



<b>SWBTC</b>	Fuel supply system DC9 EDC MS5	SWBTC_XXX_3_3_1_3_EN	Issue 2004-09-06
Eddy Deprez	+32 2 722 86 89	Links	Replace 2003-06-24
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 <p><b>SCANIA</b></p> <p>Web based pre-knowledge technical course</p>	<p>Exit</p> <hr/> <h2>Supply system DC 9</h2> <p>This course relates to the components of the supply system fitted with DC 9 (EDC MS5) engines originally fitted in production on series 4 trucks.</p> <p><b>Principal objectives</b></p> <p>This online training forms an integrated part of the Scania EDC MS5 course. This module is (or is part of) advance theoretical knowledge needed before being able to take part in the practical course supervised by an instructor. It is essential that you have a perfect command of the contents of this course as the instructor will not repeat these basics. The condition for being able to take part in the practical course is success in the final test of this module.</p> <p>Estimated duration of the training: 1 hr</p>
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Remarks

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— —



# SCANIA

Web based  
pre-knowledge  
technical course

**Self-assessment**  
This module starts with a self-assessment. This means that you must complete the questionnaire before being able to begin the course. The result will show you the knowledge you already have and of what must be focused on individually. Using the answer “Skip question” at the appropriate time is highly recommended. Do not answer randomly... these questions will return during the final test.


**Important**  
The self-assessment can be accessed only once. The assessment can only be exited by finishing it. The results will be disclosed to you after the tests. You have a time limit per question.

The estimated total duration of the self-assessment is 5 minutes.  
Good luck!

Start the self-assessment

Remarks

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● Chapter 1

This chapter introduces the basic theory, the functionality and location of the supply system components

Remarks

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●

Chapter 1

😊

1. System structure

This module introduces  
the general structure of  
the fuel supply system

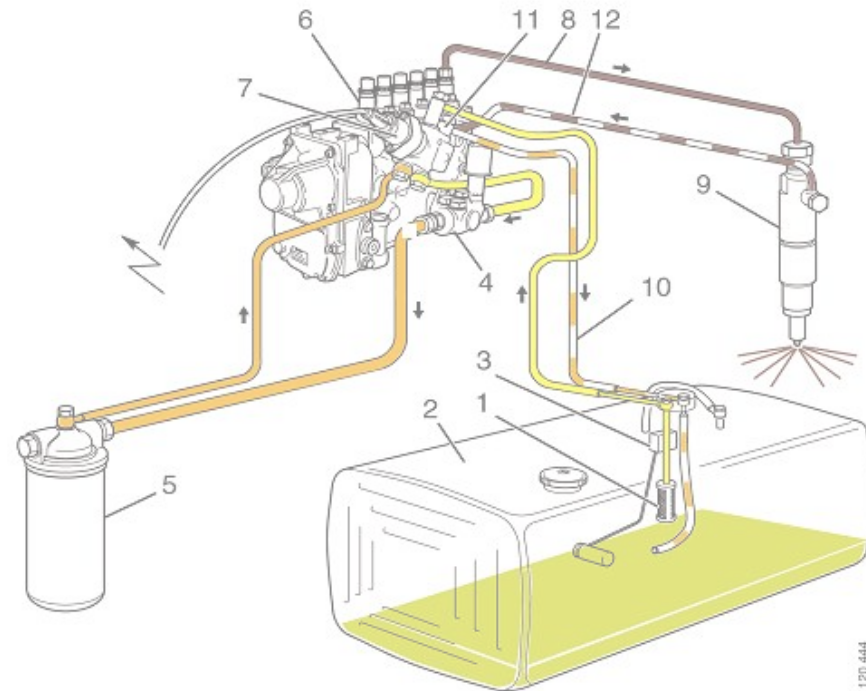
Remarks



● Chapter 1

😊 1. Module title

The fuel system consists of a fuel tank (2) with fuel pick-up unit (1), fuel lines (10), a fuel pump (4), a fuel filter (5) an injection pump (6) equipped with a fuel valve (7) and a return valve (11), as well as injectors (9) and return pipes (12).



Remarks

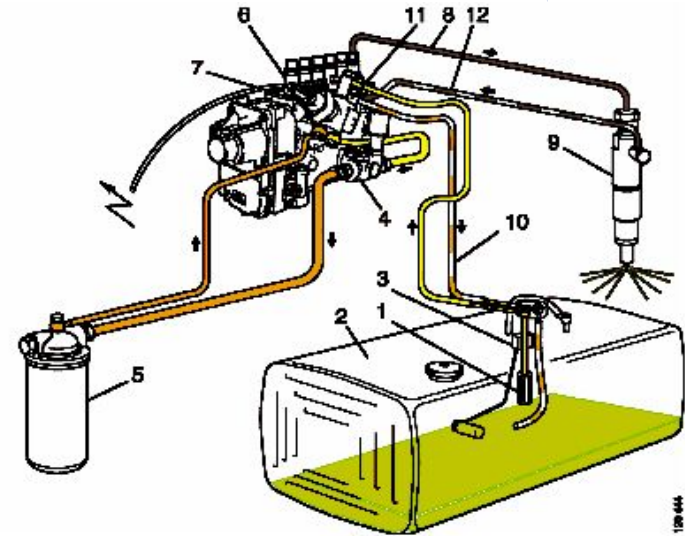


● Chapter 1

😊 1. Module title

The feed pump sucks fuel through the fuel pick-up and then forces it through the fuel filters on to the injection pump.

