NANNI MARINE ENGINE

OPERATOR MANUAL

DGBXXT09019

ENGINE

N16.900 CR3

N16.1000 CR3

N16.1100 CR3

N16.1150 CR3

N16.1200 CR3

ENERGY IN BLUE

Q00 TRACKED CHANGES

TRACKED CHANGES

CODE	INDEX	DATE	INITIALS	NATURE OF TRANSLATIONS	PAGES
DGBXXT09019	-	08/2020	LB-MC	Create	-

Please note all changes and pages associated.
For further clarity, please add a line in front of each change.

S00 SUMMARY

S00 SUMMARY

INTRODUCTION

Before operating the engine, make sure that this Manual is applicable to the engine type. Refer to the identification plate if you are not sure about the engine model designation. If you don't have the correct manual, please contact your Nanni authorized dealer.

All the information and specifications in this manual are based on the technical data available at time of publication. Changes and updates may be made by Nanni without notice.

Illustrations are intended as a general guide and may vary from the equipment fitted in the engine in some details.

If there are any equipment details that are not shown or described in this Manual, or if you have any question regarding the operation of any equipment, your authorized Nanni dealer will be glad to inform you of correct care and operating procedures. Contact a NANNI INDUSTRIES S.A.S. authorized dealer for the servicing of your engine. A list of dealers is available on our website :

www.nannienergy.com

Read this Manual carefully to learn how to operate and service your engine correctly. Failure to do so could result in personal injury or equipment damage. This Manual should be considered as a permanent part of the engine and should remain with it, even when sold.

Right-hand and left-hand sides are determined by standing at the drive or flywheel end (rear) of the engine and facing toward the front of the engine.

Write engine serial numbers and option codes (if any) in the spaces indicated in the Record Keeping Section (02). Accurately record all numbers. Your Nanni Agent also needs these numbers when you order parts. File the identification numbers in a secure place. Some engine accessories such as air cleaner, and instruments are optional. These accessories may be provided by a third party. This Manual applies only to the engine and those options available through the Nanni distribution network.

S01 INTRODUCTION

ABOUT THIS MANUAL

This Manual contains important information, tips, suggestions and warnings. We urge you to read it carefully and familiarize yourself with the engine before starting.

For your own safety and longer service life of the engine, follow the instructions and warnings contained in this manual and in all documentation provided with the boat. Ignoring them could result in damage to the engine or personal injury to you or others.

Please ensure that this Manual is always kept in the boat. It should always be available to anyone else using the engine, i.e. anyone renting, borrowing or buying the engine from you.

CONTENT & UPDATES

All the informations and specifications in this Manual are based on the technical data applicable at the time of its publication. Changes and updates may be made by Nanni without notice.

Illustrations are intended as a general guide, and may vary from the equipment fitted in the engine in some details. Some sections of the Manual do not apply to all engines. If this is the case, a text indicates which engines it applies to.
If there are any equipment details that are not shown or described in this Operator's Manual, or if you have any questions about the operation of any equipment, your authorized Nanni Dealer will be glad to inform you of correct care and operating procedures.

S02 SAFETY

SUMMARY

SAFETY SIGNALS

A signal word—**DANGER**, **WARNING**, or **CAUTION**—is used in conjunction with the safety-alert symbol.

DANGER identifies the most serious hazard with lethal possible consequences.

WARNING identifies serious hazard with possible large injury consequences.

CAUTION identifies precautions to undertake which if not followed could lead to the above mentioned safety warnings. Damage to equipement could happen.

NOTICE is used for specific attention to sensitive actions on equipment. Other signals still applying.

IMPORTANT is a signal with a meaning of care to apply to equipment.

SAFETY INFORMATION

This symbol on the engine or in this manual is an alert to the potential for personal injury. Follow recommended precautions and safe operating practices.

REPLACEMENT OF MISSING OR DAMAGED SAFETY SIGNS

Replace missing or damaged safety signs. There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this Operator Manual.

READ SAFETY INSTRUCTIONS

Carefully read all safety messages in this manual and on your genset safety signs.

Keep safety signs in good condition. Be sure new equipment components and repair parts include the current safety signs.

Replacement safety signs are available from your dealer. There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this Operator Manual.

Keep your equipment in proper working condition.

DANGER !

WARNING !

CAUTION !

NOTE !

IMPORTANT !

Please keep in mind that above safety labels have no degree of danger. Any irresponsible action could lead to a real danger situation.

Learn how to operate the equipment and how to use controls properly. Do not let anyone operate it without instruction.

Unauthorized modifications to the equipment may impair the function and/or safety and affect its life span.

If you do not understand any part of this document and need assistance, contact your Nanni representative.

ENGINE-GENSET SAFETY ICONS

Some stickers are fixed directly on the engine. They are intended to help you to quickly identify the location of certain components and avoid possible hazards when working on the engine.

Ensure that these stickers are always visible and replace them if torn or washed up.

Refers to important informations and instructions to follow before handling the engine.

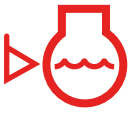
Indicates possible electrical hazards.

Indicates hot parts entailing substantial risks of burns.

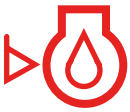
Indicates an area containing pressurised fluids.

Indicates hazardous rotating parts.

Stipulates that no flames or sparks should be created in the vicinity.



Indicates where to check the coolant level.



Indicates where to check the engine oil level.

Indicates the coolant drain orifice.

Indicates the oil drain orifice.

SAFETY PRECAUTIONS

HOT EXHAUST PRECAUTIONS

Servicing machine or attachments with engine running can result in serious personal injury. Avoid exposure and skin contact with hot exhaust gases and components.

Exhaust parts and streams become very hot during operation. Exhaust gases and components reach temperatures hot enough to burn people, ignite, or melt common materials.

WORK IN VENTILATED AREA

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

WASTE DISPOSAL

Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used in engines include such items as oil, fuel, coolant, fluids filters and batteries.

Use leakproof containers when draining fluids ; Do not pour waste into the sea, ground, down a drain, or into any other water source.

Contact your local environmental or recycling center, or your dealer for information on the proper way to recycle or dispose of waste.

UNWANTED ENGINE START

Avoid possible injury or death from engine runaway. Do not start engine by shorting across the starter motor solenoid terminals posts. Engine will start if normal circuitry is bypassed. Start engine from operator's seat.

SAFE MAINTENANCE PRACTICE

Understand service procedures before doing work. Keep work area clean and dry. Never lubricate, service, or adjust engine while it is running. Keep hands, feet, hair and clothing away from moving parts.

Fix damage immediately. Replace worn or broken parts. Remove any build up of grease, oil, or debris. On self-propelled equipment, disconnect battery ground (-) before making adjustments on electrical systems or welding.

WORK IN CLEAN AREA

Clean work area and machine before starting a job. Make sure you have all necessary tools to do your job. Have the right parts on hand. Read all instructions thoroughly ; do not attempt shortcuts.

PROTECTIVE CLOTHING

Wear close fitting clothing and safety equipment appropriate to the job. Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating the engine.

SERVICE ENGINES SAFELY

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near moving parts. If these items were to get caught, severe injury could result. Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.

PROPER USE OF TOOLS

Use tools appropriate to the work. Makeshift tools and unfollowed procedures can create safety hazards. Do not use U.S mechanical tools on metric fasteners (i.e. a 1/2 inch wrench on a 13 mm nut).

Use power tools only to loosen threaded parts and fasteners. For loosening and tightening hardware, use the correct size tools. Avoid bodily injury caused by slipping wrenches. Use only service parts meeting manufacturer specifications.

SUPPORT ENGINES PROPERLY

Always lower the attachment or implement to the base before you work on an engine. If the work requires that the engine be lifted, provide secure system. If left in a raised position, hydraulically supported device can settle or leak down. Do not support engines on any kind of props that may crumble. Do not work under an engine that is solely supported by a jack. Follow recommended procedures in this manual.

SAFE ILLUMINATED WORK AREA

Illuminate your work area adequately and safely. Use a portable safety light for working inside the engine room. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

PROPER LIFTING EQUIPMENT

Lifting heavy components incorrectly can cause severe injury or equipment damage. Use expertise of staff holding relevant(s) legal capacity to operate heavy lifting equipment, with the know-how of using slings and chains.

NOISE PROTECTION

Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionnable or uncomfortable loud noises.

GENSET OUTPUT GENERATED POWER

Genset will deliver a sizeable amount of electrical power which can be lethal if not handled properly. Thus, any service, connection or repair on the alternator can only done by a certified marine electrician.

GUARDS REQUIREMENTS

Rotating cooling system fans, belts, pulleys, and drives can cause serious injury. Keep all guards in place at all times during the engine operation. Wear close-fitting clothes. Stop the engine and be sure that fans, belts, pulleys, and drives are stopped before making adjustments, connections, or cleaning near fans and their drive components.

STAYING CLEAR OF ROTATING DRIVELINES

Entanglement in rotating driveline can cause serious injury or death. Keep all shields in place at all times. Make sure rotating shields turn freely.

Wear close-fitting clothing. Stop the engine and be sure that all rotating parts and drivelines are stopped before making adjustments, connections, or performing any type of service on engine or driven equipment.

PAINT REMOVAL BEFORE HEATING

Avoid potentially toxic fumes and dust. Hazardous fumes can be generated when paint is heated by welding, soldering, or in using a torch.

Paint removal :

- Remove paint a minimum of 100 mm (4 in.) from area to be affected by heating. If paint cannot be removed, wear an approved respirator mask before heating or welding.
- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area.
- Allow fumes to disperse at least 15 minutes before welding or heating.
- Do not use a chlorinated solvent in areas where welding will take place.
- Do all work in an area that is well ventilated to carry toxic fumes and dust away.
- Dispose of paint and solvents properly.

HIGH-PRESSURE FUEL SYSTEM OPENING RISK

High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt repair of fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system. Only technicians familiar with this type of system can perform repairs. Consult your engine representative.

AVOID HIGH-PRESSURE FLUIDS

Inspect hydraulic hoses periodically – at least once per year – for leakage, kinking, cuts, cracks, abrasion, blisters, corrosion, exposed wire braid or any other signs of wear or damage. Replace worn or damaged hose assemblies immediately with approved replacement parts. Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard.

SAFE COOLING SYSTEM SERVICE

Explosive release of fluids from pressurized cooling system can cause serious burns. Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

AVOID HEAT NEAR PRESSURIZED FLUID LINES

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severeburns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials.

Pressurized lines can accidentally burst when heat goes beyond the immediate flame area.

Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source.

WELDING NEAR ELECTRONIC CONTROL UNIT (ECU)

If welding is required around the engine, or in the engine room, ask first for a permission from the person in charge. Do not jump-start engine with arc welding equipment. Currents and voltages delivered are too high and may cause permanent damage. Direct welding onto the engine is forbidden.

1. Disconnect the negative (-) battery cable(s).
2. Disconnect the positive (+) battery cable(s).
3. Connect the positive and negative cables together. Do not attach to engine support frame.
4. Clear or move any wiring harness sections away from welding area.
5. Connect welder ground close to welding point and away from control units.
6. After welding, reverse Steps 1-5.

STATIC ELECTRICITY RISK


The removal of sulfur and other compounds in Ultra-Low Sulfur Diesel (ULSD) fuel decreases its conductivity and increases its ability to store a static charge. Refineries may have treated the fuel with a static dissipating additive.

However, there are many factors reducing the effectiveness of the additive over time. Static charges can build up in ULSD fuel while it is flowing through fuel delivery systems. Static electricity discharge in presence combustible vapors could result in a fire or explosion.

Therefore, it is important to ensure that the entire system used to refuel your engine (fuel supply tank, transfer pump, transfer hose, nozzle, and others) is properly grounded and bonded.

Consult your fuel or fuel system supplier to ensure that the delivery system is in compliance with fueling standards for proper grounding and bonding practices.

HANDLE FUEL SAFELY - AVOID FIRES

Handle fuel with care: it is highly flammable. Do not refuel the engine while smoking or when near open flame or sparks.Always stop engine before refueling. Prevent fires by keeping engine room clean of accumulated trash, grease, and debris. Always clean up spilled fuel. Use only an approved fuel container for transporting flammable liquids. Do not store fuel container where there is an open flame, spark, or pilot light such as within a water heater or other appliance.

BE PREPARED FOR EMERGENCIES


Be prepared if a fire starts. Keep a first aid kit and fire extinguisher handy. Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

HANDLE STARTING FLUID SAFELY (ETHER)

Starting fluid is highly flammable. Keep all sparks and flame away if using it. Keep starting fluid away from batteries and cables.

To prevent accidental discharge when storing the pressurized can, keep the cap on the container, and store in a cool, protected location. Do not incinerate or puncture a starting fluid container. Do not use starting fluid on an engine equipped with glow plugs or an air intake heater.

HANDLING BATTERIES SAFELY

If not handled properly, batteries are a potential source of hazards. Excess of gases in batteries may explode. Keep sparks and flames away from batteries. **Never use a cigarette lighter to observe electrolyte level**. Use a flashlight to do it. Never check battery charge in shorting posts with a metal part. Use a voltmeter or hydrometer.

Always remove grounded (-) battery clamp first and replace grounded clamp last. Sulfuric acid in battery electrolyte is poisonous and strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid hazards and acid burns in :


- Filling batteries in a well-ventilated area
- Wearing eye protection and rubber gloves
- Avoiding use of air pressure to clean batteries
- Avoiding breathing fumes when electrolyte is
- Avoiding spilling or dripping electrolyte
- Using correct battery booster or charger procedure.

If acid is spilled on skin or in eyes:

- Flush skin with water
- Apply baking soda or lime to help neutralize the acid
- Flush eyes with water for 15-30 minutes.
- Get medical attention immediately.

If acid is swallowed:

- Do not induce vomiting
- Drink large amounts of water or milk, but do not exceed 2 L (2 qt.)
- Get medical attention immediately.

PREVENT BATTERY EXPLOSIONS

Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode. Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer. Do not charge a frozen battery: it may explode. Warm up battery to 16°C (60°F) before doing it.

WARNING !

Battery posts, terminals, and related accessories contain lead and lead compounds. Rinse hands after handling batteries.

FROST PROTECTION-WINTERIZATION

See Maintenance Section 08 - Raw Water System - Risk of icing conditions / Protection against frost.

WARNING !

When the engine has been set for winterization, place "**DO NOT OPERATE**" labels onto taps, valves, parts of equipment which have been turned off. Place a large and visible reminder on the wheelhouse dashboard.

LIVE WITH SAFETY

Before returning engine to customer, make sure engine is functioning properly, especially the safety systems. Make sure that all guards and shields are in place.

PREVENT ACCIDENTS

IMPORTANT !

When engine is OFF, always set the transmission lever to neutral position.

S03 FLUIDS

SUMMARY

COOLANT

WARNING !

Products not fulfilling the demands in this section may lead to faults and damage occurring in the cooling system. This can lead to the invalidation of Nanni's warranty for faults and damage caused by the use of inappropriate coolant.

NOTE

The coolant should be changed when the cooling system is cleaned: every 6,000 hours or at least every 5 years. See Changing the coolant & cleaning the cooling system.

The coolant recommended by Scania is a mixture of water with antifreeze (ethylene glycol) and corrosion inhibitor. The coolant has several characteristics which are important for the operation of the cooling system:

- Corrosion protection.
- Antifreeze.
- Increases the boiling point.

WATER

Use only pure fresh water that is free from parti-cles, sludge and other impurities. If there is uncertainty about the quality of the water, Scania recommends use of Scania ready-mixed coolants. See the section Recommended Scania products.

ANTIFREEZE & CORROSION PROTECTION

The antifreeze and corrosion protection used in Scania engines should be antifreeze (ethylene glycol) and corrosion inhibitor.

Only Scania coolant or another product with functioning antifreeze and corrosion protection may be used in Scania engines. Products not fulfilling the demands in this section may lead to faults and damage occurring in the cooling system. This can lead to the invalidation of Scania's warranty for faults and damage caused by the use of inappropriate coolant.

ADDITION OF ANTIFREEZE & CORROSION INHIBITOR TO WATER

The coolant should contain 35-55% by volume antifreeze (ethylene glycol) and corrosion inhibitor. The percentage varies depending on the need for antifreeze.

A minimum of 35% by volume of Scania anti-freeze and corrosion inhibitor is needed to provide sufficient protection against corrosion.

NOTE

Too high a dose of antifreeze and corrosion in-hibitor will increase the amount of sludge and blockages accumulating in the radiator. Too low a concentration can lead to corrosion of the cooling system and ice formation at low temperatures.

Measure the ethylene glycol content (antifreeze and corrosion protection) with a refractometer following the instructions in the Checking the coolant's antifreeze & corrosion protection section.

RISK OF FREEZING

IMPORTANT !

The engine should not be subjected to heavy loads when ice starts to build up in the cooling system.

As the coolant starts to freeze, the water in the coolant starts to crystallise and the percentage of ethylene glycol in the coolant therefore rises. If freezing produces a great increase in the amount of ice, circulation problems could arise. There is no risk of damage by freezing if the content of Scania antifreeze and corrosion inhibitor, or an equivalent mixture of a similar product, is at least 35% by volume.

Minimal ice formation in the coolant sometimes causes minor problems without any risk of damage. For example, the auxiliary heater may not work for up to 1 hour after the engine has been started.

The chart depicts coolant properties at different percents of antifreeze and corrosion inhibitor concentration by volume.

Curve A: Ice formation starts (ice slush)

Curve B: Damage by freezing

Range 1: Safe range

Range 2: Malfunctions may occur (ice slush)

Range 3: There is risk of damage by freezing

The following example shows coolant properties with 30 percent by volume of antifreeze and corrosion inhibitor:

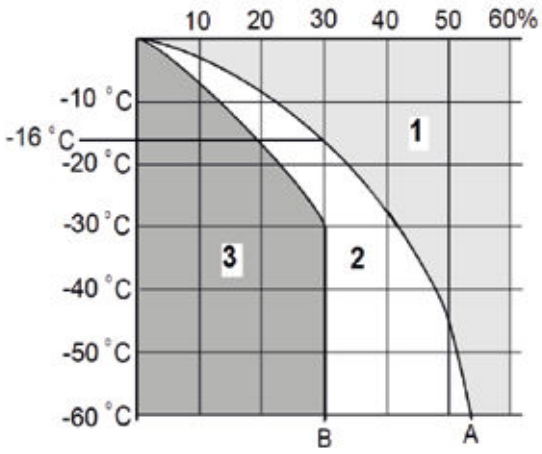
• Ice slush starts to form at -16°C (3°F).

• At -30°C (-22°F), there is a risk of cooling system malfunction.

• There is no risk of damage by freezing with a minimum antifreeze and corrosion inhibitor content of 35 percent by volume.

Example:

If the temperature is -16 C (3°F), there is a risk of damage by freezing if the percentage of antifreeze and corrosion inhibitor is 20% by volume. At 30% antifreeze and corrosion protection by volume the coolant will not contain any ice.



HOT CLIMATES

In order to retain the corrosion protection and the higher boiling point, it is essential to use coolant consisting of water mixed with antifreeze and corrosion inhibitor (ethylene glycol). This also applies in countries where the temperature never drops below 0°C (32°C).

The coolant should always contain 35-55% by volume of antifreeze and corrosion inhibitor so that the coolant properties ensure that the coolant works correctly.

TOPPING UP

Coolant must only be topped up with pre-mixed coolant. The pre-mixed coolant can either be concentrate mixed with clean freshwater or pre-mixed coolant from the factory. Use only pure fresh water that is free from particles, sludge and other impurities.

IMPORTANT !

Containers, which are used for mixing coolant, must be intended for the purpose and free from any dirt or contaminants. When the containers not in use they must be kept closed to avoid col-lecting dirt and dust.

NOTE

Within the coolant change interval, coolant may only be reused if it has been cleaned of dirt, sludge and particles. If the coolant is contaminated with oil or fuel, it must not be reused.

RECOMMENDED COOLANT

Scania Ready-Mix 50/50

Scania Ready-Mix 50/50 is a ready to use coolant containing 50 % antifreeze (ethylene glycol) and corrosion protection and 50 % water. It should be used in cold countries where there is a risk of freezing in the cooling system.

Part #	Volume litres	Volume U.S Gallons
1 921 955	5	1.3
1 921 956	20	5.3
1 921 957	210	55
1 896 695	1000	264

Scania Ready-Mix 35/65

Scania Ready Mix 35/65 is a ready-mixed cool-ant containing 35% antifreeze (ethylene glycol) and corrosion protection and 65% water. It should be used in warm countries where there is no risk of freezing in the cooling system.

Part #	Volume litres	Volume U.S Gallons
2 186 291	5	1.3
2 186 292	20	5.3
2 186 293	210	55
2 186 294	1000	264

Scania Concentrate

Scania also produces coolant with antifreeze and corrosion inhibitor in the form of a concentrate.

Part #	Volume litres	Volume U.S Gallons
1 894 323	5	1.3
1 894 324	20	5.3
1 894 325	210	55
1 894 326	1000	264

ANTIFREEZE & CORROSION PROTECTION

TABLE in LITRES & °C

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

Example:

• The total volume of the cooling system is 40 litres.

• 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.

• The required 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.

• 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).

	ADEQUATE PROTECTION AGAINST CORROSION					
VOLUME OF ETHYLENE GLYCOL (%)	35	40	45	50	60	**COOLING SYSTEM VOLUME (LITRES)**
ICE SLUSH FORMS (°C)	-21	-24	-30	-38	-50	
VOLUME OF ETHYLENE GLYCOL (LITRES)	11	12	14	15	18	30
	14	16	18	20	24	40
	18	20	23	25	30	50
	21	24	27	30	36	60
	25	28	32	35	42	70
	28	32	36	40	48	80
	32	36	41	45	54	90
	35	40	45	50	60	100
	39	44	50	55	66	110
	42	48	54	60	72	120
	46	52	59	65	78	130
	49	56	63	70	84	140
	53	60	68	75	90	150
	56	64	72	80	96	160
	60	68	77	85	102	170
	63	72	81	90	108	180
	67	76	86	95	114	190
	70	80	90	100	120	200

ANTIFREEZE & CORROSION PROTECTION

TABLE in U.S GALLONS & °F

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

Example:

• The total volume of the cooling system is 10.6 U.S gallons.

• The measured concentration of ethylene glycol is 35% by volume (freezing point -6 °F). According to the table there are 3.7 U.S gallons of ethylene glycol in the cooling system.

• The required concentration of ethylene glycol is 45% by volume (freezing point -22°F). According to the table, 4.8 U.S gallons of ethylene glycol are required in the cooling system.

• Since the cooling system already contains 3.7 U.S gallons, fill another 1.1 U.S gallons of ethylene glycol in the cooling system (4.8 - 3.7 = 1.1 U.S gallons).

	ADEQUATE PROTECTION AGAINST CORROSION					
VOLUME OF ETHYLENE GLYCOL (%)	35	40	45	50	60	**COOLING SYSTEM VOLUME (U.S GALLONS)**
ICE SLUSH FORMS (°F)	-6	-11	-22	-36	-58	
VOLUME OF ETHYLENE GLYCOL (U.S GALLONS)	2.9	3.2	3.7	4	4.8	7.9
	3.7	4.2	4.8	5.3	6.3	10.6
	4.8	5.3	6.1	6.6	7.9	13.2
	5.5	6.3	7.1	7.9	9.5	15.9
	6.6	7.4	8.5	9.2	11.1	18.5
	7.4	8.5	9.5	10.6	12.7	21.1
	8.5	9.5	10.8	11.9	14.3	23.8
	9.2	10.6	11.9	13.2	15.9	26.4
	10.3	11.6	13.2	14.5	17.4	29.1
	11.1	12.7	14.3	15.9	19	31.7
	12.2	13.7	15.6	17.2	20.6	34.3
	12.9	14.8	16.6	18.5	22.2	37
	14	15.9	18	19.8	23.8	39.6
	14.8	16.9	19	21.1	25.4	42.3
	15.9	18	20.3	22.5	26.9	44.9
	16.6	19	21.4	23.8	28.5	47.6
	17.7	20.1	22.7	25.1	30.1	50.2
	18.5	21.1	23.8	26.4	31.7	52.8

CHECKING THE COOLANT LEVEL

WARNING !

Do not open the coolant filler cap in the expan-sion tank if the engine is hot. Hot coolant and steam may spray out and cause burns. If the cap has to be opened do it slowly to release the pressure before removing the cap. Use protective gloves as coolant can cause irritation if it comes in contact with the skin.

IMPORTANT !

It is not permissible to top up large amounts of coolant via the expansion tank. Filling via the expansion tank leads to air locks in the cooling system which can lead to e.g. cavitation damage to the coolant pump shaft seal. If a large amount of coolant needs to be added, follow the instructions in the section Filling coolant.

Only pour pre-mixed coolant into the cooling system.

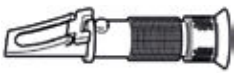
The following instructions apply to Scania expansion tanks. For other types of expansion tanks, follow the manufacturer's instructions.

1. Check the coolant level through the sight glass on the expansion tank.

2. Top up with coolant as necessary.

CHECKING THE COOLANT'S ANTIFREEZE & CORROSION PROTECTION

Specific tool

Description	Illustration
Refractometer	 

WARNING !

Avoid skin contact with coolant as this may cause irritation to the skin. Wear protective goggles and gloves when handling coolant.

IMPORTANT !

Use only pure fresh water that is free from particles, sludge and other impurities.

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1. Pour a small amount of coolant into a container and check that the coolant is pure and clear.

2. Change the coolant if it is contaminated or cloudy.

3. Measure the antifreeze and corrosion inhibitor content with the refractometer.

The following rules apply to ethylene glycol-based coolant:

- The antifreeze and corrosion inhibitor content must be minimum 35 percent by volume for corrosion protection to be sufficient.
- An antifreeze and corrosion inhibitor content greater than 55 percent by volume impairs the ability to protect against frost.
- If ice forms in the coolant, there are disruptions initially, but there is no immediate risk of damage. The engine should not be subjected to heavy loads when ice starts to form.

ENGINE LUBRICANTS

OIL GRADE DENOMINATION

LDF branded oil stands for the Scania **L**ong **D**rain **F**ield test standard. Scania LDF oils have been carefully selected after extensive testing. The approval is only granted to the highest quality engine oils available on the market.

Recommended engine oil

- Scania Oil LDF-3
- Scania Oil LDF-2
- Scania oil LDF
- Scania Oil E7.

The engine oil must fulfil the following quality requirements:

• ACEA E5/API CI-4.

• ACEA E7/API CI-4 +.

• For engines not run on low-sulphur fuel, the TBN (Total Base Number) should be at least 12 (ASTM D2896).

• Oils with a low ash content (ACEA E9/API CJ4) are not recommended.

Check with your oil supplier that the oil meets these requirements.

If the engine is used in areas of the world where engine oil with ACEA or API classification is not available, the oil grade must be measured in actual operation. In this case contact the nearest Nanni workshop.

For operation at extremely low outdoor temperatures: Consult your nearest Nanni representative on how to avoid starting difficulties.

Viscosity class	Outdoor temperatures in °C	
SAE 20W-30	-15°C	+30°C
SAE 30	-10°C	+30°C
SAE 40	-5°C	+45°c
SAE 50	0°C	+45°C
SAE 5W-30	<-40°C	+30°C
SAE 10W-30	-25°C	+30°C
SAE15W-40	-20°C	+45°C

Viscosity class	Outdoor temperatures in °F	
SAE 20W-30	5°F	86°F
SAE 30	14°F	86°F
SAE 40	23°F	113°F
SAE 50	32°F	113°F
SAE 5W-30	<-40°F	86°F
SAE 10W-30	-13°F	86°F
SAE 15W-40	-4°F	113°F

OIL GRADE LABELS

When changing oil it is important to use the correct engine oil grade. The oil filler should therefore be clearly marked with a label for the filled oil grade. However, there are only labels for oils with Scania LDF approval and oil grade ACEA E7.

Stick on a new label if the oil type or oil grade is changed in favour of any of the oil types above. Replace the label if it is missing.

If the oil grades below are used, you can order oil filler labels from your Nanni representative.

Oil grade	Colour	Part #
Scania LDF-3	Red	2 296 066
Scania LDF-2	Blue	2 296 064
Scania LDF	Grey	2 296 071
ACEA E7	White	2 296 065
Scania Low Ash	Green	2 296 067
Scania Bioethanol	Black	2 296 068
Scania BEO-2	Orange	2 296 070
ACEA E9	-	2 296 069

Oil filter label

OIL ANALYSIS

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

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

• Viscosity at 100°C (212°F): max. ±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 (according to DIN 51452): <3%.

• Fuel in the oil: <5%.

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 oil change intervals. Work out the new oil change interval for the engine in conjunction with the workshop.

REQUIREMENT !

Only Scania LDF oils may be used in conjunction with oil analysis and a possible extended oil change interval. Depending on the market, the warranty conditions may also change if the oil change intervals differ from the recommended Scania timetable.

FUELS

DANGER !

Fuels and some fluids on board ships are easily flammable. Handle fuels with care and respect all safety rules. Do not refuel the tank while the engine is running. Do not smoke during the filling process or in the engine compartment. Ventilate the engine compartment before starting. Wear protective gloves and eye protective glasses. Avoid synthetic clothing which can melt when ignited. Always keep a fire extinguisher nearby.

DIESEL FUEL

Properties

The quality of the diesel is very important for the operation and service life of the engine and the fuel system, and also for the engine performance.

REQUIREMENT !

The diesel fuel should comply with the requirements of European standard EN590.

However, larger tolerances of certain properties are accepted. Please see the table below:

Properties	Requirements
Viscosity at 40°C (104°F)	1.4-4.5 cST
Density at 15°C (59°F)	0.79-0.87 kg/dm^3
Ignitability (CET rating)	minimum 49
Lowest flashpoint	56°C (132°F)
Particulate contamination level	Classification 22/20/17 according to ISO 4406

PERMITTED SULPHUR CONTENT IN DIESEL

IMPORTANT !

