USER AND MAINTENANCE MANUAL

DIESEL CABINET NET CLEANER

D-Drive K-300-240-SD-JS and D-Drive K-240-280-SD-JD

ENGLISH
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For a thorough introduction of Your AKVA product, we ask that all users read this entire manual. If questions occur, contact us!

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This document can also be read and downloaded from our website, see www.akvagroup.com/products/user-manuals
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1 Safety

Safety for the users of our equipment is top focus when AKVA group develop new products and product manuals.

We strongly recommend that anyone who is going to be using the AKVA product, all that will perform any type of repairs, service or other maintenance to AKVA products, and all who work in areas where such products are installed, are aware of the contents in this manual.

This recommendation is based on both personnel safety as well as a desire to keep AKVA products in order, and to avoid risk of damages as a result of not following safety instructions.

1.1 Safety symbols

The following safety symbols are used in this manual:

- **Information**

  
  Show caution, danger of damaging equipment and injuries to personnel.

- **Warning, may cause injures to personnel.**

- **Dangerous situations may occur, danger of escaping.**

When staying and working on or around cage edge, it is mandatory to wear personal safety gear, such as safety vest and anti-skid footwear.

1.1.1 Other symbols used in this manual

Go to or see page or section for further instructions or more information
1.2 General safety

This high pressure system must not be operated, and no work may be performed on the system, before the safety precautions described in this manual have been read and understood by all users.

Site manager and farm manager are responsible for instructing all personnel who might be working on the site where the Net Cleaner is going to be used, are aware of this manual, and that everyone understands its content.

Safety information from this section must not be construed as a warranty by AKVA group that this high pressure net cleaner will not cause injury or damage - even if all safety instructions are followed.

Exercise great caution when using high pressure equipment. This equipment generates a lot of forces that may cause severe damage to both personnel and equipment if used incorrectly.

Whilst using this high pressure net cleaner the applicable regulations in the country where the net cleaner is being used must be complied with.

The employer is responsible for composing instructions for their personnel, explaining which of the operations can cause danger towards the user. All personnel must know these instructions, and the employer has the responsibility of making sure that the personnel understands it.
1.3 Receiving new equipment

Make sure that all parts are delivered according to the service note. If the order is not complete, or if any defects are discovered, contact AKVA immediately, see Appendix E Contact information.

AKVA group offers a 1 year warranty, covering production defects. This warranty is effective after date of shipment to original customer. Misuse of the equipment due to neglecting instructions in this and other manuals connected to the equipment may invalidate this warranty.

1.4 Inspection before use

High pressure water represents massive forces, and it is therefore important that critical components are inspected and tested regularly.

Safety valves are installed in all high pressure equipment in order to prevent the pressure inside the system from exceeding maximum pressure endured by the various components. The safety valve is set to open up for water flow in case the pressure exceeds predetermined level. Out of order valves can cause severe damage to the system, as well as endangering personnel safety and damaging equipment installed nearby.

The safety valve is set to the maximum working pressure that the equipment manages to endure. Never change this pressure point to a higher pressure.

All hoses used in this construction, must be able to endure the maximum working pressure of the equipment. Make sure that all hoses endure this pressure, by looking at the labelling on the hose outside. All hoses must be inspected for tears and other external damages. If the hose is damaged, it must be replaced before use.
1.5 Personnel safety

To avoid personnel injuries and damages to surrounding equipment, it is important to follow all instructions provided from AKVA group in this manual, as well as following the applicable regulations provided by the government in the country where the equipment is being used. When working with the Diesel Cabinet Net Cleaners, three participants is required, and clear communication and visual contact is mandatory for safe operations.

Everyone working with or around the Diesel Cabinet Net Cleaner must be trained in how to operate the equipment, and also be made aware of all of the dangers that may arise from improper use. The employer is responsible for instructing all personnel that will be working with or around the net cleaner about which operations may cause injuries to the users. All employees must be made aware of these instructions, and it is the employers responsibility that all personnel understand these instructions.

The employer is responsible for providing their employees with appropriate safety garments, such as eye-, hand- and body protection, when working on and by the cage edge, for instance during net cleaning with high pressure. Always use anti slip boots whilst walking around the cage edge. When conditions require, the employer must order all workers to use necessary safety equipment.

A helping operator is mandatory when the person operating the cleaning equipment has reduced vision of the high pressure cabinet. The person operating the net cleaner frame must be able to communicate, preferably visually, with the person operating the cabinet.

Fastening and sealing, of leaks in piping- or hose-fittings, can only be performed when the machinery is turned off and without any internal pressure.
The employer is responsible for signage, limiting access to and properly securing the area where a high pressure net cleaner is being used.

