INSTALLATION AND MAINTENANCE MANUAL

Mort Collection System

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<td>A</td>
<td>17.06.15</td>
<td>Approved (ECO-0000746)</td>
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Document no.: DC10000883  Document part no.: 10001569
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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1 Safety

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

We therefore strongly recommend that everyone who uses the equipment, all who perform any type of repairs, service or other maintenance to the product, and all who work in areas where the product is installed, read this entire manual and at least this safety chapter.

This recommendation is based on both personnel safety as well as a desire to keep the products in order and avoid damages if the safety instructions not being followed.

1.1 General safety for work on and by the cage edge

Misuse of the equipment as result of neglecting instructions in this and other relevant user manuals, will invalidate product warranty.

To avoid protruding parts in hose clamps hooking in the cage net, always cover them with a piece of layflat hose and use enough tape to keep the hose piece in place.

For safe process during installing and lifting mort collecting system up from the cage, use under water camera for surveillance. The best way to avoid damaging the net is to keep all equipment away from it during installation, use and when bringing the system up.

Always use certified ropes that are dimensioned to bear the weight of the mort cone plus center weight if used.
1.2 Safety symbols used in the manual

The following symbols are used in this manual:

\[ 
\begin{align*} 
\textbf{Information} \\
\text{Do not use knives during installation, use and maintenance of this product. Knife use may damage the product} \\
\text{Show caution, danger of damaging equipment and mild injuries to personnel} \\
\text{Wear helmet when working in area where cran is used} \\
\text{When staying and working on or around cage edge, it is mandatory to wear personal safety garments, such as safety vest and antiskid footwear} \\
\text{Warning, may cause injuries to personnel} \\
\text{Dangerous situations will occur, danger of fish escaping} 
\end{align*} 
\]

1.7.1 Other symbols used in this manual

Go to or see page or chapter for further instructions or more information
1.3 Personnel safety

Mort Collection Systems are large installations in cages, and working with this type of equipment requires that all participates in work with this system are aware of all safety precautions and dangers during such processes, prior to commencing the work.

This entire manual must therefore be read and understood by everyone who are going to work with or by the system. Also, everyone must be aware of all safety precautions in this manual, both for personnel safety reasons, for securing the equipment, and surrounding equipment.

When working on and by the cage edge, it is mandatory to wear antiskid footwear and safety garments, such as safety vests.

When installing the Mort Collection System, at least three people must participate in the process. To avoid personnel injuries, main focus during installation is clear communication and visual contact between all participants.

When mort cones are being transported into or out of cages with crane, they may only be transported just above the water surface. They may only be lifted up from the surface when it is being lifted over cage handrails and when lifted up to the service boat deck. Never lift mort cones over areas where personnel reside.
1.4 Receiving new equipment

Make sure that all parts are delivered according to the service note. If Your order should not be complete, or any defects are discovered, contact AKVA immediately. Contact information is found in the back of this manual.

1.5 Recommended knot

Always use good and well knotted knots when installing and fastening equipment in cages. The risk of knots loosening is higher if the they are not correctly executed, equipment may fall into the cage net and damage this, causing fish escaping.

It is also important that the knots are easy to loosen when needed after the ropes have stayed in salt water or in salt water environment for some time. Regular maintenance, service and controls in periods of bad weather or directly after storms is required. Then it will be easier to untie all knots in suspensions.

**Use the knot below for these suspensions:**
- safety ropes for fastening ropes on handrails on cages
- temporary installation suspensions for cages
- safety- and lifting ropes for mort cone
1.6 Fortifying the net bottom

Double net panel underneath the mort cone is important. Check the documentation from the net supplier and make sure that the net bag is strong enough to bear the mort cone before installing it, to avoid over-load in the net bag.

Contact AKVA group if there is any doubt about how this is done. Contact information is found in the back of this manual.

1.7 Protection against damages

In addition to personnel safety, protecting the net should be the most important safety factor when installing the Mort Collection System in cages. Follow safety instructions from any manuals delivered with the equipment in addition to this manual. The following factors will need extra focus to avoid damages to the net during the installation of the mort collection system:

1.7.2 Covering hose clamps

The hose clamps have protruding parts that may hook into the net. To avoid this, cover all hose clamps with pieces of layflat hose and tape thoroughly around the hose piece.

1.7.3 Use under water camera during the installation

Use under water cameras during the installation process.

1.7.4 Lowering the equipment in the net

Avoid contact with the cage net when lowering the system into the cage. Always use certified rope, dimensioned to bear the weight of the mort cone as well as centre weight if this is installed.
2 Introduction

This user manual is part of the equipment delivered with the AKVA Mort Collection System. Keep the manual for as long as the system is used, and make sure that all changes to the equipment are noted in the back of this manual.

