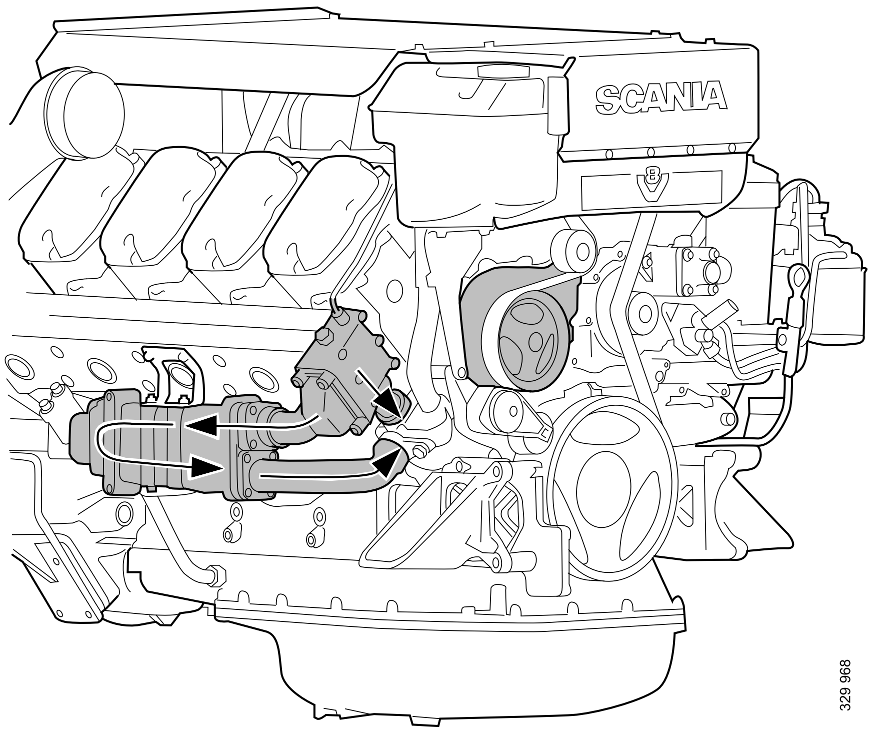
Installation manual

Cooling system

Marine engines
DI09, DI13, DI16



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Changes from the previous issue

The changes made in this document compared with the previous issue are marked with a black line in the left-hand margin. The changes are also described below.

- Information about DI13 XPI has been added.

Sea water circuit

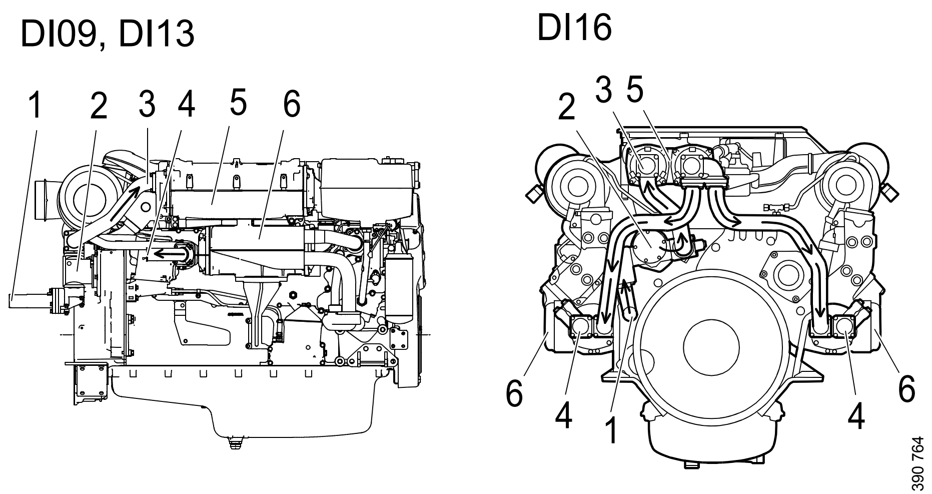
Sea water is circulated through the sea water circuit via a sea water pump, which is powered directly by the timing gear with a gear. A pump with rubber impeller is supplied as standard.

IMPORTANT!

If the pump with rubber impeller is run dry for more than approximately ½ minute, the impeller could melt.

All engines apart from DI16 XPI can also be ordered with a self-priming sea water pump. Scania recommends use of this pump if the sea water is heavily contaminated or if the engine will be repeatedly started without sea water in the system.

From the sea water pump, the water is first led through the charge air cooler, where it cools the air from the turbocharger. The water is then led through the heat exchanger, where it cools the internal coolant circuit of the engine. After the heat exchanger, the water is led to the outlet. It is also possible to connect a water-cooled exhaust pipe bend to the sea water outlet.



Sea water circuit.
1. *Sea water intake.*
2. *Sea water pump.*
3. *Sea water intake for engines without sea water pump.*
4. *Sea water outlet.*
5. *Charge air cooler.*
6. *Heat exchanger.*

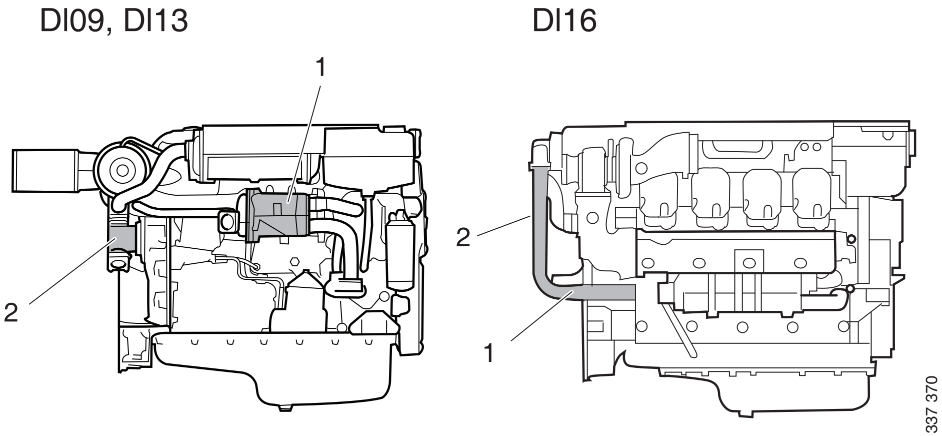
Draining the sea water circuit

Drain the sea water circuit by first closing the sea cock of the vessel and then removing the connection pipe from the heat exchanger outlet (1). Also remove the cover from the sea water pump (2) to drain it completely.

The fitter is responsible for installing extra drain points if the connection lines are not installed in a manner that enables self-draining. The fitter must also ensure that the vessel has a sea cock and that the sea water circuit can be drained.

IMPORTANT!

The engine may sustain freezing damage in winter if the sea water circuit is not drained, if the engine is not kept warm or if the vessel is laid up. To avoid damage caused by freezing during transport or storage, the sea water system should be drained even when the engine has been test run on land.



Draining the sea water circuit.

Pipes and hoses

The suction line of the sea water pump and the outlet line must have as few bends and valves as possible. It must also be kept as short as possible to keep the pressure drop low. The best material for the suction and outlet lines is copper or acid-resistant stainless steel.

The engine can be supplied with either flexible hoses or rigid, straight pipe connections for connecting the suction and outlet lines.

	Dimensions for connection of the sea water pipe (Ø mm)	
	Suction pipe	**Outlet line**
DI09, DI13	50	50
DI16 PDE	50	51
DI16 XPI	63	51

There must always be a flexible connection between the engine and the external pipe system to ensure that vibrations are not transmitted to the vessel.