Reaction forces must be balanced when using manually controlled net cleaners. During the cleaning process, only one diver may stay in the water surrounding the high pressure net cleaner. An assistant employee responsible for controlling the pumping aggregate is necessary, so that the process can be shut down immediately in case of an emergency.

Under aged personnel (under 18 years of age) must not operate the net cleaner on their own.

1.6 Equipment safety

1.6.1 Disinfecting equipment

If any of the equipment, hoses, ropes or other belonging equipment is being moved to a new location, it is decreed by law to disinfect everything to prevent contamination. We recommend rinsing with fresh water after disinfection, because the disinfectants are strong chemicals that may damage the equipments surface materials.
1.6.2 Storage

Do not store the equipment at high temperatures. It is advised that the equipment is rinsed off with a narrow beam of water directed away from people after storage, because of risk of Legionella contamination.

Salt water may damage the equipment if left drying inside the system. The high pressure pump, and internal components surrounding this, such as suction pump, filters, safety valve, hoses or other salt water leading components are especially vulnerable towards salt water. When the salt water dries out, the salt crystals will cause corrosion damages to gaskets and sealings over time, causing high abrasion and reduction of the equipment’s functions.

If the equipment is being stored for more than one week, it is recommended that the entire system is flushed with fresh water before being placed in storage. If the equipment is being stored over winter, we recommend that it is stored in a frost free environment. Either way, we recommended that the entire system is flushed through with a water and antifreeze solution, in order to prevent any water remnants left inside the system to freeze and possibly destroy the equipment in case of below zero temperatures. The the antifreeze fluid is also a good lubricant for the system and its internal components.
1.6.3 General treatment of the equipment

All mechanical and electronic equipment used in the aqua culture industry must be taken good care of to function over time and according to expectations, and in periods when they are mostly needed. Net cleaners work in demanding environments with high pressures, large amounts of water as well as a very aggressive corrosive salt water environment. Because of this, following the maintenance instructions are mandatory.

Materials that normally do not require any particular amount of maintenance are chosen for most of the critical components in our net cleaners. Most of the exterior components, however, would be too expensive if made in corrosion resistant materials. Therefore, rinsing off the equipment with fresh water after every use is highly recommended.

All movable parts, such as hinges, locks, gas regulators, wheels etc. must be lubricated after cleaning and rinsing. If scratches or other damages appear in any of the enameled surfaces, these must be clogged immediately in order to prevent further corrosion.

Before using the equipment, it is essential to always make sure that the equipment stands steadily, and if necessary, is securely attached to the foundation. This is essential in order to prevent the equipment from slipping and damaging surrounding equipment or personnel.

When moving the equipment from one installation to another, disinfection is mandatory to prevent contaminations. Always rinse with fresh water after disinfection, not all metal parts, o-rings, sealings nor other internal components are able to endure chemicals from disinfection.
2 Information

This user and maintenance manual is part of the equipment delivered with the Akvasmart Net Cleaners. Please retain this manual as long as the net cleaner is being used, and make sure that all changes to the equipment are registered in the back of this manual.

Thank You for choosing AKVA group as supplier for Your high pressure net cleaning system. Do not hesitate contacting us for more information regarding installation, use or maintenance of any AKVA equipment.

Prior to use, repairs, maintenance or any other operations related to the high pressure cleaning system, the personnel must attend proper training by AKVA group. All net cleaner users as well as other personnel working on the site must read and understand the contents of this manual, and all users must follow all procedures and safety instructions and precautions described here. This is necessary in order to ensure safe and reliable operations, product longevity and most importantly personnel safety.

This purpose of this manual, is to ensure safe and economical use and maintenance processes when working with the Diesel Cabinet Net Cleaner, as well as safe handling of the equipment. The manual will also answer most day to day questions regarding daily use. All instructions must be followed.

To ensure that the system is installed properly, and that all necessary adjustments are performed in accordance to existing standards, and for the warranty to be valid, personnel from AKVA group must participate in the startup of the system.
2.1 How to use this manual

This manual describes maintenance of the different parts in the Diesel Cabinet Net Cleaner in the safest possible way. This entire manual must be read and understood by ALL users prior to use of the net cleaner. Site owner and farm manager are responsible for ensuring that all personnel and users know and understand the contents of this manual.

Before the first section, is a table of contents. The headlines works as links to their respective section in the .pdf-file.

Section 1 is the most important section of this manual, and includes safety precautions, warnings and other safety information that ensures safest possible use and maintenance. Section 2 contains information on AKVA group and the Diesel Cabinet Net Cleaner, as well as information about the manual and how to use it.

Section 3 contains preparation instructions for before first use and before later uses, in section 4 are instructions for starting and stopping the Diesel Cabinet Net Cleaners including the emergency stop, the control panel alarms and the mobile control unit. Section 5 explains use of the net cleaning frame.