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

Sulphur content	Remark
0-2000 ppm (<0.2 %)	Normal oil change interval of up to 500 hours
2000-4000 ppm (0.2-04 %)	The oil change interval must be halved to a maximum of 250 hours.
4000 ppm (0.4 %)	Max. permitted sulphur content. If diesel with too high a sulphur content is used, this causes engine damage.

TEMPERATURE DEPENDENCE OF DIESEL

IMPORTANT !

Mixing kerosene or other paraffins with the diesel fuel is prohibited. The injectors may be damaged.

It is not permissible to mix petrol with diesel fuel. In the long term, petrol can cause wear in the injectors and engine.

At temperatures lower than those specified for the diesel, paraffin wax may precipitate from the diesel fuel and block filters and pipes. The engine can then lose power or stop.

The diesel fuel is adapted for use in the specific climate of each country. If an engine is to be operated in a temperature zone with a temperature lower than normal, first identify the temperature properties of that particular diesel fuel.

BIODIESEL (FAME)

Use of biodiesel

IMPORTANT !

For engines with SCR systems, a maximum of 10% mixture of biodiesel should be used.

Scania uses the term biodiesel to refer to a renewable diesel made from greases or oils and methanol. The biodiesel should conform to the requirements of European standard EN 14214 or Brazilian standard ANP-45. For biodiesel in accordance with EN 14214 or ANP-45, the generic term FAME is frequently used.

Normal diesel in accordance with EN 590 can contain up to 7% biodiesel from the diesel supplier. There are grades of diesel that comply with EN 590 but contain a higher mixture of biodiesel.

Scania approves up to a 10% mixture of biodiesel for all engines.

For PDE engines, Scania approves the use of up to 100% biodiesel in accordance with EN 14214 or ANP-45. However, this does not apply to engines with an SCR system, for which only a 10% mixture is permitted.

MAINTENANCE INTERVAL

IMPORTANT !

Make sure that maintenance intervals are different when operating on diesel or biodiesel.

With a greater mixture of biodiesel than 10%, the renewal intervals for the following are halved:

- Fuel filter.
- Oil filter.
- Engine oil.

The viscosity grade of the engine oil should be xW-40. xW-30 grade oils are unsuitable due to the fuel dilution effect.

Check the engine oil level regularly. If the oil level exceeds the maximum level, the oil must be changed. Check the cause if the oil level exceeds the maximum level and contact your nearest Nanni representative if you suspect a fault, or in case of doubt.

STORAGE OF BIODIESEL

IMPORTANT !

Biodiesel must not be stored for more than 6 months.

Biodiesel has a maximum storage life of 6 months from the date of production to the expiry date. The fuel is affected by light, temperature, water, etc. during storage, which affects the fuel characteristics and durability.

Biodiesel also has lower stability against oxidation than diesel. This can result in a thickening of the fuel and blocking of parts of the fuel system, e.g. the fuel filter. Bacterial growth can occur when fuel is stored in tanks under unfavourable conditions. Avoid storage in barrels or auxiliary tanks, except when fuel turnover rates are high. Check tank cleanliness whenever refuelling takes place.

If the engine has been refuelled with biodiesel, and is stationary for a long period, condensation water can form in the fuel tank resulting in bacterial growth.

See also the Preservative fuel paragraph in the following pages.

HVO

HVO is a synthetic diesel which is manufactured through the hydrogenation of plants and animal fats. To the user, HVO is reminiscent of diesel in accordance with EN590, apart from HVO having a somewhat lower density. Scania approves the use of up to 100% HVO for all engines in accordance with the European standard EN 15940.

GTL

GTL is a synthetic fuel that is often refined from natural gas. To the user, GTL is reminiscent of diesel in accordance with EN590, apart from GTL having a somewhat lower density and less odour. Scania approves the use of up to 100% GTL in accordance with the European standard EN 15940.

WATER IN FUEL

Water is a non-flammable and incompressible liquid. For this reason, its presence is particularly harmful to the operation of the engine and to the entire fuel injection system. Water easily enters the tank by simple condensation and especially when it is left or partially empty. Fill up the fuel tank before storage/winter storage. Check the water-diesel separator regularly and clean it as required. Anticipate the replacement of the fuel filter. If a large quantity of water is present in the tank, drain it and flush the entire fuel and injection system with clean diesel fuel. Water in the diesel fuel can cause irreparable damages to the engine and are not covered by any warranty from Nanni Industries.

MICRO-ORGANISMS IN FUEL

The presence of water in the tank automatically leads micro-organisms and bacteria to grow and will mix with the fuel. These micro-organisms grow rapidly with a favourable temperature. Depending on their size, they can pass through filters and penetrate in the fuel injection system and cause a total engine failure which is not covered by Nanni Industries warranty. In the event of fuel contamination, contact the nearest Nanni agent who may, if necessary, use an approved disinfectant.

INERT IMPURITIES IN FUEL

Others impurities than micro-organisms and bacteria do exist : they are rust debris falling out from the internal walls of the metal tanks.

Some types of fibreglass tanks are also subject to osmosis over time and tiny particles may come off internal walls and circulate in the diesel fuel. These impurities can pass through the filters and creep into the injection system and cause a total failure of the engine which is not covered by Nanni Industries warranty.

LONG TERM DIESEL FUEL STORAGE

Long-term storage of diesel fuel, where the diesel comes into contact with water, may lead to the growth of micro-organisms (bacteria and fungus).

PRESERVATIVE PRODUCTS

PRESERVATIVE OIL

Always use an engine oil meeting the requirements in the Oil grade section.

Beware that moist in oil opened container drums has ability to deplete oil characteristics.

PRESERVATIVE COOLANT

Use coolant containing 50% by volume of glycol. Example: BASF MPG Glysacorr P113 and Valvoline Zerex P113 FP.

WARNING !

Ethylene glycol can be fatal if ingested and can cause skin irritation and eye damage.

PRESERVATIVE FUEL

Preservative fuel must not contain biodiesel. Even small amounts of 5-10% biodiesel can have adverse effects on the engine when in longterm storage.

DISPOSING OF WASTE FLUIDS

Prior to contemplate any draining, make sure that all adequate gear such as: funnel(s), hose(s), suitable container(s) and so on, are at hand. Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them. Wear gloves and eye protection glasses. Follow all safety rules. Wait for engine to cool down. Do not let waste to drip on the ground, down a city drain, or into any water source. Improperly disposing of engine coolants, oils, or other chemical fluids is a threat against environment and is an offence in many countries.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your Nanni engine representative or service dealer.

ENGINE IDENTIFICATION

NOTE !

Minor engine details may not be exactly as shown. Some components may not be part of the engine ordered. Not binding pictures.

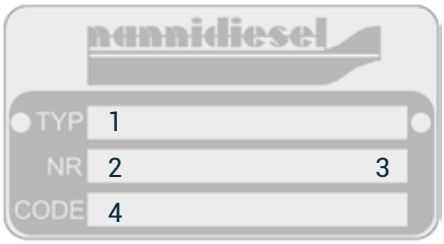
Both the engine and the transmission have an identification plate containing important informations.

Keep these plates accessible and in good condition. Record and keep the engine and transmission serial number and designation. These numbers should always be quoted when ordering service and replacement parts. Depending of engine, identification plate is as follow :

Or :

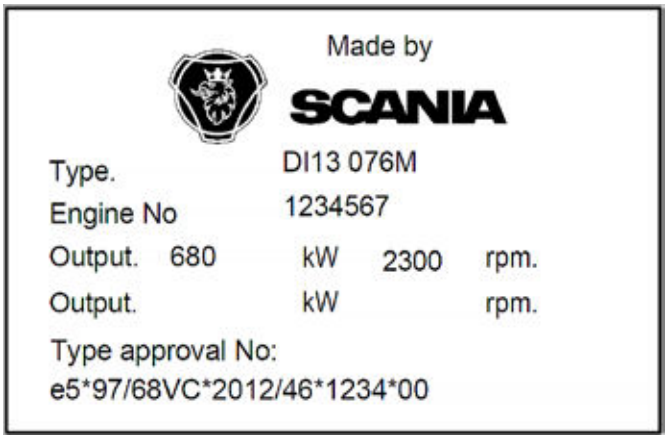
TYP indicates the commercial designation of the engine.
• NR indicates the engine serial number.
• CODE lists various specifications of the engine.

Example :



1 : Type of engine
2 : Engine number
3 : Engine code
4 : Nanni number

ORIGINAL SUPPLIER ENGINE PLATE



Example : **DI13 076M**

DI : Supercharged diesel engine with watercooled charge air cooler.
13 : Displacement in whole dm^3.
076 : Performance and certification code. The code indicates, together with the application code, the normal gross engine output.
M : Code for application. M means for marine use.

S04 ENGINE WARRANTY

ENGINE HOMOLOGATION

The engine type can be exhaust emission certified. It means that Nanni guarantees that all engines of the same type that are manufactured are approved and certified by the authorities in accordance with different exhaust emissions standards.

However, for the engine to be in accordance with this standards, special requirements for maintenance and service are to be followed :

- Only Nanni replacement parts must be used.
- Maintenance intervals must be observed.
- The engine must not be modified in any way except with accessories and service kits approved by Nanni Industries S.A.S. France.
- Service of the fuel system must always be carried out by an authorized Nanni workshop.
- No modifications to the air intake and exhaust system may be undertaken.
- Seals may only be broken by authorized personnel.
- The operation instructions stated in the relevant manuals should be follow by the user.

Nanni's responsibility for the engine specification being in accordance with the certification will be invalidate if one or several of this conditions are not followed.

ENGINE RESPONSABILITY

Nanni designs its engines to have minimum environmental impact. This objective, however, can only be achieved with your full cooperation.

Our operating and maintenance instructions are to help you to protect your engine and adopt environmentally responsible behaviour.

Ensure you only use the fuels and oils recommended. Using another type of fuel or oil could cause major malfunctions, an higher fuel consumption, a reduced engine service life, and a greater discharge of exhaust gases.

When draining the oil and changing the oil or fuel filter, dispose of the waste in an appropriate container. These fluids cause major damage to flora and fauna if discharged into nature. Use an absorption kit in the event of accidental discharge of oil or fuel into the water.

WARRANTY

This manual is supplemented by a Warranty Information Booklet. We recommend that you read this publication thoroughly.

Pay special attention to the applicable duty cycle and to the resulting limitations. Failure to comply with the warranty conditions will void the Warranty.

The validity of the Warranty is also dependent on proper installation and maintenance operation being carried out by an authorized Nanni representative.

NOTE !

Late or improper maintenance or use of spare parts other than Nanni original spare parts will invalidate Nanni's responsibility for the engine accordance with homologation and will void the Warranty.

Modifications to the engine's settings, as well as any other technical modification (accessories, spare parts, additional equipment, etc) ***ARE FORBIDDEN WITHOUT WRITTEN AUTHORIZATION FROM NANNI INDUSTRIES S.A.S.***

Any modification will void the Warranty. Damage caused by failure to follow operation instructions or incorrect operation is also not covered by the warranty.

S04 ENGINE WARRANTY

PROPOSITION 65 STATE OF CALIFORNIA

WARNING !

Diesel engine exhaust and some of its constituants are known to the state of California to cause cancer, birth defects, and other reproductive harm.

Battery posts and terminals, related devices do contain lead or lead compounds, chemicals known to the State of California to cause cancer, birth defects or other reproductive harm. Thoroughly wash your hands after handling any of the above components.

EPA WARRANTY

EPA and CARB warranties only apply to new engines having the certification label affixed to the engine and sold as stated above in the geographic areas.

The presence of an EU number signifies that the engine has been certified with the European Union countries per Directive 97/68/EC. The EPA and/or CARB emissions warranties do not apply to the EU countries.

When applied onto engine, Emission Control label must never be removed from engine block neither covered with a layer of paint. This label is the evidence showing that the engine is meeting U.S emissions regulations. It must be kept available at anytime once the vessel has entered waters being in the scope of the North American Emission Control Area (ECA).

EMISSION CONTROL SYSTEM(S) LAWS

The U.S. EPA and CARB prohibit the removal or rendering inoperative of any device or element of design installed on or in engines/equipment in compliance with applicable emission regulations prior to or after the sale and delivery of the engines/equipment to the ultimate purchaser.

EUROPEAN UNION (EU) DECLARATION OF EMISSIONS CONFORMITY

The presence of an EU number on the label signifies that the Marine Diesel Engine has been certified with the European Union countries per Directives 97/68/EC as amended by Directive 2004/26/EC. The EU engine family is listed on the Emissions Label.

When installed in accordance with the manufacturer's instructions, Nanni Industries Marine Diesel Propulsion Engines without integral exhaust certified under Directive 97/68/EC as amended by Directive 2004/26/EC produce exhaust emissions of carbon monoxide, hydrocarbons, nitrogen oxides and particle emissions complying with the requirements of the Recreational Craft Directive 2003/44/EC.

S05 COMPONENTS

SUMMARY

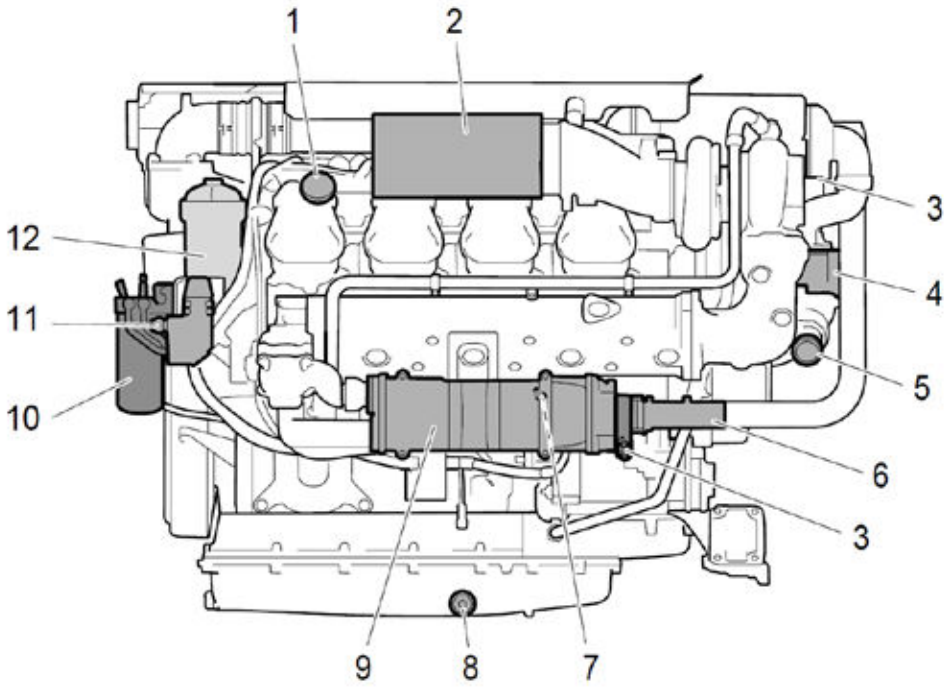
ENGINE MAIN COMPONENTS

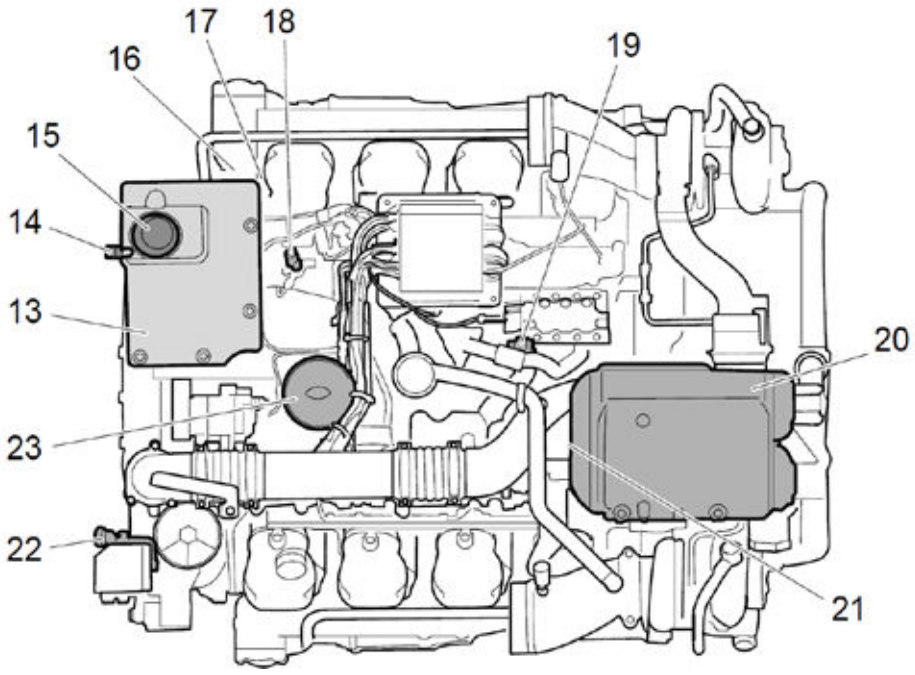
NOTE !

Minor engine details may not be exactly as shown. Some components may not be part of the engine ordered. Not binding pictures.

P/N	COMPONENTS
1	Oil filter
2	Air filter
3	Sacrificial anodes (6 off)
4	Sea water pump
5	Sea water outlet intake
6	Sea water outlet (1 on each side)
7	Valve for draining anf filling coolant (1 on each side behind the heat exchanger)
8	Oil plug
9	Heat exchanger (1 on each side)
10	Fuel filter
11	Hand pump for fuel
12	Oil filter)
13	Expansion tank
14	Level glass for checking coolant level
15	Filling coolant
16	Engine number, stamped into the cylinder block
17	Engine data plate
18	Fuel manifold bleed nipple
19	Bleed nipple on high pressure pump
20	Charge air cooler
21	Holes for draining condensation in charge air cooler (2 off on the underside)
22	Oil dipstick
23	Centrifugal oil cleaner

ENGINE VIEWS N16 CR3





NOTES

S06 INSTRUMENTATION

SUMMARY

INTRODUCTION

This chapter is intended for professionals and seasoned technicians. Users of this equipment are assumed to be fluent in handling marine systems, and must be able to carry out related electrical tasks. This chapter describes the features of the unit, the use and specifications.

Including software embedded, the SI.3 is a 3.5" full-colour display with Linux operating system. The screen is a QVGA high brightness display and hardware accelerated. With configurable backlit soft keys, operators can interact efficiently with the engine. The SI.3 has multifunctional capability and is used as instrumentation display machine control. This chapter provides important information regarding the proper use of the device.

PRESENTATION

The screen displays engine informations and allows the Start and Stop of the SCANIA engines through two push buttons (top and bottom).

A pulse on the **Start** push button (top) will send a start message on the CAN bus, which, in turn will crank the engine.

A pulse on **Stop** push button (bottom) will send a stop message on the CAN bus, stopping the engine.

The screen will also display engine occuring error event through the CAN bus network.

Above: front view of the SI.3 showing display screen during booting sequence.

PRODUCT IDENTIFICATION

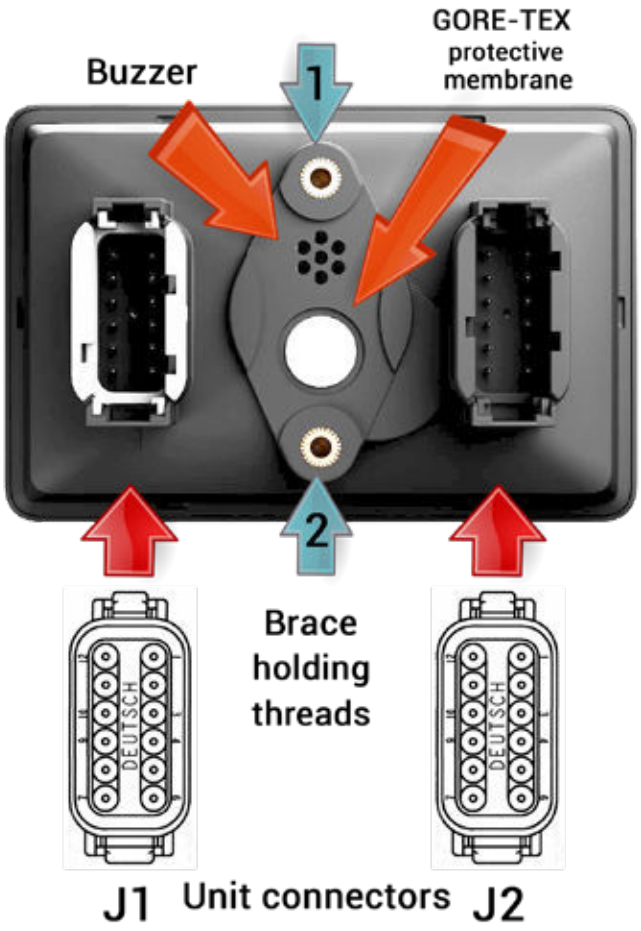
Each unit bears two identification labels with serial number, part number and revision which identifies the unit. This information is required when technical support is needed.

FRONT SIDE

Panel buttons

Command buttons are located on the right side of the unit. An Led is coming up when relevant button is activated.

REAR SIDE



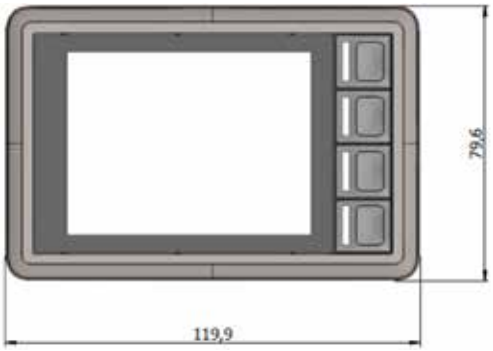
Connectors layout

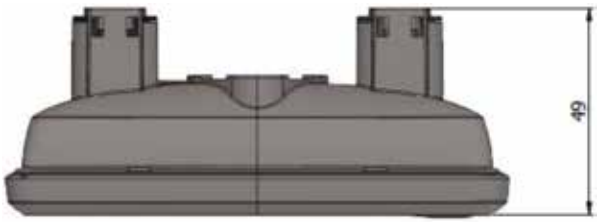
Pin	Function	Pin	Function
J1-1	Power 12/24V	J2-1	Configurable input -1
J1-2	GND	J2-2	Configurable input -2
J1-3	Switched power	J2-3	Configurable input -3
J1-4	Switched output 1	J2-4	Configurable input -4
J1-5	Switched output 2	J2-5	Analog GND
J1-6	CAN 1 Shield	J2-6	Analog input - 1
J1-7	CAN 1 +	J2-7	Analog input - 2
J1-8	CAN 1 -	J2-8	Analog input - 3
J1-9	USB GND	J2-9	Ethernet RD+
J1-10	USB Data -	J2-10	Ethernet RD-
J1-11	USB Data-	J2-11	Ethernet TD+
J1-12	USB Vbus	J2-12	Ethernet TD-

DIMENSIONS & WEIGHT

The rugged unit is made of thermoplastic polymer compound (PBT), impact resistant and flame retarded.

Item	Description
Dimensions	119,9 (W) x 79,6 (H) x 49 (D), in mm
Weight	0,250 kg
Spacing threads	48,5 mm
Threads dimension	M5
Threads depth	7,7 mm
Enclosure	PBT+ PC plastic





MOUNTING

The SI.3 supports two different mounting methods, a RAM mount or a panel mount. These two mounting methods are described below.

For both fastening methods, use the appropriate M5 x 0.8 button head screw of type MRT (Torx).

The recommended torque for the screws is of 1.5-2.0 Nm. Using fluid locker or locking washers (split ring, toothed lock, etc.) is required for good securing. Ensure that the M5 mounting screws are clean and dry before mounting.

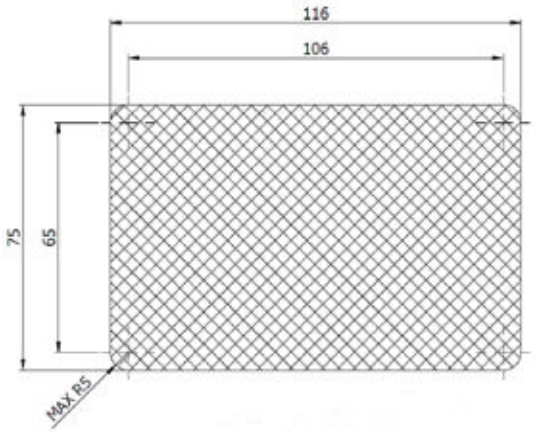
Bracket (RAM) mount :

Bracket kneecap ref is:
RAM-B-238U

Panel mount:

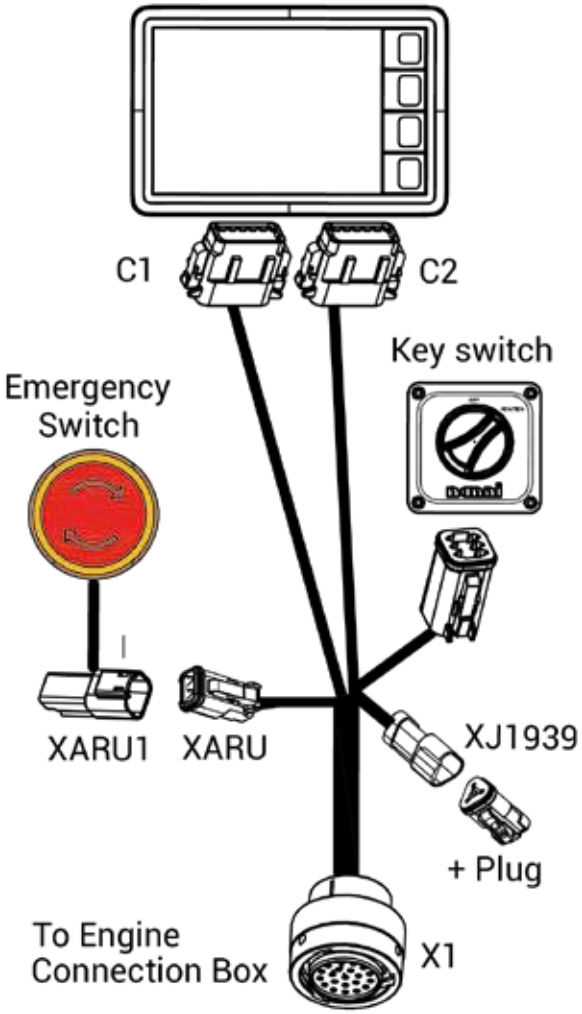
Panel mounting requires a bracket (P/N C000135-81) and a rubber frame (P/N C000144-44) as per picture below. The mounting bracket is designed for min 1,5 mm and max 3 mm panel thickness. Screw length should be of 10 mm.

Ensure that the SI.3 is mounted onto a smooth and flat surface. Fastening the unit to an uneven surface may stress the enclosure, damage the outer flange or possibly even flex the circuit board inside, leading to a premature breakdown. Below, cutout template dimensions:



ELECTRICAL CONNECTIONS

Once the SI.3 has been fitted in place, connections must be made. The harness is a plug and play system and is delivered with relevant poka-yoke connectors for troublefree connection to the Engine Control Box. To this purpose, a cable extension may be required.



Provision is made for wheelhouse standalone or wheelhouse + flybridge connection. Above harness 674760 is identical either for wheelhouse or for flybridge connection. See end of chapter for complete configuration layout drawing with options.

Internal electrical protection

The unit is internally short circuit protected to -32V to +32 V.

DISPLAYED DATA

After powering, and after SI.3 booting, the normal sequence displays engine function parameters such as :

Engine Rotary peer minutes : xxxx Tr/min or RPM
Engine Oil pressure : xx Bar
Engine Température : xxx °C
Engine Battery Voltage: xx V
Engine hours : xxx hrs
Engine Load : xxx %
Throttle position. xxx %
Engine Fuel Rate: xxx L/min
Engine Boost pressure : xx kPa

Normal sequence operation

During normal operation, the screen display is as below:

Fault sequence operation

When an engine fault occurs, several events will be displayed on the SI3 screen.

1. The background of the screen will turn white and a pop up with an engine icon will be displayed. Underneath, it will show SPN, FMI and OC numbers.

2. The buzzer will sound.

3. This pop up may be removed during 20 sec in pressing the second button on the right side of the unit, activating the HIDE function.

4. The display returns to normal operation and, after a delay, the pop up fault will come back if fault has not been resolved in the mean time.

5. The buzzer may be disabled in pressing the bottom right button (MUTE).

Below, an example of fault pop up :

SAFEGUARD FUNCTION

The SI.3 being only an engine status display, there is no safeguard to disable the engine start when transmission is engaged forward or backward.

A Safeguard interlock is located in the Engine Control Box through the Neutral Safety Switch Port. It is the duty of the shipyard to make the appropriate wiring.

Upon delivery, the Neutral Safety Switch port is shorted to allow preliminary engine tests only. The engine supplier has no responsability in case of improper safeguard wiring.

FAULT CODES

Fault codes generated in the CAN network are sent via CAN message DM1. This document describes how to interpret these fault codes from the DM1 message.