If there is one common sea water circuit for several engines, then there must be a shut-off mechanism, e.g. an automatically operated solenoid valve, so that sea water is not pumped through the engine if it is not running.

It must be possible to drain suction and outlet lines when necessary. The suction and outlet lines must be dimensioned for the prevailing sea water flow and pressure drop conditions.

Pressure ratios

It is not normally necessary to check the different pressure ratios for propulsion engines that are located below or only marginally above the water line provided they have short suction and outlet lines with dimensions matching the connections on the engine.

An excessive pressure rise or too much vacuum for the pump with rubber impeller reduces the service life of the impeller and reduces cooling capacity.

The following pressure ratios must apply:

- The pressure difference between the suction side and the pressure side of the sea water pump must not exceed 2 bar.
- The vacuum on the suction side must not exceed 0.3 bar. If the vacuum is greater than 0.3 bar, there is an increased risk of cavitation damage to the sea water pump.
- If the engine is positioned above the highest suction height for the sea water pump (i.e. 3 m), a special feed pump must be installed. The feed pump must not raise the internal engine pressure above 2 bar.

The table below indicates the pressure drop through the engine sea water circuit at different flows. Other pressure drops caused by e.g. sea cock, sea water filter, pipes, level differences or reverse gear oil cooler must also be taken into consideration.

Flow (l/min)	**Pressure drop (bar)**	
	DI09, DI13	**DI16**
190	0.40	0.30
250	0.45	0.35
300	0.50	0.40
350	-	0.45
400	-	0.50
480	-	0.60

Sea water intake

The sea water intake must be positioned deep enough in the vessel so that it does not come above the water level when the vessel rolls and so that it is protected by the keel.

If the suction line must have a long horizontal stretch because there is a large distance between the sea water intake and the engine, the line must be positioned low enough to be under the water surface. The suction line is then filled with water even when the engine is not running.

The suction height for the sea water pump must never exceed 3 m, calculated without compensating for the pressure drop in the suction line.

The suction line must be fitted with a sea cock. This must have an opening diameter that is at least as large as the inner diameter of the suction line to prevent excessive pressure drops.

It is important that the sea cock be easily accessible.

Sea water filter

Contaminants, sludge or sand sucked into the sea water line could cause the sea water system to become blocked. This, in turn, reduces sea water pump capacity and engine cooling capacity. Sand and contaminants in the water also reduce the service life of the impeller and sea water pump.

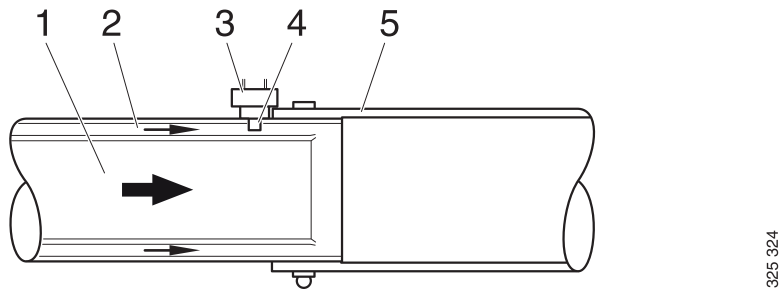
To reduce the risk of sea water pump damage and blockage in the sea water system, a dirt-separating filter must be installed in the suction line. The filter mesh should have a hole size of maximum 2 mm.

The filter must be positioned so that it is easy to disassemble for cleaning.

Warning system for low sea water flow

Some engines with sea water cooled exhaust lines downstream of the engine can have hose connections. In case of a fault in the sea water circuit or blockage of the sea water intake, the hose connections could overheat and melt or catch fire. A warning system should therefore be installed to provide a warning if the sea water flow stops.

An example of a suitable warning system is a temperature monitor that detects the water temperature and the exhaust gas temperature if the sea water flow stops. Another option is a flow monitor installed in the sea water line to the exhaust hose.



Connecting a temperature monitor in the sea water outlet

1. *Exhaust flow*
2. *Sea water flow*
3. *Temperature monitor*
4. *Adapter with sensor body*
5. *Exhaust hose*

Coolant circuit

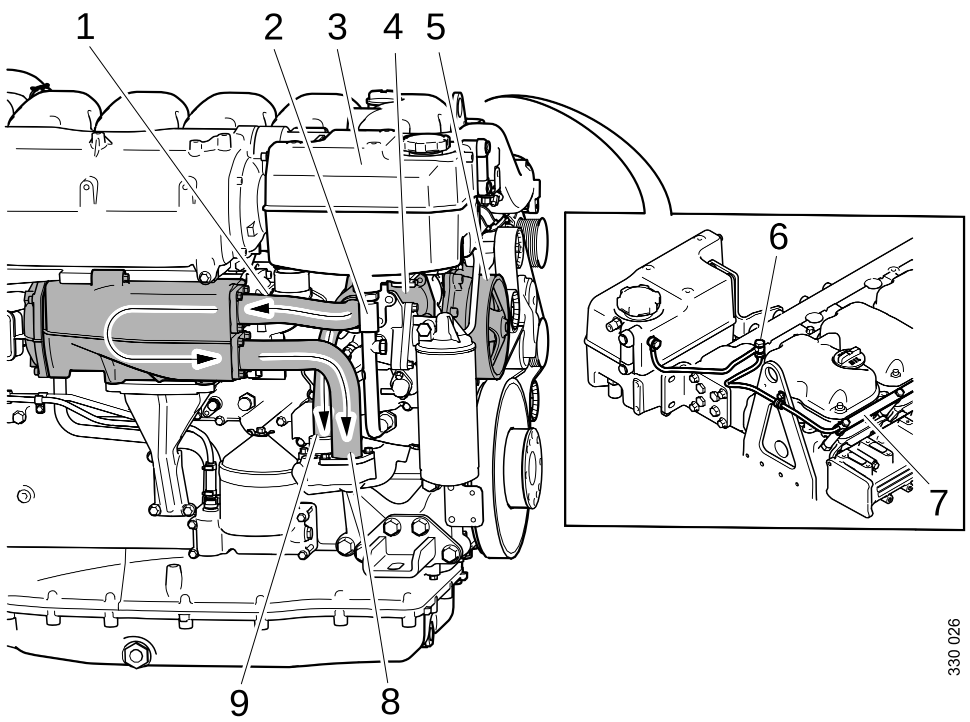
Scania marine engines normally have a closed cooling system, with coolant pumped through the engine and a heat exchanger in a closed circuit.

The exhaust manifold is connected to the coolant circuit. On DI16 XPI, the turbochargers are also connected to the coolant circuit.

On keel cooling engines, the charge air cooler may be connected to the coolant circuit. Higher power outputs for DI16 and DI13 with keel cooling have a separate coolant circuit for the charge air cooler, whereas all DI09 with keel cooling have a separate circuit.

Coolant is circulated through the engine and the heat exchanger by a belt-driven centrifugal pump. Coolant flows backwards from the coolant pump through the engine to the thermostat housing.

When the thermostat is closed, the coolant flows directly from the thermostat housing to the suction side of the coolant pump. When the thermostat has opened, the coolant flows first through the heat exchanger for cooling and then on to the suction side of the coolant pump.



