

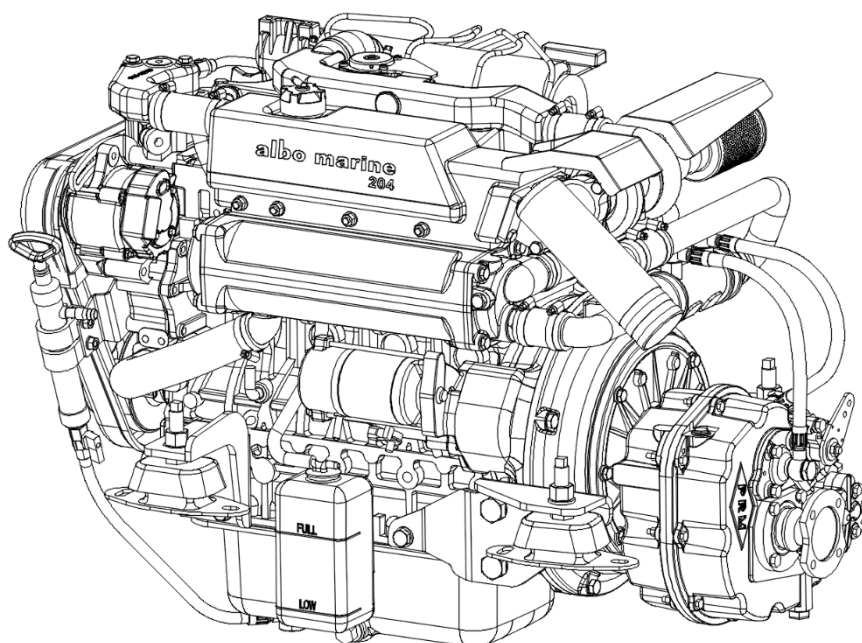
Operation & Installation Guide



Marine Engine

03 Series

AB149 - AB159



PLEASE READ AND KEEP THIS MANUAL CAREFULLY.

Product Information

Model	:
Serial No	:

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ALBO Marine Propulsion Engine

Welcome to Albosan Marine.

Thank you for purchasing an Albo marine propulsion engine. We have prepared this guide to provide you with important information and recommendations to ensure the smoothest and most economical operation of the marine propulsion engine.

If you do not understand or need clarification regarding any phrase or terminology in this guide, contact Albosan or its distributor so that we can provide you more advice and technical support.

All information and recommendations provided in this guide are information available at the time of publication and may be subject to change at any time.

General Declaration

It is the responsibility of the Buyer / founder / owner to comply with the relevant laws, instructions, to take the necessary health and safety measures and to protect the machine before it is put into service.

The following warning symbols and inscriptions in this manual warn users and service personnel of the potential hazards of the engine. Please read carefully to the end of the manual.

 **DANGER :** *It warns against dangers that may result in serious personal injury or death.*

 **WARNING :** *It warns against hazards that may result in personal injury or death, or working conditions where safety measures must be taken.*

 **CAUTION :** *It warns against hazards that may result in serious personal injury or equipment damage, or working conditions where safety measures must be taken.*

1. Safety Measures

Careful handling is your best insurance against accidents. Read and understand this section carefully before using the engine. Regardless of experience time, all users should read this manual and other related manuals before starting the engine or any equipment connected to the engine. It is the user's responsibility to provide all operators with this information and the necessary training for safe use.

1.1 Follow Safety Instructions

- Carefully read and learn this "USER MANUAL" and "LABELS ON THE ENGINE" before starting and using the engine.
- Learn how to use and work safely. Learn the equipment and its limits. Always keep the engine in good condition.
- Before allowing other people to use your engine, explain how it Works and have them read this user manual.
- DO NOT make any changes to the engine. UNAPPROVED CHANGES to the engine may adversely affect the function and/or safety of the engine and shorten engine life. If the engine does not perform properly, first consult your ALBOSAN marine engine distributor on the ground.



1.2 Wear Safety Clothing and Use Personal Protective Equipment (PPE)

- When working around the engine, do not wear clothing that does not fit on the body, torn and fluffy, which can cause personal injury by getting caught in working control elements and protrusions or pulleys and other moving parts.
- According to the operation performed, use additional protective equipment (PPE) such as helmets, safety protection, safety glasses and gloves.
- DO NOT use the engine or equipment connected to the engine when you are under the influence of alcohol, drugs, or when you are tired.
- DO NOT use radio or music player headphones when starting the engine.



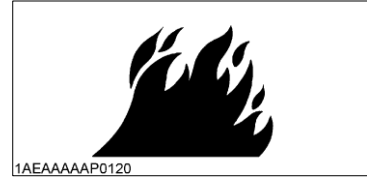
1.3 Engine Start-Up and Pre-use Checks

- Be sure to examine the engine before starting. Do not start the engine if it is defective. Ensure immediate repair.
- Make sure all protective and enclosures are in place before starting the engine. Replace missing or damaged ones.
- Before starting, make sure that you and others are at a safe distance from the engine.
- Always keep the engine at least 3 feet (1 meter) away from buildings and other structures.
- Do not allow children and animals to approach the running engine.
- DO NOT start the engine by short-circuiting the starter terminals. The vehicle can shift and move directly into gear. Do not disable or cancel any security devices



1.4 Keep the Engine and Surrounding Area Clean

- Make sure the engine is stopped before cleaning.
- Keep the engine clean and do not contain dirt, grease residues or garbage near the engine to avoid causing a fire. Keep flammable liquids away from sparks and heat in suitable containers and cabinets.
- Check for leaks and remove leaks, if any.
- DO NOT stop the engine without idling; first wait for the engine to cool down. Leave the engine idling for about 5 minutes before stopping, unless there is a safety problem that requires an emergency stop.



1.5 Safe Handling of Fuel and Lubricants – Keep Away From Fire

- Always stop the engine before refueling and/or lubrication.
- DO NOT smoke or allow flames or sparks in workspace. The fuel is highly flammable and explosive under certain conditions.
- Refuel in a well-ventilated and open environment. If fuel and / or lubricants are spilled, wait for the engine to cool down and replenish as much as necessary.
- DO NOT mix gasoline or alcohol with diesel fuel. The mixture may cause fire or serious damage to the engine.
- DO NOT use non-approved containers, such as baskets, bottles, or jars. Use approved fuel storage containers and fillers.



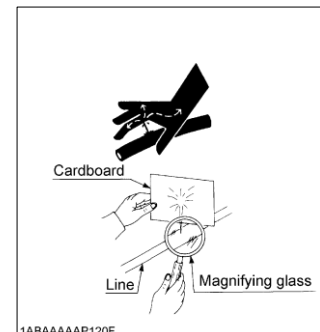
1.6 Exhaust Gases and Fire Prevention

- Accumulation of the engine exhaust fumes can be extremely harmful. Ensure that the engine is operated in a well-ventilated environment and that there are no living creatures near it.
- The exhaust gas coming out of the muffler is extremely hot. Do not expose dry grass, mown grass, oil or other flammable materials to exhaust gas to avoid causing fire. Always keep the engine and muffler clean.
- To avoid fire, be careful of flammable substances leaking from hoses and lines. Be sure to check for leaks in hoses and lines such as fuel, hydraulic fluid by following the maintenance checklist.
- Do not short-circuit the power cables and wires to avoid causing a fire. Check that all power cables and cable installations are in good condition. Keep all electrical sockets clean. Naked or insulated cables can cause dangerous electric shocks and personal injuries.



1.7 Liquid Leakage

- Take the pressure of the air, oil and cooling systems before separating any lines, fittings or related parts.
- Be careful about possible pressure discharges that may occur when separating any device from pressurized systems. DO NOT check for pressure leaks manually by hand. High pressure oil or fuel may cause personal injury.
- The liquid released under pressure penetrates the skin and has a force that can lead to serious injury.
- The liquid leaking through the small holes may not be visible. Use a piece of card or board to check for suspected leak sites: DO NOT use your hands or any limbs. Use safety glasses or eye protection during leak checks.
- Seek medical attention immediately if you are injured by leaking fluid. This fluid can cause gangrene or severe allergic reactions.



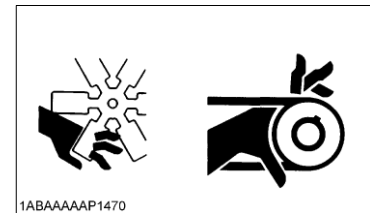
1.8 Measures against Burns and Battery Explosion

- To avoid burns that may occur during engine operation and immediately after stopping, pay attention to hot parts and liquids such as mufflers, muffler cover, hoses, engine housing, coolant and engine structure.
- DO NOT remove the handle cover when the engine is running or immediately after stopping. Otherwise, hot water bounces off the tower. Allow the tower to cool enough to touch before removing the cover. Use safety glasses.
- Before starting the engine, be sure to close the coolant relief valve, secure the pressure cap and connect the Pipe Band. Removing or loosening these parts will cause serious personal injury.
- The battery has a risk of explosion. Hydrogen and oxygen gases can be extremely explosive when charging the battery.
- DO NOT use or charge the battery if the battery fluid level is below the lower mark. Otherwise, parts of the structure may decay prematurely, reducing their service life or leading to explosion. Immediately, add pure water until the level is between the UPPER and LOWER marks.
- Keep sparks and open flames away from the battery, especially when charging. DO NOT light matches near the battery.
- DO NOT check the battery charging status by placing a metal object between the terminals. Use a voltmeter or hydrometer.
- DO NOT charge a frozen battery. Explosion hazard is present. Warm the frozen battery to at least 16°C (61°F).



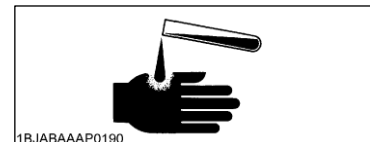
1.9 Keep Your Hands and Body Away From Moving Parts

- Make sure that the engine is stopped before checking or adjusting the belt tension.
- Keep your hands and body away from moving parts such as V-belt, Drive belt, pulley or Flywheel. Rotating parts can cause serious personal injury.
- DO NOT start the engine without safety mufflers. Firmly attach the safety enclosures before operation.



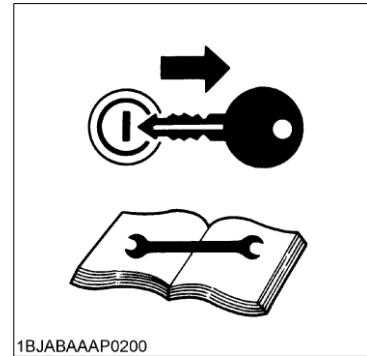
1.10 Disposal of Antifreeze and Liquids

- Antifreeze is toxic. Wear rubber gloves to avoid personal injury. Wash immediately in case of skin contact.
- DO NOT mix different types of antifreezes. The mixture can react chemically and release harmful substances. Use approved original KUBOTA antifreeze.
- Be sensitive to the environment and Environmental Protection. Before all liquid discharge operations, determine an appropriate disposal method. Comply with relevant environmental protection regulations when destroying oil, fuel, coolant, brake fluid, filters and batteries.
- When liquid is being discharged from the engine, place a suitable container under the engine housing.
- DO NOT pour waste into the ground, drainage, or other water source. Dispose of liquid waste in accordance with environmental laws.



1.11 Safety Checks and Maintenance Procedure

- Place the engine on a wide flat surface during inspection and service operations. DO NOT work only on parts supported by jacks or a crane. Always support the engine with wedges and appropriate stands before service operations.
- Disconnect the battery from the engine before servicing. Place a "DO NOT OPERATE" label on the ignition key entry so that it is not accidentally started.
- To avoid sparks caused by an accidental short circuit, always disconnect the battery's chassis cable (-) first and connect it finally.
- Ensure that the engine is stopped and the switch is removed before daily and periodic maintenance, service and cleaning.
- Check and maintain after the engine, coolant, muffler and muffler cover are completely cooled.
- Always use appropriate tools and fastening equipment. Make sure that the tools and equipment are in good condition before starting the service work. Learn how to use them before starting the service process.
- Use ONLY the correct engine rotation methods when rotating the engine manually. DO NOT attempt to rotate the engine by pulling or forcing it from the V-Belt. This may cause serious personal injury or premature damage to the V-Belt.
- Replace fuel and lubrication pipes with hose clamps every 2 years or less, depending on whether they are damaged. Because they're made of rubber, they get old over time.
- When the service work is performed by two or more people, make sure that the entire process is completed safely.
- Always keep the first aid kit and fire extinguisher at arm's length.



1.12 Warning and Caution Labels



1.13 Care of Warning and Caution Labels

1. Keep warning and caution labels clean and do not allow them to be blocked with other materials.
2. Clean the warning and caution labels with soap and water and dry them with a soft cloth.
3. Replace damaged or missing warning and caution labels with new labels from your ALBOSAN dealer.
4. If a part with warning and caution labels is replaced with a new part, make sure that the new labels are in the same place as the labels on the replaced part.
5. Attach new warning and caution labels to a clean, dry surface and press bubbles from the outside.

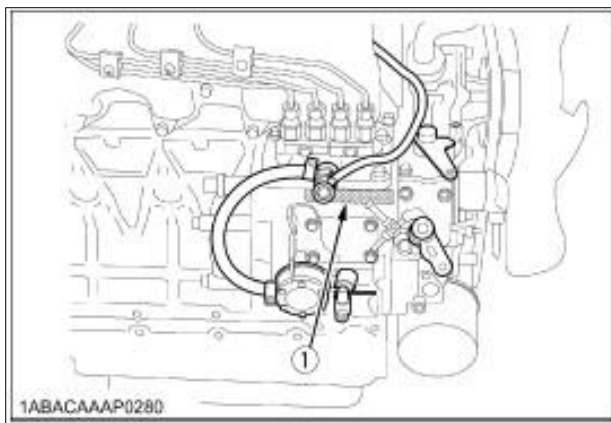
2. Servicing of the Engine

Your dealer will be happy to take care of your new engine and help you get the highest performance from the engine. When you read this guide thoroughly, you will find that you can perform some regular maintenance on your own. However, if you need spare parts or extensive maintenance, be sure to contact your ALBOSAN dealer.

For service operations, contact the ALBOSAN dealer where you purchased your engine or your local ALBOSAN dealer.

If you need spare parts, have your engine serial number ready to give to your dealer.

Check the serial number already and write it in the appropriate space in the table below.



Engine Serial Number Position (1)

	TYPE	SERIAL NUMBER
ENGINE		
DATE OF PURCHASE		
NAME OF DEALER		
(Filled by the buyer.)		

ENGINE INFORMATION TABLE

3. Pre-Operation Check

3.1 Break-In

During the engine break-in period, observe the following by all means:

1. Change the engine oil and oil filter cartridge after the first 50 hours of operation. (See “ENGINE OIL” in “PERIODIC SERVICE” section.)
2. When ambient temperature is low, operate the machine after the engine has been completely warmed up.

3.2 Daily Check

To prevent trouble from occurring, it is important to know the conditions of the engine well. Check it before starting.



CAUTION : To avoid personal injury;

- Be sure to install shields and safeguards attached to the engine when operating.
- Stop the engine in a flat and wide area before checking.
- Keep dust or fuel away from the battery, cables, muffler and engine to avoid causing fire.

Always check and clean these parts before daily operation.

Item		Ref
1. Parts which had trouble in previous operation.		-
2. By walking around the machine	(1) Oil or water leaks	
	(2) Engine oil level and contamination	
	(3) Amount of fuel	
	(4) Amount of coolant	
	(5) Dust in air cleaner dust cup	
	(6) Damaged parts and loosened bolts and nuts	
3. By inserting the key into the starter switch	(1) Proper functions of meters and pilot lamps; no stains on these parts	
	(2) Proper function of glow lamp timer	
4. By starting the engine	(1) Color of exhaust fumes	
	(2) Unusual engine noise	

4. Operating the Engine

4.1 Starting the Engine (Normal)

⚠ CAUTION : To avoid personal injury;

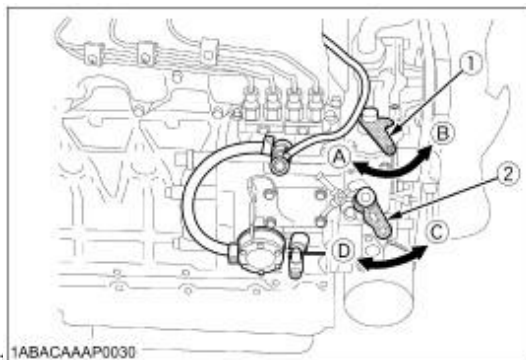
Do not allow children to approach the machine while the engine is running.