Abbreviations used

FMI = Fault Mode Identifier
SPN = Suspected Parameter Number
OC = Over Crank _ Number of faults occurances

Explanation table of FMI codes

Code	Explanation
0	Data valid but above normal operational range (that is, engine overheating)
1	Data valid but below normal operational range (that is, engine oil pressure too low)
2	Data erratic, intermittent, or incorrect
3	Voltage above normal or shorted high
4	Voltage below normal or shorted low
5	Current below normal or open circuit
6	Current above normal or grounded circuit
7	Mechanical system not responding properly
8	Abnormal frequency, pulse width, or pending
9	Abnormal update rate
10	Abnormal rate of change
11	Failure mode not identifiable
12	Bad intelligent device or component
13	Out of calibration
14	Special instructions
15	Data valid but above normal operating range - least severe level
16	Data valid but above normal operating range - moderately severe level
17	Data valid but below normal operating range - least severe level
18	Data valid but below normal operating range - moderately severe level
19	Received network data in error
20	Data drifted high
21	Data drifted low

Explanation table of SPN codes

SPN	SPN Name	SPN Description
46	Pneumatic Supply Pressure	Pneumatic pressure in the main reservoir, sometimes referred to as the wet tank.
51	Engine Throttle Valve 1 Position	Position of the valve used to regulate the supply of a fluid, usually air or fuel/air mixture, to an engine.
91	Accelerator Pedal Position 1	The ratio of actual position of the analogue engine speed/torque request input device (such as an accelerator pedal or throttle lever) to the maximum position of the input device.
94	Engine Fuel Delivery Pressure	Gage pressure of fuel in system as delivered from supply pump to the injection pump.
97	Water In Fuel Indicator	Signal which indicates the presence of water in the fuel.
98	Engine Oil Level	Ratio of current volume of engine sump oil to maximum required volume.
100	Engine Oil Pressure	Gauge pressure of oil in engine lubrication system as provided by oil pump.
102	Engine Intake Manifold #1 Pressure	The gauge pressure measurement of the air intake manifold.
103	Engine Turbocharger 1 Speed	Rotational velocity of rotor in the turbocharger.
105	Engine Intake Manifold 1 Temperature	Temperature of pre-combustion air found in intake manifold number 1 of engine air supply system.
107	Engine Air Filter 1 Differential Pressure	Change in engine air system pressure, measured across the filter, due to the filter and any accumulation of solid foreign matter on or in the filter.
108	Barometric Pressure	Absolute air pressure of the atmosphere.
110	Engine Coolant Temperature	Temperature of liquid found in engine cooling system.
111	Engine Coolant Temperature	Ratio of volume of liquid found in engine cooling system to total cooling system volume.
131	Engine Exhaust Back Pressure	Mass flow rate of fresh air entering the engine air intake, before any EGR mixer, if used.
132	Engine Intake Air Mass Flow Rate	
156	Engine Injector Timing Rail 1 Pressure	The gage pressure of fuel in the timing rail delivered from the supply pump to the injector timing intake.
167	Charging System Potential (Voltage)	Electrical potential measured at the charging system output. The charging system may be any device charging the batteries.
168	Battery Potential/Power Input 1	This parameter measures the first source of battery potential as measured at the input of the ECM/actuator etc. coming from one or more batteries, irrespective of the distance between the component and the battery.
171	Ambient Air Temperature	Temperature of air surrounding vessel / engie compartment.
172	Engine Air Intake Temperature	Temperature of air entering vehicle air induction system.
174	Engine Fuel Temperature 1	Temperature of fuel passing through the first fuel control system.
175	Engine Oil Temperature 1	Temperature of the engine lubricant.
188	Engine Speed At Idle, Point 1 (Engine Configuration)	Stationary low idle speed of engine which includes influences due to engine temperature (after power up) and other stationary changes (calibration offsets, sensor failures, etc).
190	Engine Speed	Actual engine speed which is calculated over a minimum crankshaft angle of 720 degrees divided by the number of cylinders.
234	Software Identification	Software identification of an electronic module.

Continuing next page on SPN # 532.

SPN	SPN Name	SPN Description
532	Engine Speed At High Idle, Point 6 (Engine Configuration)	Engine speed of high idle of the engine torque map.
558	Accelerator Pedal 1 Low Idle Switch	Switch signal which indicates whether the accelerator pedal kickdown switch is opened or closed.
559	Accelerator Pedal Kickdown Switch	Switch signal which indicates whether the accelerator pedal kickdown switch is opened or closed.
590	Engine Idle Shutdown Timer State	Status signal which indicates the current mode of operation of the idle shutdown timer system.
597	Brake switch	Switch signal which indicates that the driver operated brake foot pedal is being pressed.
598	Clutch switch	Switch signal which indicates that the clutch pedal is being pressed.
636	Engine position sensor	
641	Engine Variable Geometr Turbocharger Actuator #1	Actuator that controls the variable geometry turbocharger geometry.
645	Engine Tachometer Signal Output	
651	Engine Injector Cylinder #01	
652	Engine Injector Cylinder #02	
653	Engine Injector Cylinder #03	
654	Engine Injector Cylinder #04	
655	Engine Injector Cylinder #05	
656	Engine Injector Cylinder #06	
657	Engine Injector Cylinder #07	
658	Engine Injector Cylinder #08	
677	Engine Starter Motor Relay	Activates the starter.
723	Engine Speed 2	Engine Speed 2
788	Transmission Clutch Actuator	Identifies the status of the actuator that controls the clutch.
968	Engine Idle Increment Switch	Switch signal which indicates the position of the idle increment switch.
972	Accelerator Interlock Switch	Switch signal used to disable the accelerator and remote accelerator inputs, causing the engine to return to idle.
974	Remote Accelerator Pedal Position	The ratio of actual position of the remote analogue engine speed/torque request input device (such as an accelerator pedal or throttle lever) to the maximum position of the input device.
986	Requested Percent Fan Speed	Fan speed as a ratio of the actual fan drive (current speed) to the fully engaged fan drive (maximum fan speed).
1110	Engine Oil Temperature 2	Temperature of the engine lubricant.
1239	Engine Fuel Leakage 1	Status signal which indicates fuel leakage in the fuel rail of the engine. Location can be either before or after the fuel pump.
1322	Engine Misfire for Multiple Cylinders	When a misfire occurs in any one of the cylinders.

Continuing next page on SPN # 1323.

SPN	SPN Name	SPN Description
1323	Engine Misfire Cylinder #1	Engine misfire detected in cylinder.
1324	Engine Misfire Cylinder #2	Engine misfire detected in cylinder.
1325	Engine Misfire Cylinder #3	Engine misfire detected in cylinder.
1326	Engine Misfire Cylinder #4	Engine misfire detected in cylinder.
1327	Engine Misfire Cylinder #5	Engine misfire detected in cylinder.
1328	Engine Misfire Cylinder #6	Engine misfire detected in cylinder.
1329	Engine Misfire Cylinder #7	Engine misfire detected in cylinder.
1330	Engine Misfire Cylinder #8	Engine misfire detected in cylinder.
1442	Engine Fuel Valve 1 Position	The position of a gaseous fuel valve that is metering the fuel flow to the engine.
1443	Engine Fuel Valve 2 Position	The position of a gaseous fuel valve that is metering the fuel flow to the engine.
1483	Source Address of Controlling Device for Engine Control	The source address of the SAE J1939 device currently controlling the engine.
1484	Other ECUs Have Reported Fault Codes Affecting Operation	
1485	ECM Main Relay	
1569	Engine Protection Torque Derate	Torque has been derated for protection of the engine.
1632	Engine Torque Limit Feature	Torque limit rating described in the current record.
1675	Engine Starter Mode	Start cannot take place for one of several different reasons.
1761	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Ratio of volume of diesel exhaust fluid to the total volume of diesel exhaust fluid storage container.
2791	Engine Exhaust Gas Recirculation 1 (EGR1) Valve Control	Desired percentage of maximum Exhaust Gas Recirculation (EGR) valve opening.
2797	Engine Injector Group 1	A first collection of fuel injector circuits that are grouped together.
2798	Engine Injector Group 2	A second collection of fuel injector circuits that are grouped together.
2858	Machine Data Configuration 1	There is a problem involving the parameter list for the data structure for configuring operations within the Controller Application being communicated with.
2859	Machine Data Configuration 2	There is a problem involving one (or more) of the PGN(s) within the parameter list for the data structure for configuring operations within the Controller Application being communicated with.
2860	Machine Data Configuration 3	There is a problem involving the first output control list for the data structure for configuring operations within the Controller Application being communicated with.
2861	Machine Data Configuration 4	There is a problem involving the second output control list for the data structure for configuring operations within the Controller Application being communicated with.
2862	Machine Data Configuration 5	There is a problem involving the third output control list for the data structure for configuring operations within the Controller Application being communicated with.
3031	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Temperature of the diesel exhaust fluid in the storage tank.

Continuing next page on SPN # 3216.

SPN	SPN Name	SPN Description
3216	Aftertreatment 1 Intake NOx	The amount of combined NO and NO2 in the exhaust entering the aftertreatment system measured by a NOx sensor at the aftertreatment intake, represented in NOx molecule parts per million non-NOx molecules in exhaust bank 1.
3226	Aftertreatment 1 Outlet NOx	The amount of combined NO and NO2 in the exhaust entering the aftertreatment system measured by a NOx sensor at the aftertreatment outlet, represented in NOx molecule parts per million non-NOx molecules in exhaust bank 1.
3241	Aftertreatment 1 Exhaust Gas Temperature 1	The reading from the exhaust gas temperature sensor located farthest upstream in the aftertreatment system in exhaust bank 1.
3242	Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature	Temperature of engine combustion by-products entering the diesel particulate filter in exhaust bank 1.
3245	Aftertreatment 1 Exhaust Gas Temperature 3	The reading from the exhaust gas temperature sensor located farthest downstream in the aftertreatment system in exhaust bank 1.
3246	Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature	Temperature of engine combustion by-products leaving the diesel particulate filter exhaust in exhaust bank 1.
3249	Aftertreatment 1 Exhaust Gas Temperature 2	The reading from the exhaust gas temperature sensor located midstream of the other two temperature sensors in the aftertreatment system in exhaust bank 1.
3251	Aftertreatment 1 Diesel Particulate Filter Differential Pressure	Exhaust differential pressure measured between the intake and exhaust of a diesel particulate filter in exhaust bank 1.
3275	Aftertreatment 2 Exhaust Gas Temperature 1	The reading from the exhaust gas temperature sensor located farthest upstream in the aftertreatment system in exhaust bank 2.
3279	Aftertreatment 2 Exhaust Gas Temperature 3	The reading from the exhaust gas temperature sensor located farthest downstream in the aftertreatment system in exhaust bank 2.
3283	Aftertreatment 2 Exhaust Gas Temperature 2	The reading from the exhaust gas temperature sensor located midstream of the other two temperature sensors in the aftertreatment system in exhaust bank 2.
3340	Engine Charge Air Cooler 1 Intake Pressure	Pressure of air at intake to 1st or only charge air cooler, from multiple first stage turbochargers being cooled and feeding multiple second stage turbochargers.
3360	Aftertreatment 1 Diesel Exhaust Fluid Controller	The Diesel Exhaust Fluid Controller has the ability to read attributes of the SCR system, including but not limited to, diesel exhaust fluid level, diesel exhaust fluid temperature, diesel exhaust fluid quality, and diesel exhaust fluid dosing rate.
3361	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit	The diesel exhaust fluid dosing unit is a device that mixes the diesel exhaust fluid and air, and delivers a metered quantity of this mixture to the exhaust stream.
3362	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Input Lines	The diesel exhaust fluid dosing unit is a device that mixes the diesel exhaust fluid and air, such that it contains an input line from the air tank and an input line from the diesel exhaust fluid tank.
3363	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater	Percentage of heating applied to the aftertreatment 1 diesel exhaust fluid tank heater.
3464	Engine Throttle Actuator 1 Control Command	The control command to throttle actuator 1, normalized to percent.
3468	Engine Fuel Temperature 2	Temperature 2 of fuel.
3471	Aftertreatment 1 Fuel Pressure Control Actuator	Diagnostic SPN for the actuator controlling aftertreatment 1 fuel pressure.
3472	Aftertreatment 1 Air Pressure Control Actuator	
3480	Aftertreatment 1 Fuel Pressure 1	First fuel pressure measurement for the aftertreatment 1 system.
3485	Aftertreatment 1 Supply Air Pressure	Pressure of the supply air for aftertreatment 1.
3515	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2	Temperature of the diesel exhaust fluid at the device measuring diesel exhaust fluid quality.

Continuing next page on SPN # 3516.

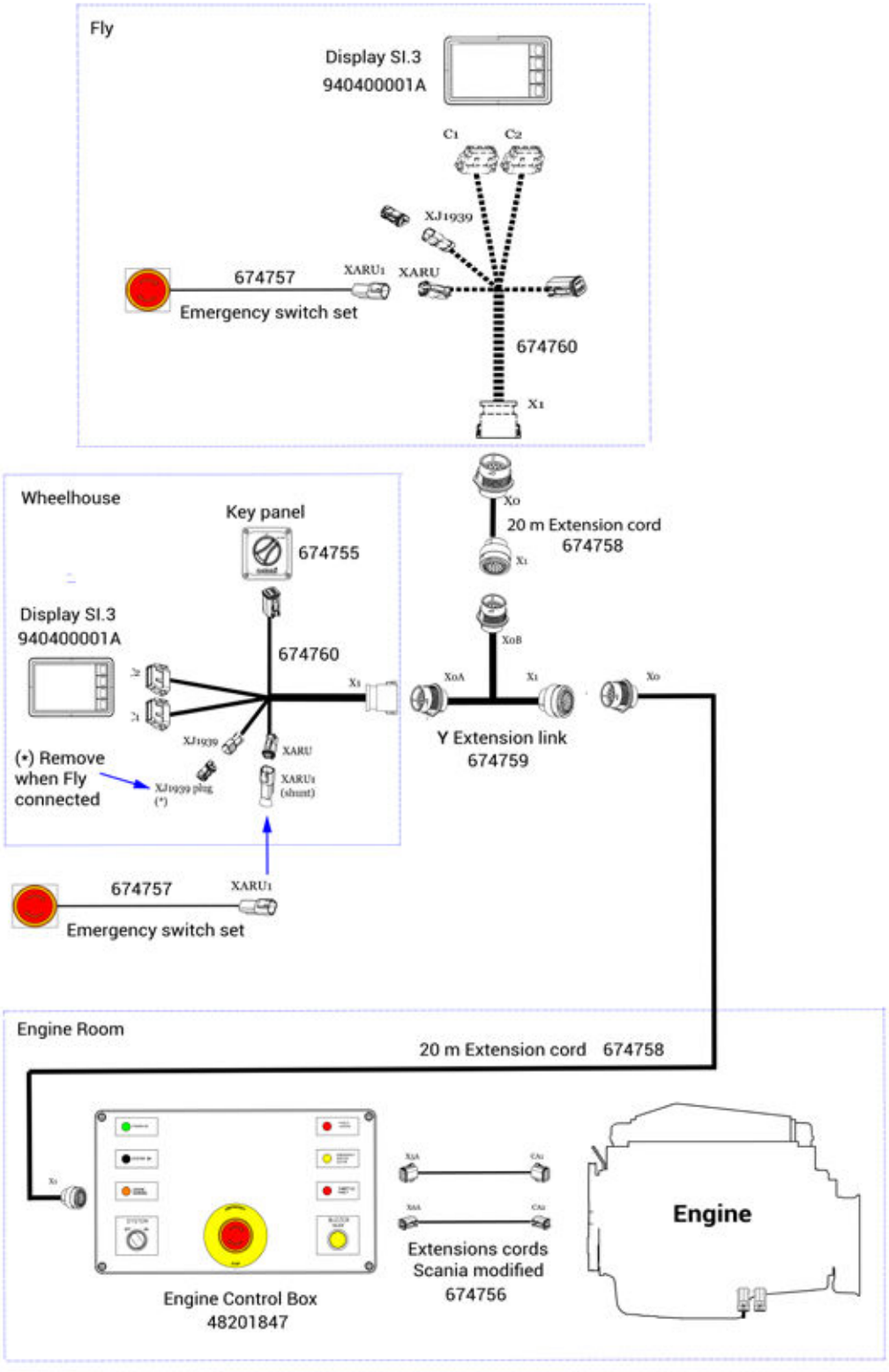
SPN	SPN Name	SPN Description
3516	Aftertreatment 1 Diesel Exhaust Fluid Concentration	A measure of the concentration of urea in water.
3563	Engine Intake Manifold #1 Absolute Pressure	The absolute pressure measurement of the air intake manifold.
3606	Engine Controlled Shutdown Request	A signal issued by the engine control system to a user or external system requesting for a controlled shutdown.
3607	Engine Emergency (Immediate) Shutdown Indication	A signal issued by the engine control system to a user or external system indicating that it is immediately shutting the engine down.
3673	Engine Throttle Valve 2 Position	The sensed position feedback of the valve, coming from a second electrical actuator for a second throttle plate, used to regulate the supply of a fluid, usually air or fuel//air mixture.
3822	Engine Exhaust Gas Recirculation 1 Valve 2 Position	The position of the second exhaust gas recirculation valve expressed as a percentage of full travel.
3936	Aftertreatment Diesel Particulate Filter System	Non-specific failures of the aftertreatment diesel particulate filter system.
4090	NOx limits exceeded, root cause unknown	On-Board Diagnostics has determined that the limits for NOx in the exhaust stream have been exceeded, but the root cause cannot be determined by the OBD system.
4094	NOx limits exceeded due to Insufficient Diesel Exhaust Fluid Quality	On-Board Diagnostics has determined that the limits for NOx in the exhaust stream have been exceeded due to an insufficient diesel exhaust fluid quality.
4095	NOx limits exceeded due to Interrupted Diesel Exhaust Fluid Dosing	On-Board Diagnostics has determined that the limits for NOx in the exhaust stream have been exceeded due to an interruption in diesel exhaust fluid dosing activity.
4096	NOx limits exceeded due to Empty Diesel Exhaust Fluid Tank	On-Board Diagnostics has determined that the limits for NOx in the exhaust stream have been exceeded due to the diesel exhaust fluid tank being empty.
4201	Engine Speed 1	The engine speed as measured by speed sensor 1.
4202	Engine Speed 3	The engine speed as measured by speed sensor 3.
4225	NOx limits exceeded due to error in the NOx control system	On-Board Diagnostics has determined that the limits for NOx in the exhaust stream have been exceeded due to an error in the NOx control system.
4301	Aftertreatment 1 Fuel Injector 1 Heater Control	Heating level that the controller is commanding the aftertreatment 1 fuel injector 1 heater control to maintain.
4334	Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure	The SCR dosing diesel exhaust fluid absolute pressure (measured closest to dosing valve) for aftertreatment system 1 (exhaust bank 1).
4337	Aftertreatment 1 Diesel Exhaust Fluid Dosing Temperature	The diesel exhaust fluid dosing temperature (measured closest to dosing valve) for aftertreatment system 1 (exhaust bank 1).
4341	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Preliminary FMI	Used to identify the applicable J1939-73 FMI detected in the diesel exhaust fluid line heater 1, by the manufacturer's control software in exhaust bank 1.
4343	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Preliminary FMI	Used to identify the applicable J1939-73 FMI detected in the diesel exhaust fluid line heater 2, by the manufacturer's control software in exhaust bank 1.
4345	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 Preliminary FMI	Used to identify the applicable J1939-73 FMI detected in the diesel exhaust fluid line heater 3, by the manufacturer's control software in exhaust bank 1.
4347	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 4 Preliminary FMI	Used to identify the applicable J1939-73 FMI detected in the diesel exhaust fluid line heater 4, by the manufacturer's control software in exhaust bank 1.
4374	Aftertreatment 1 Diesel Exhaust Fluid Pump Motor Speed	Rotational speed of the motor driving a pump for diesel exhaust fluid used in an aftertreatment system.

Continuing next page on SPN # 4427.

SPN	SPN Name	SPN Description
4427	Aftertreatment 2 Diesel Exhaust Fluid Tank Temperature	Temperature of the diesel exhaust fluid in the storage tank.
4782	Diesel Particulate Filter 1 Soot Density	Soot density in diesel particulate filter 1.
4809	Aftertreatment 1 Warm Up Diesel Oxidation Catalyst Intake temperature	The temperature measured at the intake of the warm up oxidation catalytic converter in exhaust bank 1.
4810	Aftertreatment 1 Warm Up Diesel Oxidation Catalyst Outlet Temperature	The temperature measured at the outlet of the warm up oxidation catalytic converter in exhaust bank 1.
4814	Engine Coolant Pump command	Command for a coolant pump that can be driven at varying output level.
5264	Engine Exhaust Gas Recirculation 2 (EGR2) Valve Control	Desired percentage of maximum Exhaust Gas Recirculation 2 (EGR2) valve opening. 0% means the valve is closed. 100% means maximum opening (full gas flow).
5265	Engine Exhaust Gas Recirculation 2 (EGR2) Valve 2 Control	Desired percentage of maximum Exhaust Gas Recirculation 2 (EGR2) valve 2 opening. 0% means the valve is closed. 100% means maximum opening (full gas flow).
5285	Engine Charge Air Cooler 1 Efficiency	An indication of the CAC's ability to reduce the temperature of the combustion air that is being routed through the CAC1.
5401	Engine Turbocharger Turbine Bypass Actuator	Diagnostic SPN for the actuator controlling the engine turbocharger turbine bypass valve.
5419	Engine Throttle Actuator 1	Device used to control the flow of air or air/fuel mix to the engine.
5421	Engine Turbocharger Wastegate Actuator 1	Device used to control the turbocharger wastegate.
5435	Aftertreatment 1 Diesel Exhaust Fluid Pump State	State of Aftertreatment 1 Diesel Exhaust Fluid dosing pump.
5485	Aftertreatment 1 Diesel Exhaust Fluid Pump Orifice Flow	The Exhaust Emission Controller aftertreatment reagent pump orifice flow. Could indicate that the flow is being restricted.
5541	Engine Turbocharger 1 Turbine Outlet Pressure	Gage pressure of the combustion by-products exiting the turbine side of the turbocharger 1.
5543	Engine Exhaust Brake Actuator Command	The control command applied to the engine exhaust brake actuator.
5706	Aftertreatment 1 Diesel Exhaust Fluid Pump Heater	Percentage of heating applied to the aftertreatment 1 diesel exhaust fluid pump heater.
5743	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module	Module will take temperature sensor inputs from the Aftertreatment Selective Catalytic Reduction Temperature Sensors and multiplex the sensor values to the engine ECU via the J1939 network.
5745	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater	Aftertreatment DEF heater internal to the Aftertreatment Dosing Unit.
5841	Diesel Exhaust Fluid Quality Malfunction	The diagnostic system has determined that the engine has been operated with a diesel exhaust fluid (reagent) quality malfunction.
7461	Aftertreatment 1 Diesel Exhaust Fluid Pump 2 Motor Speed	Rotational speed of the motor driving a pump for diesel exhaust fluid used in an aftertreatment system.

End of SPN codes table.

SYSTEM LAYOUT INCLUDING OPTIONS



S07 STARTING & RUNNING

SUMMARY

BEFORE STARTING

FUEL SYSTEM

The fuel is drawn from the tank by the fuel feed pump and is injected into the combustion chamber by the injection pump. A fuel filter is placed between the feed pump and the injection pump.

The injection pump delivers a larger amount of fuel than required for combustion. The fuel that is not burned is re-injected into the tank through an over-flow pipe.

CAUTION !

The injection pump is an extremely precise unit. Water entry in the fuel system will cause major failure to the injection pump and to the whole fuel system.

A fuel prefilter with a water separator should be installed between the fuel tank and the fuel filter on the engine. The prefilter should be installed as close as possible to the engine fuel filter. It must never be installed on the engine as vibrations affect the water/fuel separation process.

If the fuel tank is located below the engine injection pump, an additional electric fuel feed pump should be installed between the prefilter and the feed pump of the engine.

RAW WATER SYSTEM

The raw water system allows to cool the engine coolant and the exhaust gas.

Raw water is drawn into the heat exchanger by the engine raw water pump. The raw water is drained via the exhaust elbow, where it is mixed with exhaust gases.

The siphon breaker prevents raw water entry into the cylinders via the raw water/exhaust system.

NOTE !

The use of a siphon breaker is mandatory if the exhaust elbow is under the waterline at full load or at less than 200 mm above it. A siphon breaker is mandatory in all Sail Boat and when there's a risk of water entry in the engine.

A raw water filter must be fitted between the raw water intake and the raw water pump of the engine.

NEUTRAL SAFEGUARD

Once wired, the neutral safety switch from the engine control box will display a warning message on the SI-7, SI-9 or other similar control screen if transmission is engaged forward or backward before engine crank:

When this pop up appears, the engine will not start, unless transmission is put to neutral.

CHECKS BEFORE STARTING

WARNING !

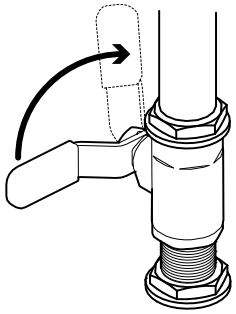
Put all the protective covers back before starting the engine.

CAUTION !

Open the sea cock before starting the engine. The raw water pump impeller will be damaged if it runs dry even for few seconds, and may lead to engine overheating.

Perform all of the following operations before starting the engine :

1. Open sea cock. Prime the raw water system if necessary.



2. Start the compartment fan (if fitted) for at least five minutes. Otherwise, open the hold.
3. Check that there is sufficient fuel.
4. Move the control lever to the neutral position.
5. Open fuel cock, prime the system if necessary.
6. Check the engine and transmission oil level and fill with the recommended oil if necessary.
7. Check the coolant level, top up if necessary.
8. Check the mechanical control cables, lubricate as required.
9. Check there are no fuel, oil, coolant or water leaks.
10. Check the alternator belt.
11. Turn ON the main battery switch.

STARTING THE ENGINE

DANGER !

The propeller can cause serious injury when rotating. Check that nobody is in the water near the propeller before starting. Never use a start spray or any other equivalent product These products are highly flammable.

CAUTION !

Always preheat the engine. Never race the engine while it is cold. Do not crank the engine continuously for more than 10 seconds at a time. Let it cool down for 2 minutes between cranking attempts. Failure to follow these guidelines may result in starter motor burnout.

NOTE !

If the engine does not start after 3 attempts, remove the key and drain the water in the waterlock. Failure to do so may lead to water ingress in the cylinders. When starting the engine for the first time, let it run at idle for several minutes and check for leaks or malfunction.

COLD WEATHER OPERATION

NOTE !

Engines may be equipped with coolant heaters as cold weather starting aids. Engine coolant heaters should be used when temperatures are at or below 0 °C (32 °F).

Turn on the engine coolant heater for a minimum of 2 hours before starting the engine. Additional information on cold weather operation is available from your Nanni engine distributor or authorized servicing dealer.

Synthetic oils improve flow at low temperatures, especially in arctic conditions.

S07 STARTING & RUNNING

ENGINE START

In the wheelhouse, turn the Key switch to energize the electronic system.

IGNITION AND CRANKING

Press the top right button on the SI-3 and the engine will crank.

Example of engine status display after cranking:

ENGINE STARTED

To insure adequate lubrication, operate engine at or below 1200 rpm with no load for 1-2 minutes. Extend this period to 2–4 minutes at freezing or sub-zero temperatures.

1. Check oil pressure gauge as soon as engine starts. If gauge needle does not level up to minimum oil pressure specification within 5 seconds, stop the engine and determine the cause.
2. Watch coolant temperature gauge. Do not place engine under full load until properly warmed up.

It is a good practice to operate the engine under a lighter load and at lower speeds than normal for the first few minutes after start-up.

STARTING WITH BOOSTER BATTERIES

CAUTION !

Make sure to use batteries with the same rated voltage as the engine's system voltage. On an engine with a two pole electrical system, connect the other end of the jumper cable to the negative pole (-) of the booster battery.

1. Connect the jumper cable to the positive pole (+) of the flat battery, then to the positive pole (+) of the booster battery.
2. Connect the jumper cable to the negative pole (-) of the booster battery. Connect the other end to a bolt of the engine block.

Start the engine following the starting procedure.

3. Let the engine run at idle for few minutes to charge the battery.
4. Stop the engine and remove the cables in the exact reverse order from installation.

ENGINE RELUCTANT TO START

If a water lift (water lock) muffler is installed on the exhaust line, excessive cranking could cause seawater to enter the cylinders and damage the engine. To start engine, reduce starting attempts to three and if not OK, undertake to do this :

1. Close the seacock to avoid filling the muffler with water.
2. Try to start the engine by following the regular starting procedure.
3. When the engine does start, stop the engine immediately and turn off the switch.
4. Re-open the seacock and restart the engine.

IDLING ENGINE

Avoid excessive engine idling as it may cause the coolant temperature to fall below its normal range. This, in turn, causes crankcase oil dilution, due to incomplete fuel combustion, and permits formation of gummy deposits on valves, pistons, and piston rings. It also promotes rapid accumulation of engine sludge and unburned fuel in the exhaust system.

Once an engine is warmed to normal operating temperatures, engine should be idled at slow idle speed. Slow idle speed for engine is set at the factory. If an engine is left idling for more than 5 minutes, stop and restart later.

Above : temperature and pressure on classic gauges.

NORMAL ENGINE OPERATION

Check engine coolant temperature and oil pressure. Temperatures and pressures will vary between engines and with changing operating conditions, temperatures, and IIf coolant temperature rises above the maximum coolant temperature, reduce load on engine. Unless temperature drops quickly, stop engine and determine cause before resuming operation.

Operate the engine under a lighter load and at slower than normal speed for first 15 minutes after start-up. DO NOT run engine at slow idle unless necessary for maneuvering out of dock and harbor.

Stop engine as soon as possible if there are any signs of part failure. Symptoms that may be early signs of engine problems are :

- Sudden drop in oil pressure
- Abnormal coolant temperatures
- High marine gear oil temperature
- Unusual noise or vibration
- Sudden loss of power
- Excessive black exhaust
- Excessive fuel consumption
- Excessive oil consumption
- Fluid leaks

BREAK IN

Operate the engine with care for the first 50 hours of operation.

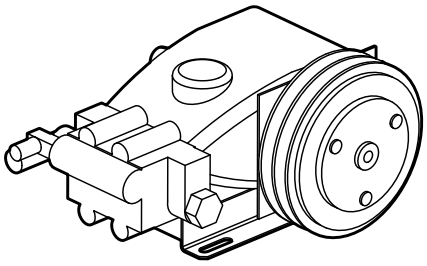
Do not race the engine while it is cold. Do not operate it at full load except for short periods. Never run the engine at constant engine speed for long periods during the break in period.

Check the oil and coolant level frequently during the running-in period. The oil consumption can be more important during the running in period.

See Maintenance section.

