

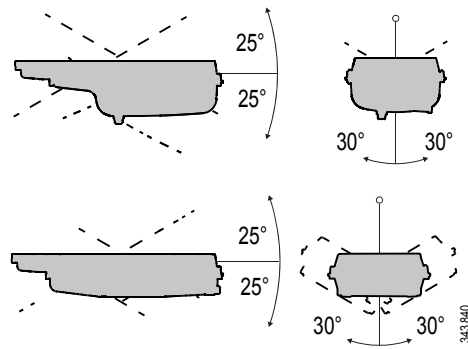
Inspection intervals

	Daily	First time at		Interval (hours)				Minimum		
		first start	500	500	1,000	2,000	6,000	annually	every 5 years	
				S	M	L	XL			
Lubrication system	X	X								
Checking the oil level										
Changing the oil					X ¹	X ¹	X ¹	X ¹	X	
Cleaning the centrifugal oil cleaner					X ¹	X ¹	X ¹	X ¹	X	
Renewing the oil filter				X ¹	X ¹	X ¹	X ¹	X		
Cooling system	X									
Checking the coolant level										
Checking coolant antifreeze or corrosion protection			X				X	X	X	
Cleaning the cooling system and changing coolant								X		X
Air cleaner	X									
Reading the vacuum indicator										
Renewing the filter element							X ¹	X		X
Renewing the safety cartridge							X	X		X
Fuel system	X	X								
Checking the fuel level										
Renewing the fuel filter						X ¹	X ¹	X ¹		X
Miscellaneous	X	X								
Checking the drive belt						X	X	X	X	
Checking for leaks								X	X	
Checking and adjusting valve clearances and injectors			X			X	X			

1 More often if required.

Maximum angles of inclination during operation

Maximum permissible angles during operation vary, depending on the type of oil sump; see illustration.

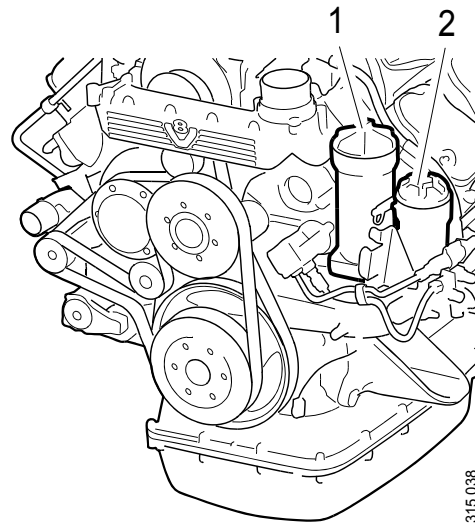


Renewing the oil filter



IMPORTANT!

Clean the centrifugal oil cleaner when renewing the oil filter. Otherwise, the oil filter will be blocked and resistance in the filter will increase. If this happens, an overflow valve in the filter retainer opens and lets the oil pass without being filtered.



1 Oil filter

2 Pressure filter

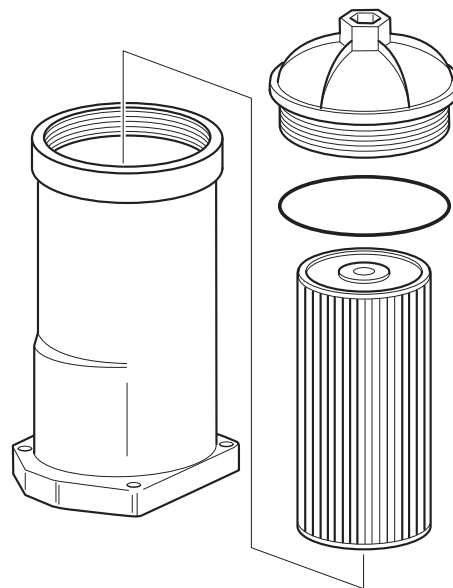
1. Unscrew the filter with a socket wrench with hexagon driver e.g. 36 mm socket 588 475.