Thank you for choosing AKVA group ASA as supplier for your mort collection system. Do not hesitate to contact us for more information regarding installation, use or maintenance for this system or any other AKVA product.

The purpose of this manual is to enable the user to install and maintain the Mort Collection System in a safe and economical way. The manual will show how to perform installation and maintenance procedures, and will hopefully answer any day-to-day-questions regarding the system. If any necessary information is missing from this manual, please contact AKVA group ASA for assistance and help to find a solution to any problems. Contact the AKVA service department, your subcontractor, your local AKVA office or our main office in Norway for assistance and help.
2.1 How to use this manual

This manual describes how to safely install, test and maintain the Mort Collection System. This entire manual must be read and understood by ALL participants in the installation process prior to the installation.

The table of contents is listed in the start of the manual. The headlines in this list works as links to their respective chapters in the .pdf-version of the manual.

Chapter 1 is the most important chapter of the manual, listing all safety precautions, warnings and other safety information that ensures safe maintenance.

Chapter 2 describes how to use this manual, and also contains information about AKVA group ASA, as well as information regarding the various parts in the Mort Collection System.

The following chapters, 3-9, explains the preparations for each of the part, and how to assemble them to a working system.

Chapter 10 describes two different procedures on how to install the system in a cage. The processes refer to previous chapters where they are described more thoroughly. Chapter 11 explains how to bring the system up from the cage, and how to control and run the system, and chapter 12 describes all necessary maintenance instructions.

Four appendixes are found in the back of the manual: Index, with links to the rest of the manual in the .pdf-document, 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 contact information.

This entire manual must be read, understood, and used as aid during installation, testing and maintenance work.
2.2 About AKVA group

With four main brands, AKVA group ASA 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 assumed to be the key to the future. Research, project management, fast deliveries and customer follow-up have been our focus to ensure that we contribute to a positive development within the aquaculture industry. Our goal is to deliver the best possible and most cost efficient equipment in order to keep preserving sustainable fish farming.

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

AKVA has a continuous development of products, and we continue to improve product safety, functions, range of use and reliability. The purpose of this manual is to enable users to install, test and maintain the components of the Mort Collection System in a safe and economic way.

All of our equipment is pre-installed, tested and delivered from our own production department. This means that our customers have total control over which components to choose from, grouping collocation, testing and deliveries. Our production staff consists of people with great expertise and engagement for producing the best possible products for you. Having our own production site gives you excellent service in case something should go wrong, or if you are in need of any assistance. Our service staff is available on the telephone or on location in order to assist you if necessary. Safety, both for users and equipment is our main focus when developing products and product manuals.
2.3 About the Mort Collection System

A prerequisite for a healthy and vibrant fish environment is that all of the morts are removed from the cage as quickly as possible. AKVA group, HSE and several fish farming companies has developed an automatic, robust and very practical system for removing morts. The system is fits today’s Polarcirkel plastic cages, Wavemaster steel cages, nets and various other fish farm infrastructure solutions.

The Mort Collection System is offered as semi-open or as a fully closed system. The system may be delivered with central collector, where morts are transported directly from cage for further treatment. Most feed AKVA group barges have integrated silage tanks in the hull below feed selector valves.

Two intakes combined with a collecting bowl (mort cone) with steep angle and smooth surface ensures that morts easily enters the mort cone. Compressed air is injected through a number of small holes in a separate air chamber, creating a constant and rapid air flow. The hose system will transport morts from the mort cone up to a sieving device or directly to the central collection system, for instance silage tank.

Screw compressors with minimum air capacity of 106 cubic feet per minute (3000 litres per minute) and 10 bar pressure are recommended.

The mort cones are available in various sizes and designs, and have adjustable weights - from 200kg up to 700kg. They may be delivered with extra weights up to 1.8 tons, and may therefore replace or complement the centre weight. Mort cones include wrasse guards, preventing cleaning fish from entering the system when it is not being operated.
### 2.3.1 The method

The Mort Collection System is operated by sending pressure air through an air hose into the mort cone. The air will move upwards inside the mort cone, creating a vacuum and a current that will create a suction effect and thus transporting morts up through the system and out from the cage. Air amount and pressure and water depth are deciding factors for the system’s efficiency.

### 2.3.2 Main components overview

- Handrail pipe
- 8” Layflat hose
- Buoy for stability
- 8” Layflat hose
- 16 feet (5m) TPU helix hose
- Mort cone (morts intake)
2.3.3 Mort Cone

Top section

Bottom section

Transport- and storing socket

1. Attached top pipe for connecting the helix hose
2. Air pin for connecting the air hose
3. Bolt splitting of top and bottom
4. Lifting eye (one in each side of the mort cone)
5. Wrasse guard


**Stabilization**

ML130 Mort Cone is delivered with up to 700kg ballast. Standard ballast is 500kg.