POWER TAKE OFF

Some engines can be fit with a Power Take Off system. This system allows to power accessories like bilge pump, watermaker, etc.

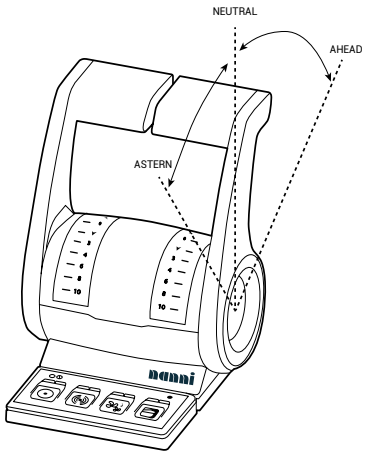


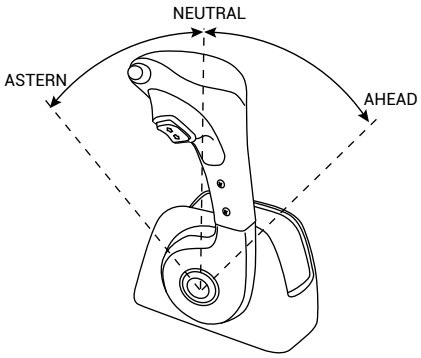
NOTE !

Any mechanical power taken from the engine from a PTO reduces the power delivered to the propeller. The use of a PTO should always be studied and approved by the R&D department of Nanni Industries S.A.S France. Contact your Nanni dealer for more informations.

REMOTE CONTROL

The remote control is an optional extra not in the scope of supply of the engine. The remote control installed on the boat can be different than the ones shown in this document.





On most boats, the control lever controls both the engine rpm and the gear shift (ahead / astern). However, some boats can be equipped with a separated shift command.

It can also be fitted with a neutral safety switch that prevents the engine from starting until the lever is in neutral position.

Consult the boat builder or your Nanni dealer if you are not sure about the operation of the remote control.

RUNNING

BEHAVIOUR OF THE BOAT

If this is your first boat or if you are not familiar with the boat, we urge you to practice controlling the boat at slow speed as a first step. Avoid violent manoeuvres or unexpected speed changes while sailing. People can fall over or overboard.

Keep also in mind that the weight distribution (passengers, equipments, etc.) inside the boat has an impact on the behaviour of the boat when cruising. Depending the position of the load, the behaviour of the boat may change, particularly in the case of a planning hull.

The condition of the hull and the propeller is also a critical factor. A dirty and / or damaged hull will modify the behaviour of the boat and therefore the engine performance. It can also cause cavitation which can seriously erode the surface of the propeller, the drive, etc.

DURING OPERATION

NOTE !

Never press the START button when the engine is running.

The solenoid of the starter motor would push up the cog and make the starter motor to start, against the turning flywheel of the engine already in motion. This action would destroy the starter motor.

Check the instruments and warning lamps after starting, and regularly when cruising.

CRUISING SPEED

A recommended engine speed is given in the ***TECHNICAL DATA*** section to help you to set your cruising speed.

NOTE !

Always consider sailing conditions and load of the boat to set the cruising speed.

Operating the engine at wide open throttle should be avoided since it is both uncomfortable and uneconomical. Note that operating the engine at a too low rpm for a long period could lead among other things to increased oil consumption.

Deposits may also form in the injection system if the engine do not reach its nominal operating temperature regularly. Run the engine at full throttle regularly in order to burn off any possible deposits in the fuel system.

MANOEUVRING

WARNING !

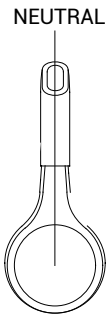
Shifting at high speed can damage both the engine and the transmission and be dangerous for passengers.

CAUTION !

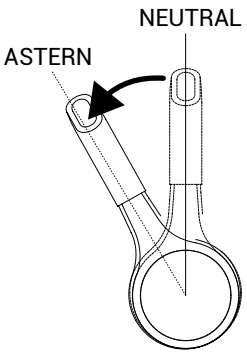
On a twin engine boat, both engines should be started during reversing manoeuvres to reduce the risk of water ingress in the stationary engine.

Carry out the following operations for forward / reverse manoeuvres :

1. Reduce engine speed to idling and, if possible, let the boat lose most of its speed.
2. Move the control lever to the neutral position and wait a few seconds.



3. Move the control lever into astern. Increase the speed.



TROLLING VALVE

The Trolling valve system allows to reduce the rotation speed of the propeller below its speed when the engine is at idle. The boat speed is reduced by 30% to 70%.

CAUTION !

The Trolling valve system must never be used for manoeuvring. It also must never be used at an engine speed of more than 1200 rpm (refer to Gear Box operating manual).

AFTER RUNNING

STOPPING THE ENGINE

CAUTION !

Never stop the engine by using the main switch. This could damage the electrical system.

Before stopping the engine, let it run at idle in neutral for few minutes, especially if the engine has been operated at high speed and load. This will allow the coolant to cool down the engine.

1. Start the fan in the engine compartment (if fitted) or open the hold.
2. Turn the key of the starter switch counter-clockwise, the engine stops and all indicators turn off. The engine stops, all lamps go out. For panel without key, press the ON/STOP button and release it. The engine stops. Turn the key of the main panel counter-clockwise. All indicators will turn off.

.

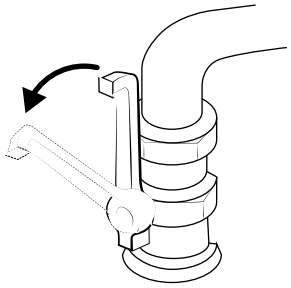
AFTER STOPPING THE ENGINE

CAUTION !

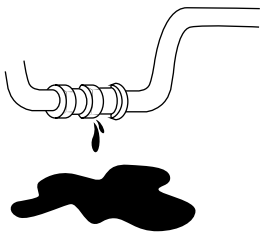
Even after the engine has stopped, some components and fluids will remain hot and under pressure for several minutes. As far as possible, limit works on the engine immediately after stopping it. Allow it to cool down first.

After the engine has stopped :

1. Turn off the main switch.
2. Close the sea cock and the fuel cock.



3. Inspect the engine compartment and check for leaks.



CAUTION !

If the boat is being towed, put the lever in neutral, stop the engine and close the sea cock to prevent the engine from being filled with raw water.

On a twin-engine boat, if cruising with a single engine, close the sea cock of the stopped engine.

Do not forget to open the sea cock before restarting the engine.

ANCHORING

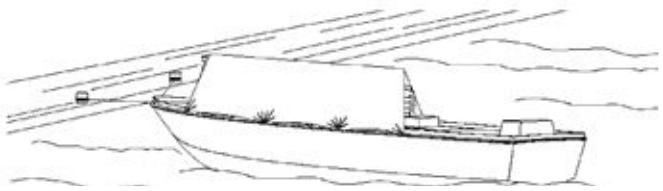
If the boat is not going to be used for some time but is being left in the water, the engine must be run to operating temperature at least once every 2 weeks. This prevents corrosion in the engine.

When the boat is at anchor or in port for an extended period of time, vegetation may develop on the hull, the keel, the drive, the rudder, the propeller, etc. It will significantly affect the behaviour of the boat and the performance of the engine if the vegetation is not removed before the next time the boat is used.

Vegetation and fouling can also obstruct the raw water system and result in damage to the engine by overheating.

Inspect and clean the boat and the raw water system each time the engine is used. Clean if necessary. If the boat is removed out of water, clean the hull and spray a coat of anti-fouling. Never paint the anodes.

Furthermore, when the boat is at anchor or in port for an extended period, water can fill the exhaust system via the exhaust outlet. It is necessary to drain regularly the waterlock when the boat is at anchor.



COLD WEATHER PRECAUTIONS

CAUTION !

Make sure that the engine compartment is not engulfed with frost as among others, a poorly charged battery may burst as a result of freezing.

S08 MAINTENANCE

SUMMARY

S08 MAINTENANCE

ABOUT

This manual is describing preventive maintenance operations to be carried out by the owner/operator of the engine. This is not a workshop repair manual.

Carrying a set of preventive maintenance operations in accordance with the service intervals will ensure engine optimal reliability and service life.

During the warranty period, it is essential to get any work carried out by a Nanni authorized workshop. Furthermore, any service should be registered in the Nanni after-sale system.

However, some regular checks, particularly those made every time the engine is used, are of the duty of the user. Some operations are explained further on for you to work on the engine in case of an emergency or if there is no repair workshop nearby.

We recommend to have all your works checked by a Nanni authorized workshop.

Repairs and/or adjustment works on the engine by unseasoned marine trained technicians is forbidden for obvious safety reasons. Improper works endangers life, even not at open sea. Operations on valve timing and injection system belong to the exclusive domain of Nanni trained representatives. These may be against EPA or other worldwide environmental regulations.

NOTE !

The service intervals and relevant informations about the preventive maintenance of the transmission are indicated in the user manual provided by the manufacturer of the transmission. Contact your Nanni representative for further information regarding the maintenance of the transmission.

The hourmeter has no reset capability and displays the total operating hours of the engine since factory acceptance tests.

GENERALITIES

WARNING !

Perform maintenance operations having the engine stopped and cold. Get the the starting key out from the panel, put it in your pocket and turn off the power supply.

Read this whole chapter and take all safety precautions before contemplating any maintenance or repair work. Make sure you understand how to perform every operation.

CAUTION !

Clean the engine before any maintenance. Watch for any oil or fluid drop as it is an evidence of a leak somewhere.

CAUTION !

Do not let oil, fuel or grease deposits to build up around the engine as they may increase the risk of fire in the engine compartment.

Moreover, these deposits may hide potential heavy unseen failures.

MAINTENANCE

The maintenance scheddule covers a number of points divided into several sections :

- Lubrication system.
- Air cleaner
- Cooling system
- Fuel system
- Various

WARNING !

Prior to any work onto the engine, the starting motor command must be disabled first. Alternatively, a related electric cable may be removed. Should the engine starts unexpectedly, there is a serious risk of injury.

There is always a risk of sustaining burns when an engine is hot. Particularly hot parts are engine manifolds, turbochargers, oil sumps, as well as hot coolant and oil in pipes and hoses.

IMPORTANT !

Upon delivery, the engine is optimised for the proposed application.

However, regular maintenance is necessary to :

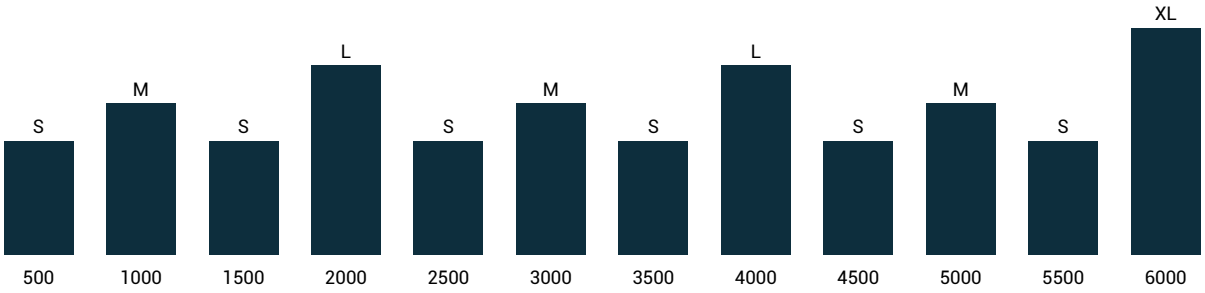
- Prevent unplanned stops
- Extend the service life of the engine
- Maximise the long-term emission performance of the engine
- Provide the best possible operating economy.

MAINTENANCE INTERVALS

The maintenance program includes the following :

- R maintenance : one event when taken into service
- S maintenance : minimum basic maintenance
- M maintenance : more extensive maintenance
- L maintenance : includes nearly all maintenance items in the form
- XL maintenance : includes all maintenance items in the form

During a period, the sequence is S-M-S-L-S-M-S-L-S-M-S-XL



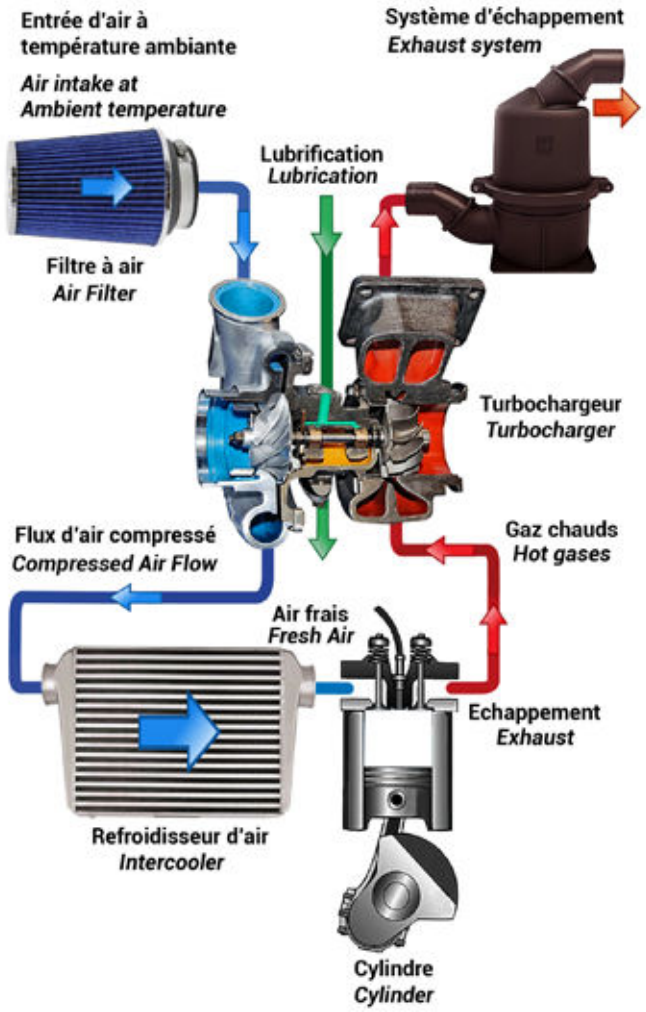
ELEMENT	COMPONENT	Daily	1st time at		Interval (hours)				Minimum	
			1st start	500	500	1000	2000	6000	annual-ly	every 5 years
				R	S	M	L	XL		
Air Cleaner	Reading the vacuum indicator	◊	◊							
	Renewing the filter element			◊	◊	◊	◊	◊	◊	
	Renewing the safety cartridge			◊	◊	◊	◊	◊	◊	
	Renewing an air filter with a non-rewebable element			◊	◊	◊	◊	◊	◊	
Lubrication	Checking the oil level	◊		◊	◊	◊	◊	◊		
	Changing the oil						◊	◊		◊
	Cleaning the centrifugal oil cleaner						◊	◊		◊
	Renewing the oil filter						◊	◊		◊
Cooling system	Checking the coolant level	◊	◊	◊	◊	◊	◊	◊		
	Checking coolant antifreeze and corrosion protect		◊				◊	◊	◊	
	Checking sacrificial anodes			◊	◊	◊	◊	◊	◊	
	Checking the sea water pump impeller			◊	◊	◊	◊	◊	◊	
	Changing the coolant and cleaning the coo-ling system							◊		◊
Fuel system	Checking the fuel level	◊	◊							
	Draining the water separating prefilter	◊		◊	◊	◊	◊	◊		
	Renewing the fuel filters			◊	◊	◊	◊	◊		◊
Miscellaneous	Checking the drive belt		◊			◊	◊	◊	◊	
	Checking for leaks	◊		◊	◊	◊	◊	◊		
	Checking and adjusting the valve clearance			◊			◊	◊		

* Operations to be performed in accordance with user and maintenance manual for your engine. For all technical information specific to your engine, refer to the user and maintenance manual.

TURBOCHARGER

CAUTION !

A turbocharger is an exhaust-driven mechanical device that boost engine power by pumping more air into the engine. A turbocharger uses a pair of fan-like castings mounted on a common shaft. One (called the turbine) is piped to the exhaust, while the other (the compressor) is piped to the engine intake. The flow of exhaust spins the turbine, which causes the compressor to turn. The compressor serves to blow air into the engine at a greater rate than it can pull it in on its own. The greater volume of air can be mixed with a greater volume of fuel, which increases the power output.



Principle of operation of a turbocharger.

TURBOSERVICE

Engine turbochargers are designed to provide long years of trouble free service, which if required, can only be performed by a specialized workshop. In view to maintain turbochargers performances for as long as possible, some basic rules must be followed.

Changing or cleaning the air filters on a regular basis is a good way to keep debris from causing problems with the intake side of turbochargers.

A turbocharged engine will definitely need more oil changes than an ordinary atmospheric one, as the turbines axle requires excellent lubrication. For this reason, oil characteristics must be followed closely. Never use low grade bargain lubrication oil.

Turbochargers get very hot when engine is running and a protective metal shield or thermal sleeve is always affixed onto the exhaust side to prevent burns. Never remove these shields.

Do not get confused : a turbocharger is driven by exhaust gases. On a supercharger, the air intake turbine is driven by a belt. In addition to a rotation speed far lower compared to a turbocharger, an amount of output power is subtracted fom the engine because of the drive system.

There is no serviceable part for the end user inside turbochargers. Any attempt to disassembling would lead to a total failure.

LUBRICATION SYSTEM

OILS

NOTE !

For more information about lubricants, please refer to the Fluids Section.

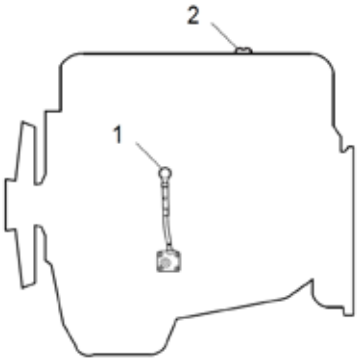
CHECKING THE OIL LEVEL

NOTE !

Leave the engine off for at least 7 minutes before you check the oil level.

1. Pull out the oil dipstick (1) and check the oil level. The correct level is between the minimum and maximum marks on the oil dipstick.

2. Fill with more oil via the oil filler (2) if the oil level is at or below the minimum mark.



CHANGING THE OIL

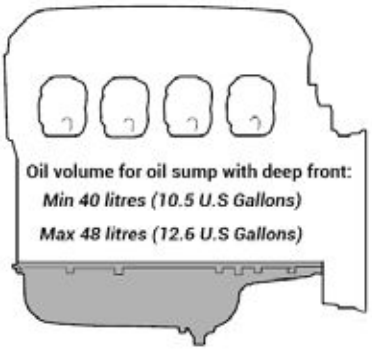
NOTE !

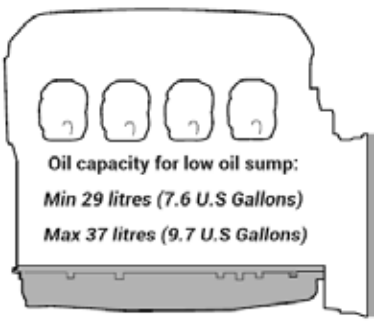
Change oil more often if the engine is subjected to particularly demanding operation, such as a dusty environment, or if deposits in the centrifugal oil cleaner are thicker than 28 mm (1.1 in). Renew the oil filter and clean the centrifugal oil cleaner when changing oil.

ENVIRONMENT

Use a suitable container. Used oil must be disposed of as specified in national and international laws and regulations.

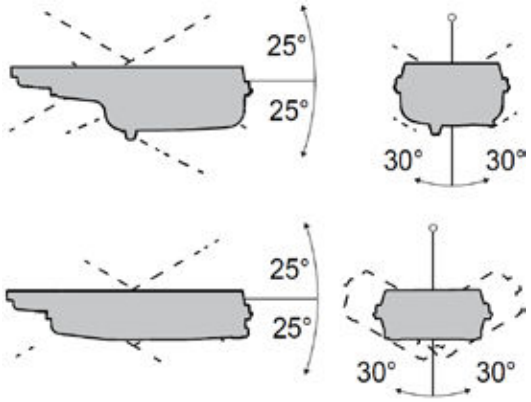
1. Unscrew the oil plug and drain the oil when the engine is hot. In certain engines, the oil is pumped out using a bilge pump. When draining via the valve, the oil should be hot. Alternatively, use a pump. This is so that draining occurs more quickly.
2. Clean the magnet on the oil plug.
3. Refit the oil plug.
4. Fill with oil.
5. Check the level on the oil dipstick.





MAXIMUM ANGLES OF INCLINATION DURING OPERATION

Maximum permissible angles of inclination during operation vary, depending on the type of oil sump. See illustration below:



CLEANING THE CENTRIFUGAL OIL CLEANER

When the centrifugal oil cleaner is cleaned, there should be some dirt deposits on the paper in the rotor cover. If the paper is clean, the equipment is not working as it should. If this is the case, investigate the cause of this.

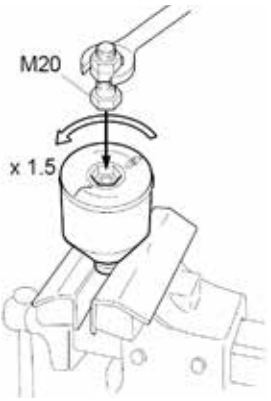
Renew the paper more frequently if the dirt deposits are thicker than 28 mm (1.1 inches) during a scheduled oil change.

1. Clean the cover.
2. Unscrew the nut securing the outer cover.
3. Let the oil run out from the rotor.
4. Lift out the rotor. Wipe off the outside.
5. Loosen the rotor nut and unscrew it about 1.5 turns.

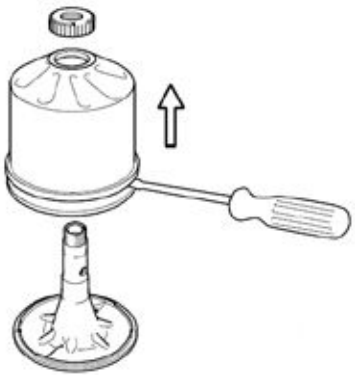
NOTE !

Take care not to damage the rotor shaft.

6. If the rotor nut is jammed: Turn the rotor upside down and fasten the rotor nut in a vice.
7. Use protective jaws so as not to damage the grooves of the rotor nut.
8. Turn the rotor 1.5 turns anti-clockwise by hand.
9. If this does not work: Screw two nuts together with an M20 screw.
10. Position the screw head at the bottom of the rotor.
11. Position a ring spanner on the lower nut and turn the rotor 1.5 turns anti-clockwise. See illustration below:

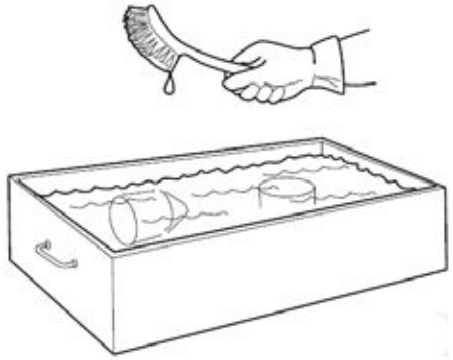


12. Remove the rotor cover by holding the rotor in both hands and tapping the rotor nut against the table. Never strike the rotor directly as this may damage its bearings.
13. Remove the strainer from the rotor cover. If the strainer is stuck, insert a screwdriver between the rotor cover and strainer and carefully prise them apart.

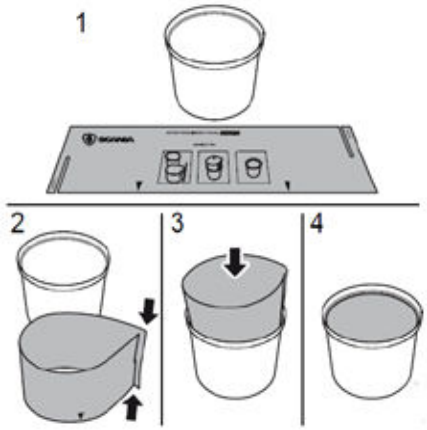


14. Remove the paper insert.
15. Scrape off any remaining dirt deposits from the inside of the rotor cover. If the deposits on the paper are thicker than 28 mm (1.1 in), the centrifugal oil cleaner must be cleaned more often.

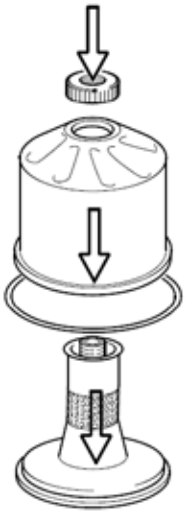
16. Wash the parts according to the applicable industrial method.
17. Check the 2 nozzles on the rotor. Ensure that they are not blocked or damaged. Renew any damaged nozzles.
18. Check that the bearings are undamaged. Renew damaged bearings.



19. Fold and fit a new paper insert on the inside of the rotor cover as illustrated below:



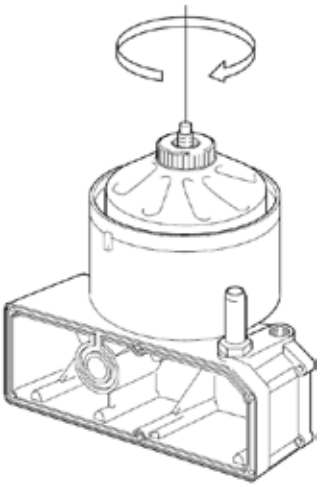
20. Fit the strainer onto the rotor.
21. Fit a new O-ring to the foot of the centrifugal oil cleaner.
22. Refit the rotor cover. Ensure that the O-ring is not outside the edges, but is in the groove.
23. Screw the rotor nut back on by hand.
24. Check that the shaft is not damaged or loose. Contact a workshop with qualified personnel if the rotor shaft needs to be renewed.



NOTE !

Take care not to damage the rotor shaft.

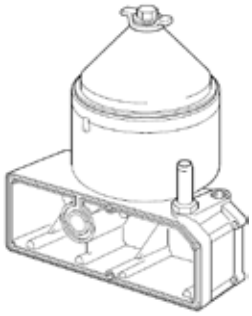
25. Refit the rotor and rotate it by hand to make sure it rotates easily:



26. Fit a new O-ring in the cover.
27. Refit the cover and tighten the lock nut.Tightening torque is of 20 Nm (15 lb-ft).

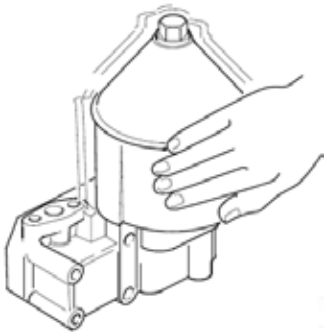
IMPORTANT !

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



OPERATIONAL TESTING OF THE CENTRIFUGAL OIL CLEANER

Operational testing need only be carried out if it is suspected that the centrifugal oil cleaner is malfunctioning. For example, if there are unusually few deposits given the distance driven.
1. Run the engine until it reaches normal operating temperature.
2. Stop the engine and listen for noise coming from the rotor. It should continue rotating for a time, even when the engine has stopped.
3. Use your hand to feel if the filter housing is vibrating.
4. If the filter housing is not vibrating, dismantle and check the centrifugal oil cleaner.



RENEWING THE OIL FILTER

Tools required

Designation	Illustration
Hexagon socket, 1/2", 36 mm	

IMPORTANT !

Clean the centrifugal oil cleaner at the same time as you change the oil filter. Otherwise, the oil filter will become blocked and the 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.

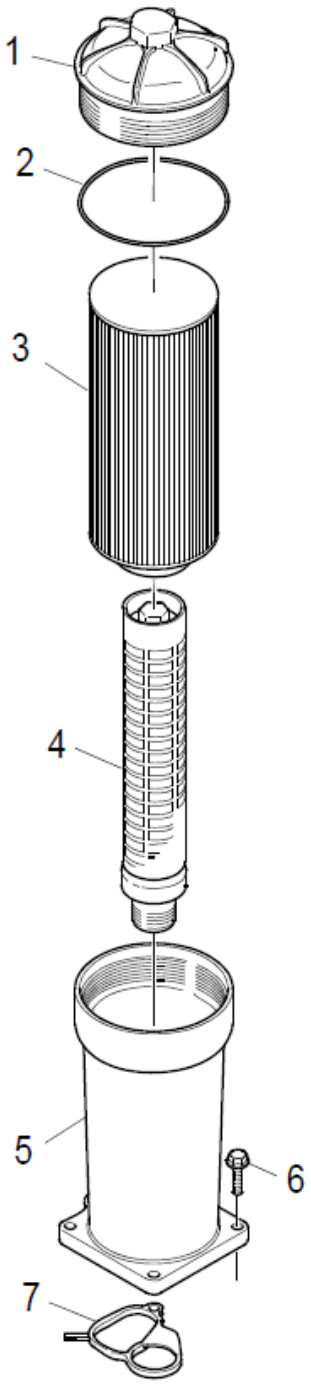
The engine must not be run without a filter element in the oil filter. There is a risk of engine damage caused by particles and by the oil pressure being too low.

1. Unscrew the filter cover using the socket.

IMPORTANT !

Do not use an adjustable spanner or other open tool, as there is a 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. Undo the old filter from the cover by carefully bending it to one side.
4. Fit a new O-ring on the cover. Lubricate the O-ring with engine oil.
5. Press a new filter into the snap fastener in the cover and tighten the filter cover to 25 Nm (18 lbf/ft).
6. Make sure the oil filter drain has emptied the oil from the filter housing. Screw on the filter cover firmly with the socket.
7. Start the engine and inspect the filter housing for leaks.



Legend:

1. Cover.
2. O-ring.
3. Filter element.
4. Pipe.
5. Filter housing.
6. Flange screw.
7. Gasket.

AIR CLEANER

Reading the vacuum indicator

If the indicator's red plunger is fully visible, renew the air cleaner filter element following the instructions below.

Renewing the filter element

WARNING !

Never start the engine without the air filter in position. If you do this, you risk personal injury and severe engine damage.