Section 6 describes how to clean the Diesel Cabinet cleaner, and also preparations before storage. Maintenance instructions are found in section 7, and maintenance plans and forms are listed in section 8.

Five appendixes are found in the back of the manual: first, an overview over all tables and illustrations, then the index list, a deviation form for all deviations with the system, pages for notes about new and extra information are also in the back of the manual and AKVA group contact information.

This entire manual, and especially section 1 Safety must be read and understood before commencing any work on the equipment
2.2 About AKVA group

With four house brands, AKVA group is a world leading supplier of technical aquaculture equipment. Since 1980 we have developed and produced fish farming equipment, both for cages at sea and for land based hatcheries. AKVA represents an industrial standard, which is presumed to be the turn key of the future. Research, project management, fast deliveries and customer follow-up are our focus to ensure that we deliver the best possible and most cost efficient equipment, and thus contributing to preserve a sustainable aquaculture and a positive development within the aquaculture industry.

AKVA have a wide variety of products, for example: plastic and steel cages, high pressure net cleaners with cleaning rigs, boats, feed barges, feeding systems, cameras, sensor systems, under water lighting, software for fish farming and recycling systems.

AKVA practice continuous product development to improve the equipment’s safety, functions, manner of operation and working reliability. This manual enables the operator to use and maintain the Diesel Cabinet Net Cleaner in a safe and economically sustainable way.

All of our products are pre-installed, tested and delivered from our own production department or approved collaborators. This means that our customers have total control over available components, grouping collocation, testing and deliveries. Our production staff consists of productive people with great expertise for producing the best possible products. Having our own production sites gives our customers excellent service in case something goes wrong, or if assistance for any reason is required. AKVA hold most of the parts for our products in stock, and our service staff are available by telephone or on site to assist if necessary. Safety, both for users and equipment is our main focus when developing new equipment and product manuals.
2.3 About Diesel Cabinet Net Cleaners

The AKVA Net Cleaners were first launched under the Idema Net Cleaners brand in 1987, and are today renowned for quality, high performance and their ease of use. The first Net Cleaners had single 30cm diameter cleaning discs, operated from the cage edge using a shaft. Underwater pressure cleaning of cages containing fish has become even more common as the requirements for environmentally friendly aquaculture in larger cages provides the best scale of economics.

With this in mind we have developed and improved the Net Cleaners and can now present the best range of net cleaners and high pressure pumps ever. This combination offers you the most efficient cleaning system suited for all types and sizes of cages. In Net Cleaning, filtered high pressure sea water is used to remove marine fouling on the nets.

AKVA Net Cleaners use rotating cleaning discs mounted on support frames in various shapes and combinations. We use rugged, tailor-made high pressure pumps to drive the cleaning discs. The cleaning process starts with submerging the frame on the inside of the net, using only sea water under high pressure.

AKAV net cleaning systems do not use chemicals or scrubbing action making them environmentally friendly while ensuring minimal wear on the nets.

The large Net Cleaners can be operated in automatic mode by two persons using a crane, winch, cap stand or as an integrated option on the ROV (Remotely Operated Vehicle). The smallest Net Cleaners can easily be operated from the cage by a single person.
2.3.1 Main components

Illustration 2.1: Main Components, front

Illustration 2.2: No canopy
Illustration 2.3: Main Components, side

Illustration 2.4: Main Components, rear
The yellow discharge valve:

Open position:                                               Closed position:

Illustration 2.5: Discharge valve open and closed
Control panel:
The control panel is placed in the cabinets front right side:

Illustration 2.6: Control panel, key description

Start Key – Allows the operator to start sequence in Manual Mode or initiate an auto start sequence when in Auto Mode.

Stop Key – Allows the operator to initiate the stop sequence in either mode of operation. As a safety feature, the stop key will skip the cool-down state when it is pressed twice or held in auto mode. Once shut down, the controller will enter manual mode to eliminate an auto crank condition if the auto start condition is still present.

Auto Key – Allows the operator to change from Auto to Manual or Manual to Auto Mode by press-hold for 3 seconds.

Alarm Silence Key – Allows the operator to acknowledge alarms on the controller when warnings and shut-downs are present.

Manual Throttle Increase Key – Allows the operator to manually increase the engine throttle in Manual Mode.
**Manual Throttle Decrease Key** – Allows the operator to manually decrease the engine throttle in Manual Mode.

**Menu Key** – Allows the operator to get in and out of the menus.

**Back Key** – Allows the operator to move back one step while in the menu.

**Enter Key** – Allows the operator to enter a value in the menu when selected and is used to acknowledge internal and external alarms/shut-downs.