The injection pump distributes the fuel through the delivery pipes to the injectors and then to the combustion chambers when right pressure is achieved.



1 Suction line with strainer	5 Fuel filter	9 Injector
2 Fuel tank	6 Injection pump	10 Return line
3 Fuel level sensor	7 Fuel valve	11 Overflow valve
4 Fuel pump	8 Delivery pipe	12 Leak-off fuel pipe

Remarks

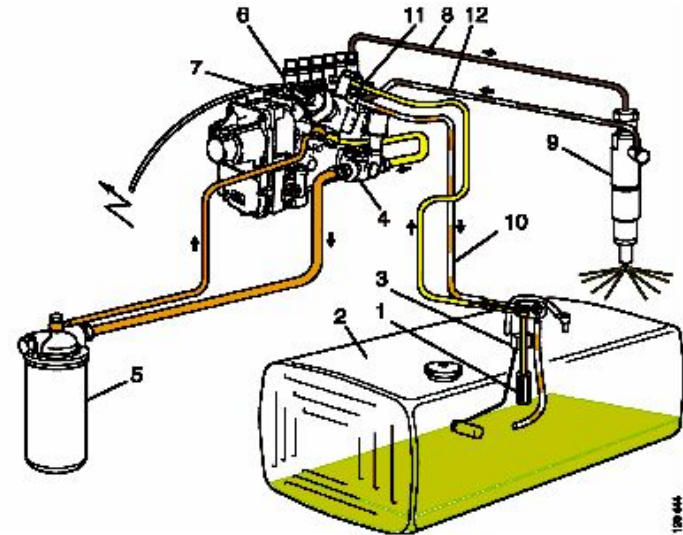


● Chapter 1

😊 1. Module title

This distribution is carried out at the right time and the quantity of fuel injected corresponds to the power requested from the driver through the accelerator pedal.

The system surplus fuel and eventual leak from injectors is returned to the tank through the overflow valve.



- |                              |                  |                       |
|------------------------------|------------------|-----------------------|
| 1 Suction line with strainer | 5 Fuel filter    | 9 Injector            |
| 2 Fuel tank                  | 6 Injection pump | 10 Return line        |
| 3 Fuel level sensor          | 7 Fuel valve     | 11 Overflow valve     |
| 4 Fuel pump                  | 8 Delivery pipe  | 12 Leak-off fuel pipe |

Remarks

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Module 1

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● Chapter 1

😊 1. Module title

Question 1 (45 sec)

In the supply circuit, what is the feed pump used for?

- To draw the fuel from the injectors.
- To bleed the supply circuit.
- To draw the fuel from the fuel filter and send it into the circuit.
- To draw the fuel from the tank and supply the system with fuel.
- Skip Question


Wrong answer. The correct answer is in this module on page 1.

Remarks



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● **Chapter 1**

😊 1. Module title

😊 2. Fuel tank and lines

This module introduces the components of the fuel tank and lines

Remarks

 Chapter 1

 1. Module title

 2. Module title

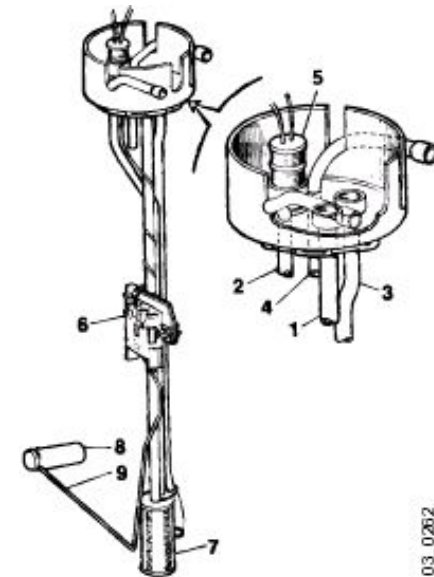
Scania trucks are supplied with one or two fuel tanks. The fuel line to the engine is connected to the right-hand tank.

Trucks with two tanks therefore have a plastic connection pipe between the two tanks.

There is a fuel pick-up unit in the fuel tank. This fuel pick-up unit is connected to the injection pump by suction and return lines.

A third line supplies a possible auxiliary heater.

The return line from the injection pump is angled towards the strainer at the bottom of the fuel pick-up unit so that the warm return fuel can help to prevent waxing in cold weather.



03\_0262

Remarks



## Chapter 1

1. Module title

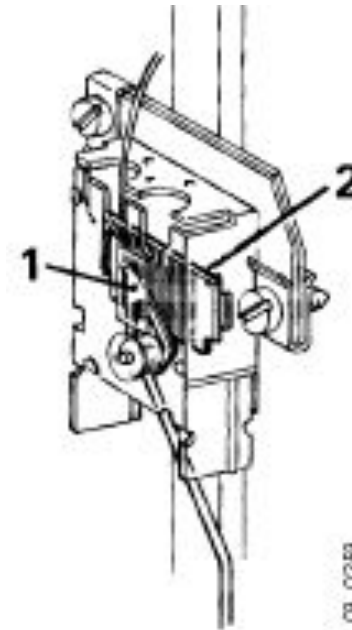
2. Module title

The float actuates the slip ring connector via the float arm and causes it to move on the coil and, via increased or decreased resistance.

This enables the fuel level gauge to indicate what quantity of fuel remains in the tank.

A plastic fuel line runs from the suction pipe and follows the frame side member from the tank towards the engine.

