removing/installing fuel pump 7.22013.02.0 for the BMW 5 (E39) and 5 (E39) touring series (except M5 and diesel models).

With this inexpensive and environmentally friendly solution, it is no longer necessary to replace the entire fuel pump together with its mounting. Only the fuel pump itself is replaced.

How to use the tool is explained step by step in detail in the Service Information SI 0068 as well as in the installation instructions included with the replacement fuel pump by MSI.
6 Annex

6.1 Sources and Further Reading

[1] Technische Filterbroschüre (Technical Filter Booklet)
MSI Motor Service International
50 003 596-01 (German)
50 003 596-02 (English)

[2] Biodiesel
Marcus Taupp
Bayerische Julius-Maximilians-Universität Würzburg
Institut für Pharmazie und Lebensmittelchemie
Lehrstuhl für Lebensmittelchemie
Julius Maximilian University of Bavaria at Würzburg
Institute of Pharmaceutics and Food Chemistry, Food Chemistry Chair
Prof. Dr. P. Schreier

Prof. (Emeritus) Dr. A. Zeman
Universität der Bundeswehr München - Fachbereich Maschinenbau - Umwelttechnik und Chemie
(German Federal Armed Forces University, Munich – Engineering Faculty – Environmental Studies and Chemistry)

MSI Motor Service International
8.40002.56.0 (German)
8.40002.57.0 (English)
8.40002.58.0 (French)

MSI Motor Service International
50 003 931-01 (German)
50 003 931-02 (English)
50 003 931-03 (French)
50 003 931-04 (Spanish)
50 003 931-09 (Russian)

MSI Motor Service International
50 003 960-01 (German)
50 003 960-02 (English)
50 003 960-03 (French)
50 003 960-04 (Spanish)
50 003 960-09 (Russian)

MSI Motor Service International
8.40002.36.0 (German)
8.40002.37.0 (English)
6.2 Technical Information

Service - Tips & Information
**Emission Control & OBD**
with PIERBURG products

<table>
<thead>
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<th>Article no.</th>
<th>Language</th>
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<td>German</td>
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<tr>
<td>50 003 960-02</td>
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<table>
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<td>50 003 960-04</td>
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Service - Tips & Information
**Electric Fuel Pumps**
Models, Damages, Reasons

<table>
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<th>Language</th>
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</tr>
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<td>Russian</td>
</tr>
</tbody>
</table>

Service - Tips & Information
**Fuel Systems**
Components and Solutions for Universal Applications

<table>
<thead>
<tr>
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<th>Language</th>
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<tbody>
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<tr>
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<td>English</td>
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<td>8.40002.58.0</td>
<td>French</td>
</tr>
</tbody>
</table>

Service - Tips & Information
**Fuel Supply for Injection Engines**

<table>
<thead>
<tr>
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<th>Language</th>
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<tbody>
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Service - Tips & Information
**Vacuum Pumps**

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<thead>
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<th>Article no.</th>
<th>Language</th>
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<tbody>
<tr>
<td>8.40002.39.0</td>
<td>de-en-fr-es-it</td>
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</table>
6.3 Wall charts

Wall chart
**OBD & PIERBURG**
On board diagnosis and PIERBURG products
840 x 549 cm (DIN A1)

<table>
<thead>
<tr>
<th>Article no.</th>
<th>Language</th>
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<tbody>
<tr>
<td>50 003 961-01</td>
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</tr>
<tr>
<td>50 003 961-02</td>
<td>English</td>
</tr>
</tbody>
</table>

Wall chart
**OBD & Secondary Air System**
Finding and correcting errors
420 x 594 cm (DIN A2)

<table>
<thead>
<tr>
<th>Article no.</th>
<th>Language</th>
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<tbody>
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<td>50 003 969-01</td>
<td>German</td>
</tr>
<tr>
<td>50 003 969-02</td>
<td>English</td>
</tr>
</tbody>
</table>

Wall chart
**OBD & Exhaust Gas Recirculation System**
Finding and correcting errors
420 x 594 cm (DIN A2)

<table>
<thead>
<tr>
<th>Article no.</th>
<th>Language</th>
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</thead>
<tbody>
<tr>
<td>50 003 971-01</td>
<td>German</td>
</tr>
<tr>
<td>50 003 971-02</td>
<td>English</td>
</tr>
</tbody>
</table>
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