- Be sure to install the boat on which the engine is installed, on a flat place.
- Do not run the engine on gradients.
- Do not run the engine in an enclosed are. Exhaust gas can cause air pollution and exhaust gas poisoning.
- Keep your hands away from rotating parts (such as pulley, belt, flywheel etc.) during operation.
- Do not operate the machine while under the influence of alcohol or drugs.
- Do not wear loose, torn or bulky clothing around the machine. It may catch on moving parts or controls, leading to the risk of accident. Use additional safety items, e.g. hard hat, safety boots or shoes, eye and hearing protection, gloves, etc., as appropriate or required.
- Do not wear radio or music headphones while operating the engine.
- Check to see if it is safe around the engine before starting.
- Reinstall safeguards and shields securely and clear all maintenance tools when starting the engine after maintenance.

IMPORTANT:

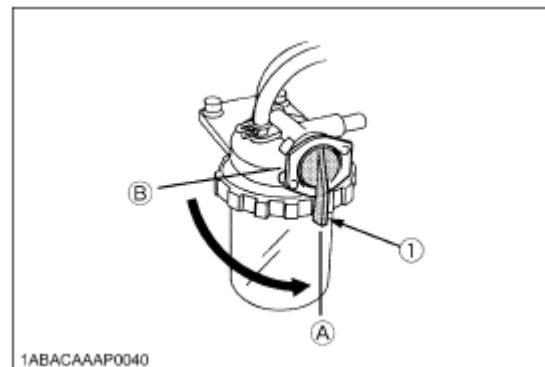
- Do not use ether or any starting fluid for starting the engine, or a severe damage will occur.
- When starting the engine after a long storage (of more than 3 months), first set the stop lever to the "STOP" position and then activate the starter for about 10 seconds to allow oil to reach every engine part.

1. Set the fuel lever to the "ON" position.
2. Place the engine stop lever to the "START" position.
3. Place the speed control lever at more than half "OPERATION".



(1) Speed control lever
(2) Engine stop lever

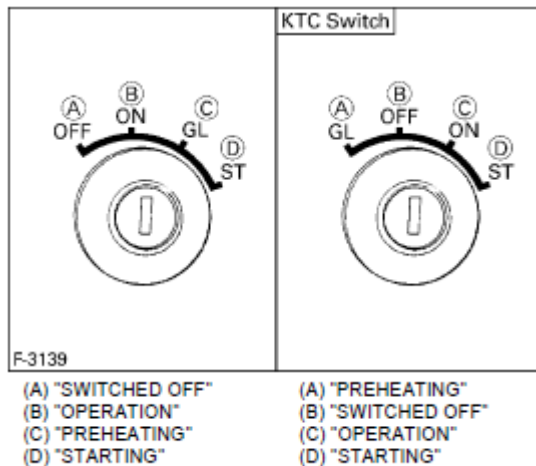
(A) "IDLING"
(B) "OPERATION"
(C) "START"
(D) "STOP"



(1) Fuel lever

(A) "ON"
(B) "OFF"

4. Insert the key into the key switch and turn it "ON".



5. Turn the starter switch to the "PREHEATING" position to allow the glow lamp to redden.

NOTE:

(With lamp timer in use.)

- The glow lamp goes out in about 5 second when the lamp timer is up. Refer to this for pre-heating. Even with the glow lamp off, the glow plug can be pre-heated by turning the starter switch to the "PREHEATING" position.
6. Turn the key to the "STARTING" position and the engine should release the key immediately when the engine starts.
7. Check to see that the oil pressure lamp and charge lamp are off. If the lamps are still on, immediately stop the engine and determine the cause. (See "CHECKS DURING OPERATION in "OPERATING THE ENGINE" section.)

NOTE:

- If the oil pressure lamp should be still on, immediately stop the engine and check;
 - If there is enough engine oil.
 - If the engine oil has dirt in it.
 - If the wiring is faulty.
8. Warm up the engine at medium speed without load.

IMPORTANT:

- If the glow lamp should redden too quickly or too slowly, immediately ask you ALBOSAN dealer to check and repair it.
- If the engine does not catch or start at 10 seconds after the starter switch is set at "STARTING" position, wait for another 30 seconds and then begin the engine starting sequence again. Do not allow the starter motor to run continuously for more than 20 seconds.

4.2 Cold Weather Starting

If the ambient temperature is below 5°C (23°F)* degrees and the engine is very cold, start it as follows:

1. Perform steps (1) to (4) in the starting of the engine section.
5. Turn the key to the "PREHEATING" position and keep it there for a certain period mentioned below.

IMPORTANT:

- Shown below are the standard preheating times for various temperatures. This operation, however, is not required, when the engine is warmed up.

Ambient Temperature	Preheating Time
Above 10°C (50°F)	NO NEED
10°C (50°F) to 5°C (23°F)	Approx. 5 seconds
Below -5°C (23°F)	Approx. 10 seconds
Limit of continuous use	20 seconds

6. Turn the key to the "STARTING" position and the engine should start.
(If the engine fails to start after 10 seconds, turn off the key for 5 to 30 seconds. Then repeat steps (5) and (6).)

IMPORTANT:

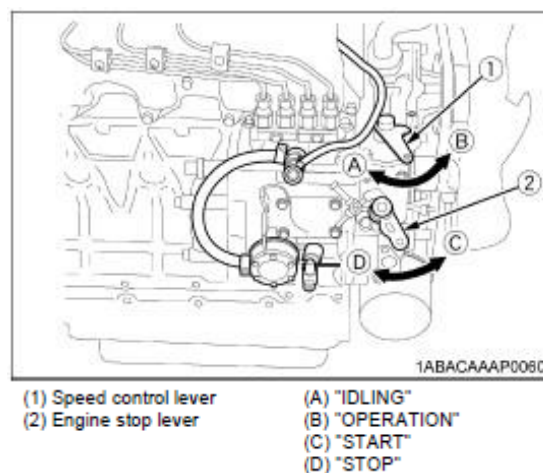
- Do not allow the starter motor to run continuously for more than 20 seconds.
- Be sure to warm up the engine, not only in winter, but also in warmer seasons. An insufficiently warmed-up engine can shorten its service life.
- When there is fear of temperature dropping below -15°C (5°F) detach the battery from the machine, and keep it indoors in a safe area, to be reinstalled just before the next operation.

4.3 Stopping the Engine

1. Return the speed control lever to low idle, and run the engine under idling conditions.

IMPORTANT:

- If equipped with a turbo-charger, allow the engine to idle for 5 minutes before shutting it off after a full load operation. Failure to do so may lead to turbo-charger trouble.
2. The engine should stop with the starter switch paced at the OFF position. (In case of non-stopping engine, set the engine stop lever to the "STOP" position manually.)
 3. After stopping the engine, remove the key. (Be sure to return the engine stop lever to the START position to be ready for the next starting in case of manually stopping.)



4.4 Checks during Operation

While running, make following checks to see that all parts are working correctly.

4.4.1 Cooler Cooling Water (Coolant)



WARNING :

Do not remove the cooler cap until the cooling water temperature is well below the boiling point. Then gently loosen the cover to the stop position to remove the remaining pressure before removing the cover completely.

If the engine is overheating and then overflows the hot coolant fluid from the cooler and hoses, stop the engine immediately and perform the following controls to determine the cause of the problem.

1. Check to see if the coolant runs short or if there is any coolant leak;
2. Check to see if there is any obstacle around the cooling air inlet or outlet;
3. Check if the belt is loosening excessively.
4. Check to see if the cooler water pipe is clogged.
5. Check whether the antifreeze/water ratio in the mixture is 50/50.

4.4.2 Oil Pressure Lamp

The lamp lights up to warn the operator that the engine oil pressure has dropped below the prescribed level. If this should happen during operation or should not go off even after the engine is accelerated more than 1000rpm, immediately stop the engine and check the following:

1. Engine oil level (See "ENGINE OIL" in "PERIODIC SERVICE" section.)
2. Lubrication system (See "ENGINE OIL" in "PERIODIC SERVICE" section.)

4.4.3 Fuel



CAUTION : To avoid personal injury;

- Fluid escaping from pinholes may be invisible. Do not use hands to search for suspected leaks; Use a piece of cardboard or wood, instead. If injured by escaping fluid, see a medical doctor at once. This fluid can produce gangrene or a severe allergic reaction.
- Check any leaks from fuel pipes or fuel injection piper. Use eye protection when checking for leaks.

Be careful not to empty the fuel tank. Otherwise air may enter the fuel system, requiring fuel system bleeding. (See "FUEL" in "PERIODIC SERVICE" section.)

4.4.4 Color of Exhaust

While the engine is run within the rated output range:

- The color of exhaust remains colorless.
- If the output slightly exceeds the rated level, exhaust may become a little colored with the output level kept constant.
- If the engine is run continuously with dark exhaust emission, it may lead to trouble with the engine.

4.4.5 Immediately Stop the Engine IF;

- The engine suddenly slows down or accelerates.
- Unusual noises are suddenly heard.
- Exhaust fumes suddenly become very dark.
- The oil pressure lamp or the water temperature alarm lamp lights up.

4.5 Reversed Engine Revolution and Remedies



CAUTION : To avoid personal injury;

Reversed engine operation can make the machine reverse and run it backwards. It may lead to serious trouble.

- Reversed engine operation may make exhaust gas gush out into the intake side and ignite the air cleaner; it could catch fire.

Reversed engine revolution must be stopped immediately since engine oil circulation is cut quickly, leading to serious trouble.

4.5.1 How to Tell When the Engine Starts Running Backwards

1. Lubrication oil pressure drops sharply. Oil pressure warning light, if used, will light.
2. Since the intake and exhaust sides are reversed, the sound of the engine changes, and exhaust gas will come out of the air cleaner.
3. A louder knocking sound will be heard when the engine starts running backwards.

4.5.2 Remedies

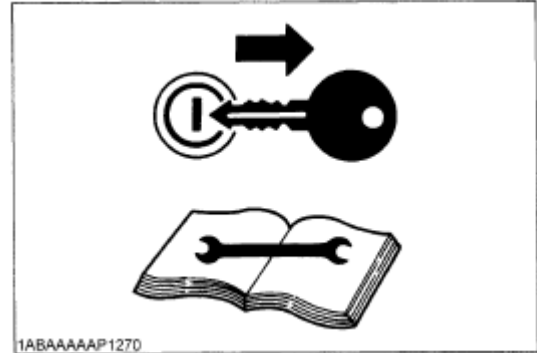
1. Immediately turn the starter switch to the "OFF" position and set the engine stop lever to the "STOP" position to stop the engine.
2. After stopping the engine, check the air cleaner, intake rubber tube and other parts and replace parts as needed.

5. Maintenance

CAUTION : To avoid personal injury;

Be sure to conduct daily checks, periodic maintenance, refueling or cleaning on a level surface with the engine shut off and remove the key.

- Before allowing other people to use your engine, explain how to operate, and have them read this manual before operation.
- When cleaning any parts, do not use gasoline but use regular cleanser.
- Always use proper tools that are in good condition. Make sure you understand how to use them, before performing any service work.
- When installing, be sure to tighten all bolts lest they should be loose. Tighten the bolts by the specified torque.
- Do not put any tools on the battery, or battery terminals may short out. Severe burns or fire could result. Detach the battery from the engine before maintenance.
- Do not touch muffler or exhaust pipes while they are hot; Severe burns could result.



5.1 Service Intervals

Observe the following for service and maintenance.

Interval	Item	Ref.	Note	
Every 50 Hours	Check of fuel pipes and clamp bands			@
See NOTE	Change of engine oil		⊙	
Every 100 Hours	Cleaning of air cleaner element		*1	@
	Cleaning of fuel filter			
	Check of fan belt tightness			
	Draining water separator			
Every 200 Hours	Check of cooler hoses and clamp bands			
	Replacement of oil filter cartridge		⊙	
	Check of intake air line			@
Every 400 Hours	Replacement of fuel filter cartridge			@
	Cleaning water separator			
Every 500 Hours	Removal of sediment in fuel tank			
	Cleaning of water jacket (cooler interior)			
	Replacement of fan belt			
Every year	Replacement of air cleaner element		*2	@
Every 800 Hours	Check of valve clearance		*3	
Every 1500 Hours	Check of fuel injection nozzle injection pressure		*3	@
Every 3000 Hours	Check of turbocharger		*3	@
	Check of injection pump		*3	@
Every two years	Change the cooler coolant (L.L.C.)			
	Replacement of cooler hoses and clamp bands			
	Replacement of fuel pipes and clamp bands		*3	@
	Replacement of intake air line		*4	@

IMPORTANT:

⊙ Must be performed after the first 50 hours of operation.

*1 Air cleaner should be cleaned more often in dusty conditions than in normal conditions.

*2 After 6 times of cleaning.

*3 Consult your local ALBOSAN Dealer for this service.

*4 Replace only if necessary.

- The items listed above (@ marked) are registered as emission related critical parts in the U.S EPA non-road emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the above instruction. Please see the Warranty Statement in detail.

5.1.1 Interval of Changing the Engine Oil

Models	Oil Pan Depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
All models	200 Hours	150 Hours
Initial	50 Hours	

- API service classification: Above CF-4 grade
 - Ambient temperature: below 35°C (95°F)
- * 90mm oil pan depth is optional.

5.1.2 Lubricating Oil

With strict emission control regulations now in effect, the CF-4 and CG-4 engine oils have been developed for use with low sulfur fuels, for On-Highway vehicle engines. When a Non-Road engine runs on high sulfur fuel, it is advisable to use a “CF, CD or CE” classification engine oil with a high Total Base Number (a minimum TBN of 10 is recommended). If CF-4 or CG-4 lubricating oil is used with a high sulfur fuel, replace the lubricating oil at shorter intervals.

Lubricating oil recommended when a low-sulfur or high sulfur fuel is employed.

Classification	Low sulfur	High sulfur	Remarks
CF	O	O	*TBN≥10
CF-4	O	X	
CG-4	O	X	
CH-4	O	X	
CI-4	O	X	

O: Recommendable
X: Not Recommendable

6. Periodic Service

6.1 Fuel

⚠ CAUTION : Fuel is flammable and can be dangerous. You should handle fuel with care.

To avoid personal injury:

- Do not mix gasoline or alcohol with diesel fuel. This mixture can cause an explosion.
- Be careful not to spill fuel during refueling. If fuel should spill, wipe it off at once, or it may cause a fire.
- Do not fail to stop the engine before refueling. Keep the engine away from the fire.
- Be sure to stop the engine while refueling or bleeding and when cleaning or changing fuel filter or fuel pipes. Do not smoke when working around the battery or when refueling.
- Check the above fuel systems at a well ventilated and wide place.
- When fuel and lubricant are spilled, refuel after letting the engine cool off.
- Always keep spilled fuel and lubricant away from engine.

6.1.1 Fuel Level Check and Refueling

1. Check to see that the fuel level is above the lower limit of the fuel level gauge.
2. If the fuel is too low, add fuel to the upper limit. Do not overfill.

Flash point °C (°F)	Water and Sediment, Volume %	Carbon Residue on, 10 percent Residuam, %	Ash, weight %
Min	Max	Max	Max
52 (125)	0.05	0.35	0.01

Distillation Temperatures, °C (°F) %90 Point		Viscosity Kinematic cSt or mm ² /s (at 40°C)		Viscosity (Saybolt) SUS (at 37,8°C (100°F))	
Min	Max	Min	Min	Max	Min
282 (540)	338 (640)	1.9	4.1	32.6	40.1

- Cetane Rating: the minimum recommended Fuel Cetane Rating is 45.