**Note:** The plastic pipe must be protected against intense heat when e.g. welding.





1 Slip ring connector  
2 Coil

03\_0253

Remarks

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	Module 2	Exit	Report	Go to test	
	<p>● Chapter 1</p> <p>😊 1. Module title</p> <p>😊 2. Module title</p>	<p>Question 1 (40 sec)</p> <p><b>A vehicle fitted with two tanks is equipped with:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> An electric pump which automatically transfers the fuel over to the right-hand tank.</li> <li><input type="checkbox"/> A return and suction line on each tank.</li> <li><input checked="" type="checkbox"/> A plastic connection pipe between the tanks.</li> <li><input type="checkbox"/> Two valves which the driver must control according to the status of the tanks.</li> <li><input type="checkbox"/> Skip Question</li> </ul> <p>Wrong answer. The correct answer is in this module on page 1.</p>			

Remarks

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Module 2

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● Chapter 1

😊 1. Module title

😊 2. Module title

Question 2 (40 sec)

**The return pipe coming from the injection pump is angled towards the strainer at the fuel pick-up unit with the aim of:**

- To avoid a too significant heating of the tank walls.
- Avoiding splashes and then the formation of air bubbles.
- Warm fuel helping to prevent waxing in the event of freezing.
- Drawing the cleanest possible fuel in order to lengthen the service life of the fuel filter.
- Skip Question

Wrong answer. The correct answer is in this module on page 1.

Remarks

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Module 3 estimated time .....

Exit Report Go to test

● **Chapter 1**

😊 1. Module title

😊 2. Module title

😊 3. **Fuel valve**

This module introduces the fuel valve, as well as its location on the vehicle

Remarks



● Chapter 1

😊 1. Module title

😊 2. Module title

😊 3. Module title

## Operation

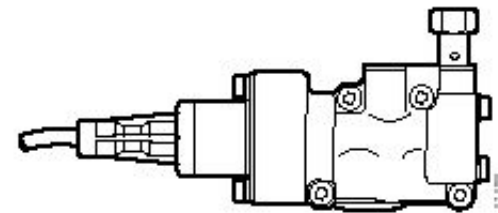
The fuel valve is a solenoid valve which opens and closes the fuel supply to the engine.

The route of the fuel through the valve depends on whether it is open or closed.

The fuel valve is open when the power is switched on. This is why ignition has to be switched on when bleeding the fuel system.

When power is switched off, the valve closes. The fuel pump then draws fuel from the injection pump instead of supplying it.

The engine stops due to lack of fuel.



*Fuel valve and return valve*

Remarks

**Chapter 1**

1. Module title

2. Module title

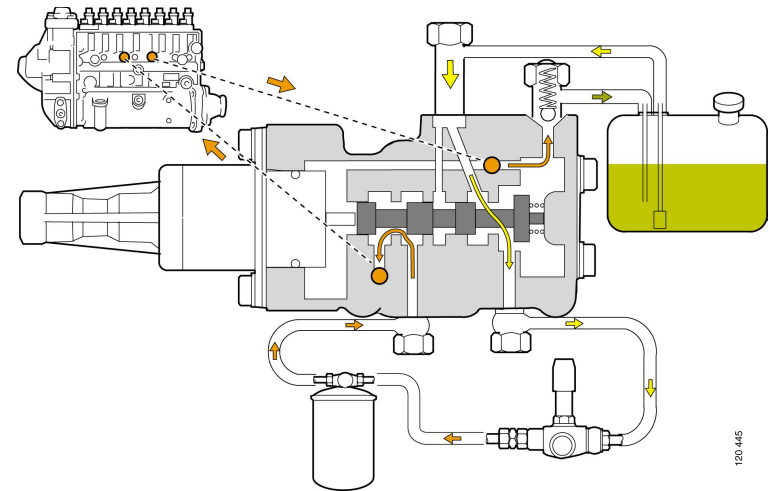
3. Module title

**Open fuel valve**

The fuel pump draws fuel from the tank through the fuel valve. It then pushes the fuel through the filter towards the injection pump.

Excess fuel from the injection pump flows back to the tank via the fuel valve and overflow valve. This limits the pressure in the low pressure section and facilitates bleeding.

Fuel leak-off from the injectors is returned via a connection on the return valve.