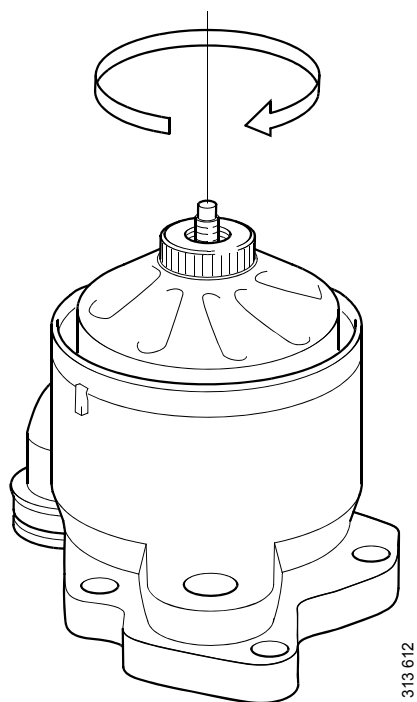
IMPORTANT!

Do not use an adjustable spanner or other open tool as there is risk of damaging the filter cover.

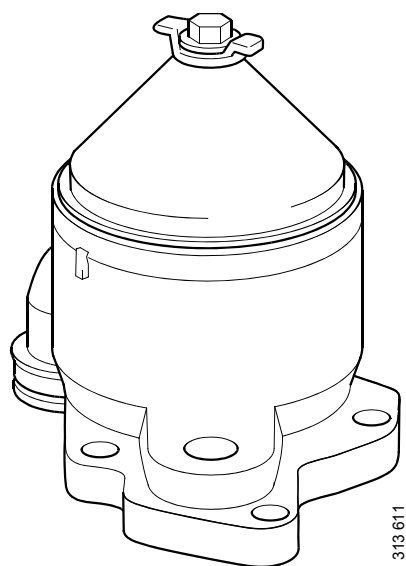
2. Lift out the filter housing cover with filter element. The filter housing will drain automatically once the filter has been removed.
3. Renew the O-ring in the cover. Lubricate the O-ring with engine oil.
4. Press a new filter into the snap fastener in the cover and tighten the filter cover to 25 Nm (18 lbf/ft).



17. Refit the rotor and rotate it by hand to make sure it rotates easily.



18. Renew the O-ring on the cover of the oil cleaner housing and fit the cover. Tighten the lock nut to 15 Nm.



Antifreeze and corrosion inhibitor concentration table

35% by volume of antifreeze provides sufficient protection against corrosion.

Example:

1. The total volume of the cooling system is 40 litres in this example.
2. The measured concentration of ethylene glycol is 35% by volume (freezing point -21°C). According to the table, there are 14 litres of ethylene glycol in the cooling system.
3. The measured concentration of ethylene glycol is 45% by volume (freezing point -30°C). According to the table, 18 litres of ethylene glycol are required in the cooling system.
4. Since there are already 14 litres in the cooling system, 4 litres of ethylene glycol must be added to the cooling system ($18 - 14 = 4$ litres).

Volume of ethylene glycol (%)	For calculation			Adequate protection against corrosion					Cooling system volume (litres)
	20	25	30	35	40	45	50	60	
Ice slush forms ($^{\circ}\text{C}$)	-6	-9	-12	-21	-24	-30	-38	-50	
Volume of ethylene glycol (litres)	5	6	8	11	12	14	15	18	30
	6	8	10	14	16	18	20	24	40
	8	10	13	18	20	23	25	30	50
	9	12	15	21	24	27	30	36	60
	11	14	18	25	28	32	35	42	70
	12	16	20	28	32	36	40	48	80
	14	18	23	32	36	41	45	54	90
	15	20	25	35	40	45	50	60	100
	17	22	28	39	44	50	55	66	110
	18	24	30	42	48	54	60	72	120
	20	26	33	46	52	59	65	78	130
	21	28	35	49	56	63	70	84	140
	23	30	38	53	60	68	75	90	150
	24	32	40	56	64	72	80	96	160
	26	34	43	60	68	77	85	102	170
	27	36	45	63	72	81	90	108	180
	29	38	48	67	76	86	95	114	190
30	40	50	70	80	90	100	120	200	

Cleaning the cooling system

Note:

Clean the cooling system more often than specified in the inspection programme if necessary.



IMPORTANT!

Do not use caustic soda or other alkaline detergent as this could damage the aluminium.