Sulfur, weight, %	Copper Strip Corrosion	Cetane Number
Max	Max	Min
0.50	No. 3	40

IMPORTANT:

- Be sure to use a strainer when filling the fuel tank, or dirt or sand in the fuel may cause trouble in the fuel injection pump.
- For fuel, always use diesel fuel. You are required not to use alternative fuel, because its quality is unknown or it may be inferior in quality. Kerosene, which is very low in cetane rating, adversely affects the engine. Diesel fuel differs in grades depending on the temperature.
- Be careful not to let the fuel tank become empty, or air can enter the fuel system, necessitating bleeding before next engine start.

Diesel fuel specification type and sulfur content % ppm used, must be compliant with all applicable emission regulations for the area in which the engine is operated. Use of diesel fuel with sulfur content less than 0.10 % 1000 ppm is strongly recommended.

6.1.2 Air Bleeding the Fuel System

CAUTION : To avoid personal injury:

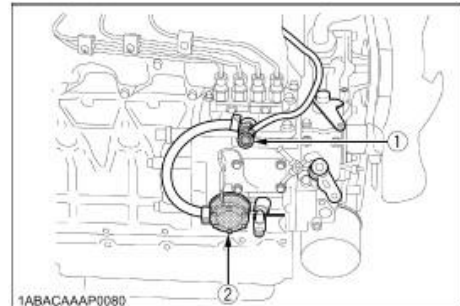
- Do not bleed a hot engine as this could cause fuel to spill onto a hot exhaust manifold creating a danger of fire.

Air bleeding of the fuel system is required if;

- After the fuel filter and pipes have been detached and refitted
- After the fuel tank has become empty; or
- Before the engine is to be used after a long storage.

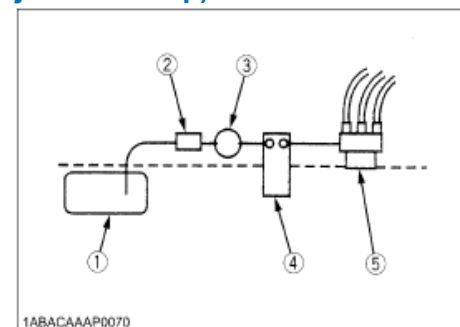
6.1.2.1 Procedure A (Gravity Feed Fuel Tanks Only)

1. Fill the fuel tank to the fullest extent. Open the fuel filter lever.
2. Open the joint bolt on top of the fuel injection pump.
3. Turn the engine, continue it for about 10 seconds, then stop it, or move the fuel feed pump lever by hand (optional).
4. Close the joint bolt on top of the fuel injection pump.



6.1.2.2 Procedure B (Fuel Tanks Lower Than Injection Pump)

1. For fuel tanks that are lower than the injection pump. The fuel system must be pressurized by the fuel system electric fuel pump.
2. If an electric fuel pump is not used, you must manually actuate the pump by lever to bleed.
3. The primary fuel filter (5) must be on the pressure side of the pump if the fuel tank is lower than the injection pump.
4. To bleed follow (2) through (4) above.



IMPORTANT:

Tighten air vent plug of the fuel injection pump except when bleeding, or it may stop the engine suddenly.

- (1) Fuel tank below injection pump
- (2) Pre-filter
- (3) Electric or Mechanical pump
- (4) Main Filter
- (5) Injection pump

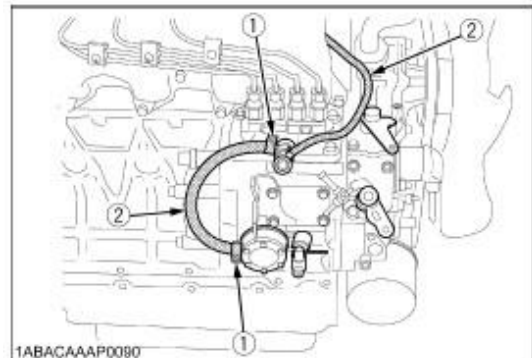
6.1.3 Checking the Fuel Pipes

CAUTION : To avoid personal injury;

- Check or replace the fuel pipes after stopping the engine. Broken fuel pipes can cause fire.

Check the fuel pipes every 50 hours of operation. When if;

1. If the clamp band is loose, apply oil to the screw of the band, and tighten the band securely.
2. If the fuel pipes, made of rubber, became worn out, replace them and clamp bands every 2 years.
3. If the fuel pipes and clamp bands are found worn or damaged before 2 years' time, replace or repair them at once.
4. After replacement of the pipes and bands, air-bleed the fuel system.



(1) Clamp band
(2) Fuel pipe

IMPORTANT:

- When the fuel pipes are not installed, plug them at both ends with clean cloth or paper to prevent dirt from entering. Dirt in the pipes can cause fuel injection pump malfunction.

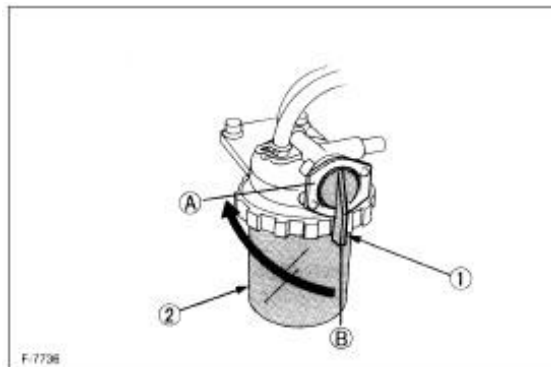
6.1.4 Cleaning the Fuel Filter Pot

Every 100 hours of operation, clean the fuel filter in a clean place to prevent dust intrusion.

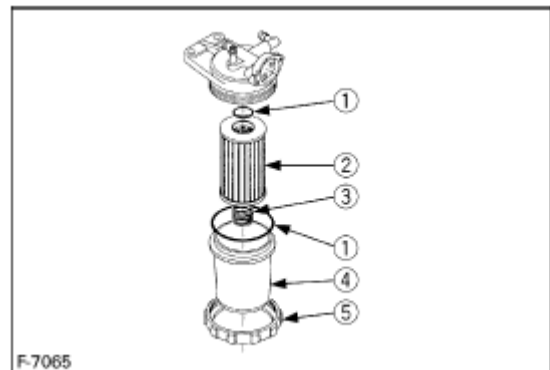
1. Close the fuel filter lever.
2. Remove the top cap, and rinse the inside with diesel fuel.
3. Take out the element, and rinse it with diesel fuel.
4. After cleaning, reinstall the fuel filter, keeping out of dust and dirt.
5. Air-bleed the injection pump.

IMPORTANT:

- Entrance of dust and dirt can cause a malfunction of the fuel injection pump and the injection nozzle. Wash the fuel filter cup periodically.



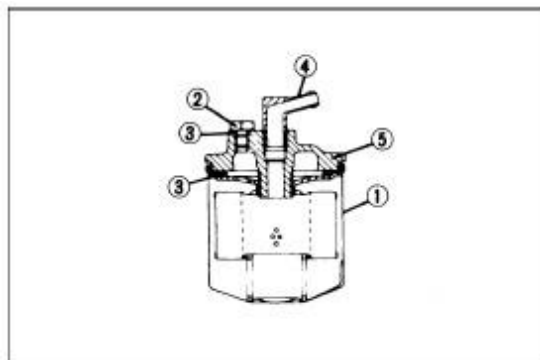
(1) Fuel filter lever
(2) Fuel filter pot
(A) "OFF"
(B) "ON"



(1) O ring
(2) Filter element
(3) Spring
(4) Filter bowl
(5) Screw ring

6.1.5 Fuel Filter Cartridge Replacement

1. Replace the fuel filter cartridge with a new one every 400 operating hours.
2. Apply fuel oil thinly over the gasket and tighten the cartridge into position by hand-tightening only.
3. Finally, vent the air.



IMPORTANT:

- Replace the fuel filter cartridge periodically to prevent wear of the fuel injection pump plunger or the injection nozzle, due to dirt in the fuel.

- (1) Fuel filter cartridge
(2) Air vent plug
(3) O ring
(4) Pipe joint
(5) Cover

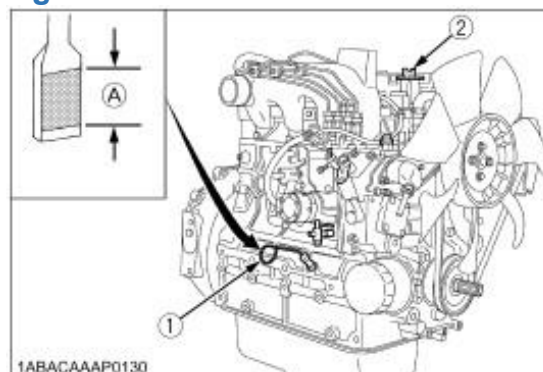
6.2 Engine Oil

⚠ CAUTION : To avoid personal injury:

- Be sure to stop the engine before checking and changing the engine oil and the oil filter cartridge.
- Do not touch muffler or exhaust pipes while they are hot; severe burns could result. Always stop the engine and allow it to cool before conducting inspections, maintenance, or for a cleaning procedure.
- Contact with engine oil can damage your skin. Put on gloves when using engine oil. If you come in contact with engine oil, wash it off immediately.

6.2.1 Checking of Oil Level and Adding Engine Oil

1. Check the engine oil level before starting or more than 5 minutes after stopping the engine.
2. Remove the oil level gauge, wipe it clean and reinstall it.
3. Take the oil level gauge out again, and check the oil level.
4. If the oil level is too low, remove the oil filler plug, and add new oil to the prescribed level.
5. After adding oil, wait more than 5 minutes and check the oil level again. It takes some time for the oil to drain down to the oil pan.



- (1) Oil filler plug
(2) Oil level gauge

[Lower end of oil level gauge]
(A) Engine oil level within this range is proper.

Models	Oil Pan Depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
V2403-M-E3	9.5 L	7.6 L
V2403-M-T-E3	(2.51 US gal.)	(2.01 US gal.)

*90 mm (3.54 in.) oil pan depth is optional.
Oil quantities shown are for Standard Oil pans

IMPORTANT:

- Engine oil should be MIL-L-2104C or have properties of API classification CF or higher. Change the type of the engine oil according to the ambient temperature.

Above 25°C (77°F)	10W-30 or 10W-40 or 15W-40
0°C to 25°C (32°F to 77°F)	10W-30 or 10W-40 or 15W-40
Below 0°C (32°F)	10W-30 or 10W-40

- Use of the following oil not only disallows the engine from performing well in low temperatures until it warms up sufficiently but may also lead to excessive engine wear or engine seizure.
 - Oil with viscosity higher than 10W-30
 - Oil not recommended by KUBOTA
- When using oil of different brands from the previous one, be sure to drain all the previous oil before adding the new engine oil.

6.2.2 Changing Engine Oil**CAUTION : To avoid personal injury;**

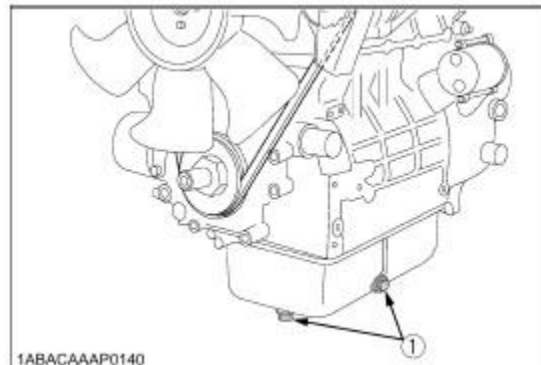
- Be sure to stop the engine before draining engine oil.
- When draining engine oil, place some container underneath the engine and dispose it according to local regulations.
- Do not drain oil after running the engine. Allow engine to cool down sufficiently.

1. Change oil after the initial 50 hours of operation and every 200 hours.
(See below table.)

Models	*Oil Pan Depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
All Models	200 Hours	150 Hours
Initial	50 Hours	

* 90 mm (3.54 in.) oil pan depth is optional.

2. Remove the drain plug at the bottom of the engine, and drain all the old oil. Drain oil will drain easier when the oil is warm.
3. Add new engine oil up to the upper limit of the oil level gauge.



(1) Oil drain plug

6.2.3 Replacing the Oil Filter Cartridge

CAUTION : To avoid personal injury;

- Be sure to stop the engine before changing the oil filter cartridge.
- Allow engine to cool down sufficiently, oil can be hot and cause burns.
- 1. Replace the oil filter cartridge after the initial 50 hours of operation and every 200 hours thereafter.

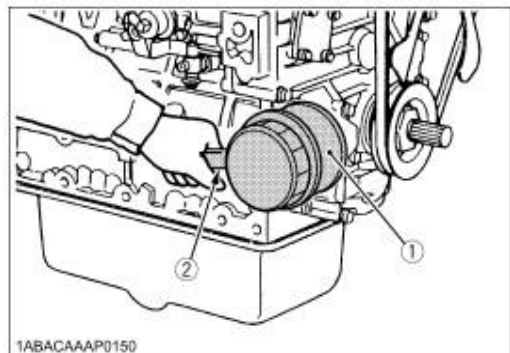
* 90 mm (3.54 in.) oil pan depth is optional.

2. Remove the old oil filter cartridge with a filter wrench.
3. Apply a film of oil to the gasket for the new cartridge.
4. Screw in the cartridge by hand. When the gasket contacts the seal surface, tighten the cartridge enough by hand. Because, if you tighten the cartridge with a wrench, it will be tightened too much.
5. After the new cartridge has been replaced, the engine oil level normally decreases a little. Thus, run the engine for a while and check for oil leaks through the seal before checking the engine oil level. Add oil if necessary.

NOTE:

- Wipe off any oil sticking to the machine completely.

Models	*Oil pan depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
All models	200 Hours	150 Hours
Initial	50 Hours	



- (1) Oil filter cartridge
(2) Remove with a filter wrench
(Tighten with your hand)

6.3 Cooler

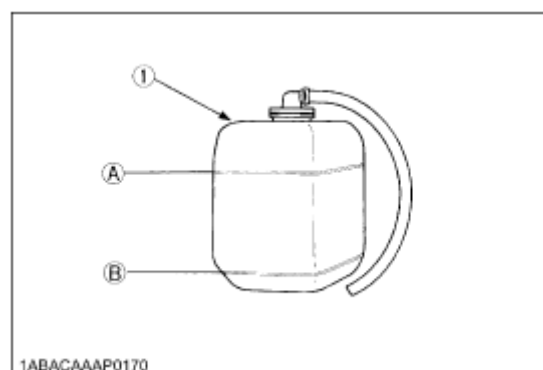
Fully filled coolant before starting the engine is sufficient for only one day of operation. Make it a rule to check the coolant level before each operation.

CAUTION : To avoid personal injuries;

- Do not stop the engine suddenly, stop it after about 5 minutes of unloaded idling.
- Work only after letting the engine and radiator cool off completely (more than 30 minutes after it has been stopped).
- Do not remove the cooler cap while coolant is hot. When cool to the touch, rotate cap to the first stop to allow excess pressure to escape. Then remove cap completely. If overheats should occur, steam may gush out from the cooler or recovery tank; severe burns could result.

6.3.1 Checking Coolant Level and Adding Coolant

1. Remove the cooler cap, after the engine has completely cooled, and check to see that coolant reaches the supply port.
2. Check the coolant level of the recovery tank. When it is between the "FULL" and "LOW" marks, the coolant will last for one day's work.
3. When the coolant level drops due to evaporation, add water only up to the full level.