**Up Key** – Allows the operator to navigate up through the menu and page forward on the main pages.

**Down Key** – Allows the operator to navigate down through the menu and page reverse on the main pages.
**Mobile control unit:** for the hydraulics *(optional)*

This unit is an attachment to net cleaners that are delivered with integrated hydraulics and joy stick, and can be fitted in conjunction with external hydraulics to operate a 12V spool.

- The red circle is the off switch
- The green I is the on switch
- The yellow are the winch up and down.

*Illustration 2.7: Mobile Control Unit*

This is a simple unit which controls the length of the rope that is connected to the net cleaner frame. Via a winch. This control unit, allows the user to release as much rope as needed, as well as reeling the rope back in.
2.3.2 Specifications

<table>
<thead>
<tr>
<th>Net cleaner</th>
<th>Engine</th>
<th>Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-136-280-SD</td>
<td>JD 6068HFU82-157kW</td>
<td>MWN 32 1500rpm</td>
</tr>
<tr>
<td>K-240-280-SD</td>
<td>JD 6068HFU82-202kW</td>
<td>LKN 45 A 1750rpm</td>
</tr>
<tr>
<td>K-300-240-SD</td>
<td>JD 6068HFU82-202kW</td>
<td>LKN 50 1900rpm</td>
</tr>
</tbody>
</table>

Table 2.1: Specifications Net Cleaners

Specifications Net Cleaner rigs:

<table>
<thead>
<tr>
<th>Net cleaner</th>
<th>Cleaning rig</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-136-280-SD</td>
<td>5 disk</td>
</tr>
<tr>
<td>K-240-280-SD</td>
<td>5 disk, 7 disk, FNC8</td>
</tr>
<tr>
<td>K-300-240-SD</td>
<td>7 disk, FNC8</td>
</tr>
</tbody>
</table>

Table 2.2: Specifications Net Cleaner Rigs
2.3.3 Model description explanation
All of our diesel net cleaners are developed according to these public standards and procedures:


All High Pressure Net Cleaners delivered by AKVA group have an uniform model description. The description contains information about capacity, structure and function. Example:

K - 136 - 300 - S - D - JD

<p>| | | | | |</p>
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<td>5</td>
</tr>
<tr>
<td>K</td>
<td>136</td>
<td>300</td>
<td>S</td>
<td>D</td>
</tr>
<tr>
<td>JD</td>
<td></td>
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</tr>
</tbody>
</table>

K = Cold water
136 = 136 liters of water per minute
300 = Water pressure is 300bar
S = Integrated suction pump
D = Diesel Engine
JD = John Deere engine

1) K = Cold water
   V = Hot water
2) Liter water per minute
3) Water pressure (bar)
4) Water supply
   - S = Integrated suction pump
   - X = Without suction pump
5) Engine type
   - H = Hydraulic
   - B = Gasoline
   - E = Electro
   - D = Diesel
6) Engine Manufacturer
   - CO = Comer
   - VA = Vanguard
   - HO = Honda
   - HZ = Hatz
   - IV = Iveco
   - JD = John Deere
   - SU = Sunfarb
7) Volume/effect
   - B and D - effect in Hp
   - E - effect in kW
   - H - Vol.=ccm/rev
3 Before use

Before starting up the net cleaner, this entire manual must be read and understood. Take extra notice of the safety section.

Read through this entire manual to make sure that every process is performed correctly, reducing the risk of damaging the equipment or injuring personnel working on site.

High pressure water represents powerful forces. Therefore, it is important to inspect and test critical components according to maintenance plans.

Before every use, check the oil level in the engine and pump, as well as the engine coolant level according to the instructions in this section.

Personnel safety must be top priority when working on and by the cage edge. It is mandatory to wear safety garments such as anti-skid footwear and safety vest.
3.1 Priming the system for first start up

First time the pump is run, the header tank must be primed.

Procedure:

1. Connect a water supply to the hose tail

![Illustration 3.1: The hose tail](image)

2. Open the blue primer valve

3. Fill the system until the header tank and filter housing is full. This will indicated on the MPC10 controller by the Displaying the word “Target”

4. Proceed to section 3.2 Check oil levels.
3.2 Check oil levels

Before every use, check the oil level in the engine and pump according to the instructions in the following pages

3.2.1 Engine

The engine has a dipstick for checking oil level, refer to the images below.

Illustration 3.2: Dipstick

Procedure:

1. Determine the oil level from the dipsticks.

2. Add oil if the oil level reaches the “Add” area. Drain oil if it reaches the “Overfill” area.

Illustration 3.3: Dipstick (rear of pump unit)

Illustration 3.4: Refill engine oil here (cabinet rear)
3.2.2 Pump

The pump has an oil level window (oil see glass) placed on the side of the pump, and a refill point sits at the rear of the cabinet near the fuel filter.