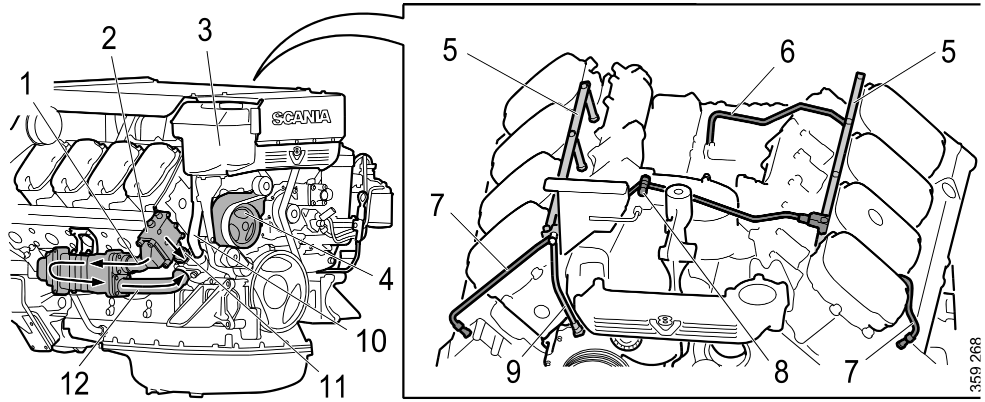
Coolant circuit, DI09 and DI13

1. *Heat exchanger intake from thermostat housing*
2. *Static line pipe*
3. *Expansion tank*
4. *Thermostat housing*
5. *Coolant pump*
6. *Venting from exhaust manifold*
7. *Venting from cylinder heads*
8. *Heat exchanger outlet to suction side of coolant pump*
9. *Bypass pipe*

Engines with heat exchanger have a separate expansion tank located at the very front of the engine. The expansion tank is connected to the suction side of the coolant pump via a static line pipe. There are bleed pipes from the exhaust manifold and cylinder heads up to the expansion tank. On DI16, there are also bleed pipes from the coolant pump and oil cooler cover. The expansion tank has a pressure cap with an opening pressure of 0.75 bar.

Note:

Scania engines must always have corrosion protection in the coolant circuit in the form of antifreeze.



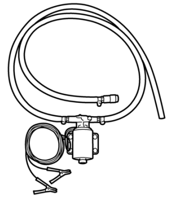
Coolant circuit DI16

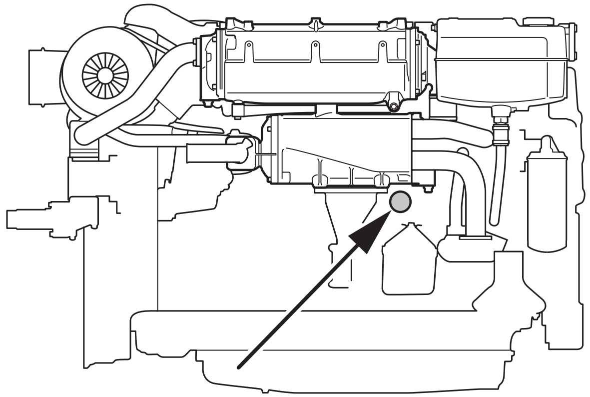
1. *Heat exchanger intake from thermostat housing*
2. *Thermostat housing*
3. *Expansion tank*
4. *Coolant pump*
5. *Venting from cylinder heads*
6. *Venting from the oil cooler cover*
7. *Venting from exhaust manifold*
8. *Connection to expansion tank*
9. *Venting from the coolant pump*
10. *Static line pipe*
11. *Bypass pipe*
12. *Heat exchanger outlet to suction side of coolant pump*

Draining coolant

The fitter must ensure it is possible to drain coolant.

Tool

Number	Description	Image
2 443 679	Coolant pump	 360 625



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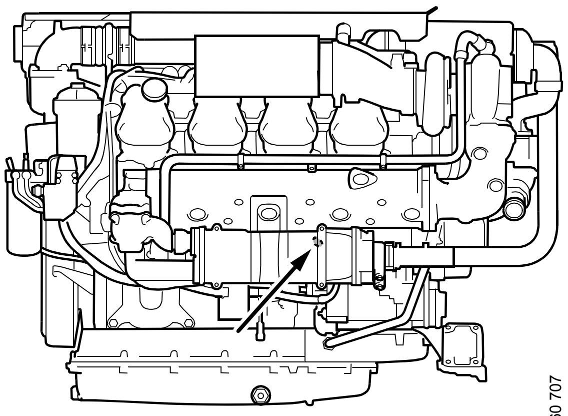
Example of drain valve, DI09 and DI13.

WARNING!

If the engine has been warmed up, the coolant is very hot and can cause burns.

Environment

Use a suitable container. Dispose of used coolant according to national and international laws and regulations.



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Example of drain valve, DI16 (1 on each side behind the heat exchanger).

1. Connect coolant pump 2 443 679 to the lowest drain valve in the cooling system.
2. Place the other hose from the pump into an empty plastic container.
3. Connect the pump's 2 cable terminals to the battery's negative and positive terminal. Check that draining starts. If it doesn't, swap the position of the cable terminals.

Filling coolant

The fitter must ensure it is possible to top up coolant.

IMPORTANT!

It is not permissible to fill large amounts of coolant via the expansion tank. Filling via the expansion tank leads to air pockets in the cooling system, which can damage the coolant pump shaft seal, among other things.

Never fill a large amount of cold coolant in a hot engine. There is great risk of cracks forming in the cylinder block and cylinder heads.

1. Connect coolant pump 2 443 679 to the lowest drain valve in the cooling system.
2. Connect the pump's 2 cable terminals to the battery's negative and positive terminal. Check that filling starts. If it doesn't, swap the position of the cable terminals.
3. Start the engine and leave it running for a while. Check that there are no leaks.
4. Check the level of the coolant and top up as necessary.

Sea water and coolant flow of the water pumps

Pump with rubber impeller

The table indicates the sea water and coolant flow at different engine speeds for the pump with rubber impeller. These flows apply for pumps with new impellers. Flows may also vary if a cam other than the standard cam is used.

Max. external pressure drop applies for the separate charge air circuit for keel cooling engines with two coolant circuits.

Engine speed (rpm)	DI13 XPI		DI16 XPI	DI09, DI13 PDE, DI16 PDE	DI09, DI13 PDE
	Flow (l/min)	Max. external pressure drop (bar)	Flow (l/min)	Flow (l/min)	Max. external pressure drop (bar)
1,200	230	0.65	360	180	0.55
1,500	270	0.95	430	215	0.70
1,800	305	1.35	470	250	0.85
2,100	310	1.45	480	260	1.00
2,300	295	1.30	470	250	-

Self-priming pump

The table indicates the sea water and coolant flow at different engine speeds for the self-priming pump. The self-priming pump cannot be selected for DI16 XPI.

Max. external pressure drop applies for the separate charge air circuit for keel cooling engines with two coolant circuits.

Engine speed (rpm)	**DI09, DI13**	**DI16**	
	Flow (l/min)	**Flow (l/min)**	**Max. external pressure drop**
1,200	100	100	0.55
1,500	190	190	0.70
1,800	230	260	0.85
2,100	270	320	1.00
2,300	300	350	-

Connecting an external expansion tank

If it is necessary to increase cooling system volume, e.g. if an external heating system is connected, it may be necessary to increase expansion capacity by connecting an external expansion tank.

Note:

If an external expansion tank is to be connected, the existing expansion tank must be removed. Bleed pipes for keel cooling engines must be used.

Expansion capacity should be at least 3% of total coolant volume.