External: Cleaning the radiator and charge air cooler

1. Check that the radiator and the charge air cooler are not clogged on the air side and that the cooling fins are not damaged.
2. Carefully scrape away any deposits from the radiator cooling fins. Use a paraffin-based engine cleaner if necessary.
3. Carefully straighten bent cooling fins using a steel brush or the like.



WARNING!

To ensure proper handling of cooling system detergent, study the warning text on the package.

Miscellaneous

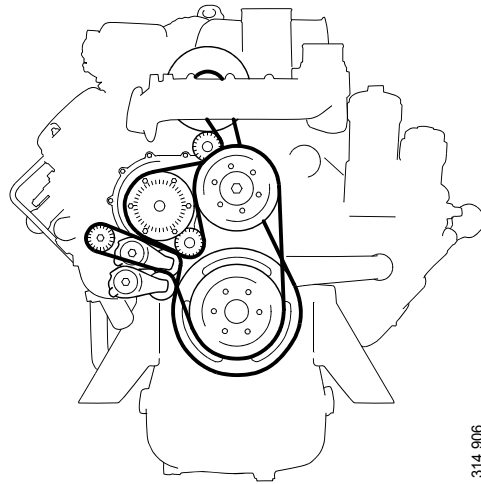
Checking the drive belt



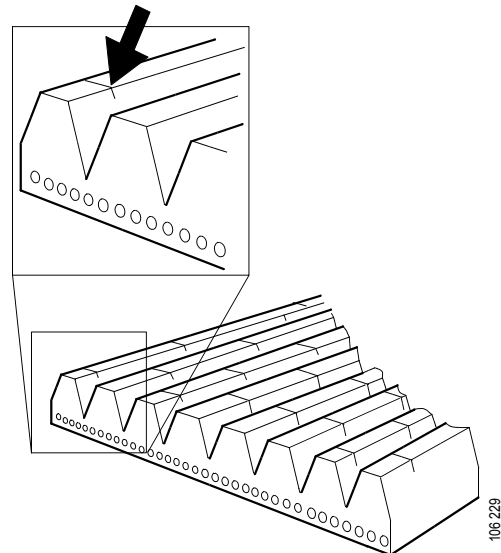
IMPORTANT!

Refit the drive belt with the same direction of rotation as it had before removal.

Check the drive belt thoroughly, particularly at the idler rollers.



Check the drive belt for cracks.



The drive belt must be renewed if it has cracks.

3. Any warranted part which is scheduled for replacement as required maintenance in Scania's written instructions for maintenance and use of the engine by owner shall be warranted for the period of time prior to the first scheduled replacement point for that part. If the part fails prior to the first scheduled replacement, the part shall be repaired or replaced by the engine manufacturer according to Subsection (4) below. Any such part repaired or replaced under warranty shall be warranted for the remainder of the period prior to the first scheduled replacement point for the part.
4. Repair or replacement of any warranted part under the warranty provisions of this article shall be performed at no charge to the owner at a warranty station.
5. Notwithstanding the provisions of Subsection (4) above, warranty services or repairs shall be provided at all manufacturer distribution centers that are franchised to serve the subject engines.
6. The owner shall not be charged for diagnostic labor that leads to the determination that a warranted part is in fact defective, provided that such diagnostic work is performed at a warranty station.
7. The engine manufacturer shall be liable for damages to other engine components proximately caused by a failure under warranty of any warranted part.
8. Throughout the engine's warranty period defined above, the engine manufacturer shall maintain a supply of warranted parts sufficient to meet the expected demand for such parts.
9. Any replacement part, as defined in Section 1900(b), Title 13 of the California Code of Regulations, may be used in the performance of any maintenance or repairs and must be provided without charge to the owner. It is not necessary for replacement parts to be the same brand or by the same manufacturer as the original part sold with the engine. Such use shall not reduce the warranty obligations of the engine manufacturer.
10. Add-on or modified parts, as defined in Section 1900(b), Title 13 of the California Code of Regulations, that are not exempted by the California Air Resources Board may not be used. The use of any non-exempted add-on or modified parts shall be grounds for disallowing a warranty claim made in accordance with this article. The engine manufacturer

shall not be liable under this article to warrant failures of warranted parts caused by the use of a non-exempted add-on or modified part.