*Illustration 3.5: Oil Sight Glass*

*Illustration 3.6: Refill pump oil here*
3.3 Check coolant

Check the coolant level on top of the radiator.
Open the lid and check the level. Refill in the same opening.
Newer versions will have a level sender (MPC10 controller).

*Illustration 3.7: Refill Coolant here*

*Illustration 3.8: Refill Coolant Lid*
3.4 Control the safety valve

The predetermined level of pressure in the safety valve must never be changed

Safety valves are mounted on all high pressure equipment to ensure that the pressure inside the system never exceeds the component’s maximum pressure tolerance.

The safety valves are set to open for water flow when the water pressure inside the system exceeds the predetermined level. If this does not work as it should, the high pressure will cause serious consequences for both equipment and personnel.

Illustration 3.9: Safety Valve

This valve is set to a predetermined pressure depending on what system, and working pressure the pump is. It is a fixed valve and cannot be adjusted (locking tabs fitted).

In the event of excessive pressure, the valve will open and loose all water pressure, and direct the water down into the canopy skid. To reset, all pressure needs to be released and the valve should reset. If this does not happen, the valve must be replaced.
3.5 Control hoses

All hoses used with this high pressure cleaner must be constructed in order to bear the working pressure of the equipment and stainless steel fittings.

Make sure the hose used is able to bear this pressure, by reading the labelling on the outside of the hose. Hoses also need to be inspected in case of tears or other damages.

In case of damage, replace the hoses before use.

3.6 Control suction hose and connection

Make sure that the suction hose is well attached to the feed pump. It is also important that the entire suction filter is below water during the running of the net cleaner.

Illustration 3.10: Suction Hose Connection Points
3.7 Control the net cleaning rig

Check the hoses on the frames for bends and kinks, the hoses must not be bent, kinked or stretched in any way. Also check for tears and other damage. Any damaged hoses must be repaired before use.

Check the hose couplings, and tighten if necessary. Run the system with feed pressure to check the conditions of all the nozzles.

The yellow discharge valve must be open during this procedure. See Illustration 2.4 Discharge valve open and closed.

Illustration 3.11: Net Cleaning Rig
4 Starting and stopping the machinery

After completing procedures in section 3.1 Priming the system for first start up and all other “before use”-procedures in sections 3.2-3.7, the net cleaning system may be started and used for net cleaning.

4.1 Before first start-up: Starting up after priming

1. Complete all instructions in section 3 Before use before starting up the net cleaner for the first time

2. Open the yellow discharge valve. This allows the engine to start without pressure and with minimum load.

3. Place the water lift strainer into the water to make sure it is fully submerged.

4. Connect the cleaning rig to the high pressure outlet of the pump unit with the high pressure hose provided.

5. Place the cleaning rig in a position/place that allows for checking the nozzles in a safe manner. Use low water flow/pressure, just enough to check nozzles are clear. This is done by ensuring the engine is on idle and the discharge valve is open.

Although the pump unit and cleaning rig are connected with High Pressure Hose, the pump unit must not run at high pressure when checking the nozzles. Discharge valve must be open, and discs should not spin.

6. Continue to section 4.2 Regular start-up.
4.2 Regular start-up

1. Start up the high pressure cleaner:
   a. Turn the ignition key and wait for the bilge light to flash 3 times.
   b. Wait for stabilized count down and press the green button on the MNC10 control panel to start the engine.
   c. Engine will now enter warm up count down and be at idling RPM.

2. Check nozzles on cleaning rig to make sure they are clear.
   
   **Discharge valve must be open during this procedure, and the engine must run in idle speed. Disks should not spin.**

3. Submerge the rig in the water.

4. Close pressure discharge valve to allow water to flow to the cleaning rig.

5. After checking the cleaning rig, press enter on the control panel.

6. Engine will ramp up to target RPM, which will also achieve target pressure from the pump. This can be seen on the pressure gauges.

7. Check pump over for water leaks, excess vibration in general or from the drive pulley/belt, and any abnormal noises, to ensure correct operation.

8. The cleaning rig will now be operating at the desired cleaning pressure, and is ready to clean the net.
4.3 Stopping the pump

Before stopping the engine, it must cool down for at least 10 seconds.

Procedure:

1. Press the red stop button on the MPC10 Control panel:

   ![Illustration 4.2: MPC10 Control Panel - Stop key]

2. Allow for 10 second cool down at the idle speed (1100rpm).

3. After cool down press red stop again to stop the engine.

4. Wait for spin down timer before the turning ignition off.

5. Open pressure discharge valve ready for restarting the pump.
   See Illustration 2.4 Discharge valve open and closed.
4.4 Emergency stop and restart

For MPC10 control panel warnings and functions, please read relevant documentation enclosed in the delivery pack.

4.4.1 Procedure for activating an emergency stop
Press the red button.
And all of the machinery will stop immediately.

In case of emergency, press the emergency stop button immediately!