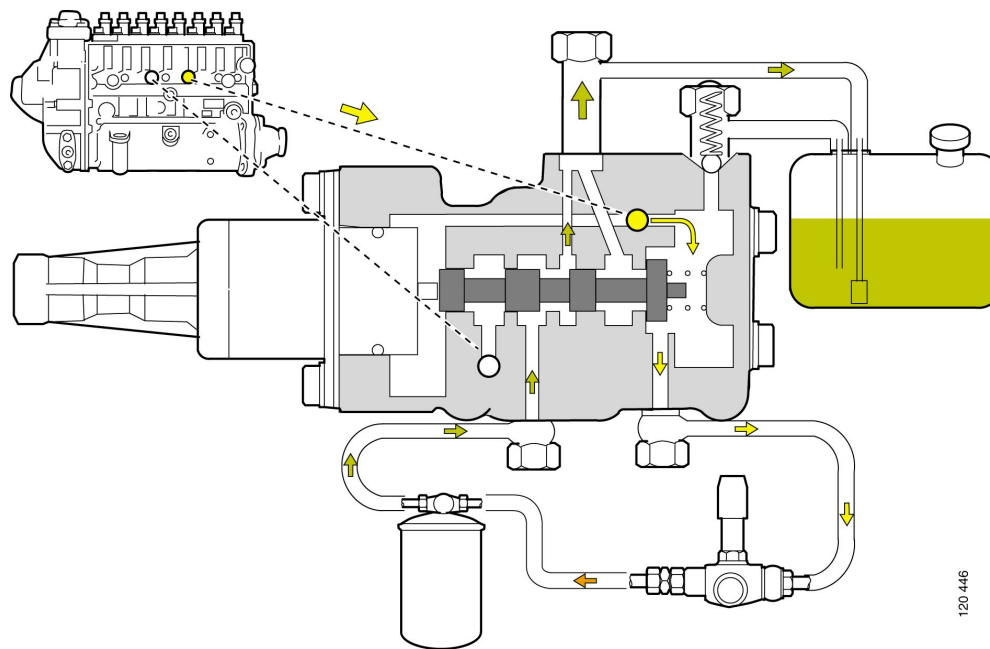
120 445

Remarks



 Chapter 1 1. Module title 2. Module title 3. Module title**Closed fuel valve**


The fuel pump draws fuel from the injection pump through the fuel valve. It then forces the fuel through the filter towards the tank.



120 446

Remarks

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Module 3
Exit
Report
Go to test

● Chapter 1

😊 1. Module title

😊 2. Module title

😊 3. Module title

Question 1 (40 sec)

**In the supply circuit, what is the overflow valve used for?**

To reduce the risk of overpressure in the fuel pump.

To increase the pressure of the fuel pump.

To limit the pressure in the low pressure section and to bleed the circuit.

To drive excess fuel past the fuel pump.

Skip Question

Wrong answer. The correct answer is in this module on page 2.

Remarks

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Module 3

Exit   Report   Go to test

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● Chapter 1

😊 1. Module title

😊 2. Module title

😊 3. Module title

Question 2 (40 sec)

**During the bleeding of the fuel system, it is necessary:**

- To fit the tank plug.
- To have the starter key on.
- To fill the filter with fuel before positioning it on the bracket.
- To remove the overflow valve.
- Skip Question

Wrong answer. The correct answer is in this module on page 1.

Remarks

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Module 4 estimated time .....

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● **Chapter 1**

😊 1.    Module title

😊 2.    Module title

😊 3.    Module title

😊 4.    **Fuel pump**

This module introduces the fuel pump, as well as its location on the vehicle

Remarks



● Chapter 1

😊 1. Module title

😊 2. Module title

😊 3. Module title

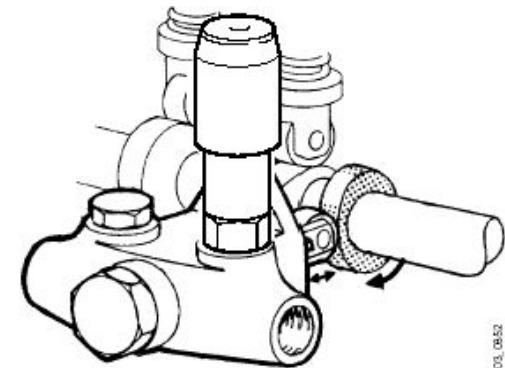
😊 4. Module title

The function of the fuel pump is to draw fuel from the tank and to push it on through the system to the injection pump.

The fuel pump is a mechanical piston-type pump, attached to the injection pump. It is powered from the injection pump camshaft which has two cams to drive the fuel pump.

There is a hand pump on the fuel pump for bleeding after service work.

The capacity of the fuel pump is sized so that fuel quantity considerably exceeds engine requirements.



To start the animation  
(you need Flash  
player)

Remarks



● Chapter 1

😊 1. Module title

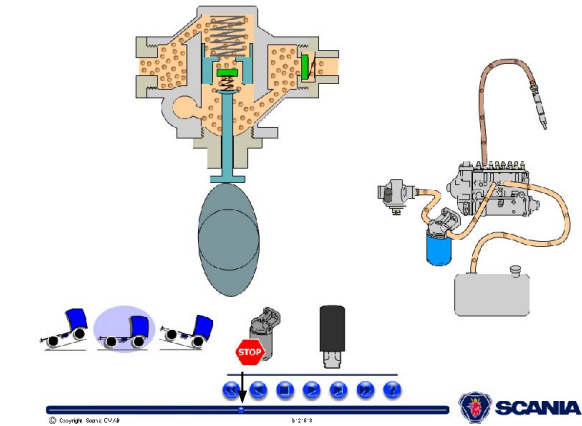
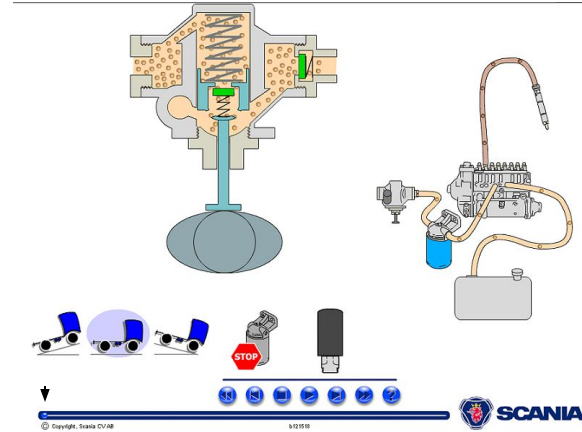
😊 2. Module title

😊 3. Module title

😊 4. Module title

The intermediate phase.  
When the cam pushes the piston back, the fuel is forced from the outer chamber towards the inner chamber through the delivery valve.