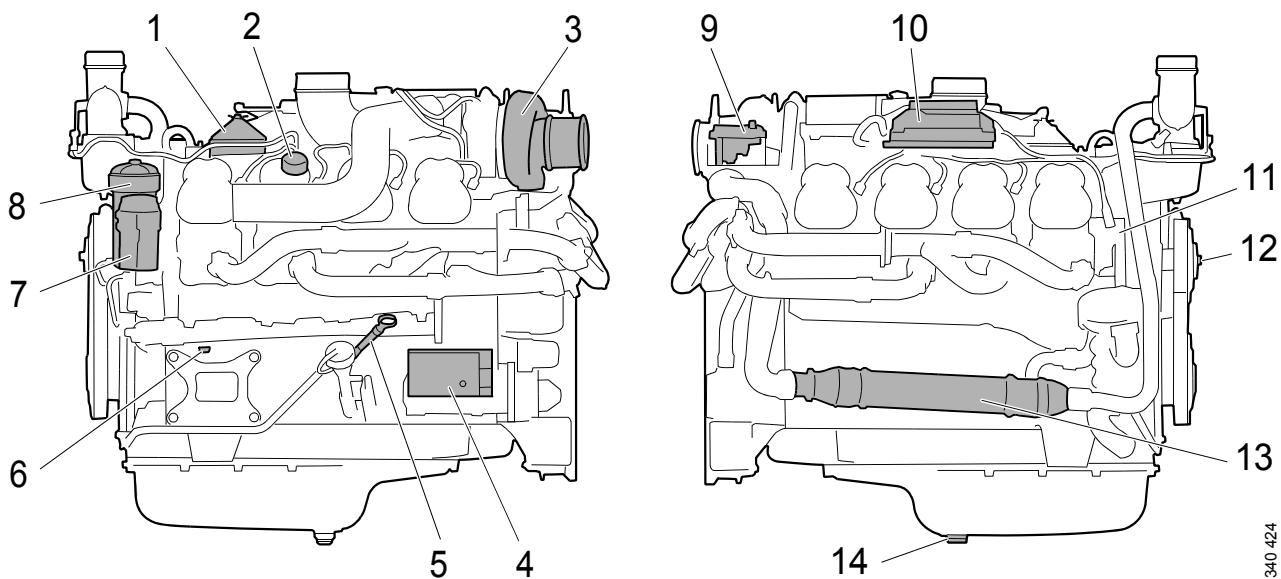
11. The Executive Officer of the California Air Resources Board may request, and in such case, the engine manufacturer shall provide, any documents which describe that manufacturer's warranty procedures or policies.

Parts covered by the Warranty

The following is a list of parts considered to be part of the Emission Control Systems covered by the Emission Warranty for Scania industrial engines which were built to conform to federal and California emission control regulations:

1. Fuel injection system.
2. Air induction system.
3. Exhaust manifold system.
4. Smoke puff limiter (included in ECU).
5. Oil filler cap.
6. EGR system (when applicable):
 - a) Cooler.
 - b) EGR valve.
7. Exhaust brake (when applicable).
8. NOx sensors:
 - a) NOx sensor, engine out.
 - b) NOx sensor, tail pipe.
9. DOC (when applicable).
10. SCR system:
 - a) DEF tank.
 - b) DEF tank level, temperature and quality sensors.
 - c) DEF hose.
 - d) DEF injector.
 - e) DEF injector pressure and temperature sensors.
 - f) Evaporator.
 - g) SCR catalyst inlet temperature sensor.
 - h) SCR catalyst including the ammonia-slip catalyst.
 - i) SCR control unit (EEC3).

Component identification



The illustration shows a normal version of a DC16 engine. The engine ordered may have different equipment.

Note:

The oil cooler is located on the top of the engine between the cylinder banks.

The water separating prefilter for the fuel is located between the fuel tank and engine.