4.4.2 Procedure for deactivating a emergency stop
Make sure that everything is OK before restarting.

The emergency stop button has to be released before restarting.

Turn the button according to the instruction arrow, and the button will be released out to starting position again.

As long as everything is found to be ok, and the cause of the emergency is removed, the system is ready to run again.

Before resetting after an emergency stop situation, establish the reason for the stop and rectify the fault
4.5.3 Placing of emergency stop buttons on the cabinet

The net cleaner cabinet includes two emergency stop buttons. One is placed in the corner next to the control panel in the cabinet's front side:

*Illustration 4.3: Front Emergency Stop Button*

The other emergency stop button is placed in the back side, between the water filter door and the fuel filling door:

*Illustration 4.4: Rear Emergency Stop Button*
5 Net Cleaning Rig

Discharge Valve cannot be opened when system is under pressure. Do not attempt to open discharge valve when system is under pressure as damage to equipment may occur.

Always use undamaged rope when lifting the net cleaning rig. If the rope is torn off, the rig will fall to the bottom of the cage, stressing the fish and risking damages to the net and other equipment.

The rope for lowering and lifting the rig is connected via safety hooks. This prevents wear and tear on the rope which would cause it to brake.

Illustration 5.1: Net Rig with attached Lifting Rope

Illustration 5.2: Attached lifting rope close up
The cleaning process is more efficient when the rig is being pulled upwards. When going down in the water, the operator does not have enough control over the rig to provide a precise cleaning operation.

Use crane when cleaning the net with the large rigs (5-7 disks). Let the rig sink to the bottom of the net, and then raise it slowly and controlled to achieve the best possible result.

The net cleaning rig must always be held under water when the machinery is running. For testing the nozzles, however it can be run above water, but only using feeding pressure: set the yellow discharge valve open. Read more about testing nozzles in section 4.1 Before first start-up: Starting up after priming.

Illustration 5.3: Pull the rig upwards for best possible cleaning
6 Cleaning and storage

6.1 After use/before storage

Regular service and good maintenance are factors which will prolong the equipment’s lifetime and functions. We recommend performing all of the items from section 8 Maintenance plans and registration according to plan, as well as after long lasting cleaning processes. This way, the equipment will always be ready for use, and this will also reduce service costs.

1. Always run fresh water through the system after use.

2. Mix 80% water and 20% antifreeze solution and run this through the system to conserve the system, to lubricate the seals and to reduce the danger of frost damages in case of storing in a below 0°C environment. If storing in colder environments, increase the amount of antifreeze solution. Check instructions on the solution bottle.

3. If the system can be exposed to frost, it is important that the amount of water inside is as low as possible, but more importantly, there has to be antifreeze solution in the water. The components can burst if large amounts of water freeze inside them.

4. Empty the pressure hose and coil it up.
6.2 Inside cabinet cleaning

General instructions to keeping the machinery clean:

- Keep the machinery clean, dry and in order.

- Clean away any spills of oil immediately.

- Do not use High Pressure Cleaners to clean the equipment, this can cause water to penetrate the engine, pump and electronics, and thus may damage these components.

- Use a mild detergent, do not use strong degreasers.

Avoid leaving salt water to dry off inside the system, rinse with fresh water after use to prevent corrosion and other damages caused by salt crystals on metals and other materials. We recommend a rinse with fresh water if the net cleaner is going to be stored for one week or more.

Also, rinsing the outside with fresh water regularly prevents corrosion in the surfaces. All moving parts, such as hinges, wheels, locks, gas regulators must be lubricated after each fresh water rinse. Check all enamel covered surfaces for scratches, and fill these with lubricant to avoid further corrosion. If, before moving, the equipment is disinfected, it has to be rinsed off with fresh water, and lubricant/wax added as mentioned above.
6.3 Cleaning the Net Cleaner Frame

Do not disconnect the net cleaner frame before the system is flushed with fresh water, these parts also needs rinsing.

Remove dirt and algae from the discs, both in front, and especially between the discs and hubs.

Clean between the discs and the disk guards.

Clean nozzles and Venturi Nozzle intakes.

*If the net cleaner is not maintained and cleaned properly, this is what you may end up with after some time:*

*Illustration 6.1: Poorly maintained Diesel Cabinet Net Cleaner*
7 Maintenance instructions

7.1 Overview oil

- Oil for engine: 15W-40 CJ4
- Amount of oil in engine: 32L

- Oil for pump: 15W-40 CJ4 or SAE 220 for High/Low Ambient Temperature Climates
- Amount of oil in pump: 14L

Use dipstick/sight glass to make sure that the oil amounts are correct.

To view the HP Pump Sight Glass (without removing the canopy side cover) there is an illuminated telescopic mirror provided in the toolkit.