The expansion tank may be positioned a maximum of 3.5 metres above the coolant pump when Scania's pressure cap with an opening pressure of 0.75 bar is used. If for some reason the expansion tank must be positioned higher, it is permissible to position it up to a height of 8.5 m if a cap without pressure function is fitted.

The expansion tank must be connected to the suction side of the coolant pump with a static line pipe to reduce the risk of steam and cavitation in the coolant pump. This pipe must have as even a rise as possible to avoid pockets of air and steam. The outer diameter of the static line pipe must be at least 25 mm for the DI09 and DI13 and 38 mm for the DI16. Scania recommends an inner diameter of at least 20 mm for the DI09 and the DI13 and 35 mm for the DI16.

The DI16 must have bleed pipes from the exhaust manifolds, cylinder heads, oil cooler cover and coolant pump, up to the expansion tank.

If the expansion tank and filling system are moved up on deck, the bleed pipe and static line pipe must be routed in 2 separate pipes. These must be connected somewhat separated from each other in the expansion tank to enable automatic system venting. Maximum inner diameter of the bleed pipes is 8 mm.

Coolant volumes

Engine type	Coolant volume (l)
DI09 with heat exchanger	30
DI09 with keel cooling[1]	18
DI09 without heat exchanger and liquid-cooled charge air cooler[1]	18
DI13 with heat exchanger	40
DI13 with keel cooling, 1 coolant circuit[1]	24
DI13 with keel cooling, 2 coolant circuits[1]	20
DI13 without heat exchanger and liquid-cooled charge air cooler[1]	20
DI16 PDE with heat exchanger	63
DI16 XPI with heat exchanger	65
DI16 with keel cooling, 1 coolant circuit[1]	53
DI16 with keel cooling, 2 coolant circuits[1]	50

1. Engine only.

Keel cooling

If the sea water is of such poor quality that it is not suitable for circulation through a sea water circuit, a keel cooling system can be installed. This may be suitable if, for example, the water has a high sludge or sand content or if there are contaminants or ice in the water that could block the sea water intake.

The engine coolant is cooled by being circulated through pipe coils or cooling elements mounted at the bottom of the vessel inside or outside the hull.

On the DI13 and DI16, the coolant for the charge air cooler may be cooled in a separate circuit, depending on the engine power. Engines with 2 cooling circuits have an extra coolant pump for the separate charge air circuit, but no extra thermostat.

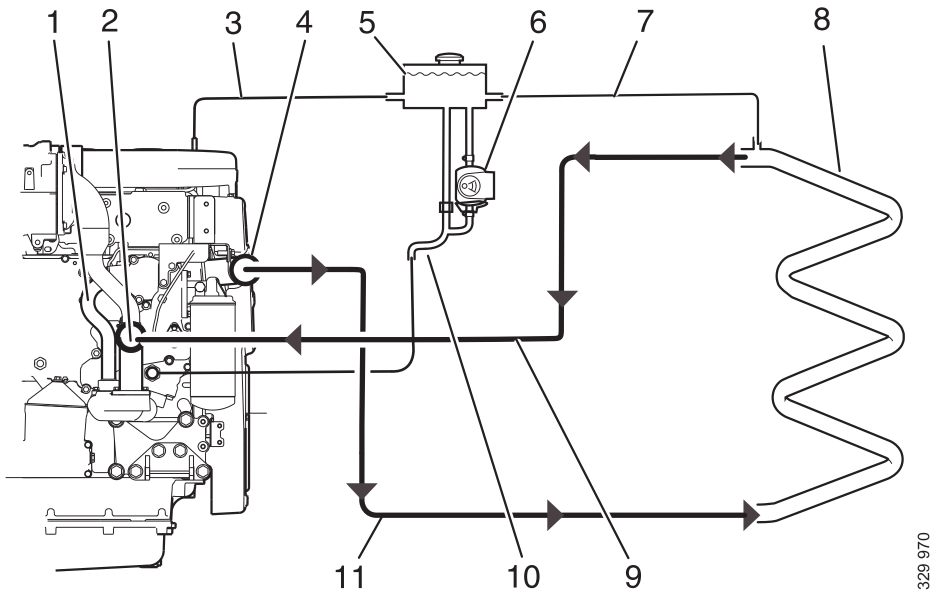
Keel cooling cannot be selected for DI16 XPI.

Keel cooling engines with 1 coolant circuit

DI13 PDE with 1 coolant circuit

Intake to the engine from the external cooling coil is drawn to the suction side of the coolant pump. The coolant is then pumped through the engine to the thermostat housing. When the thermostat has opened, the coolant flows from the thermostat housing to the keel cooling system.

The pipe for connection to the engine coolant circuit has an outside diameter of 50 mm.



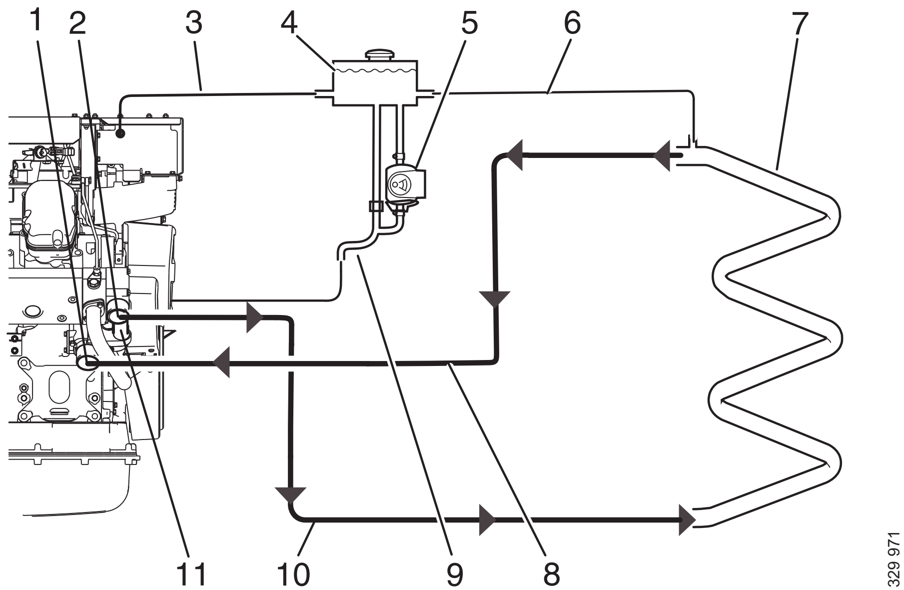
DI13 PDE with 1 coolant circuit

1. *Bypass pipe*
2. *Coolant pump suction side*
3. *Bleed pipe*
4. *Outlet from thermostat housing*
5. *Expansion tank*
6. *Coolant level monitor*
7. *Bleed pipe from highest point of cooling coil*
8. *Cooling coil*
9. *Coolant return pipe to engine*
10. *Static line pipe*
11. *Outlet from thermostat housing to coolant pipes*

DI16 PDE with 1 coolant circuit

Intake to the engine from the external cooling coil is drawn to the suction side of the coolant pump. The coolant is then pumped through the engine to the thermostat housing. When the thermostat has opened, the coolant flows from the thermostat housing to the keel cooling system.

The pipe for connection to the engine coolant circuit has an outside diameter of 63 mm.