- | | |
|-------------------------------|-------------------------|
| 1. Centrifugal oil cleaner | 8. Oil filter |
| 2. Oil filler | 9. EGR valve |
| 3. Turbocharger ¹ | 10. Engine control unit |
| 4. Starter motor | 11. Engine data plate |
| 5. Oil dipstick | 12. Coolant pump |
| 6. Valve for draining coolant | 13. EGR cooler |
| 7. Fuel filter | 14. Oil plug |

1. The DC16 084A/384A may be equipped with an exhaust brake which is connected to the turbocharger.

Reaction to fault in SCR system

Time	Warning lamp	Torque reduction ¹
Fault detected	Constant light	
After 30 minutes	Flashing	Torque is reduced by 1% per minute to 70% of the highest torque
After 4 hours	Flashing rapidly	Torque is reduced to 0% (low idling) within 2-10 minutes

1. Applies only to engines that are certified according to Tier 4.

Once the fault has been remedied and the engine control unit has received an indication that it is working, torque returns to the normal level.

If a new fault occurs within 40 hours of operation since the first fault, the warning lamp will come on. After 30 minutes of operation, the warning lamp will flash rapidly and torque will be reduced to 0% (low idling) within 30 minutes.

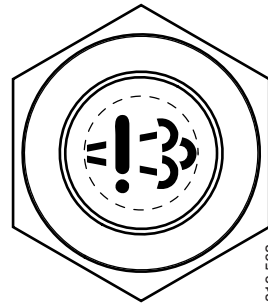


IMPORTANT!

If the torque has been reduced to 0% (low idling), the engine control unit does not detect that the SCR system is functioning again. A service technician must then reset the system so that the torque returns to the normal level.

Note:

The torque reduction applies only to engines that are certified according to Tier 4.



Symbol for fault in SCR system

Oil analysis

To be able to extend the oil change intervals using an oil analysis, Scania LDF-2 and LDF-3 oils must be used.

Oil companies can offer analysis of the engine oil.

The following conditions must remain fulfilled when the oil is changed.

- Viscosity at 100°C (212°F): max. $\pm 20\%$ of original value of the fresh oil.
- TBN (in accordance with ASTM D4739): > 3.5
- TBN (in accordance with ASTM D4739): > TAN (in accordance with ASTM D664)
- Soot (DIN 51452): < 3%

Such analysis measures the oil's TBN (Total Base Number), TAN (Total Acid Number), fuel dilution, water content, viscosity and the quantity of particles and soot in the oil.

The result of a series of analyses is used as the basis for establishing a suitable oil change interval.

If the conditions are changed, a new oil analysis programme must be carried out to establish new change intervals.

Checking oil level

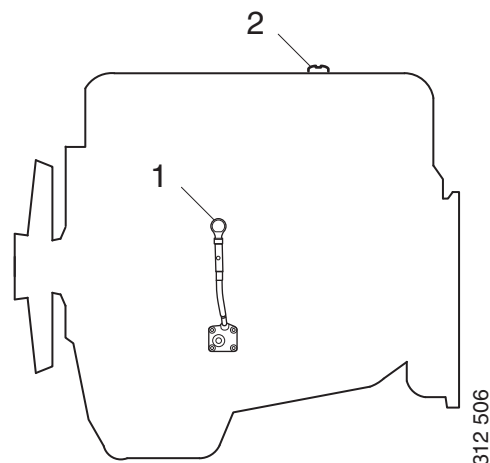
Checking the oil level with the engine switched off

Note:

Leave the engine off for at least 1 minute before checking the oil level.

1. Remove the oil dipstick (1) and check the oil level. The correct level is between the minimum and maximum marks on the oil dipstick.
2. Top up with more oil (2) when the oil level is at or below the lower mark.

Information on the correct oil type is found under the heading Oil grade.



18. Fit a new O-ring in the cover. Refit the cover and tighten the lock nut. Tightening torque 15 Nm.

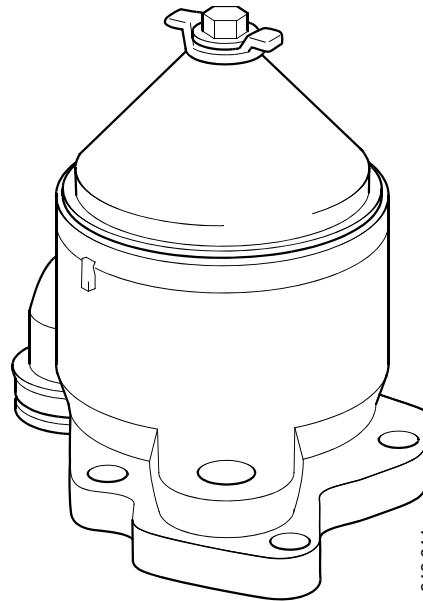


IMPORTANT!