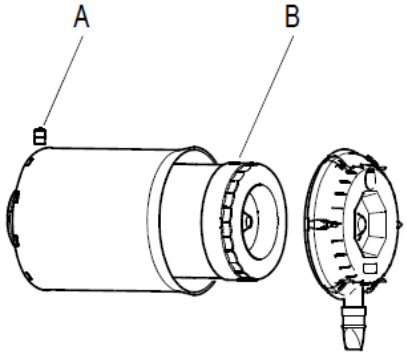
IMPORTANT !

Renew the filter element earlier than the maintenance interval if the indicator shows red.

There is always a risk that the filter element will be damaged when it is cleaned.

The filter element must not be cleaned in water or be blown clean with compressed air.

1. Remove the cover from the air cleaner.
2. Renew the filter element.
3. Insert an inspection lamp into the element and check from the outside that there are no holes or cracks in the filter paper.
4. Assemble the air cleaner.
5. Reset the vacuum indicator by pressing in the button.



Renewing the safety cartridge

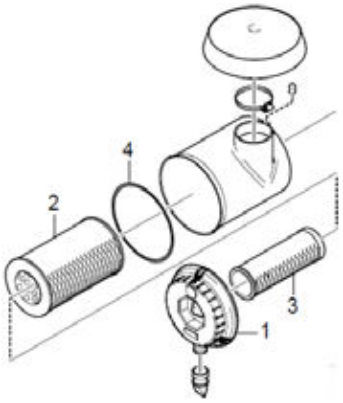
WARNING !

Never start the engine without the air filter in position. If you do this, you risk personal injury and severe engine damage.

IMPORTANT !

When you renew the safety cartridge, take great care to ensure that no dirt or other impurities get into the engine. Do not remove the safety cartridge unnecessarily.
1. Remove the cover from the air cleaner.
2. Remove the filter element.

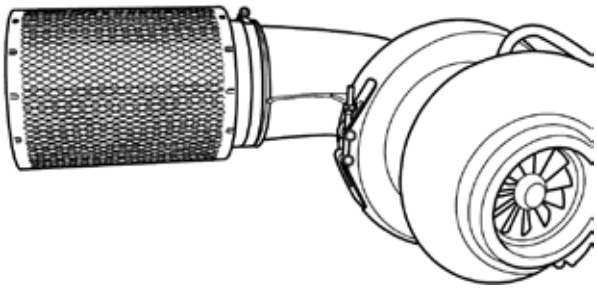
3. Remove the safety cartridge.
4. Fit a new safety cartridge from Scania.
5. Renew or clean the filter element.
6. Check the condition of the O-ring. Renew the O-ring if it is damaged or hard.
7. Assemble the air cleaner. Ensure that the Oring is not outside the edges.See picture below:



Renewing an air filter with a non-renewable element

IMPORTANT !

If the engine has air filters with a non-renewable Scania element, they should be renewed instead of cleaned.



REPLACE the air cleaner filter and safety cartridge

Special items required

Number	Description	Illustration
970317077	Kit air filter cleaner EN, ESP, SUOMI	
970317078	Kit Air filter cleaner FR, IT, DEU	

1. Remove the cover from the air cleaner.
2. Renew the filter element.
3. If the air cleaner has a safety cartridg e: Remove the safety cartridge and fit a new one.
4. Insert a torch into the filter element and check that the filter paper is free of holes and cracks.
5. Renew the O-ring if it is damaged or hard.
6. Assemble the air cleaner.
7. Ensure that the O-ring is not outside the edges.
8. Reset the vacuum indicator by pressing in the button marked in the illustration.

COOLING SYSTEM

WARNING !

Ethylene glycol can be fatal if ingested and can cause skin irritation and eye damage.

NOTE !

The coolant should be changed when the cooling system is cleaned: every 6,000 hours or at least every 5 years. See the section Changing the coolant and cleaning the cooling system.

The coolant has several characteristics which are important for the operation of the cooling system:
• Corrosion protection.
• Antifreeze.
• Increases the boiling point.
Scania recommends that the coolant used is a mixture of water with antifreeze and corrosion protection (ethylene glycol). The coolant should always contain 35-55% antifreeze and corrosion inhibitor by volume so that the coolant has the correct properties for the cooling system to work.
See the Fluids section for more informations.

CHECKING THE COOLANT LEVEL

WARNING !

Do not open the coolant filler cap in the expansion tank if the engine is hot. Hot coolant and steam may spray out and cause burns. If the cap has to be opened do it slowly to release the pressure before removing the cap. Wear protective gloves as the coolant is still very hot.

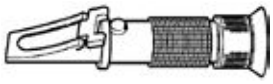
IMPORTANT !

It is not permissible to top up large amounts of coolant via the expansion tank. Filling via the expansion tank leads to air locks in the cooling system which can lead to e.g. cavitation damage to the coolant pump shaft seal. If a large amount of coolant needs to be added, follow the instructions in the section Filling coolant. Only pour pre-mixed coolant into the cooling system.

1. Check the coolant level through the sight glass on the expansion tank.
2. Top up with coolant as necessary.

CHECKING THE COOLANT ANTI FREEZE AND CORROSION PROTECTION

Tools required

Designation	Illustration
Refractometer	
	

IMPORTANT !

Use only pure fresh water that is free from particles, sludge and other impurities.

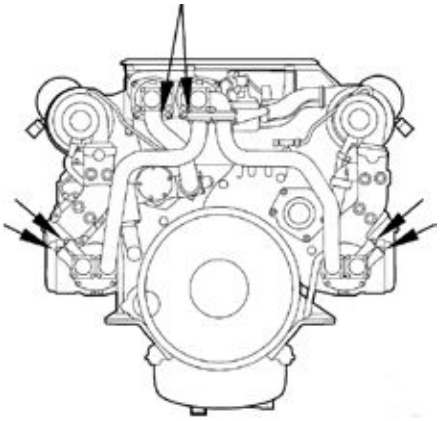
1. Pour a small amount of coolant into a container and check that the coolant is pure and clear.
2. Change the coolant if it is contaminated or cloudy.
3. Measure the antifreeze content with a refractometer.

The following rules apply to ethylene glycolbased coolant:

- The antifreeze and corrosion protection content must be a minimum of 35 per cent by volume for corrosion protection to be sufficient.
- An antifreeze and corrosion protection content greater than 55 per cent by volume impairs the ability to protect from frost.
- If ice forms in the coolant, there are disruptions initially, but there is no immediate risk of damage. The engine should not be subjected to heavy loads when ice starts to form.

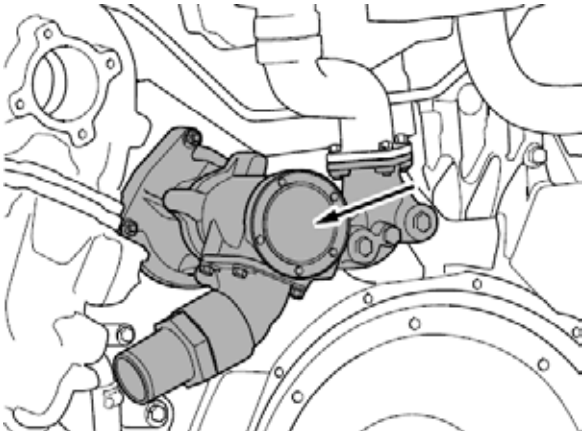
CHECKING THE SACRIFICIAL ANODES

1. Drain the sea water circuit. See the section Draining the sea water circuit.
2. Check the sacrificial anodes and scrape off all loose material from them.
3. Renew the sacrificial anode if less than half of it is left. A new sacrificial anode is 60 mm long with a diameter of 17 mm.
4. Renew the gasket when fitting.
5. If the sacrificial anodes are very corroded, the maintenance intervals must be reduced.



CHECKING THE SEA WATER PUMP IMPELLER

1. Drain the sea water circuit. See the section Draining the sea water circuit.
2. Check that the vanes of the impeller are not heavily splintered or damaged.



Renewing the sea water pump impeller

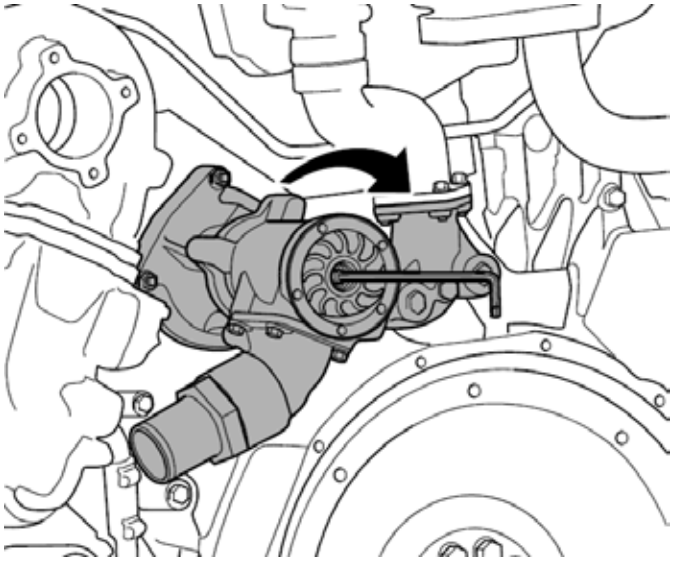
Special tool required

Number	Designation	Illustration
2 443 680	Puller	

Note:
If the impeller must be renewed frequently, the cleaning of the sea water needs to be improved. There should be a spare impeller on board. The impeller can be deformed during extended periods of inactivity. Renew the impeller before starting or remove the impeller before longer periods of stoppage.

1. Thread the puller stud into the rubber impeller using an internal hexagon key until the stud reaches the bottom.

Note:
Note the direction of rotation of the impeller vanes.

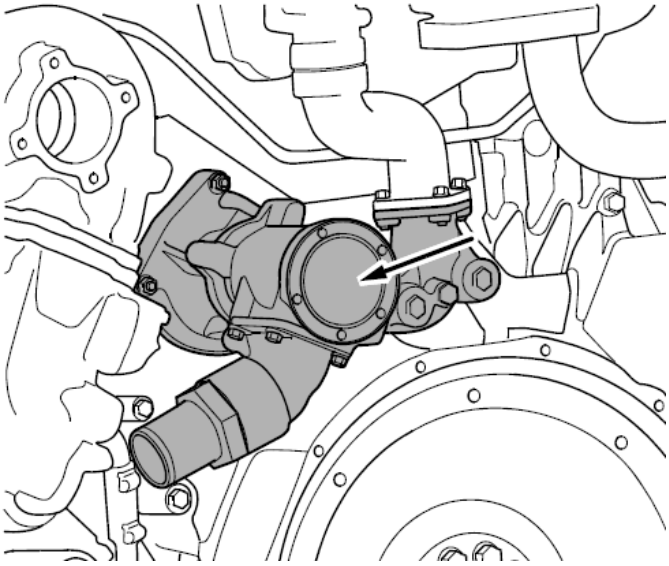


2. Screw the puller into the rubber impeller using the handle until it reaches the stud. Then continue to screw until the impeller comes loose.
3. Unscrew the stud.

IMPORTANT !

Check that the direction of rotation of the impeller vanes is the same as during removal.

4. Lubricate the impeller with pump grease and then fit it using a rubber mallet.
5. Fit the sea water pump cover. Tightening torque 7.5 Nm (5.5 lb-ft).



CHECKING THE SEA WATER PUMP IMPELLER

Special tool required

Number	Illustration
2 443 679 Coolant pump	

WARNING !

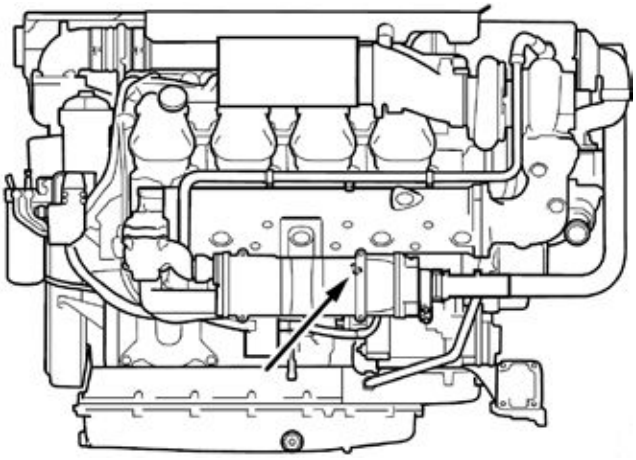
Do not open the coolant filler cap in the expansion tank if the engine is hot. Hot coolant and steam may spray out and cause burns. If the cap has to be opened do it slowly to release the pressure before removing the cap.

Use protective gloves as coolant can cause irritation if it comes in contact with the skin. Hot coolant can also cause scalding.

ENVIRONMENT

Use a suitable container. Used coolant must be disposed of as specified in national and international laws and regulations.

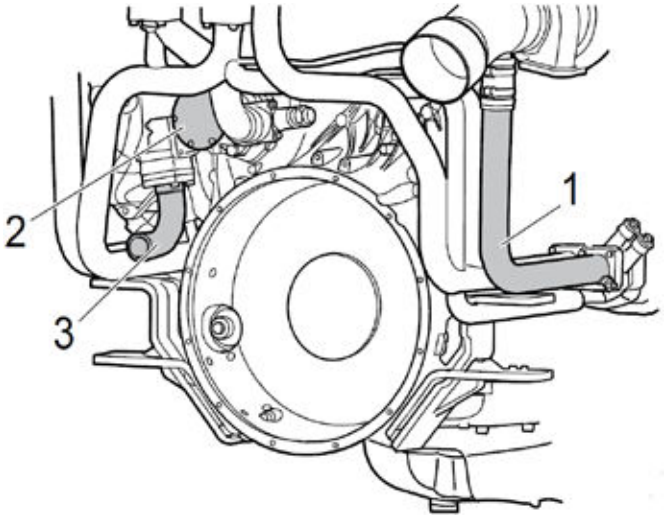
1. Open the expansion tank cap.
2. Place the hose from the coolant pump in an empty container.
3. Connect the pump to the draining nipple in the cylinder block. See illustration below paragraph.
4. Connect the pump's two cable terminals to the battery's negative and positive terminal. Make sure that the drainage starts. If the drainage does not start: Change the position of the cable terminals.
5. Repeat the procedure at the cooling system's lowest drainage point. The location of the lowest drainage point on the engine may differ depending on engine application.



DRAINING THE SEA WATER PUMP IMPELLER

1. Close the bottom valve on the sea water inlet and remove the connection pipe on the outlet from heat exchanger (1).
2. Remove the cover from the sea water pump to completely drain the pump (2).

The lowest point in the sea water circuit may be at different points, but it is usually in the sea water pump intake (3).



IMPORTANT !

Plug the connections to prevent dirt ingress into the engine.

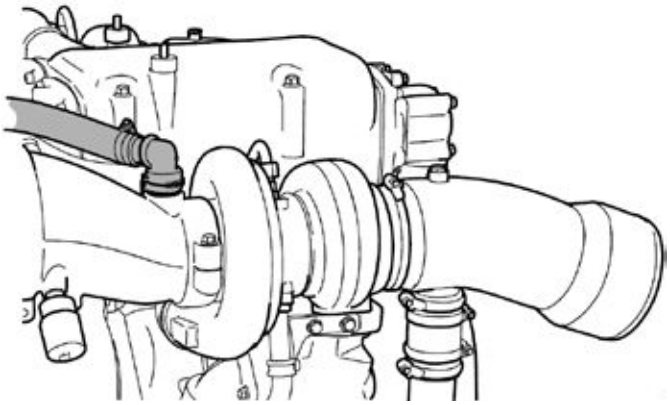
REMOVING THE CHARGE AIR COOLER

When the charge air cooler core needs cleaning, the charge air cooler must be removed if there is no space behind it to take out the core.

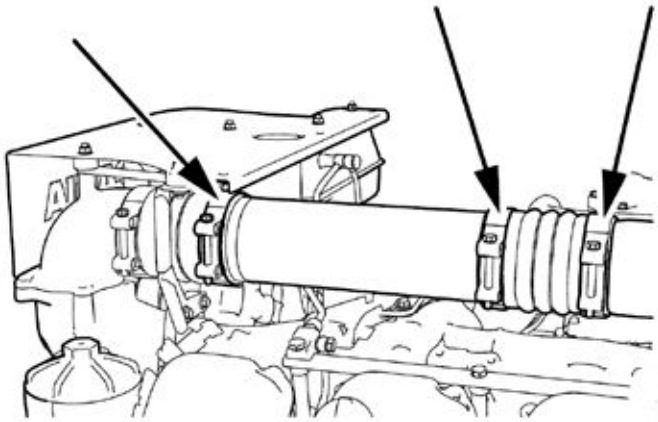
1. Make sure that the cooling system is completely drained as described in the previous section.

2. Unscrew and remove the catwalk, protective plate and the protective casing.

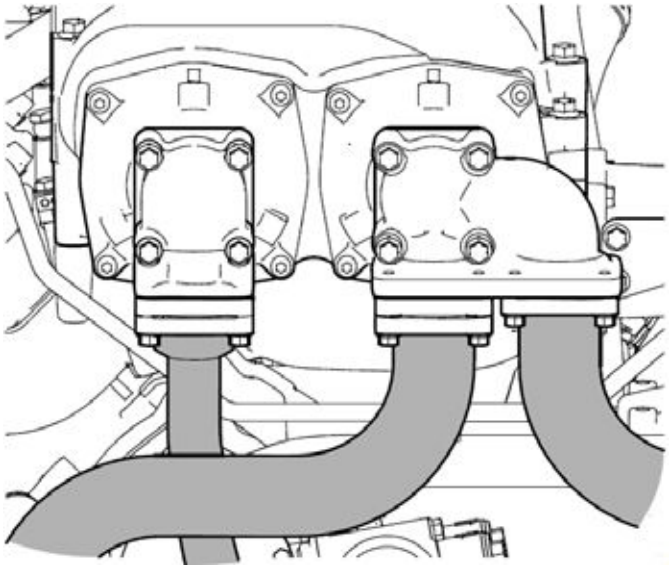
3. On the left-hand turbocharger, remove the hose between the oil mist separator and the air filter flange. Use a screwdriver to pull out the lock.



4. Loosen and remove the hose clamps for the charge air pipe.

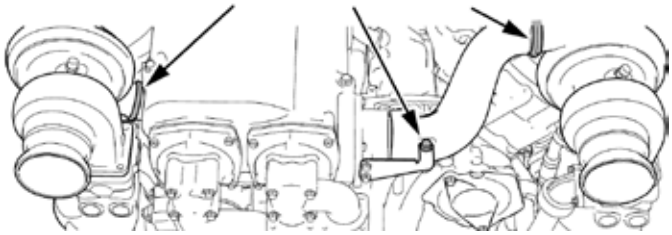


5. Remove all sea water pipes to and from the charge air cooler.

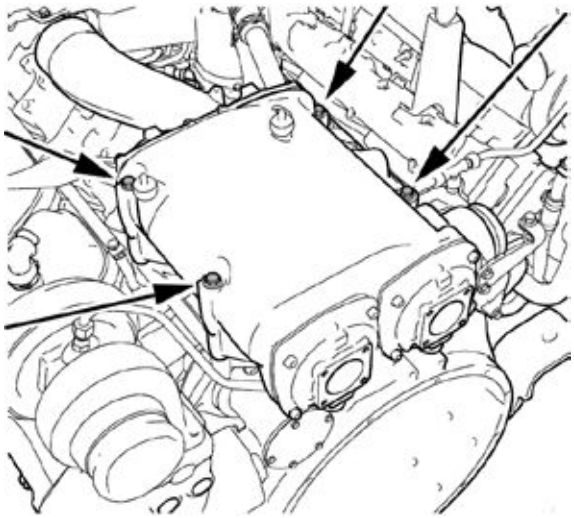


6. Right-hand turbocharger: Remove the Vclamp and the screw for the bracket. Remove the charge air pipe.

7. Left-hand turbocharger: Remove the Vclamp and carefully turn the charge air pipe during removal:



8. Remove the screws securing the charge air cooler:

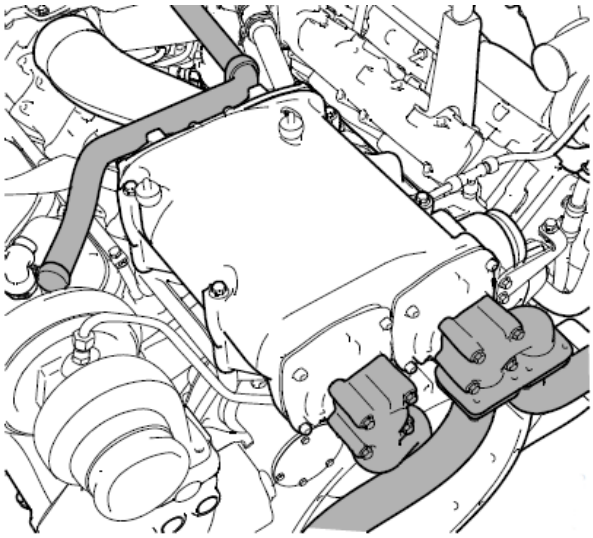


9. Lift out the charge air cooler:

CLEANING THE CHARGE AIR COOLER

The charge air cooler must be removed if there is no space behind it to take out the cooler cores. See previous section.

1. Remove the sea water pipes to and from the charge air cooler. Remove flanges and charge air pipe from the charge air cooler. Remove the old gaskets and scrape off any gasket residue.



2. Remove the screws on the charge air cooler covers (1) and remove the covers. Mark the covers so that you can put them back on the correct side.

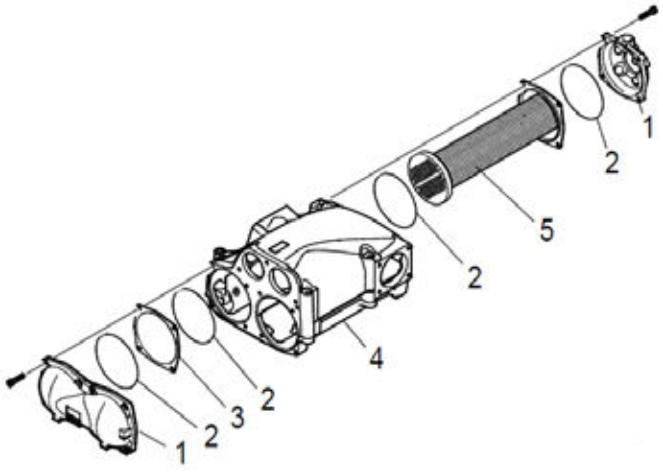
3. Press in the cooler core (5) slightly on one side and pull it out from the other side.

4. Clean the cooler core on the outside with paraffin-based engine detergent. Remove any internal deposits using a round rod. Renew the cooler core if it is damaged.

IMPORTANT !

Do not use caustic soda as this could damage the aluminium.

5. Renew damaged or hard O-rings (2).
6. Assemble the charge air cooler. Tighten the M8 screws on the cover to 15 Nm (11 lb-ft).



Legend:

1. Cover.
2. O-rings.
3. Spacer.
4. Charge air cooler housing.
5. Cooler core.

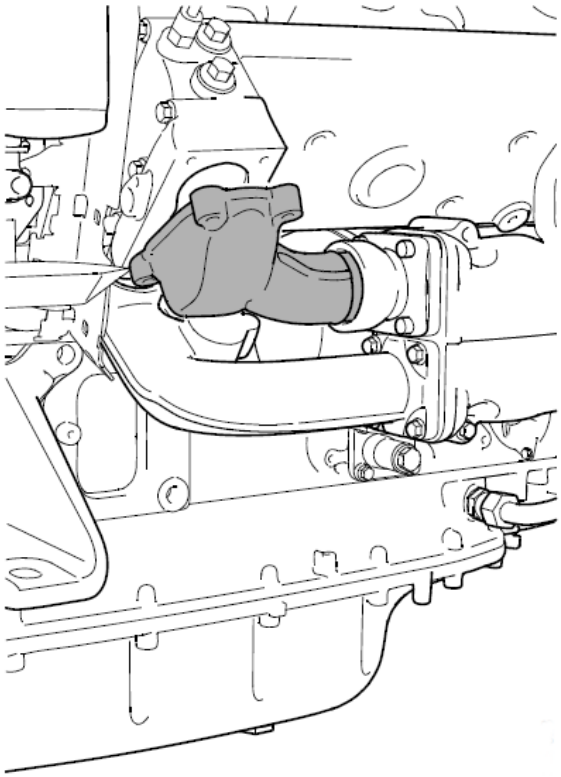
REMOVING THE HEAT EXCHANGER

When the heat exchanger core needs cleaning, the heat exchanger must be removed.

WARNING !

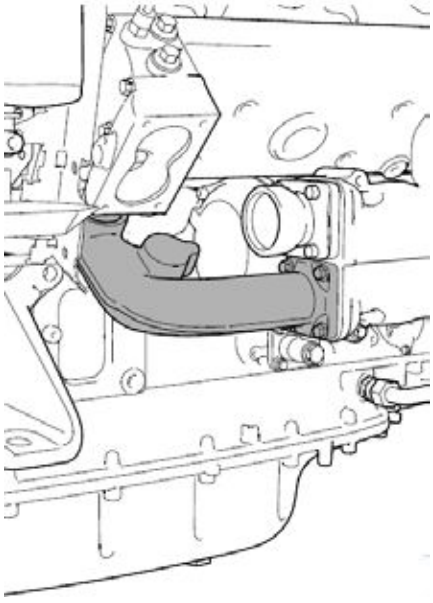
Use protective gloves as coolant can cause irritation if it comes in contact with the skin. Hot coolant can also cause scalding.

1. Make sure that the cooling system is empty as described earlier.
2. Remove the sea water pipe between the charge air cooler and heat exchanger.
3. If the engine has a water-cooled exhaust pipe bend: Remove the sea water pipe between the heat exchanger and the exhaust pipe bend.

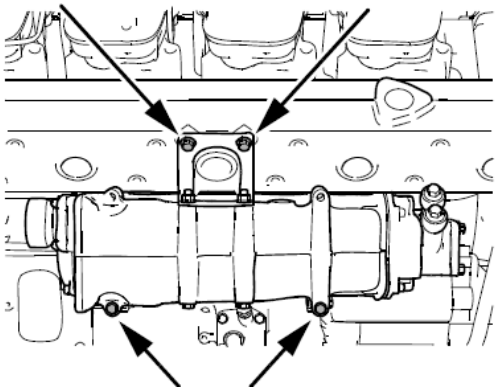


4. Remove the coolant pipe with the thermostat housing cover.

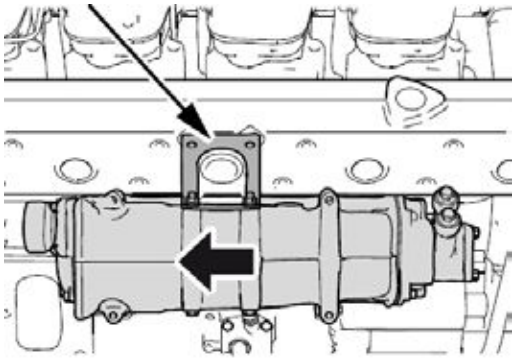
5. Remove the coolant pipe from the heat exchanger:



6. Remove the screws on the heat exchanger and the 2 upper screws on the exhaust manifold bracket:



7. Remove the heat exchanger by holding it in the bracket, moving the heat exchanger slightly to the side and removing it:



CLEANING THE HEAT EXCHANGER

1. Remove the screws on the heat exchanger covers (1) and remove the covers. Mark the covers so that you can put them back on the correct side.

2. Press in the cooler core (5) slightly on one side and pull it out from the other side.

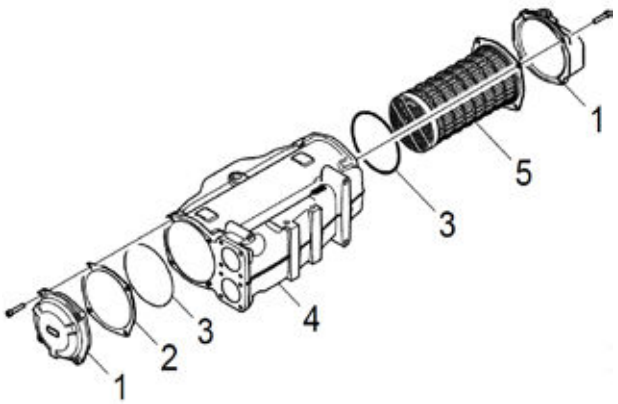
3. Clean the cooler core on the outside with paraffin-based engine detergent. Remove any internal deposits using a round rod. Renew the cooler core if it is damaged.

IMPORTANT !

Do not use caustic soda as this could damage the aluminium.

4. Renew damaged or hard O-rings (3).

5. Assemble the heat exchanger. Tighten the M8 screws on the covers to 15 Nm (11 lb/ft).

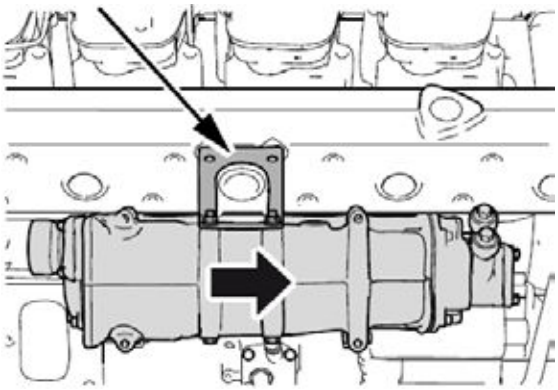


Legend:

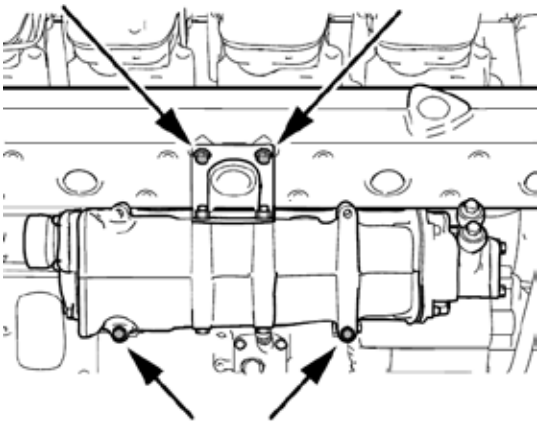
1. Cover.
2. Spacer.
3. O-rings.
4. Heat exchanger housing.
5. Cooler core.