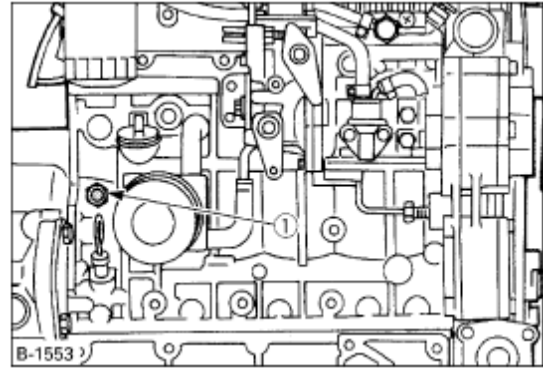


(1) Recovery tank

(A) "FULL"
(B) "LOW "

IMPORTANT:

- If the cooler cap has to be removed, follow the caution and securely retighten the cap.
- If coolant should be leak, consult your local ALBOSAN dealer.
- Make sure that muddy or sea water does not enter the cooler.
- Use clean, fresh water and 50% anti-freeze to fill the recovery tank.
- Do not refill recovery tank with coolant over the "FULL" level mark.
- Be sure to close the cooler cap securely. If the cap is loose or improperly closed, coolant may leak out and decrease quickly.

**6.3.2 Changing Coolant**

1. To drain coolant, always open drain cocks and simultaneously open the cooler cap as well. With the cooler cap closed, a complete drain of water is impossible.
2. Remove the overflow pipe of the cooler pressure cap to drain the recovery tank.
3. Prescribed coolant volume;
4. An improperly tightened cooler cap or a gap between the cap and the seat quickens loss of coolant.
5. Check and clean the plug threads and surface and the pucking thims of the water drain plug to prevent dirt and debris from entering the engine.
6. Coolant:

Model	Quantity
V2403-M-E3 V2403-M-T-E3	8.4 L (2.22 US gal.)

Season	Coolant
Summer	Pure water and cooler cleaner
Winter or all seasons (when the temperature falls below the value)	Pure water and antifreeze (See "Anti-freeze")

6.3.3 Remedies for Quick Decrease of Coolant

1. Check the tightness of the fan belt. If loose, tighten it securely.
2. Check the internal blockage in the cooler hose. If scale forms in the hose, clean with the scale inhibitor or its equivalent.

6.3.4 Checking Cooler Hoses and Clamp**CAUTION : To avoid personal injuries;**

- Be sure to check the cooler hoses and clamp bands regularly. If the cooler hose is damaged, coolant leakage and overheating may occur, or severe burns may occur.
- Check to see if cooler hoses are properly fixed every 200 hours of operation or 6 months, whichever comes first.
1. If clamp bans are loose or water leaks, tighten clamp bands securely.
 2. Replace hoses and tighten clamp bands securely, if cooler hoses are swollen, hardened or cracked.

6.3.5 Precaution at Overheating

If the coolant temperature is close to or above the boiling point, that is, in the event of “overheating”, take the following precautions. Take these precautions when the engine sound stimulator gives a warning or when the warning light is on.

1. Stop the engine in a safe place and leave it idle.
2. Do not suddenly stop the engine. Stop it after about 5 minutes of idle.
3. If the engine faints after about 5 minutes of no load operation, immediately step away from the machine. Do not open the hood or any other parts.
4. Stay away from the machine for another 10 minutes or as long as the steam output continues.
5. After making sure that there is no danger condition such as burns, eliminate the cause of overheating by looking at the “Troubleshooting” section in the manual. Then start the engine again.

6.3.6 Antifreeze



CAUTION : To avoid personal injury;

- When using anti-freeze, put on some protection such as rubber gloves (Anti-freeze contains poison.).
- If should drink anti-freeze, throw up at once and take medical attention.
- When anti-freeze comes in contact with the skin or clothing, wash it off immediately.
- Do not mix different types of anti-freeze. The mixture can produce chemical reaction causing harmful substances.
- Anti-freeze is extremely flammable and explosive under certain conditions. Keep fire and children away from anti-freeze.
- When draining fluids from the engine, place some container underneath the engine body.
- Do not pour waste onto the grounds, down a drain, or into any water source.
- Also, observe the relevant environmental protection regulations when disposing of anti-freeze.

Always use a 50/50 mix of long life coolant and clean soft water in ALBOSAN marine engines.

1. Long-life coolant (hereafter LLC) comes in several types. Use ethylene glycol (EG) type for this engine.
2. Before employing LLC-mixed cooling water, flush the radiator with fresh water. Repeat this procedure 2 or 3 times to clean up the radiator and engine block from inside.
3. Mixing the LLC:
 - Premix 50% LLC with 50% clean soft water. When mixing, stir it up well, and then fill into the radiator.
4. The procedure for the mixing of water and antifreeze differs according to the make of the antifreeze. Refer to SAE J1034 standard, more specifically also to SAE J814c.
5. Adding the LLC
 - Add only water if the coolant level reduces in the cooling system by evaporation.
 - If there is a coolant leak, add the LLC of the same manufacturer and type in the same coolant percentage.
** Never add any long-life coolant of different manufacturer. (Different brands may have different additive components, and the engine may fail to perform as specified.)
6. When the LLC is mixed, do not employ any radiator cleaning agent. The LLC contains anti-corrosive agent. If mixed with the cleaning agent, sludge may build up, adversely affecting the engine parts.
7. Kubota's genuine long-life coolant has a service life of 2 years. Be sure to change the coolant every 2 years.

NOTE:

- The above data represent industry standards that necessitate a minimum glycol content in the concentrated anti-freeze.

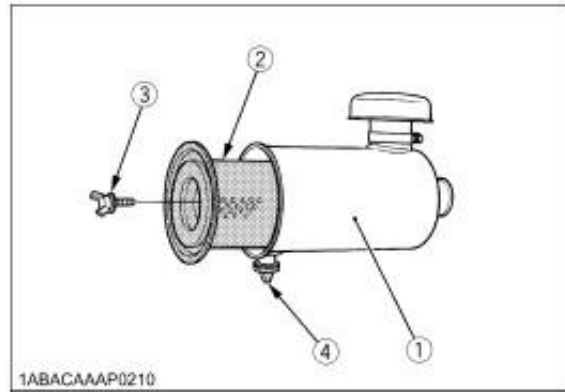
Vol % Anti-freeze	Freezing Point		Boiling Point	
	°C	°F	°C	°C
50	-37	-34	108	226

*At 1.013×10^5 Pa (760 mmHg) pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

6.4 Air Cleaner

Since the air cleaner employed on this engine is a dry type, never apply oil to it.

1. Open the evacuator valve once a week under ordinary conditions – or daily when used in a dusty place. This will get rid of large particles of dust and dirt.
2. Wipe the inside air cleaner clean with cloth if it is dirty or wet.
3. Avoid touching the primary element except when cleaning.
4. When dry dust adheres to the element, blow compressed air from the inside turning the element. Pressure of compressed air must be under 205 kPa (2.1 kgf/cm², 30psi)
5. Replace the element every year or every 6 cleanings.



- (1) Air cleaner body
- (2) Element
- (3) Wing bolt
- (4) Evacuator valve

IMPORTANT

- Make sure the wing bolt for the element is tight enough. If it is loose, dust and dirt may be sucked in, wearing down the cylinder liner and piston ring earlier and thereby resulting in poor power output.
- Do not over service the air cleaner element. Over servicing may cause dirt to enter the engine causing premature wear. Use the dust indicator as a guide on when to service.

6.4.1 Evacuator Valve

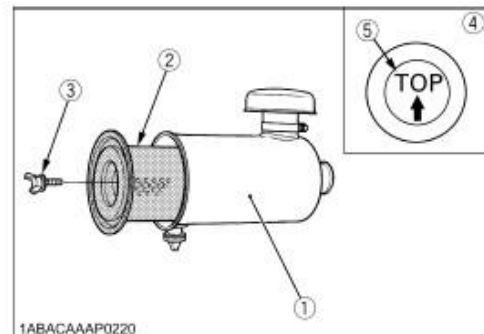
Open the evacuator valve once a week under ordinary conditions – or daily when used in a dusty place – to get rid of large particles of dust and dirt.

6.4.2 For the Air Cleaner With A Dust Cup (Optional)

Remove and clean out the dust cup before it becomes half full with dust; usually once a week, or even every day if the working surroundings are dusty. Install the air cleaner dust cup with "TOP" indicated on the rear of the cup in the up position. (However, it may be installed in either direction when the cover is placed at the lower part.)

IMPORTANT:

- If the dust cup is mounted incorrectly, dust or dirt does not collect in the cup, and direct attachments of the dust to the element will cause its lifetime to shorten to a great extent.

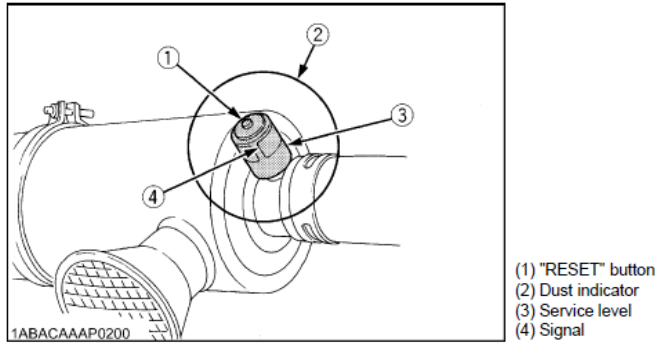


- (1) Air cleaner body
- (2) Element
- (3) Wing bolt
- (4) Dust cup
- (5) "TOP" mark

6.4.3 Dust Indicator (Optional)

If the red signal on the dust indicator attached to the air cleaner is visible, the air cleaner has reached the service level.

Clean the element immediately, and reset the signal with the "RESET" button.



6.5 Battery

⚠ CAUTION : To avoid personal injuries:

- Make sure that the battery electrolyte does not come into contact with your skin or clothing.
- Use eye protection and rubber gloves, as a dilute solution of sulfuric acid causes burns to the skin and punctures to the clothing. In such a case, immediately flush the contact area with plenty of water and seek medical attention.

Improper use of battery reduces service life and increases maintenance cost. With proper handling and proper maintenance procedures, you can get max. performance and the longest possible service life from the battery. If the battery charge level is low, the engine will run harder. Charge the battery at the first opportunity without delating it.

6.5.1 Battery Charge

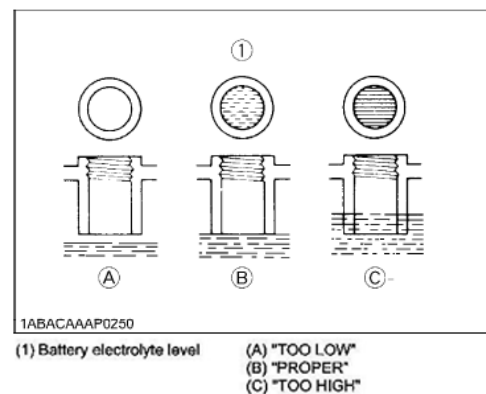
⚠ CAUTION : The battery has two types: refillable and non-refillable.

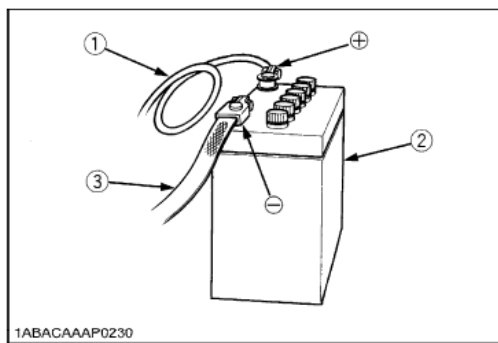
- For a refillable type battery, follow the instructions below. Do not use or refill the battery whose liquid level is below the lower level mark. Otherwise, the battery parts may deteriorate prematurely, which may shorten the service life of the battery or cause an explosion. Immediately add pure water until the liquid level is between the UPPER and LOWER marks.

⚠ CAUTION : To avoid personal injuries;

- Hydrogen and oxygen gases in the battery are extremely explosive when starting the battery. Always keep bare flames and sparks away from the battery, especially when charging the battery.
- Remove the battery air intake plugs when charging the battery.
- Start at the negative terminal when disconnecting the battery cables and at the positive terminal when reconnecting the cables.
- Do not check the battery charging status by placing a metal object between the terminals. Use a voltmeter or hydrometer.

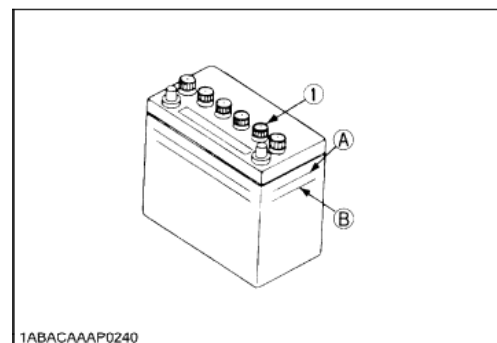
1. Make sure that each electrolyte level is below the vents, if necessary, add only distilled water in a well-ventilated environment.
2. To slow charge the battery, connect the positive terminal of the charger to the positive terminal of the battery and the negative, then charge it normally.
3. Fast charging process charges the battery at a high speed and in a short time. But this is only for emergencies.
4. Charge the battery as early as possible, otherwise the battery life will be extremely short.
5. When replacing an old battery with a new one, use a battery with the same specifications as on page 38-39.





1ABACAAAP0230

- (1) Thick cable red(+)
- (2) Battery case
- (3) Earth cable black(-)



1ABACAAAP0240

- (1) Plug
- (A) "HIGHEST LEVEL"
- (B) "LOWEST LEVEL"

IMPORTANT:

- Connect the charger positive terminal to the battery positive terminal, and negative to the negative.
- When disconnecting the cable from the battery, start with the negative terminal first. When connecting the cable to the battery, start with the positive terminal first. If reversed, the contact of tools on the battery may cause a short circuit, damages and/or injuries.

6.5.2 Long-term Storage Instructions

1. When storing the engine for long periods of time, remove the battery, adjust the electrolyte to the proper level, and store in a dry and dark place.
2. The battery naturally discharges while it is stored. Recharge it once a month in summer, and every 2 months in winter.

6.6 Electrical Wiring

⚠ CAUTION : To avoid personal injuries;

- Shorting of electric cable or wiring may cause a fire.
 - Check to see if electric cables and wiring are swollen, hardened or cracked.
 - Keep dust and water away from all power connections.
- Loose wiring terminal parts, make bad connections. Be sure to repair them before starting the engine.

6.7 Fan Belt

6.7.1 Adjusting Fan Belt Tension

⚠ CAUTION : To avoid personal injuries;

- Be sure to stop the engine and remove the key before checking the belt tension.
- Be sure to reinstall the detached safety shield after maintenance or checking.

1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to belt between the pulleys.
3. If tension is incorrect, loosen the alternator mounting bolts and, using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within acceptable limits.

**Proper fan
belt tension**

A deflection of between 7 to 9 mm (0.28 to 0.35 in.) when the belt is pressed in the middle of the span.

4. Replace fan belt if it is damaged.

IMPORTANT

- If belt is loosen or damaged and the fan is damaged, it could result in overheats or insufficient charging. Correct or replace the belt.

7. Carriage and Storage

7.1 Carriage

 **CAUTION : To avoid personal injuries:**

- Fix the engine securely not to fall during operation.
 - Do not stand near or under the engine while carrying it.
 - The engine is heavy. In handling it, be very alert not to get your hands and body caught in.
1. Use carrier such as crane when carrying the engine or hurt your waist and yourself. Support the engine securely with rope not to fall while carrying it.
 2. When lifting the engine, put the hook securely to metal fittings attached to the engine. Use strong hook and fittings enough to hang the engine.

7.2 Storage

 **CAUTION : To avoid personal injuries:**

- Do not clean the machine with engine running.
- To avoid the danger of exhaust fume poisoning, do not operate the engine in a closed building without proper ventilation.
- When storing the engine just after running, let the engine cool off.