To reduce the risk of oil leakage it is important to tighten the cover to the correct tightening torque.

Note:

A torque wrench together with a ratchet head is suitable for use during maintenance of the centrifugal oil cleaner.

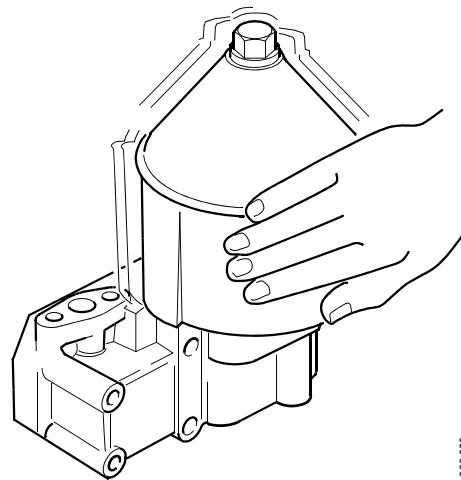


Operational testing

Operational testing need only be carried out if it is suspected that the centrifugal oil cleaner is not working properly. For example, if there is an abnormally small amount of deposit in the centrifugal oil cleaner in relation to the distance driven.

The rotor rotates very fast and should continue to turn when the engine has stopped.

1. Run the engine until it is warm.
2. Turn off the engine and listen for the sound from the rotor. Use your hand to feel if the filter housing is vibrating.
3. If the filter housing is not vibrating, dismantle and check the centrifugal oil cleaner.



Antifreeze and corrosion inhibitor

Only the product Scania coolant, or other products that are tested to provide proper antifreeze and protection against corrosion for Scania, may be used in Scania engines. Products that do not satisfy the requirements for use in a Scania engine can result in faults in and damage to the cooling system. This can lead to the invalidation of Scania's warranty for faults and damage caused by the use of inappropriate coolant.

The antifreeze and corrosion inhibitor used in Scania engines should be of the ethylene glycol type.

Scania concentrate

Designation	Contents	Part No.	Volume litre	Volume US gallons
Coolant	Antifreeze and corrosion inhibitor (concentrate)	1 894 323	5	1.3
Coolant	Antifreeze and corrosion inhibitor (concentrate)	1 894 324	20	5.3
Coolant	Antifreeze and corrosion inhibitor (concentrate)	1 894 325	210	55
Coolant	Antifreeze and corrosion inhibitor (concentrate)	1 894 326	1,000	264

Scania Ready Mix

Designation	Contents	Part No.	Volume litre	Volume US gallons
Coolant	Scania antifreeze and corrosion inhibitor Ready Mix 50/50	1 921 955	5	1.3
Coolant	Scania antifreeze and corrosion inhibitor Ready Mix 50/50	1 921 956	20	5.3
Coolant	Scania antifreeze and corrosion inhibitor Ready Mix 50/50	1 921 957	210	55
Coolant	Scania antifreeze and corrosion inhibitor Ready Mix 50/50	1 896 695	1,000	264

Renewing the fuel filter using a bleeding tool

Engines with XPI have dual fuel filters in the form of a water separating suction filter and a pressure filter.

Removal

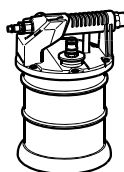
Designation

Hexagon socket, 1/2" drive, 36 mm

Illustration



Bleeding tool



Environment

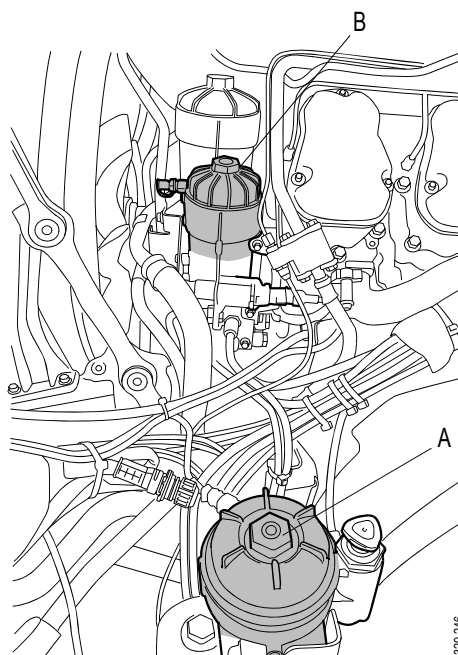
Avoid spillage and use a suitable container. Used fuel must be disposed of as specified in national and international law.