FITTING THE HEAT EXCHANGER

1. Fit the heat exchanger by holding the bracket for the exhaust manifold, moving it slightly to the side and fitting it:

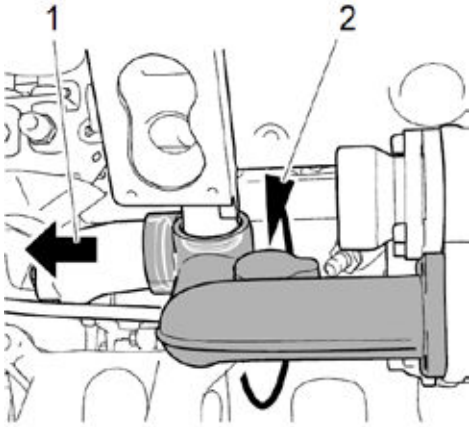


2. Fit all screws by hand and then tighten them. Tightening torque 50 Nm (37 lb/ft):

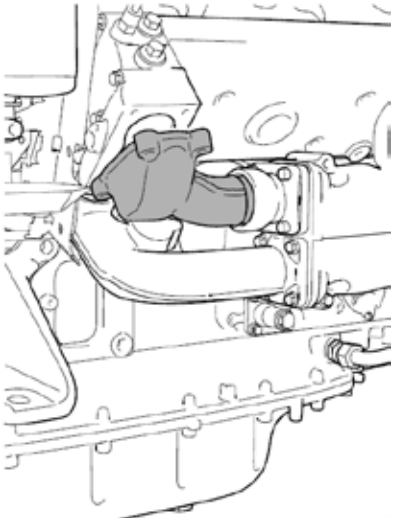


3. Lubricate and fit the coolant pipe from the heat exchanger. Angle the pipe from the thermostat housing inwards and push it onto the connection:

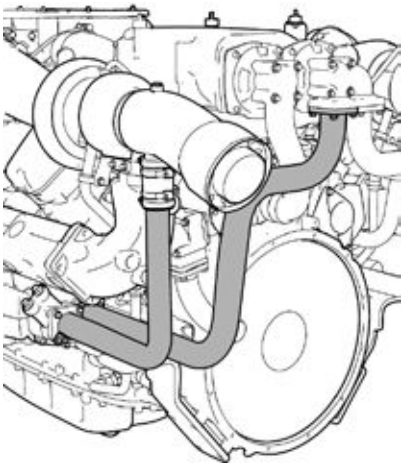
4. Fit the coolant pipe with the thermostat housing cover:



5. Fit the sea water pipe between the charge air cooler and heat exchanger.

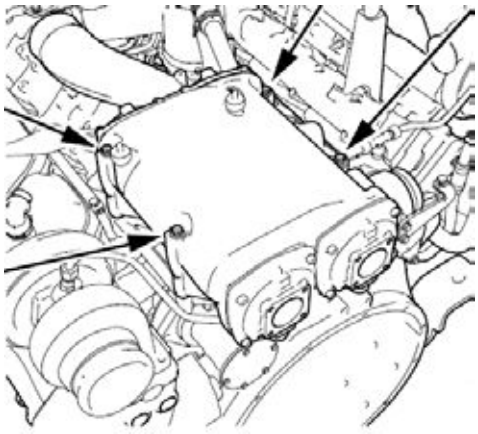


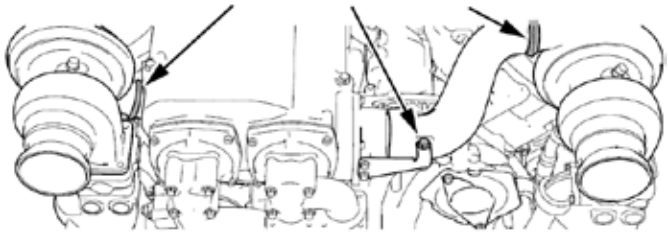
6. If the engine has a water-cooled exhaust pipe bend: Fit the sea water pipe between the heat exchanger and the exhaust pipe bend:



FITTING THE CHARGE AIR COOLER

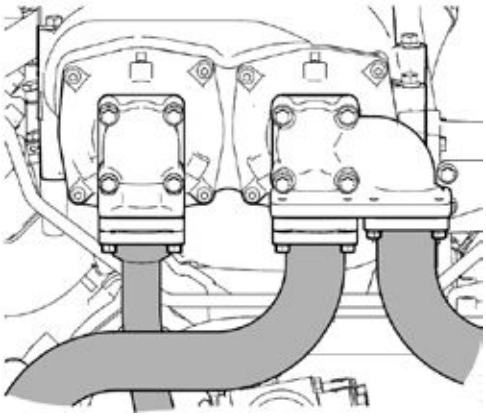
1. Fit the charge air cooler. Tighten the 4 screws to 50 Nm (37 lb-ft):





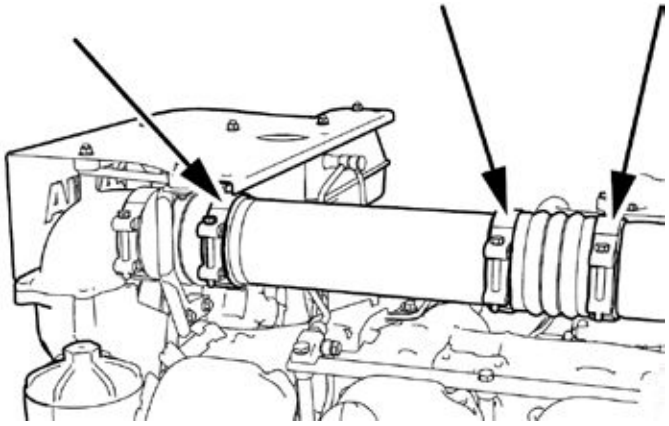
2. Carefully fit the charge air pipe from the lefthand turbocharger and tighten the V-clamp to 20 Nm (15 lb-ft).

3. Fit the charge air pipe from the right-hand turbocharger. Fit the V-clamp first and then the screw on the bracket.

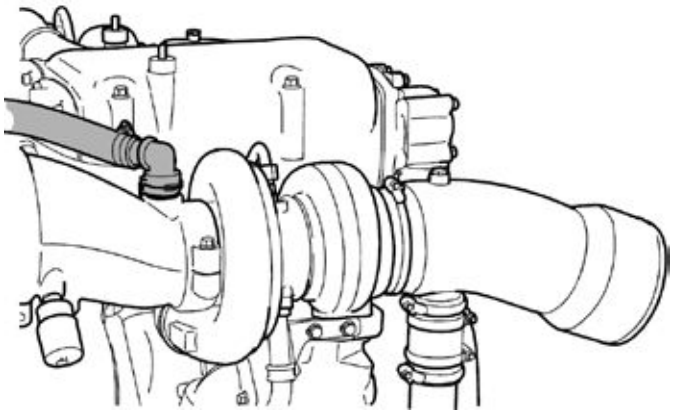


4. Fit the sea water pipe from the sea water pump, first to the charge air cooler (the inner pipe) and then from the charge air cooler to the heat exchanger (the outer pipe).

5. Fit the charge air pipe and the hose clamps:



6. Fit the crankcase ventilation hose:



7. Fit the catwalk:
– Loosely fit the protective plate to the charge air pipe. Tighten the screws later.
– Fit the protective casing. Tighten the screws later.
– Fit the catwalk with screws.
– Tighten all screws. The protective plate and protective casing must be tightened to a tightening torque of 15 Nm (11 lb-ft).

Internal: Removing oil and grease

ENVIRONMENT

Use a suitable container. Used coolant must be disposed of as specified in national and international laws and regulations.

Always fit a new thermostat and a new cover to the expansion tank after cleaning, as the oil in the cooling system destroys the seals. If the engine is equipped with a coolant filter, also renew this filter.

It may be necessary to wash it multiple times if the cooling system is very dirty. One cause of contamination can be that oil is lying on top of the coolant and collecting high up in the cooling system. If several rinses are needed, this is not necessarily because work has been carried out incorrectly. Oil residues often need to be rinsed repeatedly from the expansion tank and the external heating system to be completely clean.

Repeated washing is more effective and preferable to using higher concentrations of detergent (max. 10%) or cleaning for a longer period (max 30 minutes).

If only a small amount of dirt has collected in the expansion tank after cleaning, one extra rinse and clean of the expansion tank only is usually sufficient. There is no need to clean the whole cooling system again.

1. Run the engine until it has reached operating temperature if possible and then drain the cooling system following the previous description.

2. Remove the thermostats.

3. Fill the cooling system with clean hot water mixed with detergent 2 479 017. Detergent # 2 479 017 must make up 5-10% (depending on the degree of dirt) of the total coolant volume. If detergent # 2 479 017 is not available, use a dishwashing detergent for domestic appliances that does not foam. Concentration 1%.

4. Warm up the engine for approximately 20-30 minutes. Remember to switch on the cab heating system, if one is installed.

5. Drain the cooling system.

6. Fill the cooling system with clean, hot water and run the engine for about 20-30 minutes.

7. Repeat steps 3-6 if the cooling system is not clean.

8. Drain the water from the cooling system.

9. If necessary, clean the expansion tank by detaching all hoses and rinsing and cleaning with a degreasing agent and a dish brush.

Alternatively, dismantle the expansion tank and clean it with water with 10% of detergent # 2 479 017. Fill the expansion tank with the mixture, shake it and drain it. Renew the cover of the expansion tank.

10. Refit the thermostats.

11. Fill the cooling system with new coolant as described in the next section.

12. Check again whether further dirt or oil has collected in the expansion tank. Decide whether it it is necessary to carry out another full cleaning or whether only rinsing or cleaning of the expansion tank will suffice.

Internal: Removing deposits

ENVIRONMENT

Use a suitable container. Used coolant must be disposed of as specified in national and international laws and regulations.

---

1. Run the engine until it has reached operating temperature if possible and then drain the cooling system following the previous description.

2. Remove the thermostats.

3. Fill the cooling system with clean, hot water mixed with radiator detergent which is based on sulphamic acid and contains dispersing agents. Follow the manufacturer's instructions for the concentration and cleaning period.

4. Run the engine for the specified time. Remember to switch on the cab heating system, if one is installed.

5. Drain the cooling system.

6. Fill the cooling system with clean, hot water and run the engine for about 20-30 minutes.

7. Drain the water from the cooling system.

8. Refit the thermostats

9. Fill the cooling system with new coolant as described in the next section.

FILLING COOLANT

This procedure applies when the cooling system has been drained and needs to be filled with a large amount of coolant.

Special tool required

Number, Designation	Illustration
2 443 679 Coolant pump	

WARNING !

Use protective gloves as coolant can cause irritation if it comes in contact with the skin. Hot coolant can also cause scalding.

IMPORTANT !

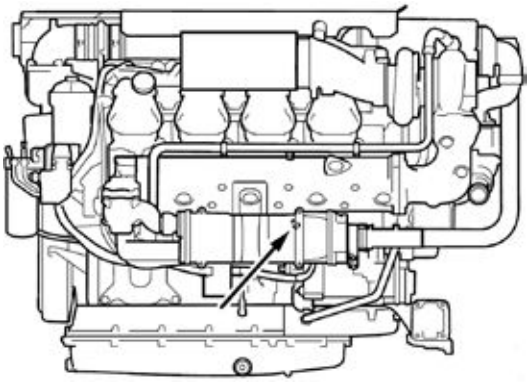
Mix the coolant as specified in the section headed Coolant. Never fill a hot engine with a large amount of cold coolant. There is a high risk of cracks forming in the cylinder block and cylinder heads Do not start the engine until the correct coolant level has been obtained. If the engine is started with an insufficient coolant level, it can damage the coolant pump shaft seal, which leads to coolant leakage.

1. Open the expansion tank cap.

2. Connect the coolant pump to the filler nipple in the cylinder block.

3. Connect the pump's two cable terminals to the battery's negative and positive terminal. Make sure that the filling starts. If the filling does not start: Change the position of the cable terminals.

4. Start the engine and run it at idling for 15 minutes.



Above: filler nipple in the cylinder block (behind the heat exchanger).

IMPORTANT !

It is very important that the engine is idling. Engine overspeed could damage the coolant pump shaft seal, which leads to coolant leakage.

5. Switch off the engine and fill with coolant to the maximum level through the expansion tank.

Air pockets may still be left in the cooling system. These will disappear after the engine has been operated for a period of time. Therefore, the coolant may need topping up at a later stage.

Finishing operations

1. Open the sea cock on the sea water inlet.

2. Start the engine and check that there are no leaks.

3. Check the coolant level and top up if necessary via the expansion tank.

FUEL SYSTEM

Cleanliness requirements

IMPORTANT !

The whole fuel system is very sensitive to dirt and also very small particles. Foreign particles in the system can cause serious malfunctions. It is therefore very impo tant that everything is as clean as possible when work is carried out on the fuel system. Wash the engine before carrying out repair work. If possible, a hot wash should be used.

It is strictly forbidden to carry out any machining work or work with compressed air near an open fuel system.

Be extra careful and always use clean, lint-free and dust-free clothes and gloves when working on the fuel system. Scania recommends using Tegera 848 gloves.

Clean tools before they are used and do not use any worn or chrome-plated tools. Material and flakes of chrome may come off.

Clean connections and the surrounding area before removal. When cleaning, cloths or paper which shed fibres must not be used. Use clean and lint free cloths, part number 588 879.

Plug or cover the connections during removal. Also clean the connections before the components are fitted. Place removed components on a thoroughly cleaned, dust-free surface. Scania recommends using a stainless steel bench top, part number 2 403 296. Cover the components with a lint-free cloth.

Checking the fuel level

Check the fuel level and fill with fuel as necessary.

Note:

If the fuel tank has been run dry or if the engine has not been used for a long time, bleed the fuel system. See the section Venting the fuel system.

DRAINING AND RENEWING THE DUAL WATER SEPARATING PREFILTER

IMPORTANT !

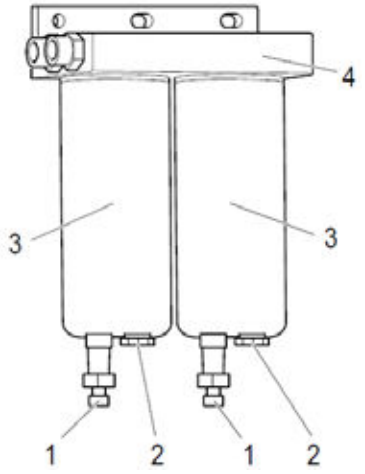
The sensor cable is sensitive. Handle it carefully.

ENVIRONMENT

Use a suitable container. The fuel collected must be disposed of as specified in national and international laws and regulations.

1. Close the shut-off cock in the fuel pipe and position a container under the filter.
2. Detach the sensor cables from the contact housings (1) on the filters.
3. Open the filter drain plugs (2) and allow the fluid to run down into the container.
4. Unscrew the filters (3) from the filter head (4).
5. Discard the old filters and use new ones.
6. Lubricate the O-rings on the filters with engine oil.
7. Fill the width of the filters with clean fuel.
8. Screw the filters into position until the Orings rest against the filter head. Tighten the filters another quarter to three quarter turn by hand.
9. Open the shut-off cock on the fuel pipe and check that the fuel system is sealed.
10. Connect the sensor cable to the contact housings on the filters.
11. Bleed the fuel system according to the instructions in the Venting the fuel system section.

Water separating prefilter.
1. Contact housing.
2. Drain plugs.
3. Filter.
4. Filter head.



DRAINING AND RENEWING THE SINGLE WATER SEPARATING PREFILTER

IMPORTANT !

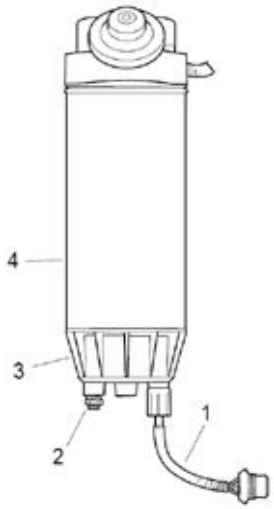
The sensor cable is sensitive. Handle it carefully.

ENVIRONMENT

Use a suitable container. The fuel collected must be disposed of as specified in national and international laws and regulations.

Before starting work: Close the shut-off cock in the fuel pipe and position a container under the filter.

1. Detach the sensor cable from the contact housing on the filter bracket.
2. Open the drain tap in the filter cover and let the fluid run down into the container.
3. Unscrew the filter cover.
4. Unscrew the filter from the filter head.
5. Discard the old filter and use a new filter.
6. Lubricate the O-ring in the filter cover with engine oil.
7. Screw the filter cover onto the new filter by hand. Make sure that the drain tap is fully closed.
8. Lubricate the O-ring on the filter with engine oil.
9. Fill the width of the filter with clean fuel.
10. Screw the filter into position until the O-ring rests against the filter head. Tighten the filter another 1/2 to 3/4 turn by hand.
11. Open the shut-off cock on the fuel pipe and check that the fuel system is sealed.
12. Screw the sensor cable in the contact housing onto the filter bracket.
13. Bleed the fuel system according to the instructions in the Venting the fuel system section.



Legend:

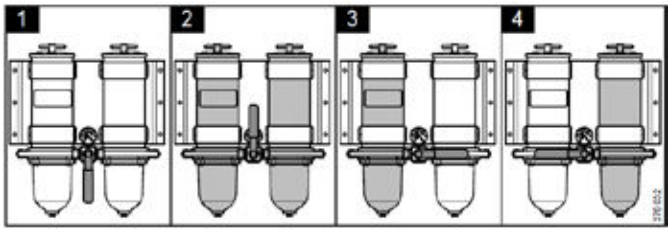
1. Sensor cable.
2. Drain tap.
3. Filter cover.
4. Filter.

DRAINING THE REVERSIBLE WATER SEPARATING PREFILTER

During operation, the rotary control should point 90° towards the filter being used.

ENVIRONMENT

Use a suitable container. The fuel collected must be disposed of as specified in national and international laws and regulations.



1. Closed; neither filter is active.
2. Both filters are active.
3. Left-hand filter is active.
4. Right-hand filter is active.

1. Switch off the filter that needs renewing. The arrow on the rotary control points towards the filter in operation.

WARNING !

Be careful that the valve does not pass the closed position when the engine is in operation. A closed position can result in the engine stopping.

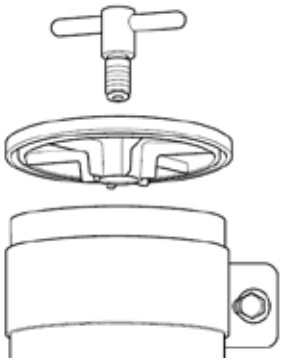
2. Remove the cover from the filter housing.

3. Undo the drain plug.

4. Tighten the drain plug when all the water has emptied.

5. Fill the filter housing with clean fuel.

6. Fit the cover. Tighten the cover screw by hand.



RENEWING THE REVERSIBLE WATER SEPARATING PREFILTER

During operation, the arrow on the rotary control should point towards the filter being used.

ENVIRONMENT

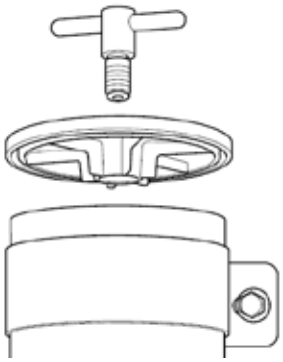
Use a suitable container. The fuel collected must be disposed of as specified in national and international laws and regulations.

1. Switch off the filter that needs renewing. During renewal, the arrow on the rotary control points towards the filter in operation.

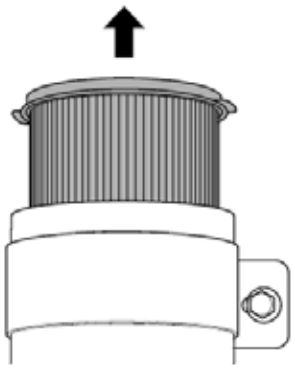
WARNING !

Be careful that the valve does not pass the closed position when the engine is in operation. A closed position can result in the engine stopping.

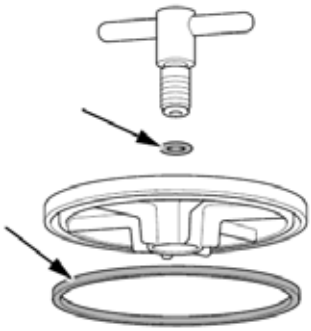
2. Clean the filter housing externally with a cloth.
3. Remove the cover from the filter housing.



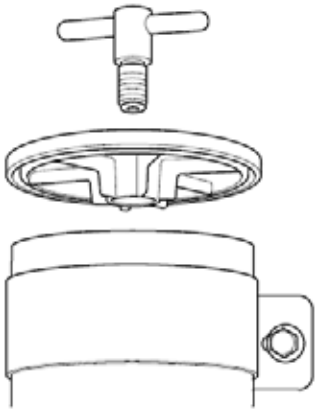
4. Remove the filter and fit the new filter.



5. Renew the O-rings in the cover.
6. Lubricate the O-rings with engine oil.



7. Fill the filter housing with clean fuel.
8. Fit the cover. Tighten the cover screw by hand.



RENEWING THE COMMUTATIVE FUEL FILTER, 16 LITRE MARINE ENGINE WITH XPI

Tools required

Number	Description
2 002 537	Grease for O-ring

ENVIRONMENT

Use a suitable container. The fuel collected must be disposed of as specified in national and international laws and regulations.

1. Start the engine. During operation, the rotary control should point 90° towards the filter being used.

2. Turn the rotary control 90° to the right so that it points towards filter B. The fuel then flows through the filter.

3. Connect a clear plastic hose to the bleed nipple sitting above filter A. Place the other end in a container with a capacity of at least 3.8 litres (1 US gallon).

4. Open the bleed nipple on side A. The remaining pressure is released.

5. Clean the exterior of the filter with a cloth.

6. Unscrew the filter.

7. Apply O-ring grease, part number 2 002 537, to the gasket on the new filter.

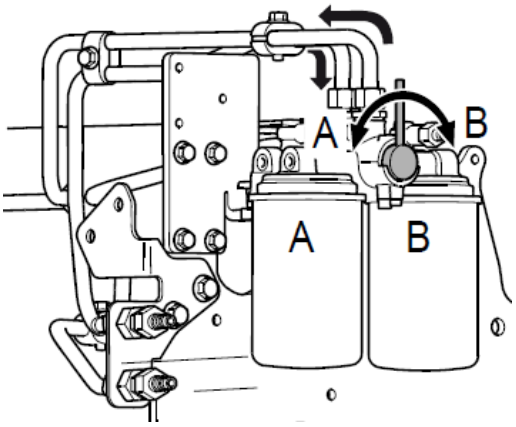
8. Screw the filter into place by hand until it makes contact. Screw a further half turn by hand.

9. Turn the rotary control 90° to the left so that the rotary control points straight up. Both filters now run simultaneously.

10. When fuel without air bubbles comes out, close the bleed nipple. Tightening torque 9 Nm. Because the engine is running, a lot of fuel will come through the hose.

11. Turn the rotary control 90° to the left so that the pointer is pointing towards filter A. Filter B can then be renewed in the same way as filter A.

See related illustration on next page:

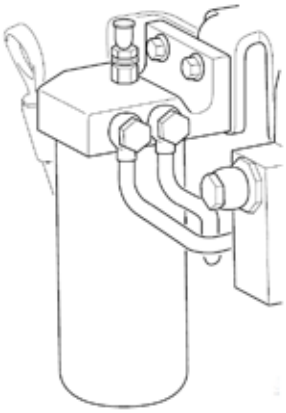


RENEWING THE FUEL FILTER

ENVIRONMENT

Use a suitable container. The fuel collected must be disposed of as specified in national and international laws and regulations.

1. Clean the exterior of the fuel filter with a damp cloth.
2. Unscrew the filter.
3. Apply oil to the gasket on the new filter.
4. Screw the filter into place by hand until it makes contact.
5. Screw a further half turn by hand.
6. Bleed the fuel system according to the instructions in the following section.



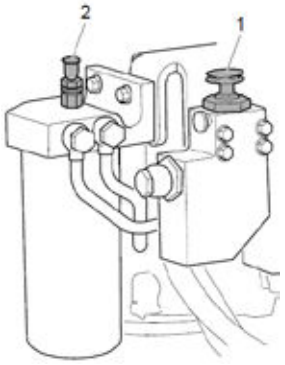
VENTING THE FUEL FILTER

VENTING THE FUEL SYSTEM USING A HAND PUMP

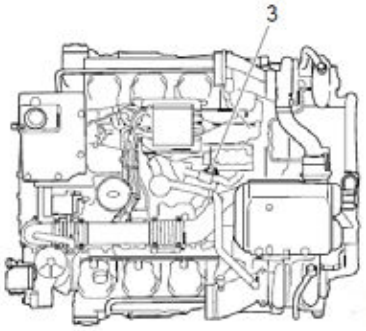
ENVIRONMENT

Use a suitable container. The fuel collected must be disposed of as specified in national and international laws and regulations.

1. Screw up the hand pump handle (1).
2. Attach a clear plastic hose to the bleed nipple on the fuel filter (2). Let the plastic hose drop into a container that holds at least 5 litres (1.3 US gallons).
3. Open the bleed nipple on the fuel filter.
4. Pump with the hand pump until fuel comes out.
5. Close the bleed nipple on the fuel filter.

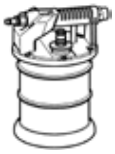


6. Attach a clear plastic hose to the bleed nipple on the high pressure pump (3). Let the plastic hose drop into a container that holds at least 5 litres (1.3 US gallons).
7. Open the bleed nipple on the high pressure pump and pump the hand pump until fuel comes out. It will take around 150 pump strokes.
8. Close the bleed nipple on the high pressure pump and screw down the hand pump handle.
9. Start the engine. The engine should be easy to start.



VENTING THE FUEL SYTSEM USING A SUCTION TOOL

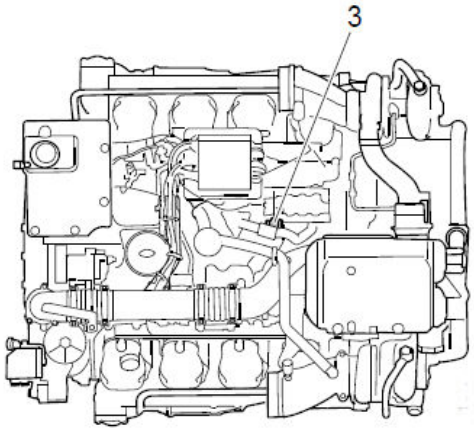
Tool required

Description	Illustration
Suction tool for fuel system	

NOTE !

Nanni recommends bleeding the fuel system using suction tools rather than with a hand pump. This is a quicker and simpler method, which ensures a complete bleeding.

1. Open the bleed niple on the high pressure pump (3) and connect the suction tool to it.
2. Hold the suction tool straight and draw out at least a full container of fuel.
3. Once the fuel coming out of the hose is free of air bubbles, then bleeding is complete.
4. Close the ventilating valve on the high pressure pump. Remove the hose and suction tool.
5. Start the engine and check that no leaks.

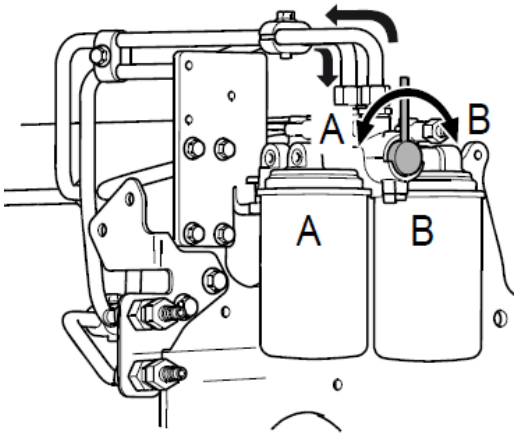


BLEEDING THE FUEL SYSTEM USING A HAND PUMP ON 16 LITRES MARINE ENGINE XPI

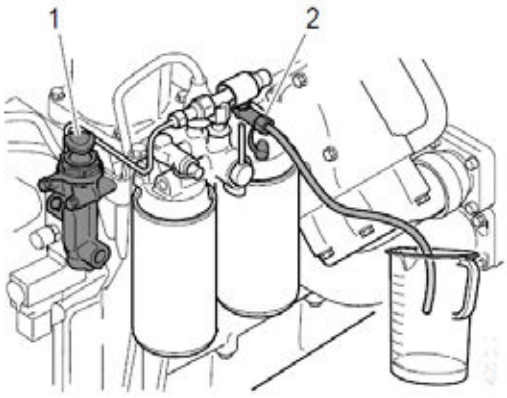
ENVIRONMENT

Use a suitable container. The fuel collected must be disposed of as specified in national and international laws and regulations.

1. Turn the rotary control so that it is pointing towards filter B. The fuel will then flow through the filter:



2. Unscrew the hand pump handle (1) and connect a transparent plastic hose to the bleed nipple on the fuel filter (2). Let the plastic hose drop into a container that holds at least 5 litres (1.3 US gallons).

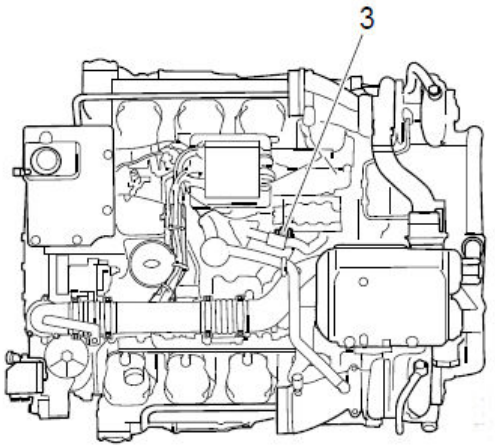


3. Open the bleed nipple on the fuel filter.

4. Pump with the hand pump until fuel without bubbles comes out.

5. Close the bleed nipple on the fuel filter. Tightening torque 9 Nm.

6. Attach a clear plastic hose to the bleed nipple on the high pressure pump (3). Let the plastic hose drop into a container that holds at least 5 litres (1.3 US gallons).