Before storing the engine for more than a few months, remove any dirt on the machine, and:

1. Drain the coolant from cooling system. Leave the cock open. Hang a note written "No water" on the pressure cap. Since water may freeze when the temperature drops below 0°C (32°F), it is very important that no water is left in the machine.
2. Remove dirty engine oil, fill with new oil and run the engine about 5 minutes to let the oil penetrate to all parts.
3. Check all the bolts and nuts, and tighten if necessary.
4. Remove the battery from the engine, adjust the electrolyte level, and recharge it. Store the battery in a dry and dark place.
5. When the engine is not used for a long period of time, run it for about 5 minutes under no load every 2 to 3 months to keep it free from rust. If the engine is stored without any running, moisture in the air may condense into dew over the sliding parts of the engine, resulting in rust there.
6. If you forget to run the engine for longer than 5 to 6 months, apply enough engine oil to the valve guide and valve stem seal and make sure the valve works smoothly before starting the engine.
7. Store the engine in flat place and remove the key from engine.
8. Do not store the engine in a place where has flammable materials such as dry grass or straw.
9. When covering the engine for storage, let engine and muffler cool off completely.
10. Operate the engine after checking and repairing damaged wirings or pipes, and clearing flammable materials carried by mouse.

8. Troubleshooting

If the engine does not function properly, use the following chart to identify and correct the cause.

➤ **When it is difficult to start the engine.**

Cause	Countermeasures
❖ Fuel is thick and doesn't flow.	✓ Check the fuel tank and fuel filter. ✓ Remove water, dirt and other impurities. ✓ As all fuel will be filtered by the filter, if there should be water or other foreign matters on the filter, clean the filter with kerosene.
❖ Air or water mixed in fuel system	✓ If air is in the fuel filter or injection lines, the fuel pump will not work properly. ✓ To attain proper fuel injection pressure, check carefully for loosened fuel line coupling, loose cap nut, etc. ✓ Loosen joint bolt stop fuel filter and air vent screws of fuel injection pump to eliminate all the air in the fuel system.
❖ Valve clearance is not as specified	✓ Adjust valve clearance to 0.23 to 0.27mm (0.009 to 0.011 in.) when the engine is cold.
❖ Leaking valve	✓ Grind valve.
❖ Fuel injection timing is not as specified	✓ Check injection timing. ✓ The injection timing 0.105 rad before top dead center
❖ Low compression	✓ Bad valve or excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts.
❖ Battery is discharged and the engine will not crank	✓ Charge battery. ✓ In winter, always remove battery from machine, charge fully and keep indoors. Install in machine at time of use.

NOTE:

➤ If the cause of the problem cannot be determined, please contact your ALBOSAN service.

➤ **When output is insufficient**

Cause	Countermeasures
❖ Compression is insufficient. Leaking valves	✓ Bad valve and excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts. ✓ Grind valves.
❖ Fuel is insufficient	✓ Check the fuel system.
❖ Overheating of moving parts	✓ Check lubricating oil system. ✓ Check to see if lubricating oil filter is working properly. ✓ Filter element deposited with impurities would cause poor lubrication. Change element. ✓ Check the clearance of bearing are within factory specs. ✓ Check injection timing. ✓ Check timing. ✓ 0.105 rad before top dead center.
❖ Valve clearance is not as specified.	✓ Adjust to proper valve clearance of 0.23 to 0.27 mm (0.009 to 0.011 in.) with engine cold.
❖ Air cleaner is dirty	✓ Clean the element every 100 hours of operation.
❖ Fuel injection pressure is not as specified.	[V3600-E3, V3600-T-E3, V3300-E3BG, V3600-T-E3BG] ✓ 13.93 MPa (142 kgf/cm²; 2020 psi) [V3800-DI-T-E3] ✓ Check the injection pressure 1. Stage 18,6 MPa (190 kgf/cm²; 2702 psi) 2. Stage 22,6 MPa (230 kgf/cm²; 3271 psi)
❖ Injection pump wear	✓ Do not use poor quality fuel as it will cause wear of the pump. Only use No.2-D diesel fuel. ✓ Check the fuel injection pump element and delivery valve assembly and replace as necessary

NOTE:

- If the cause of the problem cannot be determined, please contact your Albosan service.

➤ **When Engine Suddenly Stops**

Cause	Countermeasures
❖ Lack of fuel	✓ Check the fuel tank and refill the fuel, if necessary. ✓ Also check the fuel system for air or leaks
❖ Bad nozzle	✓ If necessary, replace with a new nozzle.
❖ Moving parts are overheated due to shortage of lubrication oil or improper lubrication.	✓ Check amount of engine oil with oil level gauge. ✓ Check lubricating system. ✓ At every oil change, oil filter cartridge should be replaced. ✓ Check to see if the engine bearing clearances is within factory specs.

➤ **When color of exhaust is especially bad**

Cause	Countermeasures
❖ Fuel governing device bad	✓ Contact dealer for repairs.
❖ Fuel is extremely poor quality	✓ Select good quality fuel. Use No. 2-D diesel fuel only.
❖ Nozzle is bad	✓ If necessary, replace with new nozzle.
❖ Combustion is incomplete	✓ Cause is poor atomization, improper injection timing, etc. Because of trouble in injection system or in poor valve adjustment, or compression leakage, poor compression, etc. Check for the cause.

NOTE:

- If the cause of the problem cannot be determined, please contact your Albosan service.

➤ **When engine must be stopped immediately**

Cause	Countermeasures
❖ Engine revolution suddenly decreases or increases.	✓ Check the adjustments, injection timing and the fuel system.
❖ Unusual sound is heard suddenly	✓ Check all moving parts carefully.
❖ Color of exhaust suddenly turns dark	✓ Check the fuel injection system, especially the fuel injection nozzle.
❖ Bearing parts are overheated	✓ Check the lubricating system.
❖ Oil lamp lights up during operation	✓ Check the lubricating system. ✓ Check if the engine bearing clearances are within factory specs. ✓ Check the function of the relieve valve in the lubricating system. ✓ Check pressure switch. ✓ Check filter base gasket.

➤ **When engine overheats**

Cause	Countermeasures
❖ Engine oil insufficient	✓ Check oil level. Replenish oil as required.
❖ Fan belt broken or elongated	✓ Change belt or adjust belt tension.
❖ Coolant insufficient	✓ Replenish coolant.
❖ Excessive concentration of antifreeze	✓ Add water only or change to coolant with the specified mixing ratio.
❖ Cooler dirty or clogged	✓ Check, clean heat exchanger.
❖ Fan belt	✓ Replace fan belt.
❖ Thermostat defective	✓ Check thermostat and replace if necessary.
❖ Temperature gauge or sensor defective	✓ Check temperature with thermometer and replace if necessary.
❖ Overload running	✓ Reduce load.
❖ Head gasket defective or water leakage	✓ Replace parts.
❖ Incorrect injection timing	✓ Adjust to proper timing.
❖ Unsuitable fuel used	✓ Use the specified fuel.

NOTE:

➤ If the cause of the problem cannot be determined, please contact your Albosan service.

9. Specifications

Model	AB149 (V2403-M)	
Type	–	Vertical, water-cooled, 4-cycle diesel
Number of cylinders	–	4
Bore and stroke	mm (in.)	87 x 102.4 (3.43 x 4.04)
Total displacement	L (cu.in.)	2.434 (148.53)
Combustion Type	–	Spherical type (E-TVCS)
SAE NET Intermittent H.P. (SAEJ1349)	kW/min ⁻¹ (rpm) (HP/min ⁻¹ (rpm))	33.9 / 2700 (45.4 / 2700)
SAE NET Continuous H.P. (SAEJ1349)	kW/min ⁻¹ (rpm) (HP/min ⁻¹ (rpm))	29.4 / 2700 (39.4 / 2700)
SAE Standby H.P. (SAEJ1349)	kW/min ⁻¹ (rpm) (HP/min ⁻¹ (rpm))	
Maximum bare speed	min ⁻¹ (rpm)	2900
Maximum bare idling speed	min ⁻¹ (rpm)	750 - 850
Order of firing	–	1-3-4-2
Direction of rotating	–	Counter-clockwise (viewed from flywheel side)
Injection pump	–	Bosch type mini pump
Injection pressure	MPa (kgf/cm ² , psi)	13.73 (140, 1991)
Injection timing (Before TDC)	–	0.30 rad (17.25)
Compression ratio	–	23.2
Fuel	–	Diesel Fuel No.2-D (ASTM D975)
Lubricant (API classification)	–	Above CF grade
Dimension	mm (in.) (length x width x height)	670.9 x 499.0 x 684.0 (26.4 x 19.8 x 26.9)
Dry weight	Kg (lbs.)	184.0 (405.7)
Starting system	–	Cell starter (with glow plug)
Starting motor	–	12 V, 2.0 kW
Charging generator	–	12 V, 480 W
Recommended battery capacity	–	12 V, 100 to 120 AH

NOTE:

- Specifications are subject to change without notice.

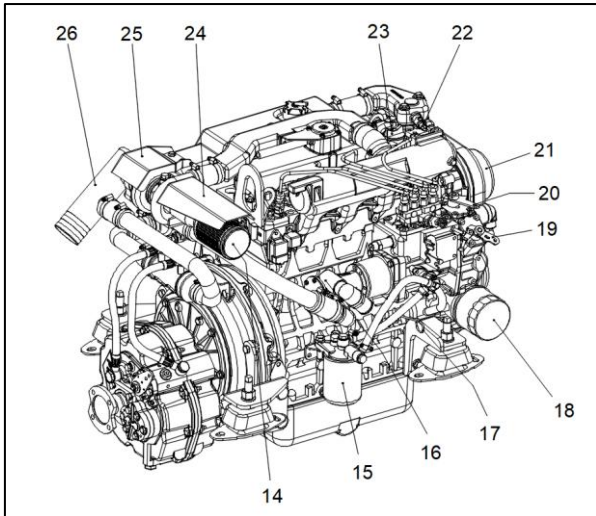
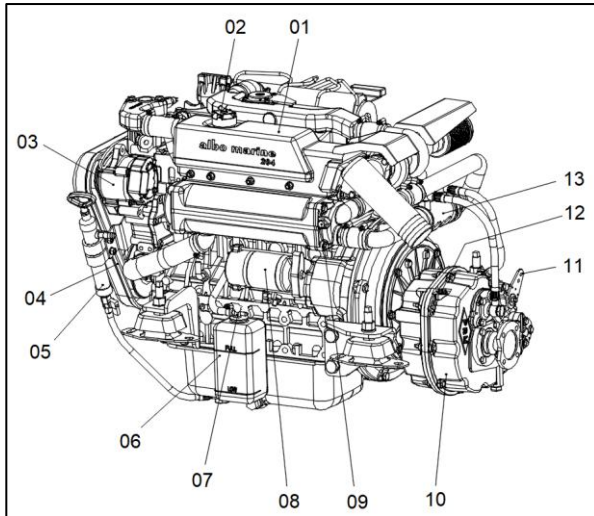
Model	AB159 (V2403-M-T)	
Type	–	Vertical, water-cooled, 4-cycle diesel
Number of cylinders	–	4
Bore and stroke	mm (in.)	87 x 102.4 (3.43 x 4.04)
Total displacement	L (cu.in.)	2.434 (148.53)
Combustion Type	–	Spherical type (E-TVCS)
SAE NET Intermittent H.P. (SAEJ1349)	kW/min ⁻¹ (rpm) (HP/min ⁻¹ (rpm))	41.2 / 2700 (55.2 / 2700)
SAE NET Continuous H.P. (SAEJ1349)	kW/min ⁻¹ (rpm) (HP/min ⁻¹ (rpm))	35.8 / 2700 (47.9 / 2700)
SAE Standby H.P. (SAEJ1349)	kW/min ⁻¹ (rpm) (HP/min ⁻¹ (rpm))	
Maximum bare speed	min ⁻¹ (rpm)	2950
Maximum bare idling speed	min ⁻¹ (rpm)	850 - 950
Order of firing	–	1-3-4-2
Direction of rotating	–	Counter-clockwise (viewed from flywheel side)
Injection pump	–	Bosch type mini pump
Injection pressure	MPa (kgf/cm ² , psi)	13.73 (140, 1991)
Injection timing (Before TDC)	–	0.16 rad (9.25)
Compression ratio	–	22.5
Fuel	–	Diesel Fuel No.2-D (ASTM D975)
Lubricant (API classification)	–	Above CF grade
Dimension	mm (in.) (length x width x height)	670.9 x 499.0 x 724.6 (26.4 x 19.8 x 28.5)
Dry weight	Kg (lbs.)	188.0 (414.5)
Starting system	–	Cell starter (with glow plug)
Starting motor	–	12 V, 2.0 kW
Charging generator	–	12 V, 480 W
Recommended battery capacity	–	12 V, 100 to 120 AH

NOTE:

- Specifications are subject to change without notice.

10. Service Points

AB149 – AB159 Service Points



1. Cooler (Heat exchanger)
2. Water Filler Cap
3. Alternator
4. Fan Belt
5. Manual Oil Pump
6. Expansion Tank
7. Expansion Tank Cover
8. Starter Engine
9. Zinc Anode
10. Marine Gearbox
11. Speed Control Lever
12. Oil Filling Plug
13. M/G Oil Cooler

14. Air Filter
15. Fuel Filter
16. Sea Water Pump
17. Oil Stick
18. Oil Filter
19. Engine Throttle Lever
20. Engine Stop Lever
21. Fan Belt Cover
22. Engine Temperature Sensor
23. Oil Filling Plug
24. Air Filter Cover
25. Exhaust Cover
26. Exhaust

11. Spanner Torque Settings

11.1 Bolt and nut compression torques for general use

	Measure x Step	kgf.m	ft-lbs.	N – m
M6 (7T): 6 mm (0.24 in.)	-	1.0 – 1.15	7.2 – 8.3	9.8 – 11.3
M8 (7T): 8 mm (0.31 in.)	-	2.4 – 2.8	17.4 – 20.3	23.5 – 27.5
M10 (7T): 10 mm (0.39 in.)	-	5.0 – 5.7	36.2 – 41.2	49.0 – 55.9
M12 (7T): 12 mm (0.47 in.)	-	7.9 – 9.2	57.1 – 66.5	77.5 – 90.5

11.2 Bolt and nut compression torques for special use

	Measure x Step	kgf.m	ft – lbs.	N – m
Head bolt	M8 x 1.25	3.8 – 4.3	27.5 – 31.1	37.3 – 42.2
Anchor bolt	M7 x 0.75	2.7 – 3.1	19.5 – 22.4	26.5 – 30.4
Flywheel bolt	M10 x 1.25	5.5 – 6.0	39.8 – 43.4	53.9 – 58.8
Bearing sleeve bolt – 1	M6 x 1.0	1.3 – 1.6	9.4 – 11.6	12.7 – 15.7
Bearing sleeve bolt – 2	M7 x 1.0	2.7 – 3.1	19.5 – 22.4	26.5 – 30.4
Injector body assembly	M20 x 1.5	5.0 – 7.0	36.2 – 50.6	49.0 – 68.6
Rocker cap blind nut	M6 x 1.0	0.4 – 0.6	2.9 – 4.3	3.9 – 5.9
Glow plug	M8 x 1.0	0.8 – 1.5	5.8 – 10.8	7.8 – 14.7
Oil switch	PT 1/8	1.5 – 2.0	10.8 – 14.5	14.7 – 19.6
Rocker arm support nut	M6 x 1.0	1.0 – 1.15	7.2 – 8.3	9.8 – 11.3
Gear shaft bolt	M6 x 1.0	1.0 – 1.15	7.2 – 8.3	9.8 – 11.3

12. Installation Recommendations

The installation details here are the basics to help with the installation. It is impossible to offer precise explanations due to the large variety in marine vehicles. Albosan therefore assumes no responsibility for any damage or injury that may occur during the installation of an Albosan Marine engine by following this guide information.

12.1 Installation of the Engine

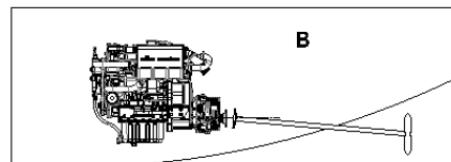
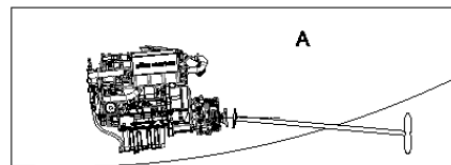
In order for the engine to be operated without Oscillation, the engine must be built on a solid ground that extends as far as possible forward and backward, solidly supported as an important part of the boat.