To start the animation.  
(you need Flash player)



Remarks



● Chapter 1

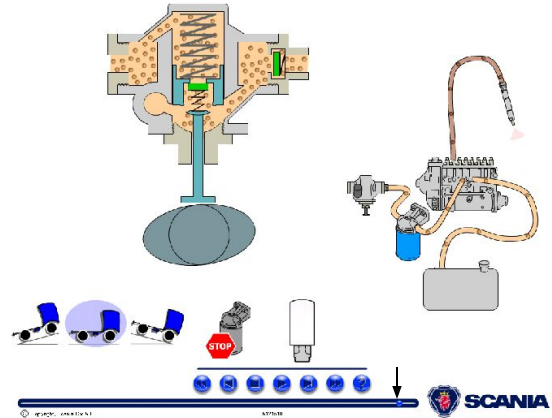
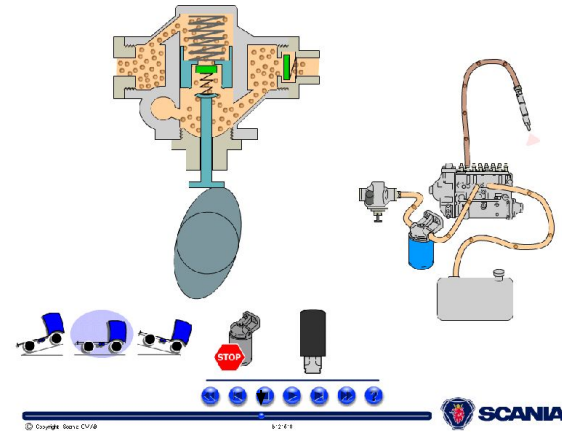
- 😊 1. Module title
- 😊 2. Module title
- 😊 3. Module title
- 😊 4. Module title

Pump and suction phase.

The pump plunger is forced towards the inner chamber by the spring. The fuel is drawn into the outer chamber.

At the same time, the fuel in the inner chamber is ejected via the check valve.

To start the animation  
(you need Flash player)



Remarks

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TRAINING

Module 4

Exit
Report
Go to test

● Chapter 1

😊 1. Module title

😊 2. Module title

😊 3. Module title

😊 4. Module title

Question 1 (40 sec)

**The fuel pump is equipped with a hand pump. This is intended to:**

- Introduce lubrication fluid.
- Facilitate starting in cold weather.
- Enable bleeding of the circuit after service work.
- Check the sealing of the supply circuit.
- Skip Question

Wrong answer. The correct answer is in this module on page 1.

Remarks



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Module 5 estimated time .....

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**Chapter 1**

- 1. Module title
- 2. Module title
- 3. Module title
- 4. Module title
- 5. **Fuel filter**

This module introduces the fuel filter, as well as its location on the vehicle

Remarks



● Chapter 1

😊 1. Module title

😊 2. Module title

😊 3. Module title

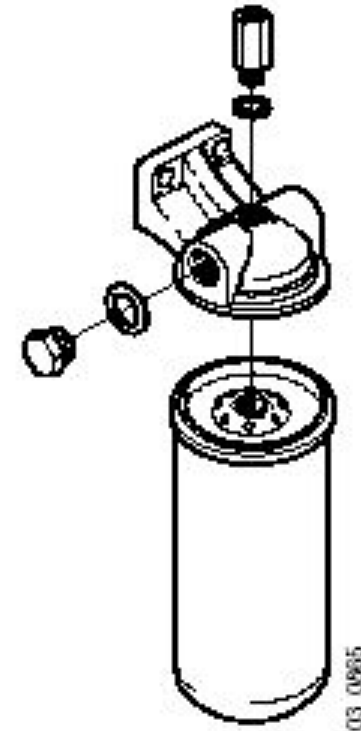
😊 4. Module title

😊 5. Module title

The fuel filter is located on a filter retainer which is bolted to the engine.

The filter consists of a metal retainer with spirally wound paper inserts.

It cannot be dismantled and must be changed as a complete unit.



Remarks

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Module 5

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● Chapter 1

😊 1. Module title

😊 2. Module title

😊 3. Module title

😊 4. Module title

😊 5. Module title

Question 1 (30 sec)

**Is it possible to replace just the paper cartridge of the filter?**

Yes

No


Yes, but only for M service.

Skip Question

Wrong answer. The correct answer is in this module on page 1.

Remarks

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Chapter 1
Exit    Rep

● **Chapter 1**

😊 1. Module title

😊 2. Module title

😊 3. Module title

😊 4. Module title

😊 5. Module title


**In this chapter you learned:**

The general structure of the fuel supply system as well as specific details of principal components.

Do not forget that the connection must be actuated in order to allow the bleeding of the circuit, without which the fuel valve blocks the passage of fuel.

Remarks

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● Chapter 2

This chapter introduces the  
injection pump and the injectors

Remarks

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● Chapter 2

😊 1. Injection pump

This module introduces the  
injection pump

Remarks



● Chapter 2

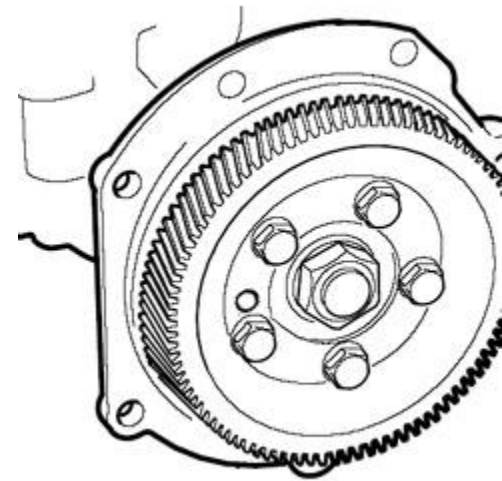
😊 1. Module title

The injection pump is driven from the engine timing gear. The injection pump camshaft has a hub with a gear wheel.