DI16 PDE with 1 coolant circuit

1. *Coolant pump suction side*
2. *Outlet from thermostat housing*
3. *Bleed pipe*
4. *Expansion tank*
5. *Coolant level monitor*
6. *Bleed pipe from highest point of cooling coil*
7. *Cooling coil*
8. *Coolant return pipe to engine*
9. *Static line pipe*
10. *Outlet from thermostat housing to coolant pipes*
11. *Bypass pipe*

Keel cooling engines with 2 coolant circuits

The coolant flows from the main circuit cooling coil to the suction side of the coolant pump. From there the coolant is routed through the engine to the thermostat housing. When the thermostat has opened, the coolant flows from the thermostat housing back to the main circuit cooling coil.

Charge air is cooled in a separate coolant circuit with an extra coolant pump. The charge air circuit has no thermostat, which means that coolant circulates continuously through the charge air cooler. This coolant circuit must be equipped with a separate expansion tank, as illustrated on the following pages.

DI09 and DI13 with 2 coolant circuits

The pipe for connection to the engine main circuit has an outside diameter of 63 mm.

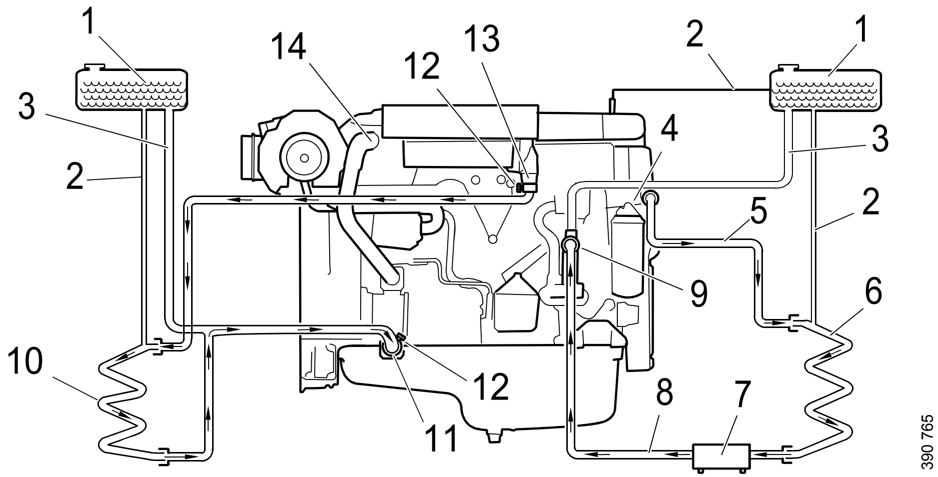
The pipe for connection to the charge air circuit has an outside diameter of 51 mm.

Install shut-off cocks to the charge air circuit outlet and inlet respectively. Then the coolant pump impeller can be renewed without emptying the charge air circuit.

The highest permitted temperature of the coolant entering the charge air circuit is 40°C.

Note:

If the coolant entering the charge air circuit is warmer than 40°C emission requirements are not met and maintenance intervals for the coolant pump impeller are shortened.



DI09 and DI13 with 2 coolant circuits

1. *Expansion tanks.*
2. *Bleed pipe.*
3. *Static line pipe.*
4. *Thermostat housing*
5. *Outlet from thermostat housing.*
6. *Cooling coil for the engine main circuit.*
7. *Auxiliary oil cooler.*
8. *Return line to the suction side of coolant pump.*
9. *Coolant pump suction side.*
10. *Cooling coil for the charge air circuit.*
11. *Inlet to charge air cooler.*
12. *Shut-off cocks.*
13. *Outlet from the charge air cooler.*
14. *Inlet to charge air cooler for engines without a coolant pump for the charge air circuit.*

DI16 PDE with 2 coolant circuits

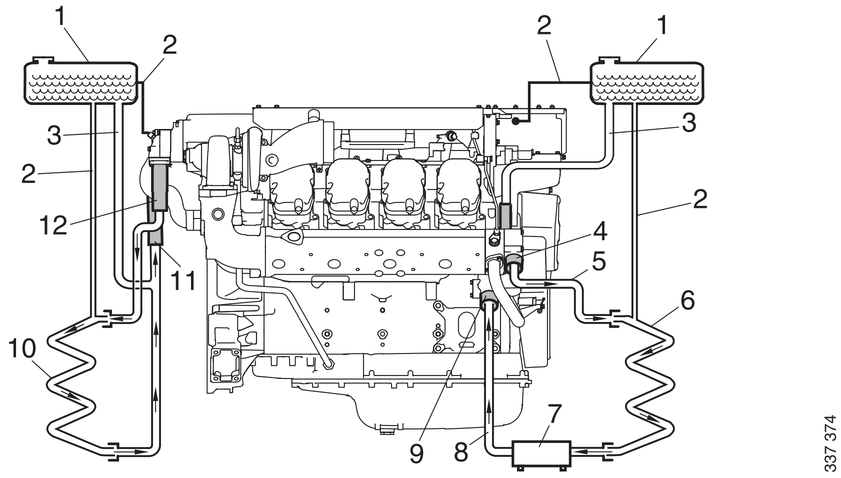
The pipe for connection to the engine main circuit has an outside diameter of 63 mm.

The pipes for connection to the charge air circuit have an outside diameter of 51 mm for the outlet and 54 mm for the inlet.

The highest permitted temperature of the coolant entering the charge air circuit is 40°C.

Note:

If the coolant entering the charge air circuit is hotter than 40 °C, the emission requirements are not met.



DI16 PDE with 2 coolant circuits.

1. *Expansion tanks.*
2. *Bleed pipe.*
3. *Static line pipe.*
4. *Thermostat housing*
5. *Outlet from thermostat housing.*
6. *Cooling coil for the engine main circuit.*
7. *Auxiliary oil cooler.*
8. *Return line to the suction side of coolant pump.*
9. *Coolant pump suction side.*
10. *Cooling coil for the charge air circuit.*
11. *Inlet to charge air cooler.*
12. *Outlet from the charge air cooler.*

Pressure drop and coolant flow

The coolant pipes and hose connections between engine and cooler must be dimensioned in a manner that prevents reduction of cooling capacity. An adequate quantity of coolant must be able to pass through the pipes, hoses and cooler.

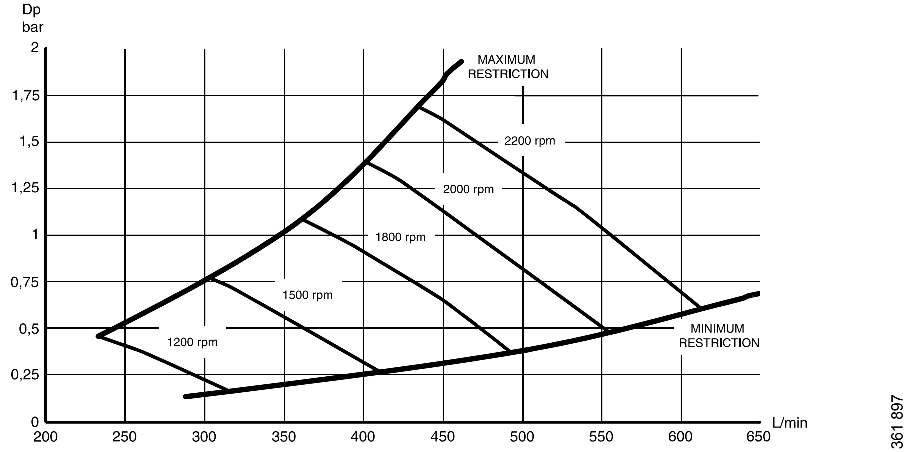
Note:

The amount of coolant passing through the cooler is reduced when components or restrictor valves are connected in the system. This leads to a reduction in cooling capacity. At the same time, this increases the pressure in the thermostat housing, hoses and cooler.