7. Open the bleed nipple on the high pressure pump and pump the hand pump until fuel without bubbles comes out. It will take around 150 pump strokes.

8. Close the bleed nipple (3 in the illustration) on the high pressure pump. Tightening torque 9 Nm. Screw down the hand pump handle.

9. Start the engine. The engine should be easy to start.

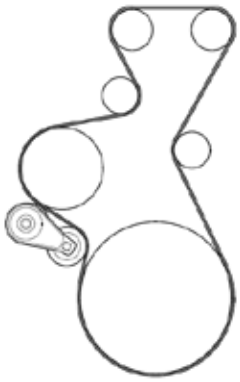
MISCELLANEOUS

CHECKING THE DRIVE BELT

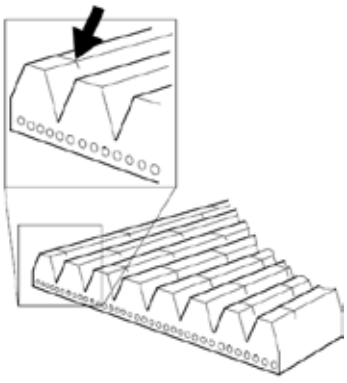
IMPORTANT !

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

2. Check the drive belt for cracks. Renew the drive belt if deep cracks have formed.

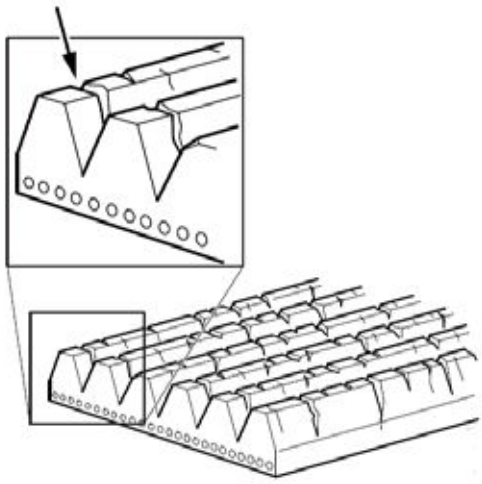


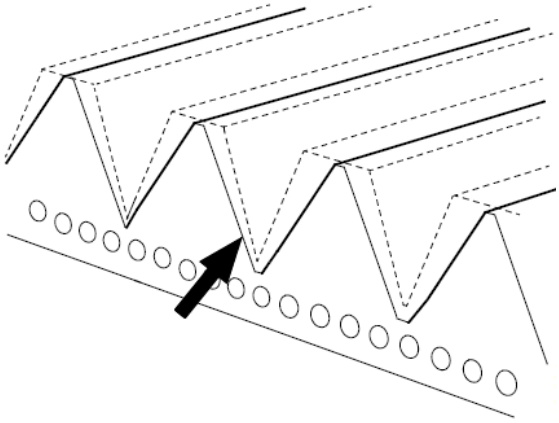
Note:
Small and shallow cracks are normal and form after only a few hours of operation. They do not mean that the drive belt needs to be renewed. If there are many deep cracks, or if parts of the drive belt have started to come off, the drive belt must then be renewed.

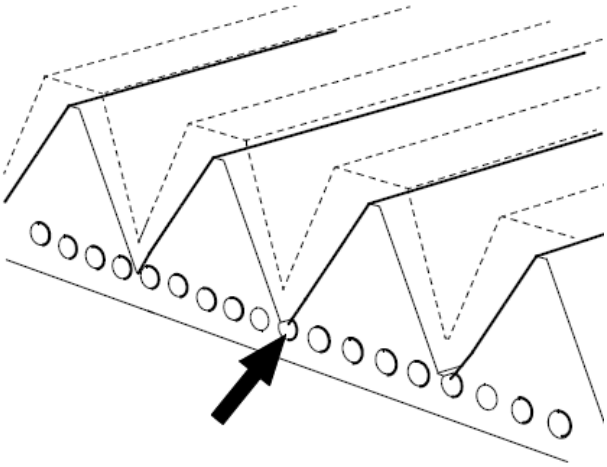


The belt is worn down to the cord. The drive belt must be renewed.

3. Check drive belt wear. Renew the drive belt if it is too worn. See the illustrations below:







CHECKING FOR LEAKAGE

IMPORTANT !

If serious leakage occurs, contact your nearest Nanni-representative.

1. Start the engine.

2. Check for leaks in the lubrication, intake, cooling, fuel, or exhaust system.

3. Tighten or renew leaking connections. Check the over-flow holes which show whether the O-rings between the cylinder liners and crankcase are leaking.

CHECKING AND ADJUSTING VALVE CLEARANCE

Tools required

Number	Description	Illustration
99309	Turning tool for rotating the flywheel from below	
2 402 509	Turning tool for rotating the flywheel from above	

Other tools

Torque wrench, 0-50 Nm
Waterproof felt-tip pen
Feeler gauge 0.45 and 0.70 mm
Flash light
Mirror

WARNING !

Block the starting device or remove a battery cable. If the engine starts unexpectedly, there is a serious risk of injury.

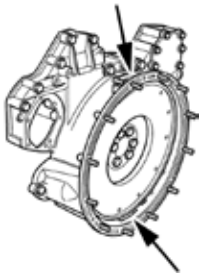
IMPORTANT !

The engine must be cold when the work is carried out. Remember to remove the turning tool from the flywheel after adjustment.

Note:

Carry out a check and adjustment of the valve clearances one more time after the first 500 hours of operation. After this, adjustment according to the regular interval takes place, which is every 2,000 operational hours.

The reference information UP TDC,DOWN TDC and the angle indications listed in the table below are engraved on the flywheel. Depending on the engine installation and type of flywheel housing, this information is visible in one of the windows, either furthest up or furthest down on the flywheel. See illustration below:.



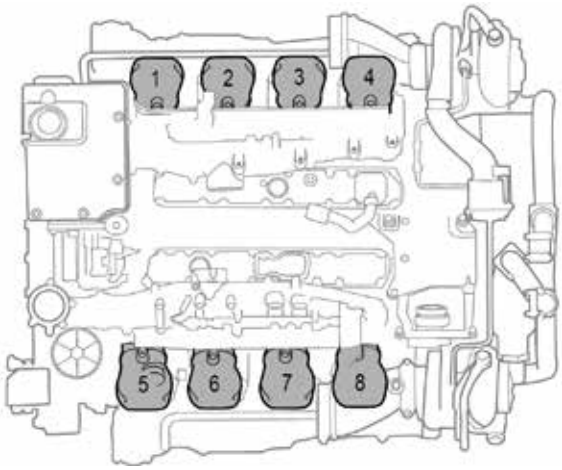
Upper and lower window to read the engraving on the flywheel.

Valve clearance, specifications	
Intake valve	0.45mm (0.018 in)
Exhaust valve	0.70mm (0.028 in)

Tightening torque	
Lock nut for valves	35 Nm (26 lb-ft)

Adjust valves according to the table below. Follow the respective column depending on whether you are reading the engraving on the flywheel in the lower or the upper window. Start adjustment at the top of the table.

Reading in the lower window	Valve transition on cylinder	Adjust valves on cylinder	Reading in the upper window
DOWN TDC	6	1	UP TDC
120/480	2	5	300/660
240/600	4	3	60/420
DOWN TDC	1	6	UP TDC
120/480	5	2	300/600
240/600	3	4	60/420



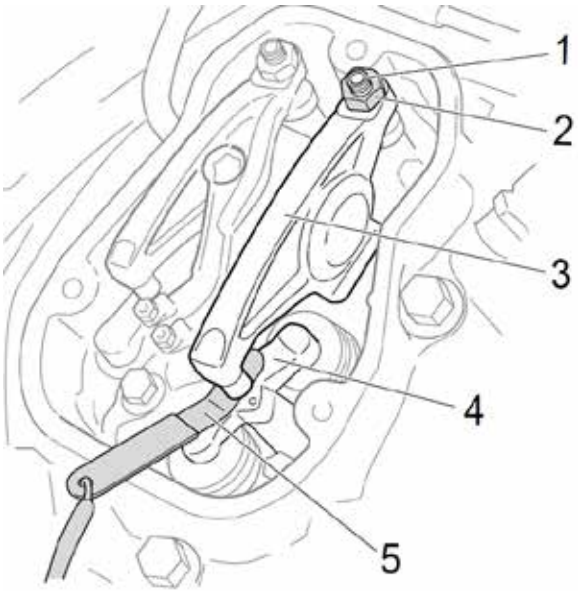
1. Clean the rocker covers and the area around them.
2. Remove the rocker covers.
3. In order to rotate the flywheel, use a turning tool compatible with the installation of the engine, i.e. whether access is from above or from underneath. Use any specified special tool or the equivalent from another supplier.
4. Start adjusting one cylinder according to the table. Rotate the flywheel until the correct engraving can be read on the flywheel. It may be necessary to rotate it more than 1 revolution.

   Rotate the flywheel in the rotational direction of the engine, which is clockwise viewed from the front of the engine and anticlockwise viewed from the back of the engine.

   During a valve transition, the exhaust valve (the long arm) is closing at the same time as the intake valve is opening.

   The UP TDC engraving on the flywheel is now visible in the window furthest up on the flywheel. The DOWN TDC engraving is visible in the lower window.
5. Read the table on the previous page to see which valve to adjust.
6. Stick the feeler gauge under the pressure pad of the rocker arm and check the valve clearance.
7. If necessary, adjust the valve clearance by

   a) loosening the lock nut on the end of the rocker arm
   b) adjusting the valve clearance with the adjusting screw
   c) tightening the lock nut.
8. Mark the rocker arm with the felt-tip pen and then continue with the next cylinder according to the table.



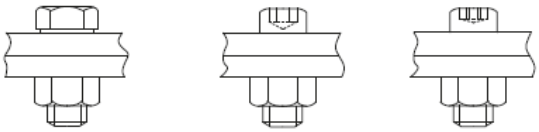
Legend:

1. Adjusting screw
2. Lock nut
3. Rocker arm
4. Valve bridge
5. Feeler gauge

GENERAL TIGHTENING TORQUES FOR SCREWS JOINTS

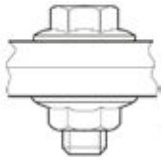
Hexagon screws, hexagon socket screws, Torx screws, hexagon nuts

Metric thread. Strength class 8.8/8.



THREAD	TIGHTENING TORQUE	
	Nm	Lb-ft
M4	2.9	21
M5	6	4
M6	9.5	7
M8	24	18
M10	47	35
M12	84	62
M14	135	100
M16	210	155
M18	290	214
M20	420	310
M22	580	428
M24	730	538

Flange screws with hexagonal head and hexagonal flange nuts

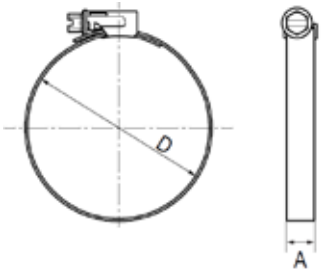


THREAD	TIGHTENING TORQUE	
	Nm	Lb-ft
M5	6.7	5
M6	10.2	8
M8	26	19
M10	50	37
M12	92	38
M14	149	110
M16	1184	136

Hose clamps

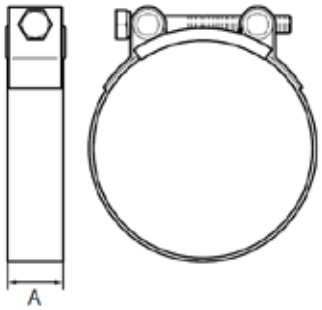
Specifications in the tables show tightening torque when tightening by hand.

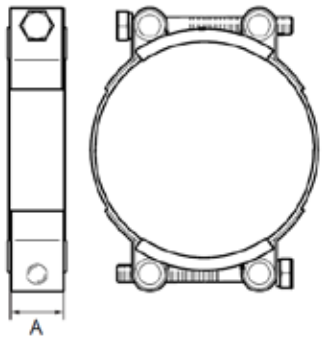
A= WIDTH (mm)	TIGHTENING TORQUE	
	Nm	LB-FT
7.5-9	1.5	1
12	5	4



Tightening torque for new unfitted hose clamp is : max 1 Nm (0.7 lb-ft).

A= WIDTH (mm)	TIGHTENING TORQUE	
	Nm	LB-FT
20	10	7
25	20	15





S09 STORAGE

SUMMARY

LONG TERM STORAGE

A set of operations must be performed to prepare and protect the engine for a long-term storage.

To perform some of the Long Term Storage operations. We recommend that you have all these operations carried out by a Nanni authorized workshop.

NOTE !

It might be necessary to adapt these operations depending the climatic conditions. Contact a Nanni authorized workshop for further informations.

For a prolonged storage (over 12 months), a specific set of measures must be performed. All these operations should be carried out by a Nanni authorized workshop.

CAUTION !

If the engine is likely to be subject to frost, drain all water in the seawater circuit.

PREPARATIONS FOR STORAGE

ENVIRONMENT

Use a suitable container. Used oil and coolant must be disposed of as specified in national and international laws and regulations.

NOTE !

Do not remove the injectors.

LONG TERM STORAGE PROCEDURE

Complete the nearest periodic maintenance inspections and operations before performing the long term storage procedure.

1. Drain and change the engine and transmission oil.
2. Change the engine oil filter.
3. Change the fuel filter and prefilter.
4. Run the engine to normal operating temperature.
5. Stop the engine and take the boat out of water.
6. Drain and clean all components of the seawater system. Protect the components against corrosion.
7. Remove the impeller from the seawater pump (if fitted). Store it in a cool and dry place. Indicate by any means that the impeller has been removed.
8. Check the engine coolant leve and condition. Top up if necessary.
9. Drain any water and contaminants from the fuel tank.
10. Fill totally the fuel tank.
11. Remove the air filter. Secure all air intake with clean clothes.
12. Clean the engine. Repair any damaged areas of paintwork with Nanni original paint.

CAUTION !

Do not point a high pressure water jet toward seals, hoses, grommets, etc.

13. Clean the hull, the hold and the drive (if fitted).
14. Check all control cables. Use grease and rust inhibitor to protect the cables.
15. Disconnect battery leads. Adjust electrolyte level if necessary. Charge the battery. Store the battery in a dry place.
16. Release tension. on belts.
17. Spray the engine with water-repellent product.
18. Remove the propeller for storage. Check the overall condition of all components of the propulsion system.

S09 STORAGE

PRESERVATIVE PRODUCTS

Preservative oil

Use a normal engine oil that meets the requirements in the section Oil grade.

Preservative coolant

Use coolant containing 50% by volume of glycol. Example: BASF MPG Glysacorr P113 and Valvoline Zerex P113 FP.

WARNING !

Ethylene glycol can be fatal if ingested and can cause skin irritation and eye damage.

Preservative fuel

Preservative fuel must not contain biodiesel. Even small amounts of 5-10% biodiesel can have adverse effects on the engine when in longterm storage.

Long-term storage of diesel, where the diesel comes into contact with water, may lead to the growth of micro organisms (bacteria and fungus). In order to minimise the growth of micro-organisms, preservative fuel should contain the following additives. The additives should be selected and added by the fuel supplier. Preservative fuel should comply with the following requirements:

- 0% biodiesel.
- Max. sulphur content 50 ppm.
- Max. water content 200 ppm.
- The fuel must contain additives to stop the growth of micro-organisms.

RESTARTING THE ENGINE

1. Perform external cleaning of the engine and control its condition.
2. Drain and change the engine and transmission oil.
3. Change oil filters.
4. Drain the coolant from the seawater system.
5. Check the condition of the raw water pump impeller. Change it if needed. Install the impeller.
6. Remove cloth and tape from openings. Install the air filter.
7. Close/Tighten all plugs and drain cocks.
8. Check the condition of hoses and clamps.
9. Check the engine coolant level and its condition. Top up if necessary.
10. Connect fully charged batteries.
11. Check the anodes.
12. Install the propeller.
13. Check the operation of the control cables and their condition.
14. Check belts. Adjust the tension.
15. Bleed the fuel system.

Once the boat is in the water :

16. Open the sea cock and prime the seawater system (if fitted).
17. Start the engine. Check for leaks and correct operation.

BATTERY

When storing the engine, adjust the battery electrolyte level and store it in a dry place at room temperature. Recharge the battery as often as possible to extend its service life.

Do not left the battery unattended for a long period of time: it will get into deep discharge (around 7-8 Volts). In such a situation, the battery will not recover.

S08 TROUBLESHOOTING

CAUTION !

If the engine does not function properly, use the following chart to identify the cause. If the cause of trouble can not be found, contact to Nanni authorized workshop. Please keep in mind that this chapter is generic and may not fully comply to your engine.

NOTE !

Some components may not be part of the engine orderes. This list is not exhaustive and is only ab assistance in case of emergencies.

	PROBABLE CAUSES
The engine fails to start	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13
The engine starts but suddenly stops	1, 2, 3, 4, 5
The engine is difficult to start	1, 2, 3, 4, 5, 6, 8, 9
The starter motor is not turning or turn slowly	8, 9
The starter motor turns but the engine does not start	1, 2, 3, 4, 5, 6, 7
The engine does not reach its rated speed at wide open throttle	2, 3, 4, 5, 6, 7, 12, 14, 15, 16, 17, 26, 28
The engine operate unevenly	1, 2, 3, 4, 5, 6, 7, 14, 15, 16, 17, 18, 19, 20, 24, 28
The engine vibrates a lot	16, 27
Black exhaust smoke	4, 5, 14, 15, 16, 19, 20, 28, 29
White exhaust smoke	4, 5, 23, 25
High fuel consumption	4, 7, 14, 15, 16, 19, 20, 22, 28
The engine overheats / coolant temperature too high	14, 15, 16, 18, 19, 20, 21, 22, 28
The control lever is hard to operate	12, 14, 15, 16, 17, 26
No shift between ahead and astern	9, 11, 12, 16, 17, 26
Battery charge warning lamp comes on	8, 9, 11, 18

The numbers refer to the possible causes indicated on the following page.*
Contact a Nanni authorized workshop.

S08 TROUBLESHOOTING

1. Lack of fuel
2. Air in fuel system
3. Fuel filter fouled or clogged
4. Fuel do not meet specified standard
5. Water/contaminants in fuel
6. Valve clearance is wrong *
7. Low compression *
8. Insufficient battery charge / Defective battery
9. Faulty electrical cables contact
10. Faulty starter or starter switch *
11. Tripped fuse / Main switch is open
12. Transmission is damaged*
13. Control lever not in neutral / Stop control pulled out
14. Too much load on board
15. Fouling on underwater hull, drive or propeller
16. Defective/incorrect propeller *
17. Faulty operation of control lever / control cables
18. Loosen or damaged belt
19. Incorrect coolant / Low coolant level / Coolant leaks
20. Cooling system does not operate correctly *
21. Faulty thermostat *
22. Sea cock valve closed / Raw water filter clogged
23. Lube oil burns. Excessive oil consumption *
24. Engine oil level too low
25. Engine oil level too high
26. Transmission oil level too low
27. Defective engine mounting *
28. Insufficient air supply *
29. Clogged air filter or lack of air on admission.

N16.900 CR3

FICHE TECHNIQUE *DATA SHEET*

CARACTERISTIQUES GENERALES *GENERAL DATA*

Base moteur *Engine Base*		Scania
Configuration *Configuration*		8 cylindres en V *8 cylinders in V*
Type *Type*		4 temps Diesel *4 strokes Diesel*
Nombre de soupapes par cylindre *N° of vales per cylinder*		4
Taux de compression *Compression Ratio*		15.7 : 1
Admission *Air intake*		Double turbocompresseur avec isolation thermique *Twin turbocharged with heat insulated*
Distribution *Valve train*		Distribution par pignons *Gear driven valve train*
Système d'injection *Fuel system*		Injection Rampe Commune (XPI) *Common Rail Injection (XPI)*
Ordre d'allumage *Firing order*		1 - 5 - 4 - 2 - 6 - 3 - 7 - 8
Sens de rotation (vue côté volant moteur) *Rotational direction (view flywheel side)*		Antihoraire *Counter clockwise*
Cylindrée *Displacement*	liltres	16.4
	in³	1000.8
Alésage *Bore*	mm	130
	in	5.1
Course *Stroke*	mm	154
	in	6.1
Régime de ralenti *Idling speed*	tr/min *rpm*	600
Régime nominal *Rated speed*	tr/min *rpm*	2300
Régime maxi coupure régulateur *High speed governor break point*	tr/min *rpm*	2350
Nombres d'émissions *Emission compliance*		IMO Tier II
		US Tier 2
		EU Stage IIIA

SYSTEME DE LUBRIFICATION *LUBRICATION SYSTEM*

Pression d'huile au ralenti *Oil pressure @ idle speed*	bar	0.7
	psi	10.2

N16.900 CR3
662 kW [900 hp]

SYSTEME DE LUBRIFICATION (suite) *LUBRICATION SYSTEM (continued)*

Pression d'huile au régime nominal *Oil pressure @ rated speed*		bar	3 / 6
		psi	43.5 / 87.0
Capacité d'huile sans filtre, angle 0° *Oil quantity excluding filter @ 0° angle*		litres	37
		gal US	9.8
Angle d'installation maxi admissible *Maximum permitted installed tilt*	volant vers le bas *front down*	°	12
	volant vers le haut *front up*	°	12
	volant lateral *lateral*		10
Inclinaison admissible en fonctionnement intermittent *Maximum permitted intermittent*	maxi *tilt*	°	25
	latéral maxi *side tilt*	°	30

PERFORMANCE *PERFORMANCE*

Régime de rotation du vilebrequin ***RPM @ cranckshaft***	**tr/min** ***rpm***	**600**	**1200**	**1500**	**1600**	**1800**	**2000**	**2300**
Couple au vilbrequin *Torque @ cranckshaft*	Nm	1399	2769	3241	3299	3194	3071	2748
	ft-lb	1032	2042	2390	2433	2356	2265	2027
Puissance au vilebrequin *Power @ cranckshaft*	hp	120	473	692	752	819	875	900
	Kw	88	348	509	553	602	643	662
Puissance à l'hélice calculée pour charge exp.2.5 *Power at calculated propeller load exp.2.5*	hp	31	177	309	363	487	634	900
	Kw	23	130	227	367	358	466	662

SYSTEME D'INJECTION *FUEL SYSTEM*

Régime de rotation au vilebrequin ***RPM @ cranckshaft***	**tr/min** **rpm**	**600**	**1200**	**1500**	**1600**	**1800**	**2000**	**2300**
Consommation spécifique de carburant *Specific fuel consumption*	g/kWh	217	217	203	202	199	204	212
Consommation de carburant charge exp.2.5 *Fuel consumption propeller load exp.2.5*	l/h	6	31	56	65	87	133	167
	gal US/h	1.6	8.2	14.8	17.2	23	35.1	44.1
Consommation de carburant à pleine charge *Fuel consumption at full load*	l/h				167			
	gal US/h				44.1			
Débit volumique de carburant à pleine charge *Total volumetric fuel flow at full load*	l/h				300			
	gal US/h				79.3			
Restriction maximale d'admission de carburant *Maximum fuel inlet restriction*	kPa				30			
	psi				4.4			
Résistance maxi au passage du carburant *Maximum permitted fuel inlet pressure*	kPa				35			
	psi				5.1			
Pression maxi admissible *Maximum permitted fuel return pressure*	kPa				35			
	psi				5.1			

N16.900 CR3
662 kW [900 hp]

SYSTEME DE REFROIDISSEMENT *COOLING SYSTEM*

Débit - liquide de refroidissement *Coolant circulation pump flow*	l/min	Inconnu
	gal US/min	Unknown
Débit - eau brute (Pompe rotor caoutchouc) *Raw water pump flow (Rubber Impeller Pump)*	l/min	470
	gal US/min	124.2
Chaleur total dégagée à puissance nominale *Total heat rejection at rated speed*	kW	582
	BTU/min	33098
Capacité liquide de refroidissement *Total coolant capacity*	l	65
	gal US	17.2
Thermostat, début d'ouverture *Thermostat, start open at*	°C	82
	°F	179.6
Thermostat, ouverture complète *Thermostat, fully open at*	°C	86 à 94
	°F	186.8 to 201.2

SYSTEME D'ECHAPPEMENT *EXHAUST SYSTEM*

Débit de gaz d'échappement *Exhaust gas flow*	kg/min	60
Contre-pression maxi admissible dans le circuit d'échappement *Permitted back pressure in the exhaust line*	bar	0.1
	inH^2O	40.15
Température d'échappement maxi *Maximum exhaust temperature*	°C	411
	°F	771.8

SYSTEME D'ADMISSION *AIR INTAKE SYSTEM*

Consommation d'air du moteur à 25°C *Engine air consumption at 25°C*	kg/min	57.3
Température d'air d'admission maxi admissible *Maximum allowance intake air temperature*	°C	30
	°F	86
Différence maxi de T° - Ambiant/air d'admission *Maximum temperature rise - ambient to engine inlet*	°C	10
	°F	50
Air d'admission - Résistance maxi admissible, filtre à air propre *Maximum air intake restriction, Clean air filter*	kPa	3
	inH^2O	12.04
Air d'admission - Résistance maxi admissible, filtre à air sale *Maximum air intake restriction, Durty air filter*	kPa	6.5
	inH^2O	26.1
Pression de suralimentation *Boost pressure*	bar	2.0
	psi	29.01

N16.900 CR3

662 kW [900 cv]

SYSTEME ELECTRIQUE *ELECTRICAL SYSTEM*

Alternateur *Alternator*	tension *voltage*	V	24
	ampère *amperes*	A	100
Démarreur électrique *Electric starter motor*		kW	7
Batterie - Courant de démarrage à froid minimum *Battery, minimum cold start current*		CCA	800
Batterie recommandée K20 *Recommanded batterie K20*		A/h	160

POIDS A SEC *DRY WEIGHT*

Poids sans transmission *Weight without transmission*	kg	1660
	lbs	3659.7

CONSEILS D'INSTALLATION *INSTALLATION TIPS*

Diamètre tuyau alimentation carburant *Fuel line supply diameter*	mm	16
	in	0.63
Diamètre tuyau retour carburant *Fuel line return diameter*	mm	12
	in	0.47
Diamètre Tuyau eau de mer *Sea water line diameter*	mm	Aspiration 63 / Sortie 2 x 51
	in	Intake 2.48 / Outlet 2 x 2.01
Diamètre ligne d'échappement *Exhaust line diameter*		en accord avec l'installation : voir contrepression *according to the installation : see back pressure*

CONSEILS D'UTILISATION *RATINGS*

Classe d'application *Rating*	M1.S
Service *Operating hours*	Illimité *Unlimited*
Facteur de charge *Load Factor*	Jusqu'à 80% *Up to 80%*
Cycle d'utilisation *Duty Cycle*	Utilisation de la puissance maximale au maximum 1 heure toutes les 3 heures de fonctionnement. Le temps d'utilisation restant sans dépasser le régime de croisière. *Full power for no more than 1 hour out of each 3 hours of operation. The remaining operation time must be at or below cruising speed.*

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N16.1000 CR3

FICHE TECHNIQUE *DATA SHEET*

CARACTERISTIQUES GENERALES *GENERAL DATA*

Base moteur *Engine Base*		Scania
Configuration *Configuration*		8 cylindres en V *8 cylinders in V*
Type *Type*		4 temps Diesel *4 strokes Diesel*
Nombre de soupapes par cylindre *N° of vales per cylinder*		4
Taux de compression *Compression Ratio*		15.7 : 1
Admission *Air intake*		Double turbocompresseur avec isolation thermique *Twin turbocharged with heat insulated*
Distribution *Valve train*		Distribution par pignons *Gear driven valve train*
Système d'injection *Fuel system*		Injection Rampe Commune (XPI) *Common Rail Injection (XPI)*
Ordre d'allumage *Firing order*		1 - 5 - 4 - 2 - 6 - 3 - 7 - 8
Sens de rotation (vue côté volant moteur) *Rotational direction (view flywheel side)*		Antihoraire *Counter clockwise*
Cylindrée *Displacement*	liltres	16.4
	in³	1000.8
Alésage *Bore*	mm	130
	in	5.1
Course *Stroke*	mm	154
	in	6.1
Régime de ralenti *Idling speed*	tr/min *rpm*	600
Régime nominal *Rated speed*	tr/min *rpm*	2300
Régime maxi coupure régulateur *High speed governor break point*	tr/min *rpm*	2350
Nombres d'émissions *Emission compliance*		IMO Tier II
		US Tier 2
		EU Stage IIIA

SYSTEME DE LUBRIFICATION *LUBRICATION SYSTEM*

Pression d'huile au ralenti *Oil pressure @ idle speed*	bar	0.7
	psi	10.2

N16.1000 CR3
736 kW [1000 hp]

SYSTEME DE LUBRIFICATION (suite) *LUBRICATION SYSTEM (continued)*

Pression d'huile au régime nominal *Oil pressure @ rated speed*		bar	3 / 6
		psi	43.5 / 87.0
Capacité d'huile sans filtre, angle 0° *Oil quantity excluding filter @ 0° angle*		litres	37
		gal US	9.8
Angle d'installation maxi admissible *Maximum permitted installed tilt*	volant vers le bas *front down*	°	12
	volant vers le haut *front up*	°	12
	volant lateral *lateral*		10
Inclinaison admissible en fonctionnement intermittent *Maximum permitted intermittent*	maxi *tilt*	°	25
	latéral maxi *side tilt*	°	30