Exchange ratio is such that the injection pump is driven at half engine speed.

Injection pump bearings, camshaft and tappets are lubricated with oil from the engine lubricating system. The pump elements are lubricated with fuel.

The injection pump has one pump element for each engine cylinder. The pump elements always have the same stroke.



Remarks



● Chapter 2

😊 1. Module title

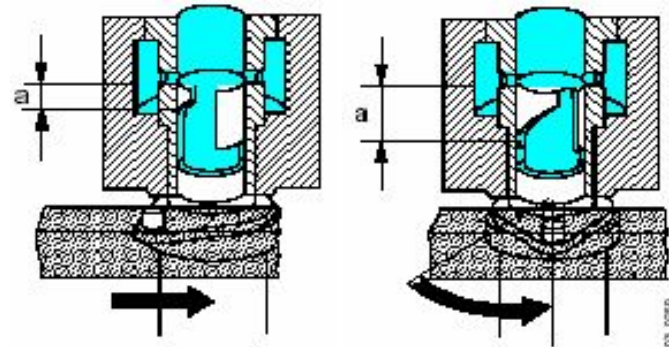
Injection quantity is determined by how much the plunger in the pump element is turned.

Mechanically, the pump plunger is turned by the control rack which is controlled by the governor.

All plungers are turned at the same time and by the same amount.

Injection starts when the pump plunger closes the inlet and spill ports in the pump element. The control edge of the pump plunger is chamfered.

Injection ceases when this chamfered control edge passes the spill port in the pump barrel.



$a$  = Fuel quantity in relation to control rack and pump element position

Remarks

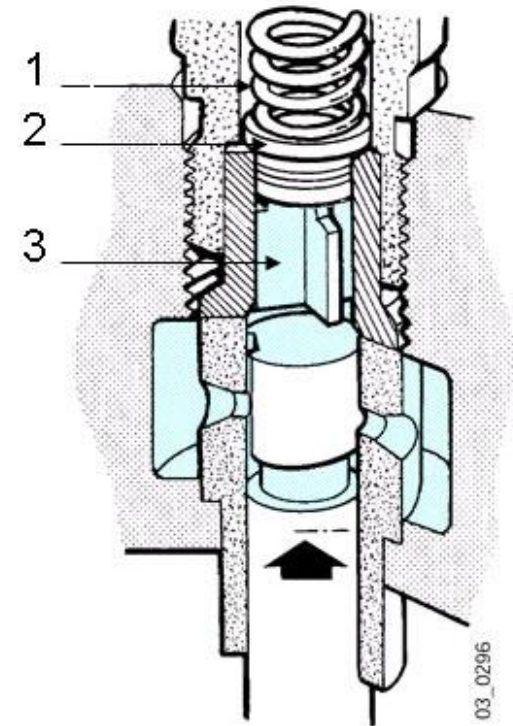


 Chapter 2 1. Module title

Above each pump element, there is a delivery valve which consists of valve housing and valve plunger. The valve plunger is held against its seat by a spring.

The delivery valve opens when the pressure reaches the set value for the injector.

The delivery valve will keep approx 30 bar pressure in the delivery pipe.



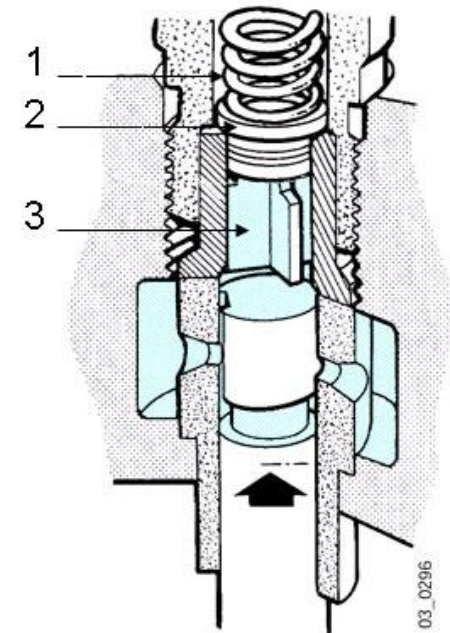
1. Spring
2. Seat
3. Delivery valve

Remarks

 Chapter 2 1. Module title

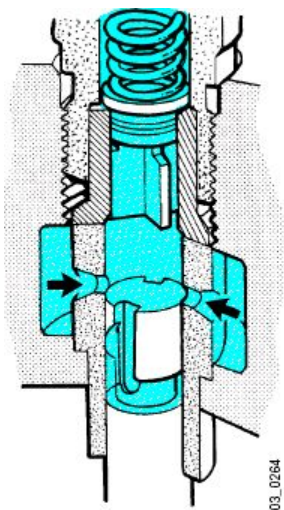
When the delivery valve plunger has closed, the available volume for the fuel in the delivery pipe increases. This lowers the pressure in the delivery pipe and injectors, decreasing the risk of flowing out from the injector.

The change in capacity is adapted to the length of the delivery pipe and this length must never be changed. The delivery valve is held in the pump housing by the delivery valve holder, which is bolted into the housing from above.