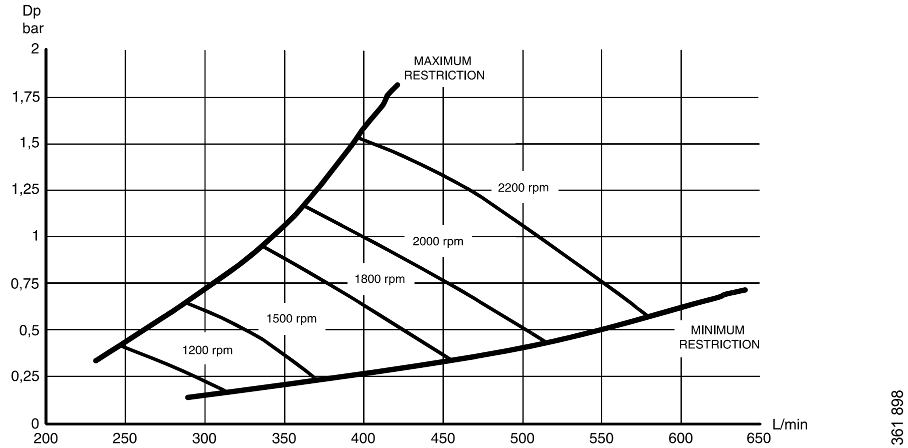
The coolant lines should be made of pipe, which is bent and jointed with short straight hoses. Ribbed hoses can hinder flow.

The maximum permitted pressure drop (Dp) over the external cooling system and the minimum coolant flow in litres/minute at different engine speeds are covered in the diagrams on this page and the next one.

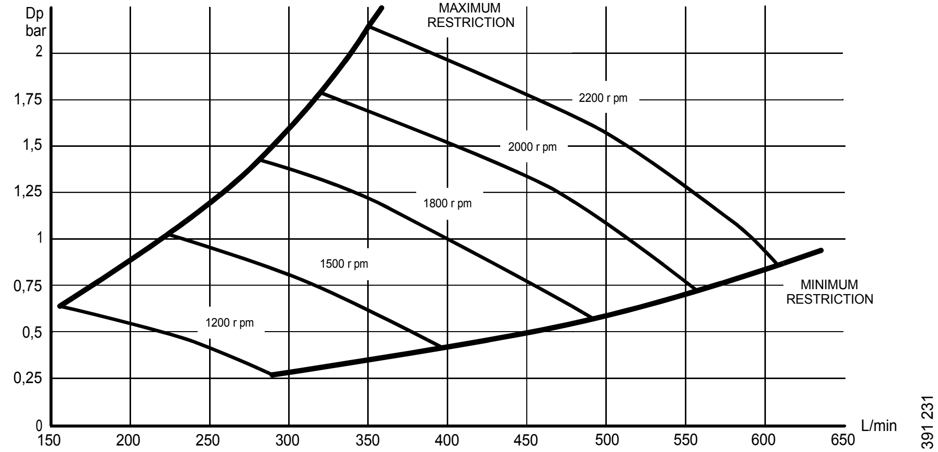
If in doubt, check that the pressure drop across the external cooling system does not exceed permissible values. The pressure drop is determined by measuring the difference in pressure between the thermostat housing and the coolant pump intake with the thermostats blocked in the open position and with no pressure cap.



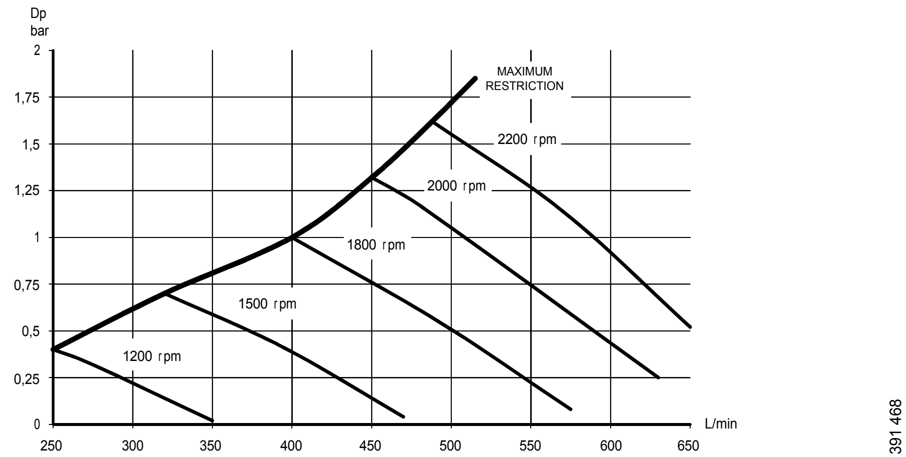
DI13 PDE with 2 coolant circuits and DI09.



DI13 PDE with 1 coolant circuit.



DI13 XPI.



DI16.

Keel cooling design and installation

Scania supplies engines prepared for connection to a keel cooling system, but does not supply complete keel cooling systems.

The keel cooling system supplier is responsible for the detailed dimensioning and design of the system.

Calculate and design the keel cooling system with the following recommendations in mind:

- Keel cooling pipes and connection lines to the engine should be made of copper or acid-resistant stainless steel. Scania recommends an inner diameter of at least 50 mm so that coolant pipes are a reasonable length.
- The system should have no sharp bends and the pipes must all have the same dimension to avoid undesired pressure drops. Information on maximum permissible pressure drop and minimum coolant flow is found in the previous section.
- If guard plates are used to protect the coolant pipes, these must be positioned so as not to interrupt the circulation around the pipes.
- If an auxiliary oil cooler, e.g. a reverse gear oil cooler, is incorporated into the system, the added heat from this cooler must be taken into account when calculating the length of the coolant pipes.
- When calculating coolant pipe length, adjustments must be made if the coolant pipes are painted or dirty. Painted or dirty pipes reduce cooling capacity. In addition, certain bottom paints can have a corrosive effect on copper pipes.
- The keel cooling system must be fitted with an expansion tank, positioned higher than the engine cooling circuit. The expansion tank must be dimensioned for an expansion capacity of 3% and a reserve volume of 5% (total 8%) of the total volume of the keel cooling system. The total volume of the keel cooling system is the sum of the keel cooling circuit volume and the engine coolant circuit volume.
- However, the reserve volume in the expansion tank must always be at least 10 litres.

  Example:

  - Total volume = 150 l.

  - Expansion capacity 3 % = 4.5 l.

  - Reserve volume (5 %) = 7.5 l. However, the reserve volume must be at least 10 l.

  Expansion tank volume should be 4.5 + 10 = 14.5 l.

- The expansion tank must be connected to the suction side of the coolant pump with a static line pipe to reduce the risk of steam and cavitation in the coolant pump. This connection should have as even a rise as possible to avoid pockets of air.

REQUIREMENT!

The outer diameter of the static line pipe must be at least 25 mm for the DI09 and DI13 and at least 38 mm for the DI16. Scania recommends an inner diameter of at least 20 mm for the DI09 and the DI13 and 35 mm for the DI16.