7.2 Engine

External cleaning: once a week
Oil check: every day
Oil change: First time after 300h use, thereafter every 300h
Change oil filter: First time after 300h use, thereafter every 300h
Air filter: change after 300h, replace when needed or every 2 years.

7.3 Internal cleaning

Rinse down the insides of the cabinet carefully with fresh water.

Make sure to keep water away from electronics!

Clean the pump body, the fuel tank and the filter housing.
Flush out the internal skid by taking out the drain plug below the control panel. This maintenance will keep corrosive build up from salt crystals in vulnerable components.
7.4 Battery

Check battery level and poles every six months. If the poles are allowed to get dirty, the battery will discharge faster because of power leakages.

Clean battery poles are also important for optimized charge. Before cleaning, remove the poles from the battery.

Use protection gloves and goggles to avoid being hurt by the very corrosive battery acid.

Use a steel brush to clean the poles. Brush and clean the poles until they are shiny and clean. Blow off any scrapings.

The negative pole may be harder to reach, so use a screwdriver or something similar to scrape off filth and rust.

7.5 Coolant

The coolant must be changed every two years.

1. Drain the coolant by opening the draining valve placed in the bottom of the radiator.

2. Refill with fresh coolant 50/50-mix with water.

3. Check the coolant level after refill. If the level is too low, more coolant must be added.
7.6 Engine filters

7.6.1 Diesel filters

Open the filter cup, check filter for impurities and change if it is clogged.

Pre filter:

Illustration 7.2: Pre Diesel Filter (right side of engine)

Final filter:

Illustration 7.3: Final Diesel Filter (left side of engine)
7.6.2 Oil filter

Use filter forceps to remove the engine oil filter. Place the forceps around the filter cup, turn to the left and release the filter. Take out the old one, clean the holder with a clean cloth, and put in the new filter. Replace the filter cup and tighten it by hand.

Illustration 7.4: Engine Oil Filter
7.6.3 Air filter

This filter has its own indicator placed on top of the engine, when it turns red, the air filter needs to be replaced.

Illustration 7.5: Air Filter Indicator

Procedure:

1. Release the cover by loosening the clamps (highlighted in Illustration 7.6 Remove Clamps, Cover and take out the Air Filter).
2. Take the filter out.
3. Check for filth and replace filter if clogged.

Illustration 7.6: Remove Clamps, Cover and take out the Air Filter
7.7 The pump

Cleaning: once a week
Oil check: every day
Oil change: first time after 50h use, thereafter every 600h
Inspection, function test: when required
Vents: when required
Pressure gaskets: when required
Pistons: when required

7.8 Feed pump

This pump is a centrifugal pump and does not use impellers. The belt needs to be checked weekly for tightness/condition and replaced when needed. The back can be removed and visually checked once a year or every 600 hours.

Illustration 7.7: Feed Pump
7.9 Ventilating the diesel system

When air appears in the diesel system, it needs to be ventilated out of the system.

Air can appear in the system after running out of diesel, changing diesel filter and after any work is done with the system.

The ventilation handle is placed on the right side of the diesel filter. When ventilating, push the handle upwards several times, until a smooth resistance is felt.

Illustration 7.8: Diesel System Ventilator
7.10 Sea water filter

With nets which are excessively dirty this filter may require to be checked after each cage has been cleaned.

The filter must be checked and washed at least twice every day, or when inlet pressure drops to less than 1.5 bar.

There are two sea water filters:
- one is the strainer on the end of the suction hose, and
- one is located at the rear above the primer valve.

Procedure:
1. Unscrew the v-clamp holding the filter clamp plate on.
2. Take the filter out of its container for inspection.
3. Clean or replace the filters when required.

Illustration 7.9: Removing the Sea Water Filter
7.11 Net cleaner rig

The spinning discs rotate at high speed (2000+ rpm) on ball bearing assemblies where high pressure water is fed through the centre. These are high pressure moving parts and are susceptible to wear.

To check the bearings, spin each disc by hand. If the bearings are okay the disc should spin smoothly and should not feel rough at all or 'as if there is grit inside it'. There should be no noise when spinning the disc if the bearings are okay. A rough/scratching noise will also indicate a problem with the bearings.

Run the system with feed pressure to check the condition of the nozzles on the net cleaner.

Make sure to check each one of the nozzles, and clean them if necessary.

Hoses and hose couplings must be checked every six months.