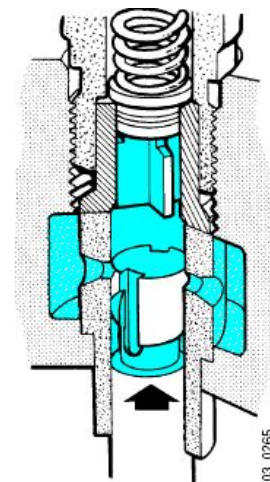


1. Spring
2. Seat
3. Delivery valve

Remarks

 Chapter 2 1. Module title**Phases of operation of the pump element and delivery valves**

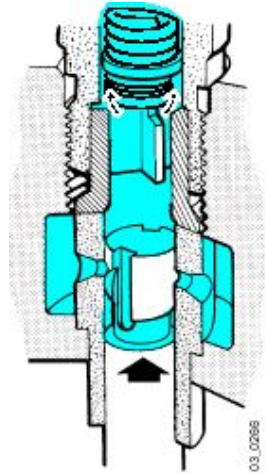
First phase of piston stroke: inlet port opens and fuel flows in.



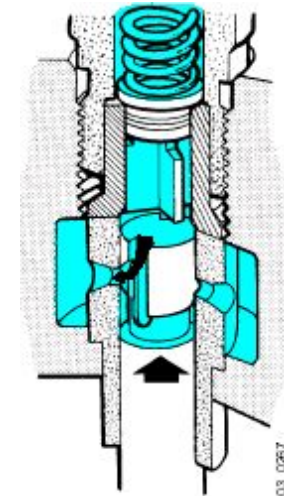
Second phase: the inlet port is open from bottom dead centre until the upper edge of the piston closes the inlet port.

Remarks

 Chapter 2

 1. Module title


Third phase of piston stroke:  
from when the upper edge of the  
plunger has closed the inlet port until  
the spill port is opened by the helix  
edge. When inlet port is opened,  
delivery valve is closed.



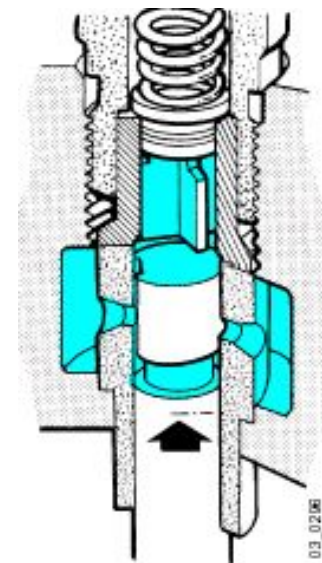
Fourth phase of piston stroke:  
from when the spill port opens  
to top dead centre.

Remarks

 Chapter 2 1. Module title

The axial groove is aligned with the port. In this position, there is no fuel delivery.

When the control rack turns the plunger to this position there is no fuel delivery in order to stop the engine.



*Non-delivery*

Remarks

 Chapter 2

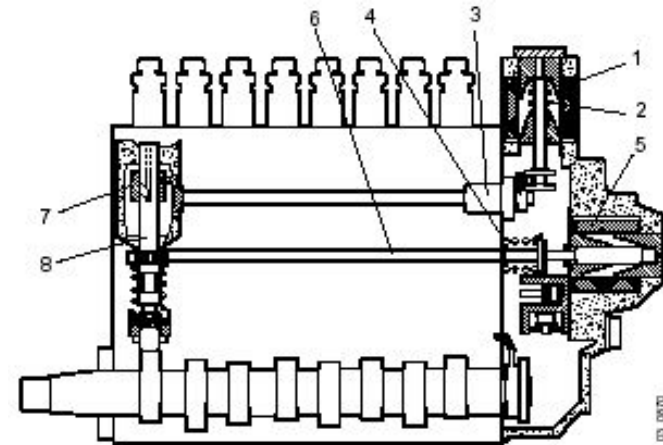
 1. Module title

### In-line pumps with adjustable injection timing

In-line pumps with adjustable injection timing have a sliding "sleeve" on the pump plunger.

This allows adjustment of prestroke in order to alter the start of feed and injection.

Injection quantity is controlled in the same way, as on a conventional pump.



- 1 Setting solenoid, injection timing
- 2 Return spring
- 3 Prestroke shaft
- 4 Return spring
- 5 Setting solenoid, fuel supply
- 6 Control rack
- 7 Stroke position sleeve
- 8 Pump plunger

Remarks

<b>SWBTC</b>	Fuel supply system DC9 EDC MS5	SWBTC_XXX_3_3_1_3_EN	Issue 2004-09-06
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**SCANIA** WEB TRAINING

Module 1

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● Chapter 2

😊 1. Module title

Question 1 (40 sec)

The injection pump runs at a speed:


- Equivalent to double the speed of the crankshaft.
- Independent to the speed of the crankshaft.
- Equivalent to half the speed of the crankshaft
- Equal to that of the crankshaft.
- Skip Question

Wrong answer. The correct answer is in this module on page 1.

Remarks

<b>SWBTC</b>	Fuel supply system DC9 EDC MS5	SWBTC_XXX_3_3_1_3_EN	Issue 2004-09-06
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Question 2 (40 sec)

**The rotation of a pump element piston influences:**

- The time point of injection.
- The opening pressure of the injector.
- The quantity of fuel injected.
- The quantity of fuel allowed into the chamber at the top of the pump plunger.
- Skip Question


Wrong answer. The correct answer is in this module on page 2.