ML130 Mort Cone also has fixing point for fastening external weight. This fixing point bears up to 1000kg.

The weight must be adjusted to the mort cone considering depth, currents and similar factors. If there is any doubt on how much weight is needed as ballast or external weight, contact AKVA group for calculation assistance. Contact information is found in the back of this manual.

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Always check documentation from the net supplier to find out how much weight the net bag is constructed to bear BEFORE installing the suction inlet to avoid overload to the net bag. Always contact net supplier if any doubts.

---

Double net below the mort cone is important. The net has a custom net funnel installed for the mort cone, if the net does not have sufficient slope. Most net suppliers already offers this solution.
**Ballast chamber**

Mort Cone ballast chamber that takes up to 145 litres.

Manganese steel balls are used as ballast, they weigh 5.5kg per litre. As standard, Mort Cone are delivered with 500kg ballast, which equals 91 litres of manganese steel balls.

The plastic construction (the Mort Cone) weighs 45kg without ballast.

Total weight for Mort Cone with ballast is 545kg.

The construction including ballast displaces 145 litres, and total weight in the sea water is therefore reduced by 145kg.

Net weight in sea is therefore 400kg.

**Ballast with centre weight or just centre weight**

The centre weight must be adjusted to the individual mort cone location, considering depth, currents and other factors affecting the installation.

The ML130 is delivered with standard ballast 500kg, up to 700kg ballast and/or additional centre weight may be delivered with this model.

<-- The FL90 Flatnose is delivered without ballast weight, therefore, we recommend centre sinker weight and minimum 450kg.
2.3.4 Air supply

For effective operation, we recommend a compressor that delivers 106 cubic feet (3 m³) per minute at 10 bar pressure as a minimum.

We recommend pipes with minimum internal diameter Ø 1.34” (Ø 34 mm) for distances up to 2625 feet (800 meters) to minimize dynamic pressure drop and system effect.

For distances over 2625 feet (800 meters), custom pipe dimensions will be necessary, contact AKVA for assistance with this. Contact information is found in the back of this manual.

Information about running and maintaining the compressor is found in the compressor manual.
Air distribution in the mort cone

Air is distributed through the pipe stub into the air chamber. Air is blown in and distributed through small holes inside the pipe, thus creating an even air flow.

Air hose dimension is Ø 3/4” ID (Ø 19 mm).
2.3.5 Storage and transport base

Mort cones must always be placed on the customized storage and transport base during storage or transport to prevent the mort cone from falling down. The base prevents damages to the mort cone, surrounding equipment as well as personnel injuries.
2.3.6 Wrasse guard

The standard mort cone includes wrasse guard, preventing cleaner fish from entering the system, when the system is not being operated. The guard will open and close automatically by the water stream from the suction intake (the main hose) when the system starts up.

\[
\text{Be aware that the guard will not keep the cleaner fish from entering the mort cone when the system is activated}
\]
2.3.7 Hose system parts

Handrail pipes are attached to the handrail or a handrail pole, and keeps the hose in place. AKVA provides 3 different types of handrails:

HP55 Standard for installation on fittings compatible with PE and steel fittings.

HP120 can be installed on handrails with hose clamps. Standard inside angle is 120 degrees.

HP150 is tied to the handrail with ropes. It minimizes tearing to the hose.
Buoy

The buoy is installed for buoyancy and to keep the hose vertically in the water when the Mort Collection System is not being used, and to secure that morts flow may be transported easily through the system. This minimizes damages and wearing of the hose insides, thus prolonging operating life of the entire system, as well as ensuring a quicker start up time.

The buoy also reduces risk of conflict between hose clamps and net, and thereby avoiding damages to the net.

Attach the buoy between each of the layflat hoses.
**Hose joiner**

Hose joiners are used between helix hose and the lower layflat hose and may also be used to splice broken hoses.

Handrail pipes, the buoy and the mort cone all have built-in hose joiners.
**Hose length**

Correct hose length is important for optimal use of the system.

The hose length is adjusted with the upper layflat hose.

1. **Handrail pipe**

2. **Layflat hose length = c-radius - b-radius**
   - c-radius = cage radius
   - b-radius = bird net support radius

3. **Buoy**

4. **Layflat hose length = depth - 26 feet (≈ 8 meters)**
   - depth = depth from water surface to cage centre

5. **Helix hose (16 feet = ca. 5 meters)**

6. **Mort Cone**

See next page for how the hose system should look in the cage when running the system with pressure
This illustration shows how the system will look when all hose lengths are correct. The hose should break the water surface just outside the bird net support (around 3 feet = 1m).
3 Preparing the installation

Follow all instructions as listed in this manual, and do not bring anything out to the cage until it is time to install in cage, this procedure is described in chapter 10.