A flexible connection should be used. Flexible connections do not allow bad accelerations. The opposite surfaces of the gearbox and tail shaft should be checked for alignment. It should be parallel-aligned and concentric at 0.0005" (0.127 mm).

12.2 Alignment

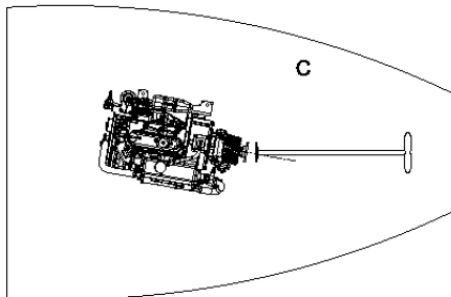
Alignment must be checked against parallel (A) and co-central (B) misalignments using a series of thickness scales. To ensure correct alignment, flexible bearings must be adjusted until alignment is achieved, and bearings must be fixed in the appropriate position.

Alignment should be checked again after the bearings are fixed. Now the connection can be connected according to the information that comes with it.

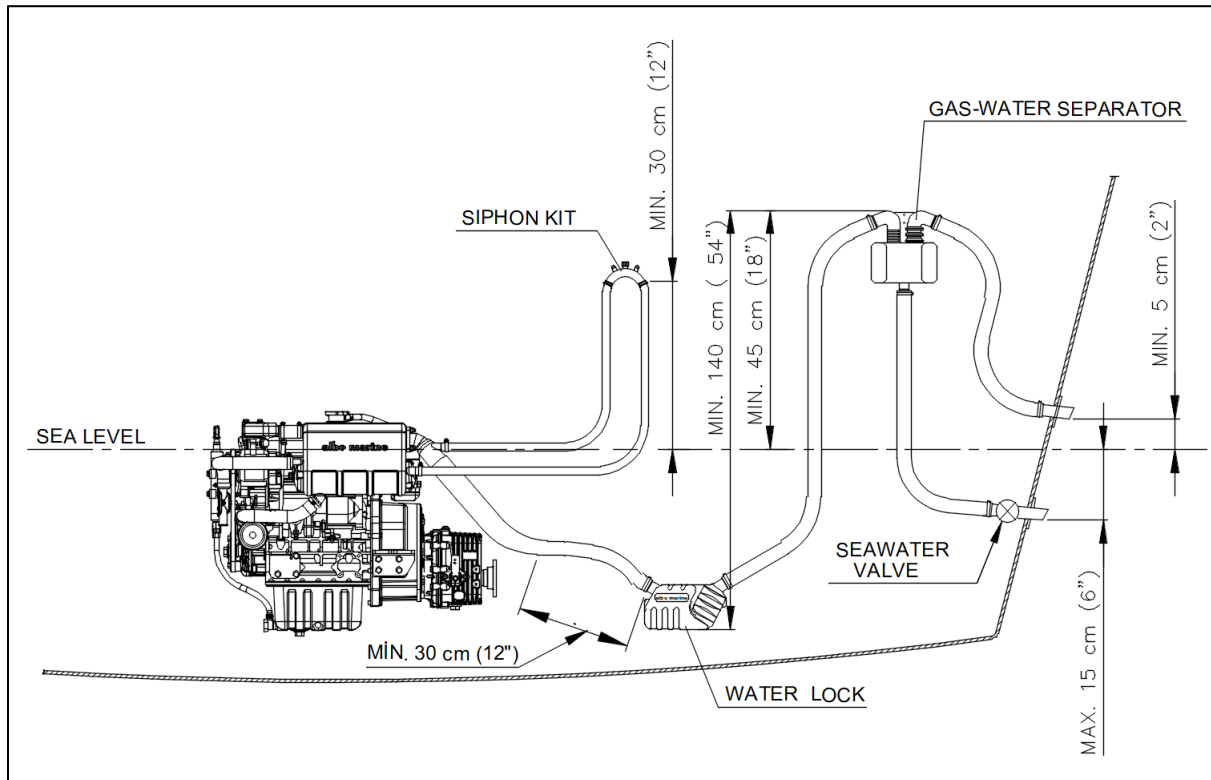


WARNING :

1. Do not install the base of the engine higher than the fixing bolt of the flexible abutment column. This will cause excessive motor movement and shaking. Place steel washers under the flexible rest so that they are tightly screwed to the engine bearing.
2. The column fixing bolt on the flexible support is fixed with the bottom safety nut, do not forget this. Also make sure that the fixing bolt is not screwed deep enough to touch the engine bearing. This will cause vibration and hard-to-detect impact sounds.



12.3 Typical Boat Installation



NOTE:

1. All exhaust hoses and taps should be inclined. Hoses must be connected without allowing sagging. 42 mm/meter (1/2 inches per foot)
2. It cannot be seen from the boat whether the exhaust of the engine used flows through the cooling water, and the water does not come out. However, when the water flow stops, the exhaust temperature will rise due to water loss. In such cases, the exhaust temperature is activated to ensure safety and stops working. See "Troubleshooting" in this guide.



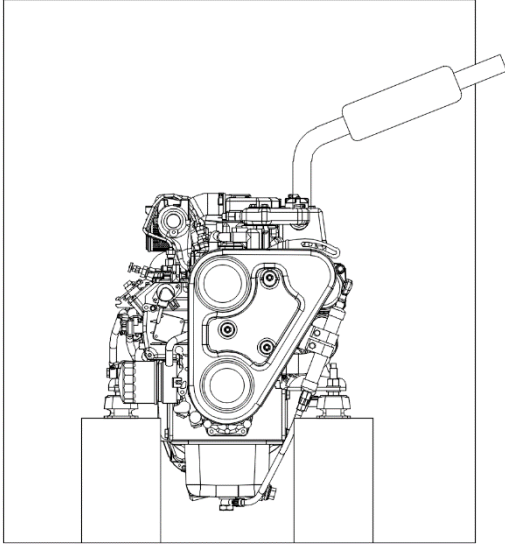
WARNING :

1. The most common problem in engine installations is water entering the exhaust manifold from the exhaust system due to siphoning. This occurs when the water injection point is close to or below the water line. Water entering the Pistons causes the crank arm to tilt, engine oil to become cloudy and the fuel pump to fail. This situation should be avoided.

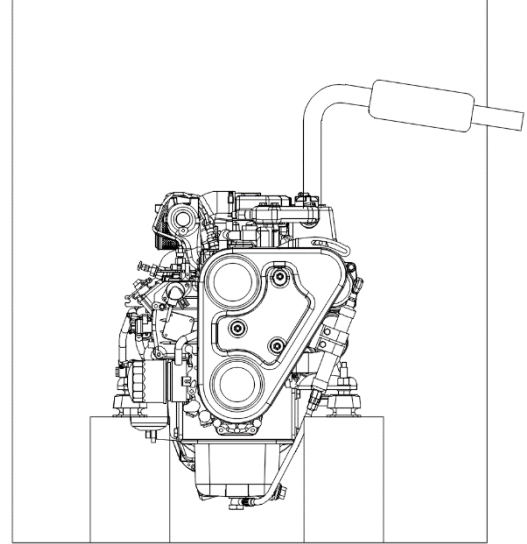
13. Dry Exhaust System

The exhaust system installed on a dry exhaust channel boat or work boat must be at least 1 1/3 BSP. In this case of a dry exhaust system, the engine is fitted with a 1 1/2 gauge male connection. A flexible exhaust makes a lot of noise; a dry exhaust muffler should be used. It depends on the person who makes the installation to use their own pipe, but attention should be paid to the following:

1. Rainwater must be prevented from entering the exhaust duct and leaking into the system and filling the silencer and eventually the engine.
2. If the crew is in danger of approaching, the system must be stopped.
3. The dry exhaust system will generate a huge amount of heat, so proper cooling must be provided.
4. Exhaust counter pressure should not exceed 79mm (3.1 in.) HG.



Şekil xx: Incorrect mounting



Şekil xx: Correct mounting

14. Fuel Installation

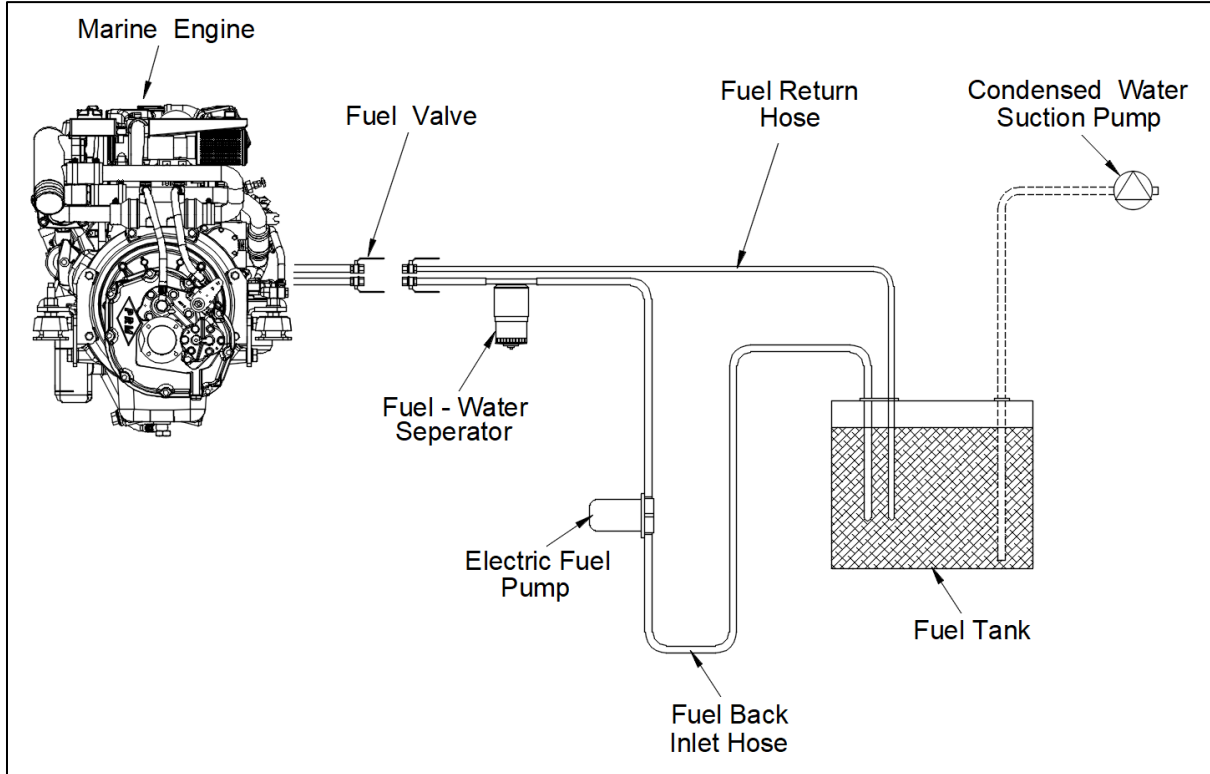
14.1 Fuel Tanks and Installations

Please refer to the user manual for the characteristics of the required fuel.



WARNING :

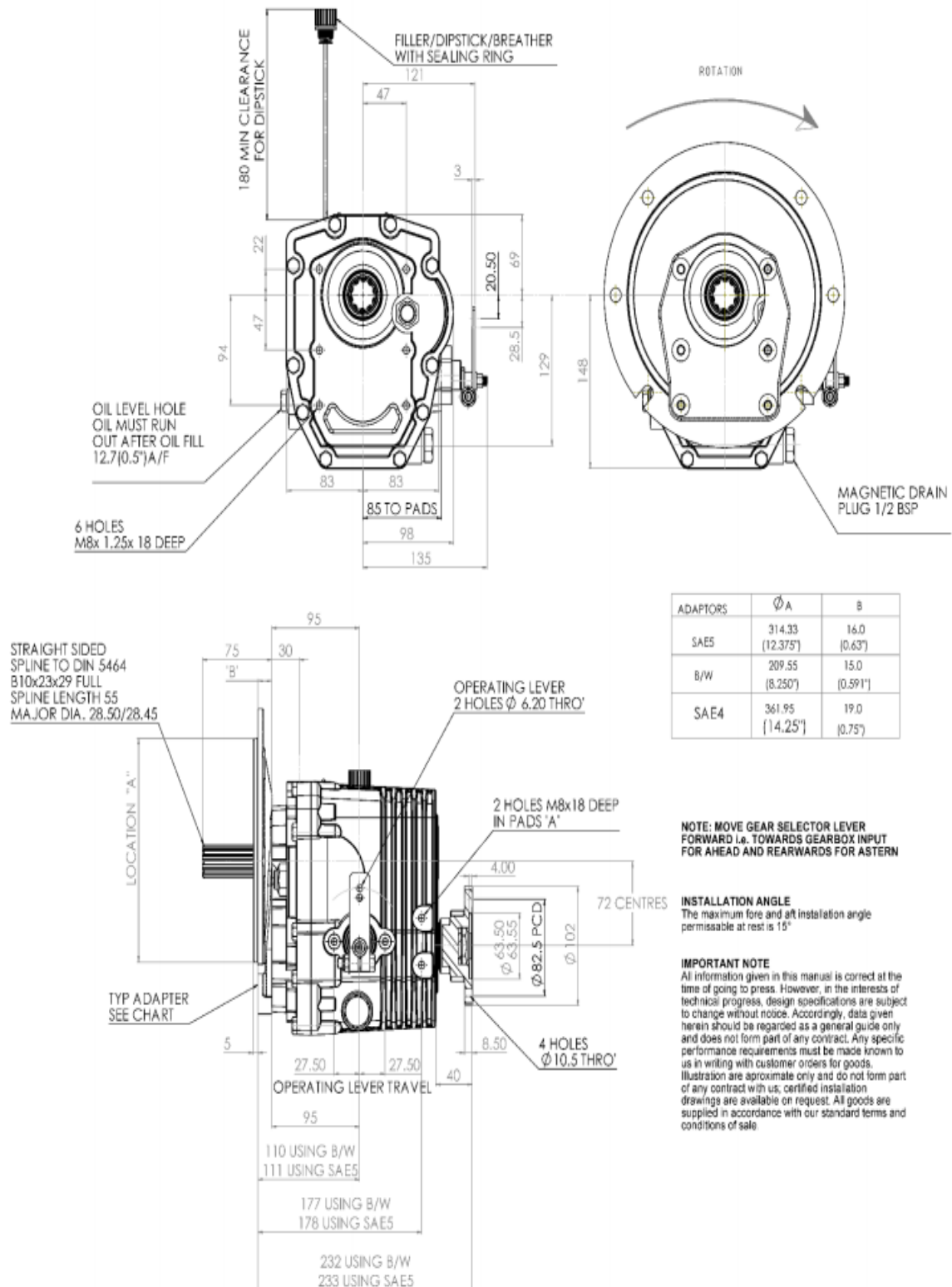
- Overflow and storage of diesel fuel during use under unsuitable conditions can lead to fire. Fuel tank structure, layout, connection for grounding, ventilation, piping, inspection and leakage testing must comply with applicable standards and regulations, USCH, NFPA and ABYC requirements.
- Do not use galvanized fuel tanks or piping systems. Sulfur residue in diesel fuel tanks can lead to deterioration of galvanized (zinc) coatings. For this reason, fuel filters can cause deposits that can block pumps and injectors.