To ensure that the filter housings are drained properly, the filter covers must be removed as follows:



IMPORTANT!

Start with the water separating suction filter (A). Do not open the pressure filter cover (B) until the filter housing for the water separating filter (A) is completely drained.



Miscellaneous

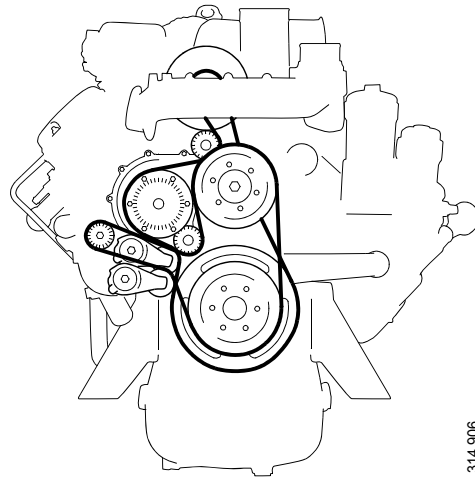
Checking the drive belt



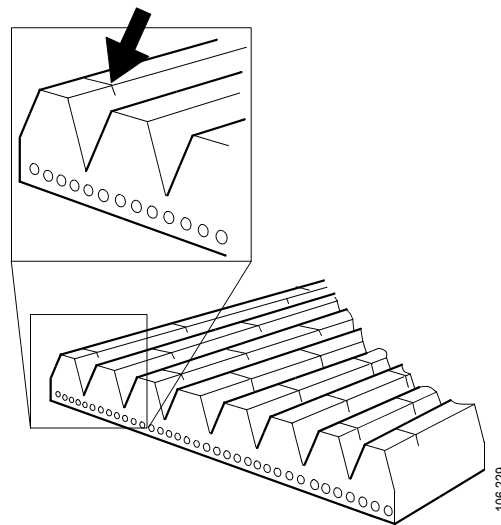
IMPORTANT!

Refit the drive belt with the same direction of rotation as it had before removal.

Check the drive belt thoroughly, particularly at the idler rollers.



Check the drive belt for cracks.



The drive belt must be renewed if it has cracks.

Diesel

Composition of the fuel

The composition of the fuel is extremely important for the operation and service life of the engine and injection system. The engine output and exhaust gases are also dependent on the fuel grade.

The requirements and testing standards for the most important characteristics are described in the Workshop Manual which can be ordered from Scania dealers or directly from Scania.

The table shows some of the key properties.

Property	Requirement
Viscosity at 40°C (104°F)	2.0-4.5 cSt
Density at 15°C (59°F)	0.82-0.86 cSt
Ignitability (CET rating)	minimum 49
Flashpoint	56°C (132°F)
Particulate contamination level	ISO 11500, class 22/20/17

Sulphur content of fuel

It is important to use low-sulphur fuel

It is important for sulphur-free or ultra-low sulphur fuel to be used on engines with SCR systems certified in accordance with Stage III B/Tier 4i and Stage IV/Tier 4f to ensure that the engine operates correctly. Use of the wrong fuel grade can cause damage to the engine and the exhaust gas aftertreatment system.

From January 2011 legislation in the USA and Europe requires all diesel engines not used on the road to be run on sulphur-free or ultra-low sulphur fuel.



REQUIREMENT!

In Europe, the fuel should be sulphur-free according to standard EN 590. This means that the sulphur content must not exceed 10 ppm.

In the USA the fuel must be an ultra-low sulphur fuel in accordance with standard ASTM D975. This means that the sulphur content must not exceed 15 ppm.

Responsibility



IMPORTANT!

The machine operator is responsible for using the correct type of fuel to ensure that local laws are complied with.