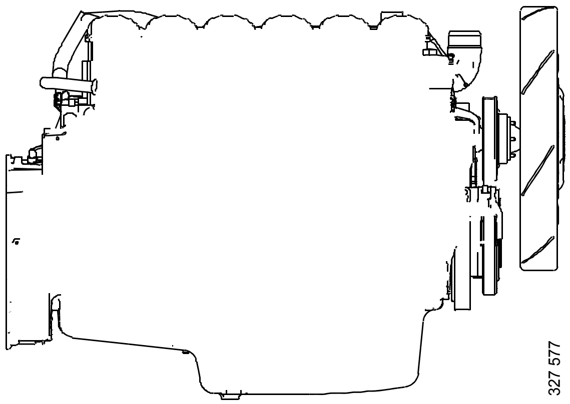
- There must be bleed pipes from the regular outlet on the engine to the expansion tank and from the highest point of the keel cooling circuit, if there are level differences in the keel cooling pipe system. The inner diameter of the bleed pipe must not be greater than 8 mm to avoid the flow becoming too great.
- If water temperature exceeds 50°C, the pipes must not be hot dip galvanised due to the risk of galvanic corrosion of iron components of the engine.
- The bleed pipes and the static line pipe must be routed in 2 separate pipes to enable automatic system venting.

Cooling system with air-cooled cooler

It is also possible to use an engine with cooling fan and conventional cooler for marine purposes. An engine of this type must normally have a coolant-cooled exhaust manifold to comply with classification requirements. Such engines are primarily used as a stand-by generator set in large vessels.

To ensure proper cooling system operation, the cooling air intake and outlet ports must have a sufficiently large area, i.e. at least the same size as the front area of the cooler. It is also important for the system to be designed in a manner that prevents air recirculation.

Information on dimensioning can be found in *01:05 Cooling system* in the installation manual for industrial engines. Note that marine engines have a greater cooling requirement due to their water-cooled exhaust manifolds.



Connecting an auxiliary oil cooler

Engines with heat exchanger

On engines with heat exchanger, the cooler for cooling the transmission oil for reverse gear and the like can be connected directly to the sea water outlet. Information on a suitable type of oil cooler can be obtained from the reverse gear supplier.

REQUIREMENT!

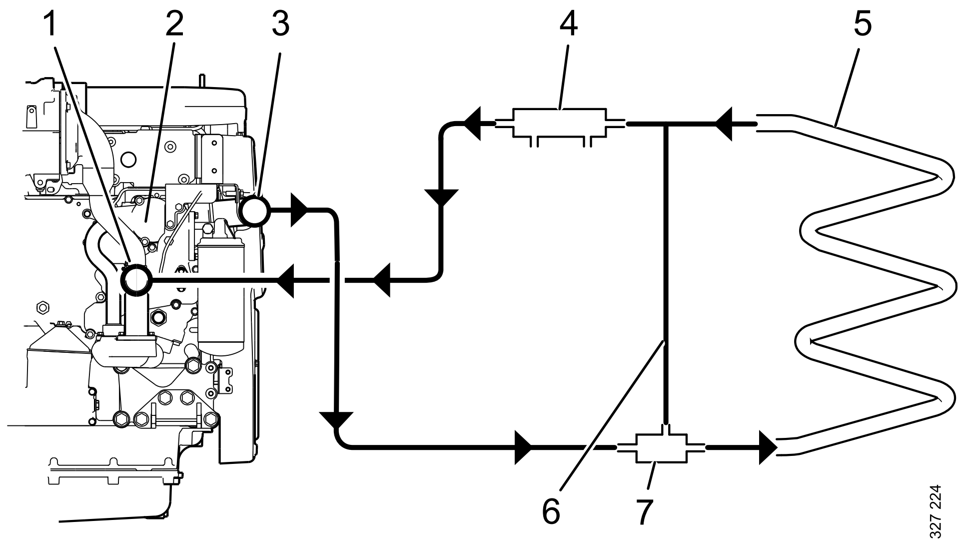
Connection pipes must have an outer diameter of 54 mm to fit existing heat exchanger connections.

The pressure drop in the lines and across the oil cooler must be included in the total system pressure drop. The total pressure drop must not exceed 1.3 bar. For this reason, the number of sharp bends should be kept to a minimum. More information on dimensioning lines is found in the Sea water circuit section.

Engines with keel cooling

An auxiliary oil cooler, e.g. a reverse gear oil cooler, can be connected to the keel cooling motor cooling system in the suction line between the coolant pipes and coolant pump intake.

In some installations, it may be necessary to connect the auxiliary oil cooler to the bypass circuit to ensure coolant flow through the oil cooler when the thermostats are closed. An example of such an installation is where the engine load is low (which means low coolant temperature and long time before the thermostats open) or when using a reverse gear slipping valve to reduce propeller speed. If an auxiliary oil coolant is connected, an external thermostat must be fitted and the engine thermostat must be locked in the open position.



Connection of auxiliary oil cooler with external thermostat on engine with keel cooling

1. *Coolant pump suction side*
2. *Thermostat housing with thermostat locked open*
3. *Outlet from thermostat housing*
4. *Auxiliary oil cooler*
5. *Cooling coil*
6. *Bypass line*
7. *External thermostat*

Connecting a cab heater

An external heating system, such as a cab heater, can be connected to the engine coolant circuit.

The connection lines must be dimensioned based on the dimensions of the connections. To ensure sufficient circulation, the minimum inner diameter should be 18 mm.

A cab heater must be equipped with a drain tap at the lowest point and venting at the highest point. Scania recommends positioning the expansion tank in the cooling system higher than an external heating system.

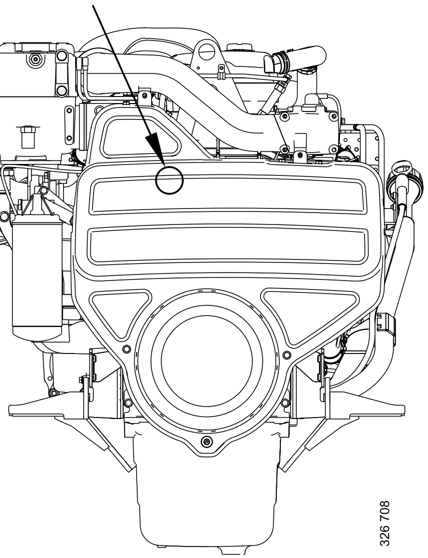
Note:

If external circuits are connected, there must always be venting on these circuits.

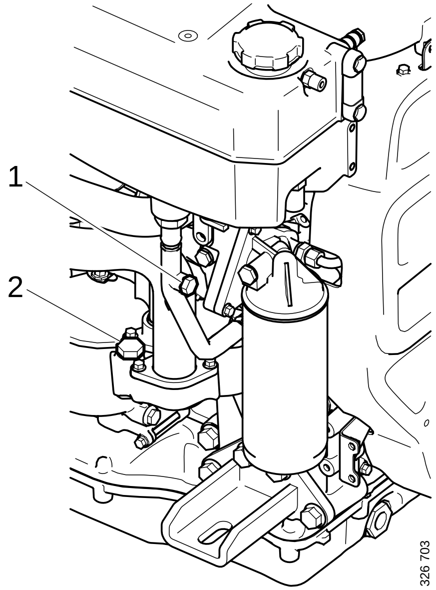
On the DI09 and the DI13, the cab heater intake line is routed to the connection above the coolant pump on the cylinder block. Cut a hole in the protective casing perforation to access the connection. The return line is connected to either the static line pipe or the flange pipe. See illustrations on next page.

On the DI16, the cabin heater intake line is connected to the thermostat housing. The return line is connected to the flange pipe.