Şekil 2: Fuel Tanks and Installations

15. PRM Marine Gearbox

15.1 PRM 125



15.1.1 Nominal Power Ratings, PRM 125 Marine Gearbox

Model	Ahead Ratio	Pleasure		Light Commercial	
		BHP	kW	BHP	kW
125D2	2.00:1	1.75	1.31	0.95	0.71
125D2.5	2.47:1	1.39	1.04	0.95	0.71
125D3	3.06:1	1.15	0.86	0.80	0.60
Max. Input Power		70	52	48	36

15.1.2 Approximate Weight & Oil Capacity

Gearbox	Approximate Dry Weight		Oil Capacity	
PRM125	16kg (35 lb)	Excluding adaptor, drive coupling and oil cooler	0.4 L	Additionally, the amount required to fill the cooling circuit

15.1.3 Flexible Input Couplings for PRM125

Part Number	Outside Diameter		No	Mounting Hole Pattern				Remarks
	mm	in		Diameter		Pitch Circle Diameter		
				mm	in	mm	in	
MT8109	215.9	8.50	6	8.74	0.344	200.0	7.875	SAE 6 ½ in
MT8110	241.3	9.50	8	8.74	0.344	222.25	8.750	SAE 7 ½ in
MT8111	298.5	11.75	6	8.13	0.320	200.0	7.875	
			6	8.13	0.320	250.0	9.843	
			6	8.13	0.320	269.9	10.625	
			6	8.13	0.320	273.1	10.750	
MT8112	156.0	6.12	5	6.35	0.250	142.1	5.593	
MT8113	151.5	5.965	8	6.50	0.256	140.0	5.512	Hawker Siddeley Marine
MT8114	266.7	10.50	6	8.10	0.320	244.5	9.625	Mitsubishi
MT8115	190.0	7.48	6	8.10	0.320	170.0	6.693	Nanni / Yanmar

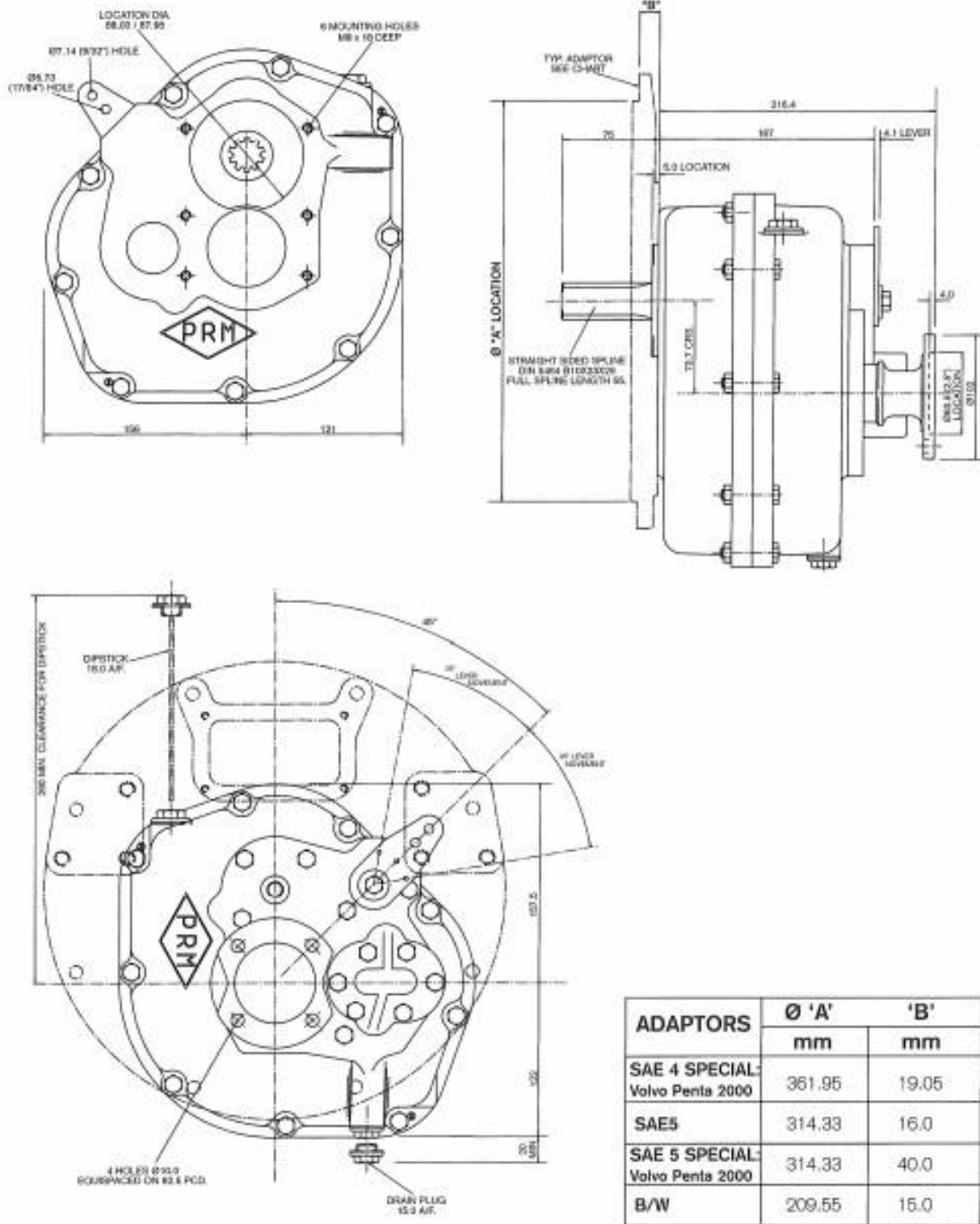
15.1.4 Adaptor Flanges for PRM125

Part Number	Description	Weight	
		kg	lb
MT4901S/A	SAE5 adaptor	7.5	16.5
MT4902S/A	SAE4 adaptor	10.1	22.0
MT8083S/A	B/W (Velvet Drive) adaptor	1.4	3.1

15.1.5 Other accessories for PRM125

Part Number	Description	Weight	
		kg	lb
MT3054	Tail shaft half coupling (pilot bored)	1.3	2.9
MT3056	Tail shaft flexible coupling	0.7	1.5

15.2 PRM150



IMPORTANT NOTE

All information given in this manual is correct at the time of going to press. However, in the interests of technical progress, design specifications are subject to change without notice. Accordingly, data given herein should be regarded as a general guide only and does not form part of any contract. Any specific performance requirements must be made known to us in writing with customer orders for goods. Illustrations are approximate only and do not form part of any contract with us; certified installation drawings are available on request. All goods are supplied in accordance with our standard terms and conditions of sale.

INSTALLATION ANGLE

The maximum fore and aft installation angle permissible at rest is 15°.

15.2.1 PRM 150 Specifications

15.2.1.1 Nominal Power Ratings, PRM150 Marine Gearbox

Model	Ahead Ratio	Pleasure		Light commercial	
		kW	BHP	kW	BHP
150D1.5	1.53:1	1.57	2.10	1.12	1.50
150D2	2.09:1	1.57	2.10	1.12	1.50
150D3	2.82:1	1.57	2.10	1.12	1.50

15.2.1.2 Approximate Weight & Oil Capacity

Gearbox	Approximate Dry Weight		Oil Capacity	
PRM150	21kg (46lb)	Excluding adaptor, drive coupling and oil cooler	1.7 L (3.0 pints)	Additionally, the amount required to fill the cooling circuit

15.2.1.3 Flexible Input Couplings for PRM150

Part Number	Outside Diameter			Mounting Hole Pattern				Remarks
	mm	in	No	Diameter		Pitch Circle Diameter		
				mm	in	mm	in	
MT4904	215.9	8.50	6	8.74	0.344	200.0	7.875	SAE 6 ½ in
MT4905	241.3	9.50	8	8.74	0.344	222.25	8.750	SAE 7 ½ in
MT4906	298.5	11.75	6	8.13	0.320	200.0	7.875	
			6	8.13	0.320	250.0	9.843	
			6	8.13	0.320	269.9	10.625	
			6	8.13	0.320	273.1	10.750	
MT4907	156.0	6.12	5	6.35	0.250	142.1	5.593	
MT4908	151.5	5.965	8	6.50	0.256	140.0	5.512	Hawker Siddeley Marine
MT4909	266.7	10.50	6	8.10	0.320	244.5	9.625	Mitsubishi
MT4910	190.0	7.48	6	8.10	0.320	170.0	6.693	Nanni / Yanmar

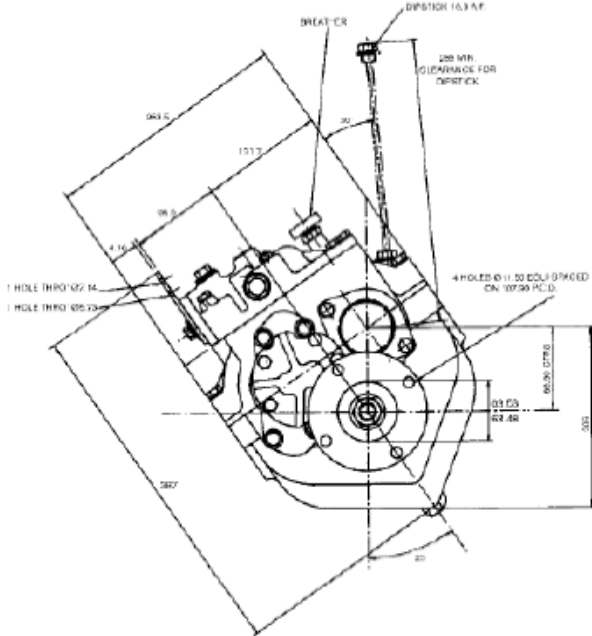
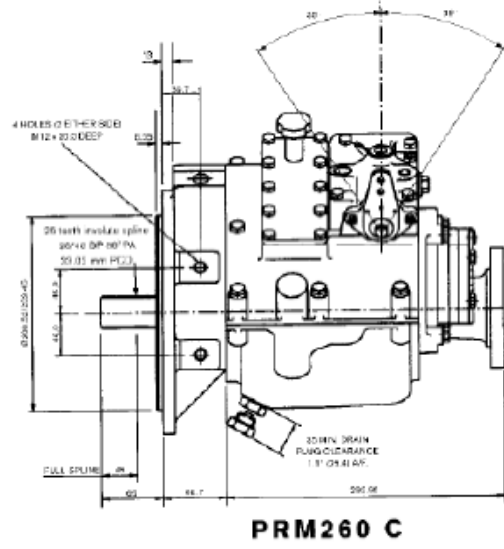
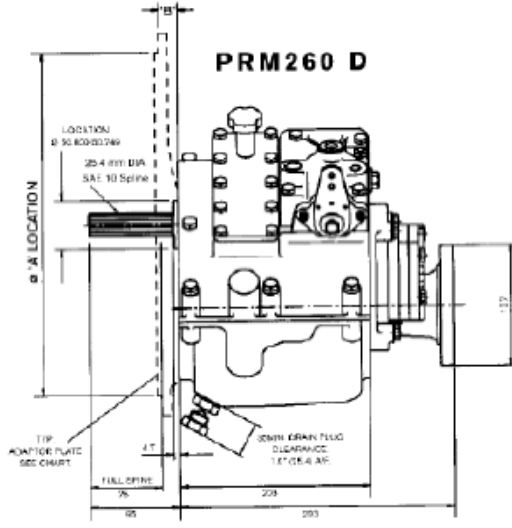
15.2.1.4 Adaptor Flanges

Part Number	Description	Weight	
		kg	lb
MT4902S/A	Special SAE4 adaptor, Volvo Penta 2000 series	10.0	22.0
MT4901S/A	SAE5 adaptor	7.5	16.5
MT4903S/A	Special SAE5adaptor, Volvo Penta 2000 series	2.7	6.0
MT8083S/A	B/W (Velvet Drive) adaptor	1.4	3.1

15.2.1.5 Other Accessories for PRM150

Part Number	Description	Weight	
		kg	lb
MT0149	Oil cooler, complete with pipes and bracket	1.5	3.3
MT3054	Tail shaft half coupling (pilot bored)	1.3	2.9
MT3056	Tail shaft flexible coupling	0.7	1.5
MT5036	Oil pressure gauge	0.1	0.2
MT0156	Neutral safety start switch	0.04	0.1

15.3 PRM 260



Önemli Not

Bu broşürdeki bütün bilgiler baskı sırasında doğrudur. Ancak, teknik ilerlemenin doğrultusunda, tasarım tanımlamaları duyuru yapmaksızın değiştirme yapılabilir. Buna göre, burada verilmiş olan bilgi, sadece genel kılavuz olarak kabul edilmelidir ve herhangi bir kontratın parçasını oluşturmamaktadır. Herhangi bir performans gereklilikleri, müşteri siparişleri ile mal için bize bilgilendirme yapılmış olmalıdır. Görseller yaklaşık olmaktadır ve herhangi bir kontratın parçasını oluşturmamaktadır; onaylı montaj çizimleri istek üzerine mevcut olmaktadır. Bütün malılar, bizim standart koşullarımız ve satış koşulları ile uygun olarak tedarik edilmektedir.

Montaj Açısı

Maksimum ön ve arka montaj açısı geri kalanda izin verilebilir değeri 15 derecedir.

ADAPTORS	Ø 'A'	'B'
	mm	mm
SAE2	447.67	16.0
SAE3	409.58	15.75
SAE4	361.96	19.05
SAE5	314.33	15.88
B/W	209.55	28.58

15.3.1 PRM 260 Specifications

15.3.1.1 Nominal Power Ratings, PRM260C Marine Gearbox

Model	Ahead Ratio	Pleasure		Light Commercial		Heavy Commercial	
		BHP	kW	BHP	kW	BHP	kW
260C2	1.96:1	3.65	2.72	3.36	2.51	3.08	2.31
260C3	2.94:1	3.65	2.72	3.36	2.51	3.08	2.31
Max. Operating speeds			4500 rev/min intermittent, 4000 rev/min continuous				

15.3.1.2 Approximate Weight & Oil Capacity

Gearbox	Approximate Dry Weight		Oil capacity	
PRM260C	63 kg (138 lb)	Excluding adaptor, drive coupling and oil cooler	1.7 L (3.0 pints)	Additionally, the amount required to fill the cooling circuit

15.3.1.3 Flexible Input Couplings for PRM260C

Part Number	Outside Diameter		Mounting Hole Pattern					Remarks
	in	mm	No	Diameter		Pitch Circle Diameter		
				in	mm	in	mm	
MT1468	14.25	362.0	6	Multi punched, Dimensions on application				SAE 7 ½ in