Illustration 7.10: Net Cleaner Rig
8 Maintenance plans and registration

8.1 First maintenance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Checked/changed after</th>
<th>Execution date</th>
<th>Executed by (signature)</th>
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<tr>
<td>Oil change, pump</td>
<td>50h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil change, engine</td>
<td>300h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change oil filter</td>
<td>300h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change air filter</td>
<td>2 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change diesel filters</td>
<td>300h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery: Check level/clean poles</td>
<td>6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspection pump belt</td>
<td>300h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump: Function test</td>
<td>1 year</td>
<td></td>
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</tbody>
</table>

*Table 8.1: First time maintenance*

**Maintenance intervals after the first maintenance:**

- Oil change, pump: every 600h
- Oil change, engine: every 300h
- Change oil filter: every 300h
- Change air filter: every 2 years
- Change diesel filters: every 300h
- Check level, battery: every 6 months
- Clean poles, battery: every 2 weeks
- Inspection pump belt: every 6 months
- Pump function test: when required
8.2 Maintenance plans

### Engine:

<table>
<thead>
<tr>
<th>Task</th>
<th>Service Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours</td>
</tr>
<tr>
<td>Cleaning</td>
<td>1</td>
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<tr>
<td>Check engine Oil</td>
<td>300</td>
</tr>
<tr>
<td>Change engine Oil</td>
<td>300</td>
</tr>
<tr>
<td>Change Air Filter</td>
<td>2</td>
</tr>
<tr>
<td>Change Diesel Filter</td>
<td>300</td>
</tr>
<tr>
<td>Inspect Coolant Level</td>
<td>1</td>
</tr>
<tr>
<td>Change Coolant</td>
<td>2</td>
</tr>
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</table>

Table 8.2: Engine Maintenance Intervals

### Pump:

<table>
<thead>
<tr>
<th>Task</th>
<th>Service Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours</td>
</tr>
<tr>
<td>Cleaning</td>
<td>1</td>
</tr>
<tr>
<td>Check Oil</td>
<td>600</td>
</tr>
<tr>
<td>Function Test</td>
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</tr>
<tr>
<td>Clean Salt Water Filter</td>
<td>1</td>
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Table 8.3: Pump Maintenance Intervals

### Centrifugal lift pump:

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<thead>
<tr>
<th>Task</th>
<th>Service Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours</td>
</tr>
<tr>
<td>Cleaning</td>
<td>1</td>
</tr>
<tr>
<td>Service / belt</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.4: Centrifugal Lift Pump Maintenance Intervals

### Battery (if installed):

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<thead>
<tr>
<th>Task</th>
<th>Service Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours</td>
</tr>
<tr>
<td>Cleaning</td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.5: Battery Maintenance Intervals
8.3 How to use the maintenance forms

Before commencing any maintenance work:

- Print all maintenance forms before commencing the procedures, and collect all forms in the site maintenance folder
- Fill in week number in the daily maintenance form
- Fill in month in the weekly maintenance form.

This is important in order maintain regular and correct maintenance.

When a task is performed, sign the correct box, under correct day or week and in the correct task row.

Maintenance that is performed more seldom than once a week must be registered in the maintenance form in section 8.4.3

Registration of further maintenance.

New maintenance forms for all net cleaners are available from our website www.akvagroup.com/products/user-manuals.
### 8.4 Maintenance forms

#### 8.4.1 Daily maintenance

*Fill in correct week numbers*

*Sign the correct box after the task is performed*

<table>
<thead>
<tr>
<th>Week__</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
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</table>

- Check engine oil
- Check pump oil
- Check sea water filter
- Check engine coolant
### 8.4.2 Weekly maintenance

*Fill in correct month names/numbers*

*Sign the correct box after the task is performed*

<table>
<thead>
<tr>
<th>Month:__________________</th>
<th>Week No.:</th>
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<tbody>
<tr>
<td>Clean the machinery outsides with fresh water</td>
<td></td>
</tr>
<tr>
<td>Clean sea water filter</td>
<td></td>
</tr>
<tr>
<td>Check Air Filter</td>
<td></td>
</tr>
<tr>
<td>Drain Water from Diesel Pre Filter</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Month:__________________</th>
<th>Week No.:</th>
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<tbody>
<tr>
<td>Clean the machinery outsides with fresh water</td>
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<td>Check Air Filter</td>
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<tr>
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<tr>
<th>Month:__________________</th>
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<td>Clean the machinery outsides with fresh water</td>
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<td>Clean sea water filter</td>
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<td>Check Air Filter</td>
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<td>Drain Water from Diesel Pre Filter</td>
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<th>Month:__________________</th>
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<td>Clean the machinery outsides with fresh water</td>
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<td>Clean sea water filter</td>
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<tr>
<td>Drain Water from Diesel Pre Filter</td>
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### 8.4.3 Registration of further maintenance

*Fill in correct date*

*Sign after the task is performed*

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5.2 Attached lifting rope close up
5.3 Pull the rig upwards for best possible cleaning

6.1 Poorly maintained Diesel Cabinet Net Cleaner

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Use one deviation form per deviation.

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Appendix E - Contact information

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