Remarks



<b>SWBTC</b>	Fuel supply system DC9 EDC MS5	SWBTC_XXX_3_3_1_3_EN	Issue 2004-09-06
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 <b>SCANIA</b> WEB TRAINING	Module 1 <span style="float: right;">Exit   Report   Go to test</span>
	<p>Question 3 (40 sec)</p> <p><b>After injection, when the pressure valve is closed again, pressure in the delivery pipe:</b></p> <p><input type="checkbox"/> Increases.</p> <p><input checked="" type="checkbox"/> Decreases.</p> <p><input type="checkbox"/> Does not vary.</p> <p><input type="checkbox"/> Skip Question</p> <p style="color: red; text-align: center;">Wrong answer. The correct answer is in this module on page 4.</p>

Remarks

<b>SWBTC</b>	Fuel supply system DC9 EDC MS5	SWBTC_XXX_3_3_1_3_EN	Issue 2004-09-06
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Module 2 estimated time .....

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●

**Chapter 2**

😊

1.    Module title

😊

2.    Injector and delivery pipe

This module introduces the injector and the delivery pipe

Remarks



● Chapter 2

😊 1. Module title

😊 2. Module title

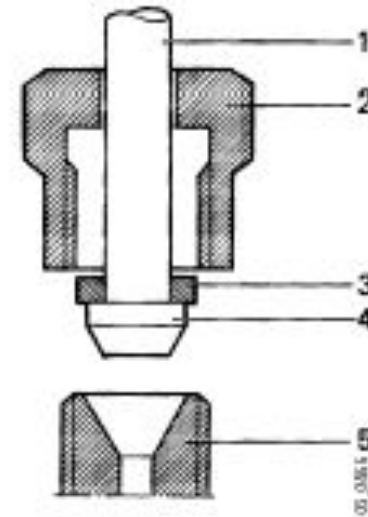
### Delivery pipe

Delivery pipes are manufactured from steel piping, with cones and cap nuts at each end.

The delivery pipes are attached with clips in order to damp vibrations in the pipe, reducing the risk of it breaking.

Broken, or otherwise damaged delivery pipes, must not be repaired by soldering or welding, but must be changed.

Delivery pipes must not be switched between different types or designs of engine as diameter and length depend on which engine type the pipe fits.



- 1 Delivery pipe
- 2 Cap nut
- 3 Washer
- 4 Cone shaped end of pipe
- 5 Connection

Remarks

**Chapter 2**

1. Module title

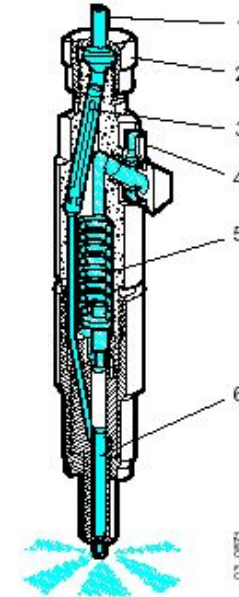
2. Module title

**Injectors**

The fuel is forced through the delivery pipes to the injectors. The injector atomises the fuel in the combustion chamber.

The movement of the nozzle needle is controlled by fuel pressure and spring force.

When fuel from the injection pump reaches a certain pressure (opening pressure), the nozzle needle lifts (start of injection).



- 1 Delivery pipe from pump
- 2 Cap nut
- 3 Edge filter
- 4 Leak-off fuel line
- 5 Spring
- 6 Nozzle needle

Remarks



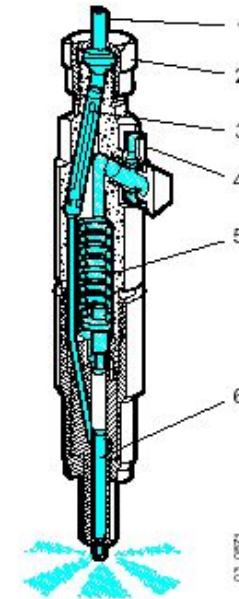
● Chapter 2

😊 1. Module title

😊 2. Module title

The fuel is then sprayed in atomised form into the engine combustion chamber through accurately calibrated holes.

The fuel that leaks between the nozzle needle and nozzle housing is routed back to the fuel tank via the leak-off line which is connected to the injector.



- 1 Delivery pipe from pump
- 2 Cap nut
- 3 Edge filter
- 4 Leak-off fuel line
- 5 Spring
- 6 Nozzle needle

Remarks

<b>SWBTC</b>	Fuel supply system DC9 EDC MS5	SWBTC_XXX_3_3_1_3_EN	Issue 2004-09-06
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Module 2

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● Chapter 2

😊 1. Module title

😊 2. Module title

Question 1 (40 sec)


**The opening pressure of the injector depends on:**

- The pressure of the fuel in the tank.
- The rotation speed of the engine.
- The length of the pipe connecting the injector to the injection pump.
- The setting of the spring in the injector.
- Skip Question

Wrong answer. The correct answer is in this module on page 2.

Remarks

<b>SWBTC</b>	Fuel supply system DC9 EDC MS5	SWBTC_XXX_3_3_1_3_EN	Issue 2004-09-06
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● Chapter 2

😊 1. Module title

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**In this chapter you learned:**

The composition and the operating principle of the injection pump with its governor and of the injectors.

The alternating motion of the pump elements is controlled by the camshaft.

The governor acts on the control rack, which rotates the pump plungers, and thus influences the quantity injected.

The injection begins when the pump plunger closes the inlet and spill ports in the pump element.

The diameter and the length of the delivery pipes depend on the type of engine.

Remarks