15.3.1.4 Other Accessories for PRM260C

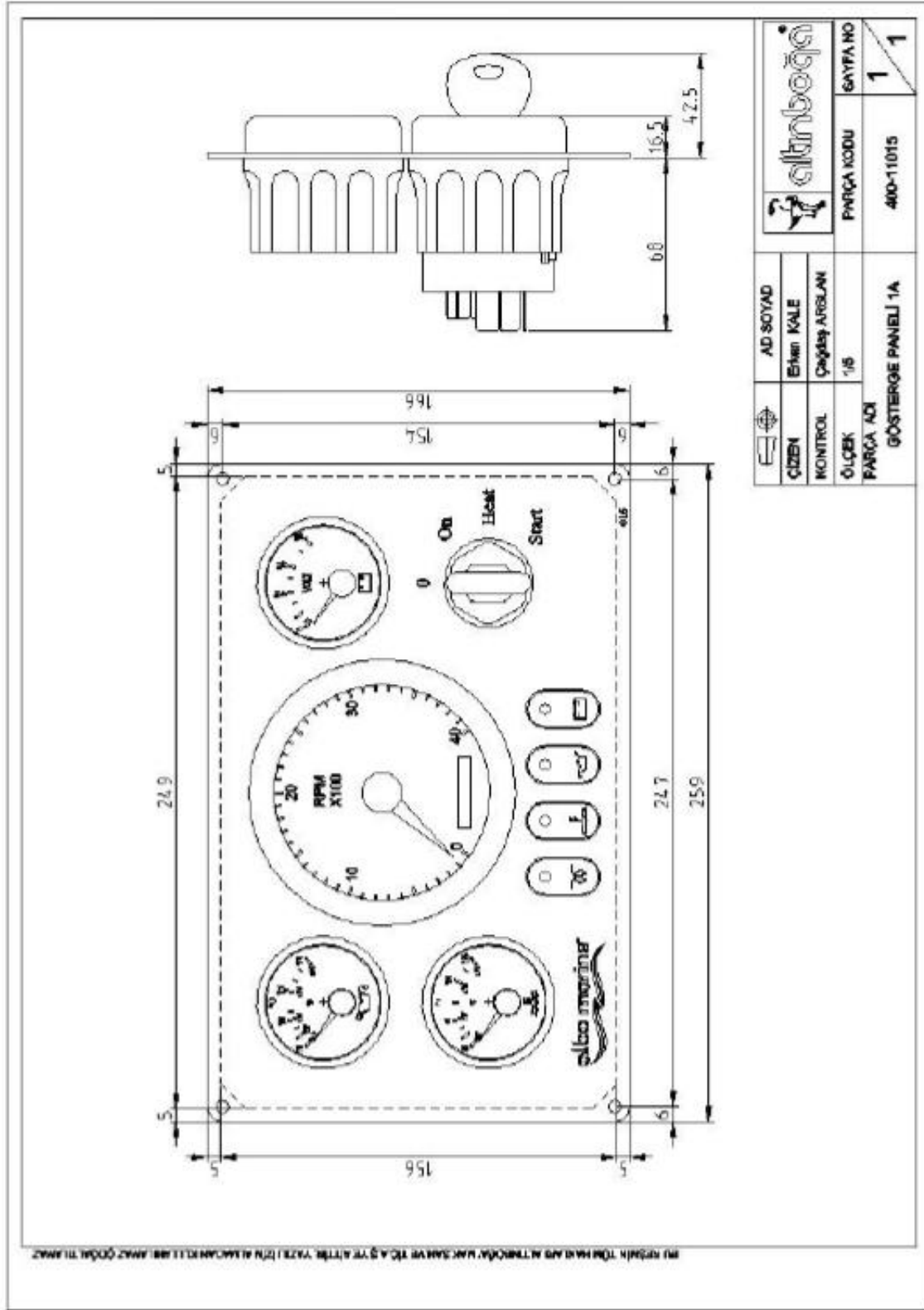
Part Number	Description	Weight	
		kg	lb
MT913S/A	Oil Cooler	1.2	2.6
MT915	Oil pipes (pair)	0.5	1.1
MT784	Oil cooler mounting bracket	0.2	0.4
MT771	Tail shaft half coupling (pilot bored)	2.5	5.5
MT1104	Tail shaft flexible coupling	1.5	3.3
MT0214	Neutral safety start switch	0.04	0.1
MT5036	Oil pressure gauge	0.1	0.2

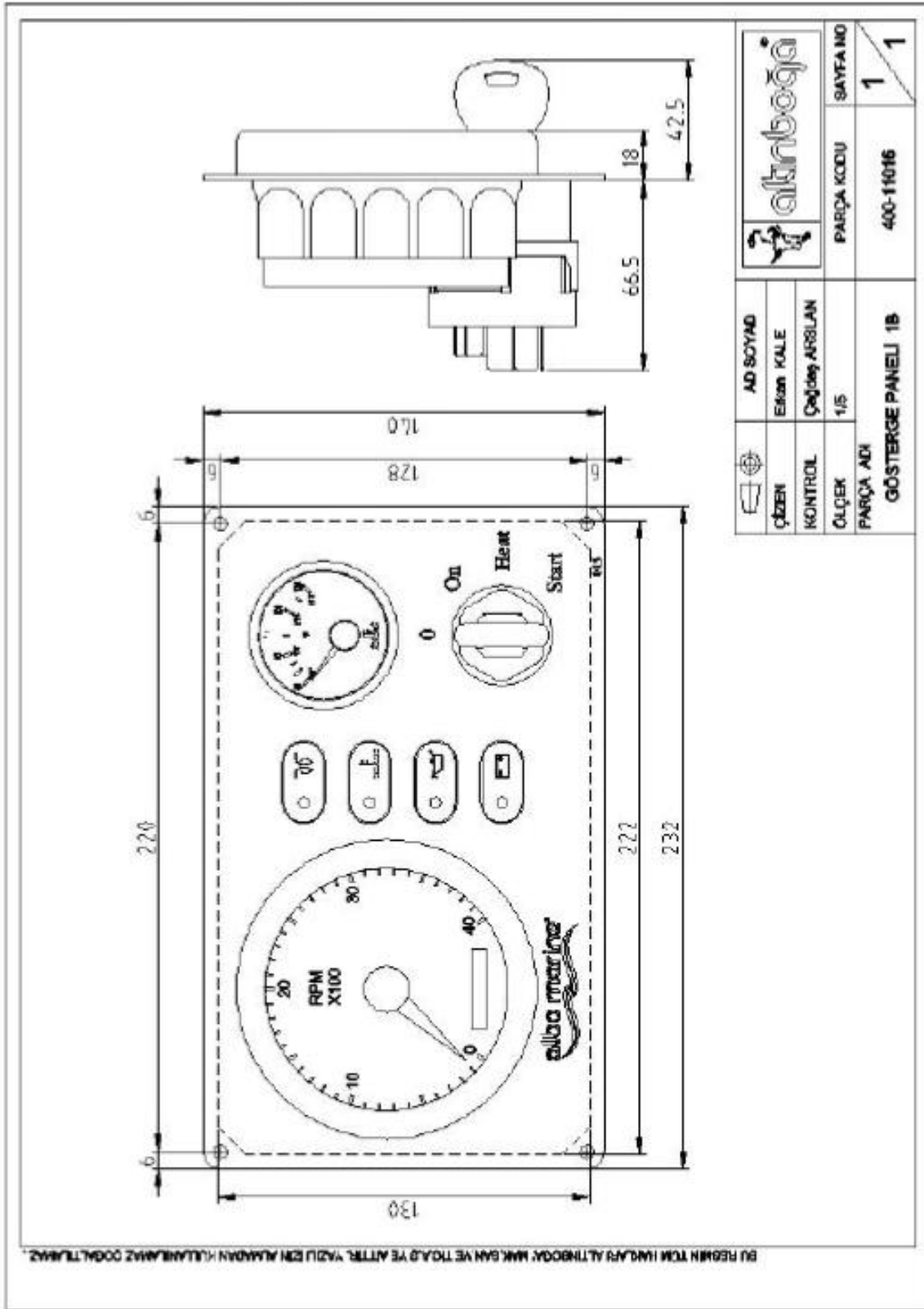
16. Control Panel

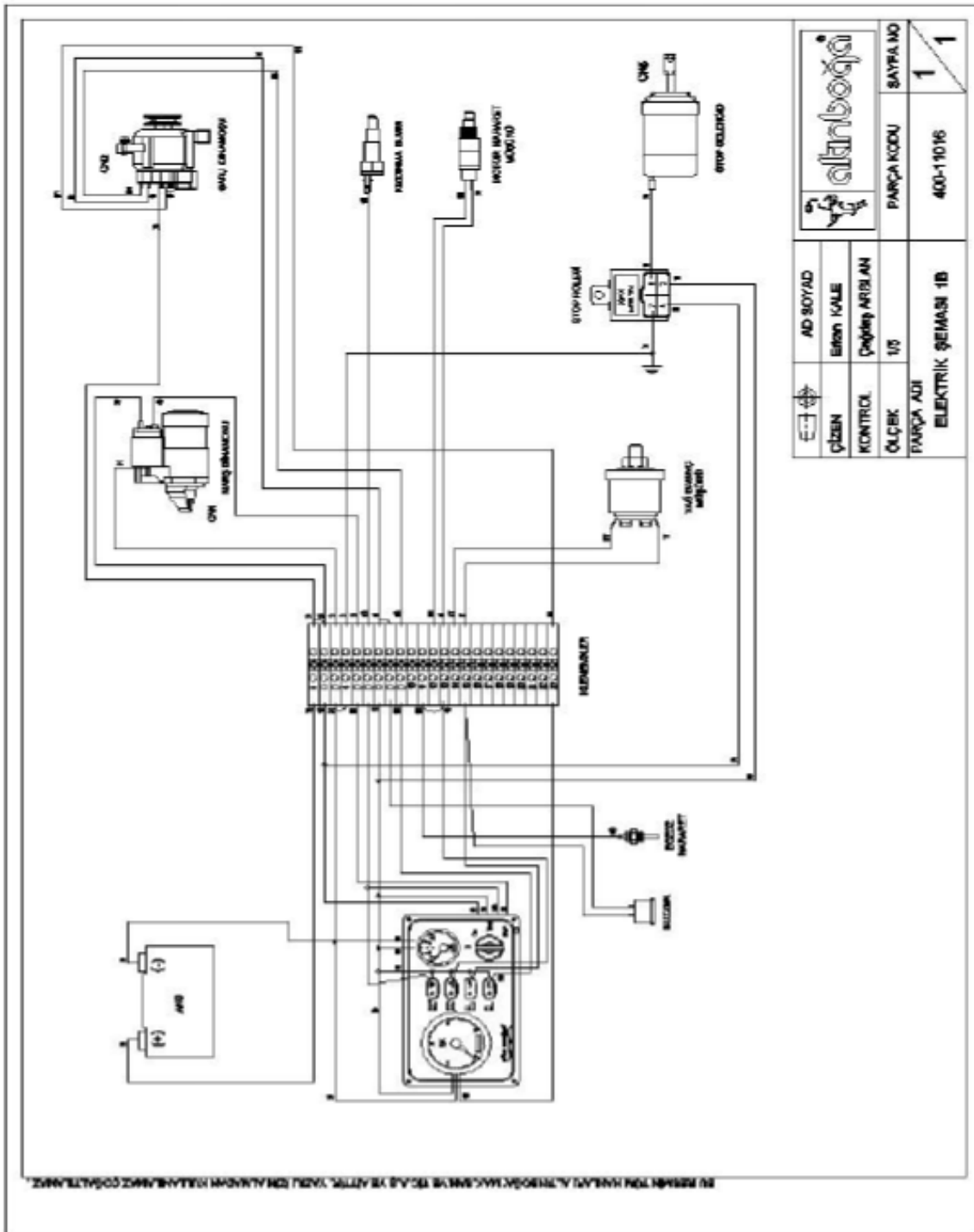


1. Control Panel
2. Oil pressure indicator
3. Speed and time indicator
4. Battery charge indicator
5. Temperature indicator
6. Glow warning lamp
7. Temperature warning lamp
8. Low oil pressure warning lamp
9. Low charge warning lamp
10. Switch Key

17. Electrical Diagram

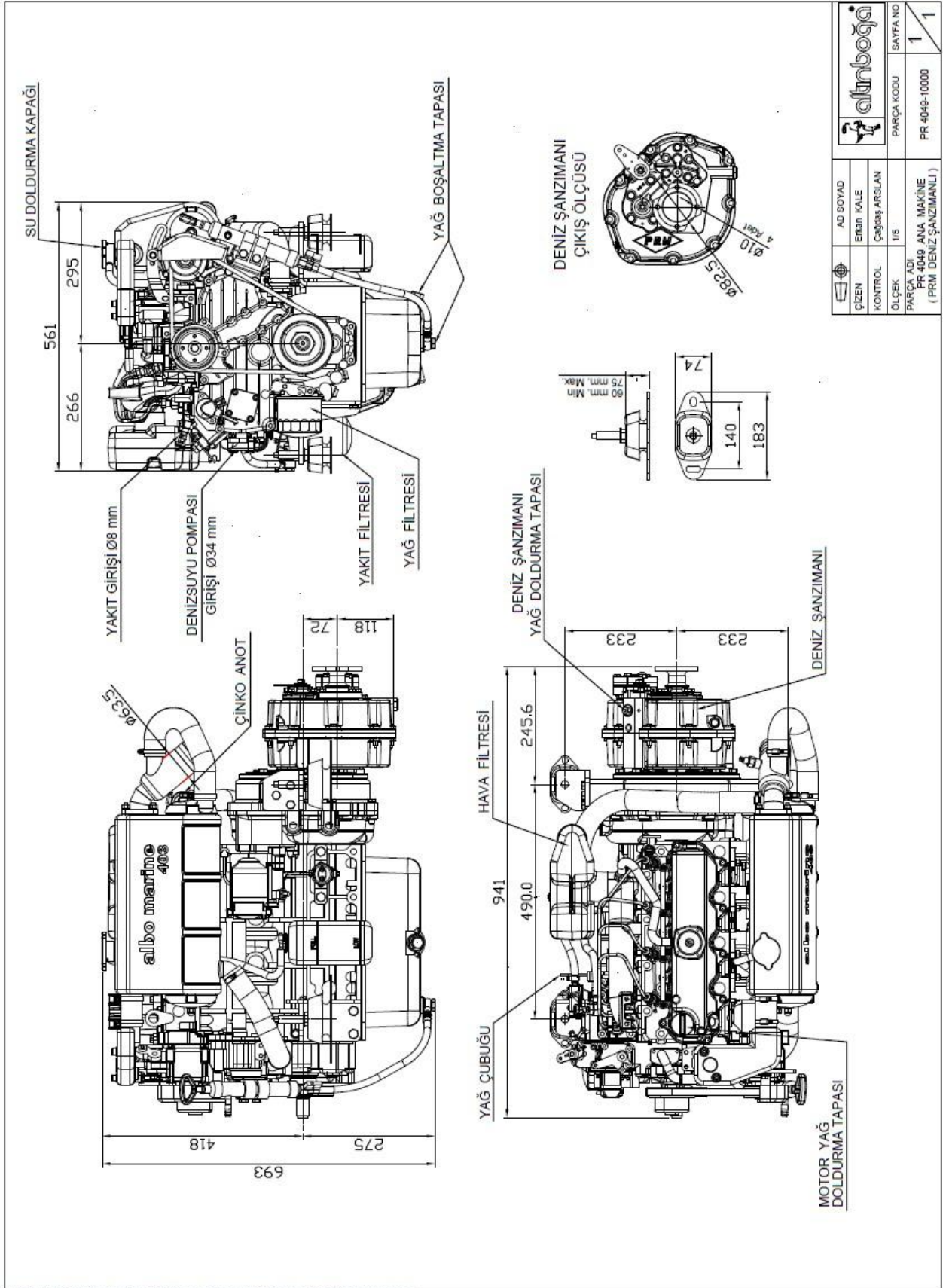






18. Dimensions

AB149 – AB159



19. Warranty Statement

All Albosan Marine engines and components are warranted by the manufacturer against defect in workmanship and material for 24 months from the date of sale, under conditions:

- If the engine is installed in the workshop/by a person, who is not authorized by Albosan Marine, installation inspection, first start and test must be done and confirmed (into guarantee certificate section provided for this reason) by authorized serviceman.
- During warranty period (24 months) all engine maintenance must be completed as scheduled and confirmed by an authorized serviceman (in the section of this booklet provided for it).
- Warranty is limited only to repair or replacement of the component found to be faulty and such repair or replacement is solely at the discretion of the manufacturer. It does not extend to normal wear and tear mechanical damage, collision damage, faulty maintenance or corrosion due to electrolysis.
- For all exchanged new parts, Albosan Marine gives further 12 months warranty.
- The warranty repairs should be done by an authorized serviceman, and the warranty is limited only to location, analysis, and repair of the defect, the replacement of faulty parts and labor required to effectively install those parts. And finally, successfully testing the repaired equipment.
- The warranty does not apply to normal wear of parts or device, mechanical damage caused by poor handling and maintenance or modification, including any damage caused by weather.
- Travel times and expenses are not covered by warranty but must be compensated by the owner.
- It is your responsibility to arrange, in case of any complaints, delivery of the engine to the nearest authorized service center for repair (with guarantee card, which you can get when you take over the engine), otherwise all transportation costs to and from the workshop shall be borne by the owner of the vessel or device.
- It is Albosan Marine obligation to perform repairs in shortest time, which will not exceed 30 days.
- Albosan Marine will in no way be liable for more than the cost of the original product.

20. Maintenance Record

Date	Working Hour of the Machine	Description	Service Officer

Keep a copy before filling out this maintenance form.