PERFORMANCE *PERFORMANCE*

Régime de rotation du vilebrequin ***RPM @ cranckshaft***	**tr/min** ***rpm***	**600**	**1200**	**1500**	**1600**	**1800**	**2000**	**2300**
Couple au vilbrequin *Torque @ cranckshaft*	Nm	1399	2769	3602	3665	3549	3414	3055
	ft-lb	1032	2042	2657	2703	2618	2518	2253
Puissance au vilebrequin *Power @ cranckshaft*	hp	120	392	769	835	910	972	1001
	Kw	88	288	566	614	669	715	736
Puissance à l'hélice calculée pour charge exp.2.5 *Power at calculated propeller load exp.2.5*	hp	35	197	344	404	542	706	1001
	Kw	26	145	253	297	399	519	736

SYSTEME D'INJECTION *FUEL SYSTEM*

Régime de rotation au vilebrequin ***RPM @ cranckshaft***	**tr/min** **rpm**	**600**	**1200**	**1500**	**1600**	**1800**	**2000**	**2300**
Consommation spécifique de carburant *Specific fuel consumption*	g/kWh	217	217	204	202	200	205	214
Consommation de carburant charge exp.2.5 *Fuel consumption propeller load exp.2.5*	l/h	7	35	62	72	96	127	187
	gal US/h	1.9	9.2	16.4	19	25.4	33.5	49.4
Consommation de carburant à pleine charge *Fuel consumption at full load*	l/h				187			
	gal US/h				49.4			
Débit volumique de carburant à pleine charge *Total volumetric fuel flow at full load*	l/h				300			
	gal US/h				79.3			
Restriction maximale d'admission de carburant *Maximum fuel inlet restriction*	kPa				30			
	psi				4.4			
Résistance maxi au passage du carburant *Maximum permitted fuel inlet pressure*	kPa				35			
	psi				5.1			
Pression maxi admissible *Maximum permitted fuel return pressure*	kPa				35			
	psi				5.1			

N16.1000 CR3
736 kW [1000 hp]

SYSTEME DE REFROIDISSEMENT *COOLING SYSTEM*

Débit - liquide de refroidissement *Coolant circulation pump flow*	l/min	Inconnu
	gal US/min	Unknown
Débit - eau brute (Pompe rotor caoutchouc) *Raw water pump flow (Rubber Impeller Pump)*	l/min	470
	gal US/min	124.2
Chaleur total dégagée à puissance nominale *Total heat rejection at rated speed*	kW	652
	BTU/min	37078
Capacité liquide de refroidissement *Total coolant capacity*	l	65
	gal US	17.2
Thermostat, début d'ouverture *Thermostat, start open at*	°C	82
	°F	179.6
Thermostat, ouverture complète *Thermostat, fully open at*	°C	86 à 94
	°F	186.8 to 201.2

SYSTEME D'ECHAPPEMENT *EXHAUST SYSTEM*

Débit de gaz d'échappement *Exhaust gas flow*	kg/min	63
Contre-pression maxi admissible dans le circuit d'échappement *Permitted back pressure in the exhaust line*	bar	0.1
	inH²O	40.15
Température d'échappement maxi *Maximum exhaust temperature*	°C	434
	°F	813.2

SYSTEME D'ADMISSION *AIR INTAKE SYSTEM*

Consommation d'air du moteur à 25°C *Engine air consumption at 25°C*	kg/min	60.3
Température d'air d'admission maxi admissible *Maximum allowance intake air temperature*	°C	30
	°F	86
Différence maxi de T° - Ambiant/air d'admission *Maximum temperature rise - ambient to engine inlet*	°C	10
	°F	50
Air d'admission - Résistance maxi admissible, filtre à air propre *Maximum air intake restriction, Clean air filter*	kPa	3
	inH²O	12.04
Air d'admission - Résistance maxi admissible, filtre à air sale *Maximum air intake restriction, Durty air filter*	kPa	6.5
	inH²O	26.1
Pression de suralimentation *Boost pressure*	bar	2.2
	psi	31.9

N16.1000 CR3

736 kW [1000 cv]

SYSTEME ELECTRIQUE *ELECTRICAL SYSTEM*

Alternateur *Alternator*	tension *voltage*	V	24
	ampère *amperes*	A	100
Démarreur électrique *Electric starter motor*		kW	7
Batterie - Courant de démarrage à froid minimum *Battery, minimum cold start current*		CCA	800
Batterie recommandée K20 *Recommanded batterie K20*		A/h	160

POIDS A SEC *DRY WEIGHT*

Poids sans transmission *Weight without transmission*	kg	1660
	lbs	3659.7

CONSEILS D'INSTALLATION *INSTALLATION TIPS*

Diamètre tuyau alimentation carburant *Fuel line supply diameter*	mm	16
	in	0.63
Diamètre tuyau retour carburant *Fuel line return diameter*	mm	12
	in	0.47
Diamètre Tuyau eau de mer *Sea water line diameter*	mm	63
	in	2.48
Diamètre ligne d'échappement *Exhaust line diameter*		en accord avec l'installation : voir contrepression *according to the installation : see back pressure*

CONSEILS D'UTILISATION *RATINGS*

Classe d'application *Rating*	M5.L (M6.S)
Service *Operating hours*	*Jusqu'à 2000 heures par an (Jusqu'à 500 heures par an)* *Up to 2000 hours per year (Up to 500 hours per year)*
Facteur de charge *Load Factor*	Jusqu'à 77% (Jusqu'à 50%) *Up to 77% (Up to 50%)*
Cycle d'utilisation *Duty Cycle*	Utilisation de la puissance maximale au maximum 1 heure toutes les 6 heures (1 heure toutes les 12 heures) de fonctionnement. Le temps d'utilisation restant sans dépasser le régime de croisière. *Full power for no more than 1 hour out of each 6 hours (1 hour out of each 12 hours) of operation.* *The remaining operation time must be at or below cruising speed.*

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N16.1100 CR3

FICHE TECHNIQUE *DATA SHEET*

CARACTERISTIQUES GENERALES *GENERAL DATA*

Base moteur *Engine Base*		Scania
Configuration *Configuration*		8 cylindres en V *8 cylinders in V*
Type *Type*		4 temps Diesel *4 strokes Diesel*
Nombre de soupapes par cylindre *N° of vales per cylinder*		4
Taux de compression *Compression Ratio*		15.7 : 1
Admission *Air intake*		Double turbocompresseur avec isolation thermique *Twin turbocharged with heat insulated*
Distribution *Valve train*		Distribution par pignons *Gear driven valve train*
Système d'injection *Fuel system*		Injection Rampe Commune (XPI) *Common Rail Injection (XPI)*
Ordre d'allumage *Firing order*		1 - 5 - 4 - 2 - 6 - 3 - 7 - 8
Sens de rotation (vue côté volant moteur) *Rotational direction (view flywheel side)*		Antihoraire *Counter clockwise*
Cylindrée *Displacement*	liltres	16.4
	in³	1000.8
Alésage *Bore*	mm	130
	in	5.1
Course *Stroke*	mm	154
	in	6.1
Régime de ralenti *Idling speed*	tr/min *rpm*	600
Régime nominal *Rated speed*	tr/min *rpm*	2300
Régime maxi coupure régulateur *High speed governor break point*	tr/min *rpm*	2350
Nombres d'émissions *Emission compliance*		IMO Tier II
		US Tier 2
		EU Stage IIIA

SYSTEME DE LUBRIFICATION *LUBRICATION SYSTEM*

Pression d'huile au ralenti *Oil pressure @ idle speed*	bar	0.7
	psi	10.2

N16.1100 CR3
809 kW [1100 hp]

SYSTEME DE LUBRIFICATION (suite) *LUBRICATION SYSTEM (continued)*

Pression d'huile au régime nominal *Oil pressure @ rated speed*		bar	3 / 6
		psi	43.5 / 87.0
Capacité d'huile sans filtre, angle 0° *Oil quantity excluding filter @ 0° angle*		litres	37
		gal US	9.8
Angle d'installation maxi admissible *Maximum permitted installed tilt*	volant vers le bas *front down*	°	12
	volant vers le haut *front up*	°	12
	volant lateral *lateral*		10
Inclinaison admissible en fonctionnement intermittent *Maximum permitted intermittent*	maxi *tilt*	°	25
	latéral maxi *side tilt*	°	30

PERFORMANCE *PERFORMANCE*

Régime de rotation du vilebrequin ***RPM @ cranckshaft***	**tr/min** ***rpm***	**600**	**1200**	**1500**	**1600**	**1800**	**2000**	**2300**
Couple au vilbrequin *Torque @ cranckshaft*	Nm	1399	2769	3799	4031	3905	3753	3359
	ft-lb	1032	2042	2802	2973	2880	2768	2477
Puissance au vilebrequin *Power @ cranckshaft*	hp	120	473	812	919	1001	1069	1100
	Kw	88	348	597	675	736	786	809
Puissance à l'hélice calculée pour charge exp.2.5 *Power at calculated propeller load exp.2.5*	hp	38	316	378	444	596	776	1100
	Kw	28	159	278	327	438	570	809

SYSTEME D'INJECTION *FUEL SYSTEM*

Régime de rotation au vilebrequin ***RPM @ cranckshaft***	**tr/min** **rpm**	**600**	**1200**	**1500**	**1600**	**1800**	**2000**	**2300**
Consommation spécifique de carburant *Specific fuel consumption*	g/kWh	217	217	205	201	201	205	215
Consommation de carburant charge exp.2.5 *Fuel consumption propeller load exp.2.5*	l/h	8	38	68	79	105	139	207
	gal US/h	2.1	10	18	20.9	27.7	36.7	54.7
Consommation de carburant à pleine charge *Fuel consumption at full load*	l/h				207			
	gal US/h				54.7			
Débit volumique de carburant à pleine charge *Total volumetric fuel flow at full load*	l/h				300			
	gal US/h				79.3			
Restriction maximale d'admission de carburant *Maximum fuel inlet restriction*	kPa				30			
	psi				4.4			
Résistance maxi au passage du carburant *Maximum permitted fuel inlet pressure*	kPa				35			
	psi				5.1			
Pression maxi admissible *Maximum permitted fuel return pressure*	kPa				35			
	psi				5.1			

N16.1100 CR3
809 kW [1100 hp]

SYSTEME DE REFROIDISSEMENT *COOLING SYSTEM*

Débit - liquide de refroidissement *Coolant circulation pump flow*	l/min	Inconnu
	gal US/min	Unknown
Débit - eau brute (Pompe rotor caoutchouc) *Raw water pump flow (Rubber Impeller Pump)*	l/min	470
	gal US/min	124.2
Chaleur total dégagée à puissance nominale *Total heat rejection at rated speed*	kW	726
	BTU/min	41287
Capacité liquide de refroidissement *Total coolant capacity*	l	65
	gal US	17.2
Thermostat, début d'ouverture *Thermostat, start open at*	°C	82
	°F	179.6
Thermostat, ouverture complète *Thermostat, fully open at*	°C	86 à 94
	°F	186.8 to 201.2

SYSTEME D'ECHAPPEMENT *EXHAUST SYSTEM*

Débit de gaz d'échappement *Exhaust gas flow*	kg/min	66
Contre-pression maxi admissible dans le circuit d'échappement *Permitted back pressure in the exhaust line*	bar	0.1
	inH²O	40.15
Température d'échappement maxi *Maximum exhaust temperature*	°C	459
	°F	858.2

SYSTEME D'ADMISSION *AIR INTAKE SYSTEM*

Consommation d'air du moteur à 25°C *Engine air consumption at 25°C*	kg/min	62.6
Température d'air d'admission maxi admissible *Maximum allowance intake air temperature*	°C	30
	°F	86
Différence maxi de T° - Ambiant/air d'admission *Maximum temperature rise - ambient to engine inlet*	°C	10
	°F	50
Air d'admission - Résistance maxi admissible, filtre à air propre *Maximum air intake restriction, Clean air filter*	kPa	3
	inH²O	12.04
Air d'admission - Résistance maxi admissible, filtre à air sale *Maximum air intake restriction, Durty air filter*	kPa	6.5
	inH²O	26.1
Pression de suralimentation *Boost pressure*	bar	2.3
	psi	33.4

N16.1100 CR3

809 kW [1100 cv]

SYSTEME ELECTRIQUE *ELECTRICAL SYSTEM*

Alternateur *Alternator*	Tension *Voltage*	V	24
	Ampère *Amperes*	A	100
Démarreur électrique *Electric starter motor*		kW	7
Batterie - Courant de démarrage à froid minimum *Battery, minimum cold start current*		CCA	800
Batterie recommandée K20 *Recommanded batterie K20*		A/h	160

POIDS A SEC *DRY WEIGHT*

Poids sans transmission *Weight without transmission*	kg	1660
	lbs	3659.7

CONSEILS D'INSTALLATION *INSTALLATION TIPS*

Diamètre tuyau alimentation carburant *Fuel line supply diameter*	mm	16
	in	0.63
Diamètre tuyau retour carburant *Fuel line return diameter*	mm	12
	in	0.47
Diamètre Tuyau eau de mer *Sea water line diameter*	mm	Aspiration 63 / Sortie 2 x 51
	in	Intake 2.48 / Outlet 2 x 2.01
Diamètre ligne d'échappement *Exhaust line diameter*		En accord avec l'installation : voir contre-pression *According to the installation : see back pressure*

CONSEILS D'UTILISATION *RATINGS*

Classe d'application *Rating*	M5.L (M6.S)
Service *Operating hours*	*Jusqu'à 2000 heures par an (Jusqu'à 500 heures par an)* *Up to 2000 hours per year (Up to 500 hours per year)*
Facteur de charge *Load Factor*	Jusqu'à 77% (Jusqu'à 50%) *Up to 77% (Up to 50%)*
Cycle d'utilisation *Duty Cycle*	Utilisation de la puissance maximale au maximum 1 heure toutes les 6 heures (1 heure toutes les 12 heures) de fonctionnement. Le temps d'utilisation restant sans dépasser le régime de croisière. *Full power for no more than 1 hour out of each 6 hours (1 hour out of each 12 hours) of operation. The remaining operation time must be at or below cruising speed.*

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N16.1150 CR3

FICHE TECHNIQUE *DATA SHEET*

CARACTERISTIQUES GENERALES *GENERAL DATA*

Base moteur *Engine Base*		Scania
Configuration *Configuration*		8 cylindres en V *8 cylinders in V*
Type *Type*		4 temps Diesel *4 strokes Diesel*
Nombre de soupapes par cylindre *N° of vales per cylinder*		4
Taux de compression *Compression Ratio*		15.7 : 1
Admission *Air intake*		Double turbocompresseur avec isolation thermique *Twin turbocharged with heat insulated*
Distribution *Valve train*		Distribution par pignons *Gear driven valve train*
Système d'injection *Fuel system*		Injection Rampe Commune (XPI) *Common Rail Injection (XPI)*
Ordre d'allumage *Firing order*		1 - 5 - 4 - 2 - 6 - 3 - 7 - 8
Sens de rotation (vue côté volant moteur) *Rotational direction (view flywheel side)*		Antihoraire *Counter clockwise*
Cylindrée *Displacement*	liltres	16.4
	in³	1000.8
Alésage *Bore*	mm	130
	in	5.1
Course *Stroke*	mm	154
	in	6.1
Régime de ralenti *Idling speed*	tr/min *rpm*	600
Régime nominal *Rated speed*	tr/min *rpm*	2300
Régime maxi coupure régulateur *High speed governor break point*	tr/min *rpm*	2350
Nombres d'émissions *Emission compliance*		IMO Tier II
		US Tier 2
		EU Stage IIIA

SYSTEME DE LUBRIFICATION *LUBRICATION SYSTEM*

Pression d'huile au ralenti *Oil pressure @ idle speed*	bar	0.7
	psi	10.2

N16.1150 CR3
846 kW [1150 hp]

SYSTEME DE LUBRIFICATION (suite) *LUBRICATION SYSTEM (continued)*

Pression d'huile au régime nominal *Oil pressure @ rated speed*		bar	3 / 6
		psi	43.5 / 87.0
Capacité d'huile sans filtre, angle 0° *Oil quantity excluding filter @ 0° angle*		litres	37
		gal US	9.8
Angle d'installation maxi admissible *Maximum permitted installed tilt*	volant vers le bas *front down*	°	12
	volant vers le haut *front up*	°	12
	volant lateral *lateral*		10
Inclinaison admissible en fonctionnement intermittent *Maximum permitted intermittent*	maxi *tilt*	°	25
	latéral maxi *side tilt*	°	30

PERFORMANCE *PERFORMANCE*

Régime de rotation du vilebrequin ***RPM @ cranckshaft***	**tr/min** ***rpm***	**600**	**1200**	**1500**	**1700**	**1800**	**2000**	**2300**
Couple au vilbrequin *Torque @ cranckshaft*	Nm	1399	2769	3799	4139	4079	3924	3512
	ft-lb	1032	2042	2802	3053	3009	2894	2590
Puissance au vilebrequin *Power @ cranckshaft*	hp	120	473	812	1002	1046	1118	1151
	Kw	88	348	597	737	769	822	846
Puissance à l'hélice calculée pour charge exp.2.5 *Power at calculated propeller load exp.2.5*	hp	40	226	395	540	623	811	1151
	Kw	29	166	291	397	458	597	846

SYSTEME D'INJECTION *FUEL SYSTEM*

Régime de rotation au vilebrequin ***RPM @ cranckshaft***	**tr/min** **rpm**	**600**	**1200**	**1500**	**1700**	**1800**	**2000**	**2300**
Consommation spécifique de carburant *Specific fuel consumption*	g/kWh	217	222	205	201	201	206	217
Consommation de carburant charge exp.2.5 *Fuel consumption propeller load exp.2.5*	l/h	8	40	71	95	110	145	219
	gal US/h	2.1	10.6	18.8	25.1	29.1	38.3	57.9
Consommation de carburant à pleine charge *Fuel consumption at full load*	l/h				219			
	gal US/h				57.9			
Débit volumique de carburant à pleine charge *Total volumetric fuel flow at full load*	l/h				300			
	gal US/h				79.3			
Restriction maximale d'admission de carburant *Maximum fuel inlet restriction*	kPa				30			
	psi				4.4			
Résistance maxi au passage du carburant *Maximum permitted fuel inlet pressure*	kPa				35			
	psi				5.1			
Pression maxi admissible *Maximum permitted fuel return pressure*	kPa				35			
	psi				5.1			

N16.1150 CR3
846 kW [1150 hp]

SYSTEME DE REFROIDISSEMENT *COOLING SYSTEM*

Débit - liquide de refroidissement *Coolant circulation pump flow*	l/min	Inconnu
	gal US/min	Unknown
Débit - eau brute (Pompe rotor caoutchouc) *Raw water pump flow (Rubber Impeller Pump)*	l/min	470
	gal US/min	124.2
Chaleur total dégagée à puissance nominale *Total heat rejection at rated speed*	kW	767
	BTU/min	43619
Capacité liquide de refroidissement *Total coolant capacity*	l	65
	gal US	17.2
Thermostat, début d'ouverture *Thermostat, start open at*	°C	82
	°F	179.6
Thermostat, ouverture complète *Thermostat, fully open at*	°C	86 à 94
	°F	186.8 to 201.2

SYSTEME D'ECHAPPEMENT *EXHAUST SYSTEM*

Débit de gaz d'échappement *Exhaust gas flow*	kg/min	67
Contre-pression maxi admissible dans le circuit d'échappement *Permitted back pressure in the exhaust line*	bar	0.1
	inH²O	40.15
Température d'échappement maxi *Maximum exhaust temperature*	°C	474
	°F	894.2

SYSTEME D'ADMISSION *AIR INTAKE SYSTEM*

Consommation d'air du moteur à 25°C *Engine air consumption at 25°C*	kg/min	63.8
Température d'air d'admission maxi admissible *Maximum allowance intake air temperature*	°C	30
	°F	86
Différence maxi de T° - Ambiant/air d'admission *Maximum temperature rise - ambient to engine inlet*	°C	10
	°F	50
Air d'admission - Résistance maxi admissible, filtre à air propre *Maximum air intake restriction, Clean air filter*	kPa	3
	inH²O	12.04
Air d'admission - Résistance maxi admissible, filtre à air sale *Maximum air intake restriction, Durty air filter*	kPa	6.5
	inH²O	26.1
Pression de suralimentation *Boost pressure*	bar	2.4
	psi	34.8

N16.1150 CR3

846 kW [1150 cv]

SYSTEME ELECTRIQUE *ELECTRICAL SYSTEM*

Alternateur *Alternator*	tension *voltage*	V	24
	ampère *amperes*	A	100
Démarreur électrique *Electric starter motor*		kW	7
Batterie - Courant de démarrage à froid minimum *Battery, minimum cold start current*		CCA	800
Batterie recommandée K20 *Recommanded batterie K20*		A/h	160

POIDS A SEC *DRY WEIGHT*

Poids sans transmission *Weight without transmission*	kg	1660
	lbs	3659.7

CONSEILS D'INSTALLATION *INSTALLATION TIPS*

Diamètre tuyau alimentation carburant *Fuel line supply diameter*	mm	16
	in	0.63
Diamètre tuyau retour carburant *Fuel line return diameter*	mm	12
	in	0.47
Diamètre Tuyau eau de mer *Sea water line diameter*	mm	Aspiration 63 / Sortie 2 x 51
	in	Intake 2.48 / Outlet 2 x 2.01
Diamètre ligne d'échappement *Exhaust line diameter*		en accord avec l'installation : voir contrepression *according to the installation : see back pressure*

CONSEILS D'UTILISATION *RATINGS*

Classe d'application *Rating*	M5.S
Service *Operating hours*	*Jusqu'à 1200 heures par an* *Up to 1200 hours per year*
Facteur de charge *Load Factor*	Jusqu'à 77% *Up to 77%*
Cycle d'utilisation *Duty Cycle*	Utilisation de la puissance maximale au maximum 1 heure toutes les 12 heures de fonctionnement. Le temps d'utilisation restant sans dépasser le régime de croisière. *Full power for no more than 1 hour out of each 12 hours of operation. The remaining operation time must be at or below cruising speed.*

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N16.1200 CR3

FICHE TECHNIQUE *DATA SHEET*

CARACTÉRISTIQUES GÉNÉRALES *GENERAL DATA*

Base moteur *Engine Base*		Scania
Configuration *Configuration*		8 cylindres en V *8 cylinders in V*
Type *Type*		4 temps Diesel *4 strokes Diesel*
Nombre de soupapes par cylindre *N° of vales per cylinder*		4
Taux de compression *Compression Ratio*		15.7 : 1
Admission *Air intake*		Double turbocompresseur avec isolation thermique *Twin turbocharged with heat insulated*
Distribution *Valve train*		Distribution par pignons *Gear driven valve train*
Système d'injection *Fuel system*		Injection Rampe Commune (XPI) *Common Rail Injection (XPI)*
Ordre d'allumage *Firing order*		1 - 5 - 4 - 2 - 6 - 3 - 7 - 8
Sens de rotation (vue côté volant moteur) *Rotational direction (view flywheel side)*		Antihoraire *Counter clockwise*
Cylindrée *Displacement*	liltres	16.4
	in³	1000.8
Alésage *Bore*	mm	130
	in	5.1
Course *Stroke*	mm	154
	in	6.1
Régime de ralenti *Idling speed*	tr/min *rpm*	600
Régime nominal *Rated speed*	tr/min *rpm*	2300
Régime maxi coupure régulateur *High speed governor break point*	tr/min *rpm*	2350
Nombres d'émissions *Emission compliance*		IMO Tier II
		US Tier 2
		EU Stage IIIA

SYSTEME DE LUBRIFICATION *LUBRICATION SYSTEM*

Pression d'huile au ralenti *Oil pressure @ idle speed*	bar	0.7
	psi	10.2

N16.1200 CR3
882 kW [1200 hp]

SYSTEME DE LUBRIFICATION (suite) *LUBRICATION SYSTEM (continued)*

Pression d'huile au régime nominal *Oil pressure @ rated speed*		bar	3 / 6
		psi	43.5 / 87.0
Capacité d'huile sans filtre, angle 0° *Oil quantity excluding filter @ 0° angle*		litres	37
		gal US	9.8
Angle d'installation maxi admissible *Maximum permitted installed tilt*	volant vers le bas *front down*	°	12
	volant vers le haut *front up*	°	12
	volant lateral *lateral*		10
Inclinaison admissible en fonctionnement intermittent *Maximum permitted intermittent*	maxi *tilt*	°	25
	latéral maxi *side tilt*	°	30

PERFORMANCE *PERFORMANCE*

Régime de rotation du vilebrequin ***RPM @ cranckshaft***	**tr/min** ***rpm***	**600**	**1200**	**1500**	**1700**	**1800**	**2000**	**2300**
Couple au vilbrequin *Torque @ cranckshaft*	Nm	1399	2769	3799	4139	4099	4039	3662
	ft-lb	1032	2042	2802	3053	3023	2979	2701
Puissance au vilebrequin *Power @ cranckshaft*	hp	120	473	812	1002	1051	1150	1200
	Kw	88	348	597	737	773	846	882
Puissance à l'hélice calculée pour charge exp.2.5 *Power at calculated propeller load exp.2.5*	hp	42	236	412	563	650	846	1200
	Kw	31	173	303	414	478	622	882

SYSTEME D'INJECTION *FUEL SYSTEM*

Régime de rotation au vilebrequin ***RPM @ cranckshaft***	**tr/min** **rpm**	**600**	**1200**	**1500**	**1700**	**1800**	**2000**	**2300**
Consommation spécifique de carburant *Specific fuel consumption*	g/kWh	217	217	205	201	201	206	219
Consommation de carburant charge exp.2.5 *Fuel consumption propeller load exp.2.5*	l/h	8	42	74	99	114	151	230
	gal US/h	2.1	11.1	19.6	26.2	30.1	39.9	60.7
Consommation de carburant à pleine charge *Fuel consumption at full load*	l/h				230			
	gal US/h				60.7			
Débit volumique de carburant à pleine charge *Total volumetric fuel flow at full load*	l/h				300			
	gal US/h				79.3			
Restriction maximale d'admission de carburant *Maximum fuel inlet restriction*	kPa				30			
	psi				4.4			
Résistance maxi au passage du carburant *Maximum permitted fuel inlet pressure*	kPa				35			
	psi				5.1			
Pression maxi admissible *Maximum permitted fuel return pressure*	kPa				35			
	psi				5.1			

N16.1200 CR3
882 kW [1200 hp]

SYSTEME DE REFROIDISSEMENT *COOLING SYSTEM*

Débit - liquide de refroidissement *Coolant circulation pump flow*	l/min	Inconnu
	gal US/min	Unknown
Débit - eau brute (Pompe rotor caoutchouc) *Raw water pump flow (Rubber Impeller Pump)*	l/min	470
	gal US/min	124.2
Chaleur total dégagée à puissance nominale *Total heat rejection at rated speed*	kW	810
	BTU/min	46064
Capacité liquide de refroidissement *Total coolant capacity*	l	65
	gal US	17.2
Thermostat, début d'ouverture *Thermostat, start open at*	°C	82
	°F	179.6
Thermostat, ouverture complète *Thermostat, fully open at*	°C	86 à 94
	°F	186.8 to 201.2

SYSTEME D'ECHAPPEMENT *EXHAUST SYSTEM*

Débit de gaz d'échappement *Exhaust gas flow*	kg/min	68
Contre-pression maxi admissible dans le circuit d'échappement *Permitted back pressure in the exhaust line*	bar	0.1
	inH²O	40.15
Température d'échappement maxi *Maximum exhaust temperature*	°C	490
	°F	914

SYSTEME D'ADMISSION *AIR INTAKE SYSTEM*

Consommation d'air du moteur à 25°C *Engine air consumption at 25°C*	kg/min	65
Température d'air d'admission maxi admissible *Maximum allowance intake air temperature*	°C	30
	°F	86
Différence maxi de T° - Ambiant/air d'admission *Maximum temperature rise - ambient to engine inlet*	°C	10
	°F	50
Air d'admission - Résistance maxi admissible, filtre à air propre *Maximum air intake restriction, Clean air filter*	kPa	3
	inH²O	12.04
Air d'admission - Résistance maxi admissible, filtre à air sale *Maximum air intake restriction, Durty air filter*	kPa	6.5
	inH²O	26.1
Pression de suralimentation *Boost pressure*	bar	2.5
	psi	36.3

N16.1200 CR3

882 kW [1200 cv]

SYSTEME ELECTRIQUE *ELECTRICAL SYSTEM*

Alternateur *Alternator*	tension *voltage*	V	24
	ampère *amperes*	A	100
Démarreur électrique *Electric starter motor*		kW	7
Batterie - Courant de démarrage à froid minimum *Battery, minimum cold start current*		CCA	800
Batterie recommandée K20 *Recommanded batterie K20*		A/h	160

POIDS A SEC *DRY WEIGHT*

Poids sans transmission *Weight without transmission*	kg	1660
	lbs	3659.7

CONSEILS D'INSTALLATION *INSTALLATION TIPS*

Diamètre tuyau alimentation carburant *Fuel line supply diameter*	mm	16
	in	0.63
Diamètre tuyau retour carburant *Fuel line return diameter*	mm	12
	in	0.47
Diamètre Tuyau eau de mer *Sea water line diameter*	mm	Aspiration 63 / Sortie 2 x 51
	in	Intake 2.48 / Outlet 2 x 2.01
Diamètre ligne d'échappement *Exhaust line diameter*		En accord avec l'installation : voir contre-pression *According to the installation : see back pressure*

CONSEILS D'UTILISATION *RATINGS*

Classe d'application *Rating*	M6.S
Service *Operating hours*	*Jusqu'à 500 heures par an* *Up to 500 hours per year*
Facteur de charge *Load Factor*	Jusqu'à 50% *Up to 50%*
Cycle d'utilisation *Duty Cycle*	Utilisation de la puissance maximale au maximum 1 heure toutes les 12 heures de fonctionnement. Le temps d'utilisation restant sans dépasser le régime de croisière. *Full power for no more than 1 hour out of each 12 hours of operation. The remaining operation time must be at or below cruising speed.*

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