The engines can be prepared for connection to a cabin heater with a special union that can be ordered as extra equipment.

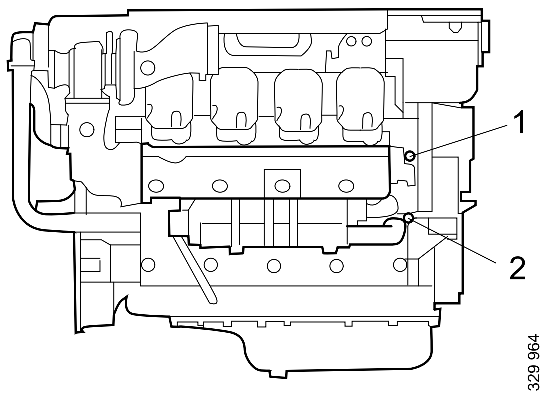


Connection of the intake line to the cab heater, DI09 and DI13, M18x1.5



Connection of the return line from cabin heater, DI09 and DI13

1. *M18x1.5*
2. *M22x1.5*



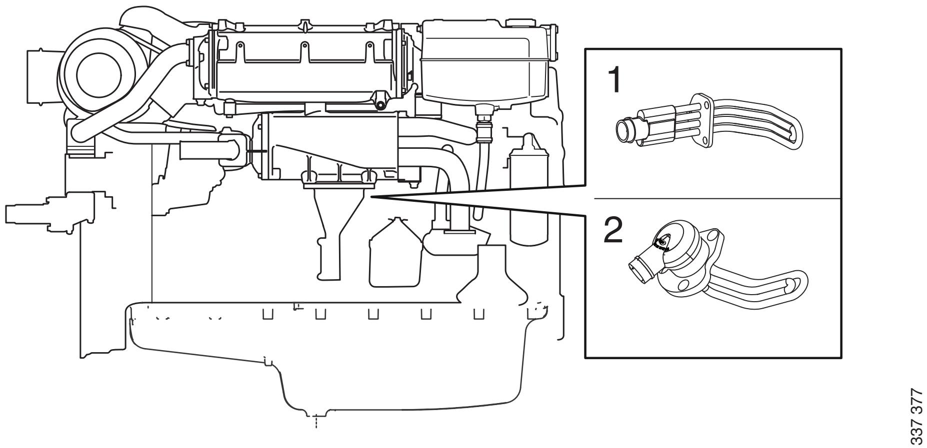
Connection of cab heater, DI16

1. *Intake line, M26x1.5*
2. *Return line, M26x1.5*

Immersion heater

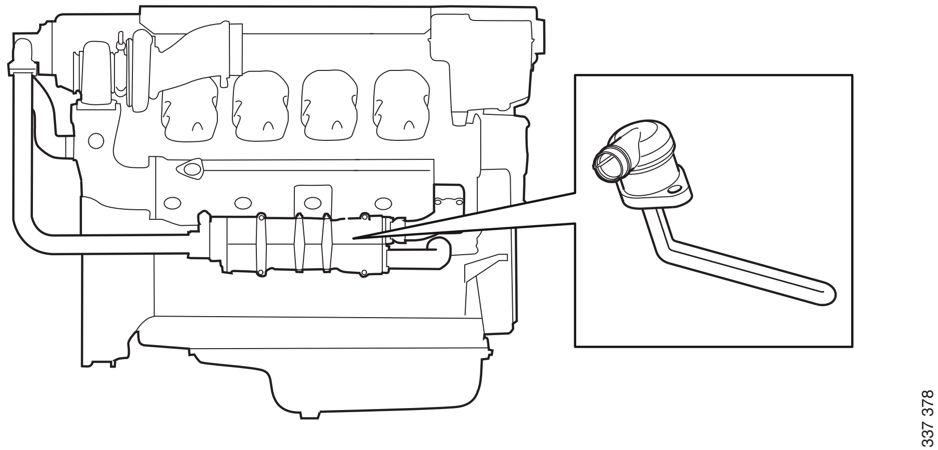
If required, the engines can be supplied with an electric immersion heater. The immersion heater has a built-in thermostat set to a thoroughly tested temperature to ensure sufficient self-circulation. It also prevents the temperature from becoming so high that oil film on e.g. the piston and cylinder liner evaporates or dries. For DI09 and DI13 with keel cooling, there is also an immersion heater without thermostat.

Both immersion heaters are available at 2 powers: 500 or 1,500 W. Choice of power depends primarily on how cold it can be around the engine. The available power supply system can also be a key factor when selecting power. Immersion heaters are available for either 115 V or 230 V power supply systems.



DI09 and DI13

1. *Immersion heater without thermostat. DI13: for keel cooling engines only*
2. *Immersion heater with thermostat*



DI16

Immersion heater with thermostat

Electrolytic corrosion

Corrosion may occur on sea water circuit components due to the electrochemical reaction between different metals.

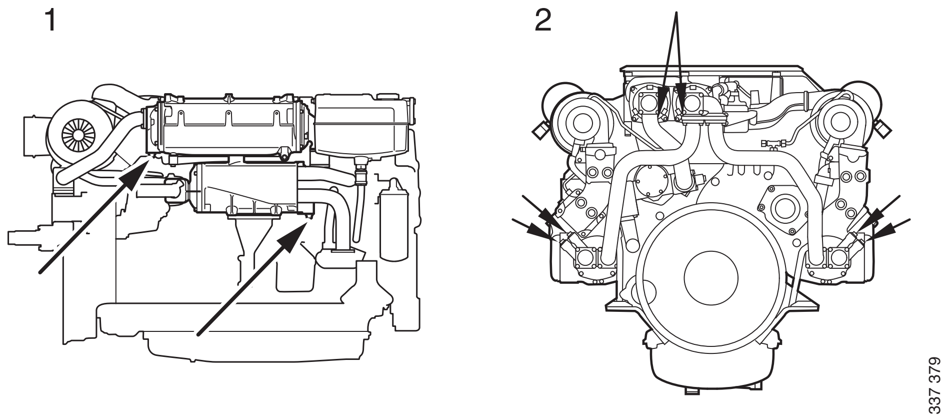
Sea water acts like an electrolyte, in which there is ionic migration from anode to cathode. The anode consists of a metal with lower potential, such as iron or steel, and the cathode consists of a metal with higher potential, such as copper. Material thus disappears from the anode into the sea water.

To avoid corrosion loss of material from sea water circuit components, there are 2 sacrificial anodes (zinc) in the system. Material then only corrodes away from the sacrificial anodes. The sacrificial anodes must be checked and renewed at regular intervals.

For extra protection of the DI09 and DI13 in very corrosive water, a spacer flange 1 728 674 for fitting 2 extra sacrificial anodes can be connected to the suction side of the sea water pump.

Note:

The space around the sacrificial anodes must not be blocked. Contact Scania for alternative positioning.



Position of sacrificial anodes
1. *DI09 and DI13: 2 off*
2. *DI16: 6 off*

Important data

Max. suction height for sea water pump	3 m
Max. internal cooling system pressure	2 bar
Max. vacuum on suction side	0.3 bar
Max. expansion tank height above the coolant pump intake with 0.75 bar pressure cap	3.5 m
Max. expansion tank height above the pump intake without pressure cap	8.5 m
Minimum outer diameter for static line pipe	DI09, DI13: 25 mm
	DI16: 38 mm
Minimum inner diameter for static line pipe	DI09, DI13: 20 mm
	DI16: 35 mm
Maximum inner diameter for bleed pipes	8 mm