Do not use knife to open packagings, use blunt scissors to avoid cuts and damages to the hose surfaces

Unpack all parts and check the delivery note that all parts are delivered. Contact AKVA group immediately if any of the parts are missing or have been damaged during transportation.

Contact information is found in the back of this manual.

For simple assembling process, lay all parts out on the assembling area in the following order, from top to bottom:

- Compressor
- Ball valve
- Air hose (from compressor to mort cone)
- System for carrying morts from cage to ensilage tank
- Handrail pipe
- 2 hose clamps, a piece of layflat hose and tape
- Upper layflat hose
  - length = cage radius - bird net support radius
- 2 hose clamps, a piece of layflat hose and tape
- Buoy
- 2 hose clamps, a piece of layflat hose and tape
- Lower layflat hose
  - length = depth from surface - 26 feet (8m))
- 2 hose clamps, a piece of layflat hose and tape
- Hose joiner
- 2 hose clamps, a piece of layflat hose and tape
- Helix hose, 16 feet (5m)
- Mort Cone with lifting rope (crows foot)
- Ballast and/or stabilization weight.
4 Attaching layflat hoses

Connected the upper end of the upper layflat hose pipe to the handrail after the system has been brought to the cage.

Attach both layflat hoses to the hose joiner on each side of the buoy with hose clamps that fit perfectly in the hose joiner slots.

All hose clamps must be covered with a short piece of layflat hose that is attached and covered with tape before installing the system in a cage. The other end of the lower flat hose is connected to the helix hose as instructed in chapter 5.

Necessary equipment:

- 8 inches (0.2m) layflat hose, 4 pieces:
  - 1 lower hose length = depth from surface to centre cage minus 26.5 feet (8m)
  - 3 small cuts that are long enough to cover both hose clamps on each hose joiner
- A knife (for making the hose pieces)
- Lubricant or soap
- 6 ABA hose clamps, 7.5 - 8 inches (190-200mm)
- Flat screw driver
Procedure for attaching the layflat hoses

1. Read through this entire procedure before commencing this procedure.

2. Measure length for the lower layflat hose:

   **Length for lower layflat hose** = cage depth - 26.5’ (8 m)

3. Cut up two short layflat hose pieces that can cover hose clamps. Keep the rest of the layflat hose in the roll.

4. Cut a 4 inch (10cm) notch along both ends of the lower layflat hose, and a similar notch in the top end of the upper layflat hose.

5. Thread a short piece of layflat hose and 2 hose clamps in to each end of the lower layflat hose and to the free end of the upper layflat hose.

6. Lubricate the insides of the layflat hose ends with lubricant or soap, and thread one end of the lower layflat hose over the buoy. Thread the other end over the hose joiner (between the lower layflat hose and the helix hose). The top end of the upper layflat hose goes over the upper end of the buoy when the system is being installed in the cage.

7. Place the hose clamps around the slots in the hose joiner, lubricate the hose clamp threads and tighten them properly. Make sure that there is no chance that the clamps will fall off.

8. Pull the short layflat hose pieces over the hose clamps and cover the pieces with tape to make sure that they are properly covered and will not fall off over time.
5 Assembling the helix hose

Attach the top end of the helix hose to the lower layflat hose by a hose joiner. The other end of the layflat hose is attached to the integrated hose joiner on top of the mort cone.

5.1 Attaching layflat hose to helix hose

**Necessary equipment:**
- 6mm hex key
- 7mm box spanner
- lubricant
- 2 pieces of layflat hose that will cover 2 hose clamps
- tape
- 4 hose clamps
- flat head screw driver

**Procedure:**

1. Read through this entire procedure before commencing this procedure

2. Thread a short piece of flat hose and 2 power clamps over each of the ends of the helix hose

3. Thread one end of the helix hose over the mort cone hose joiner

4. Attach both hose clamps in their respective hose joiner slots, lubricate the bolt threads and tighten properly

5. Tread the other end of the helix hose over the hose joiner that is already attached to the lower layflat hose

6. Attach both hose clamps in their respective connection slots in the hose joiners, lubricate the bolt threads and tighten

7. Cover the hose clamps with the short piece of layflat hose and tape thoroughly to make sure that they will stay in place.
6 Assembling the mort cone

ML90 Mort Cone requires no assembling.
Attach the centre weight to ML90 or ML130 according to the description in chapter 7, if this is being used.

6.1 ML130 Mort Cone

Necessary equipment:
- 3/4 inch (19mm) wrench

Procedure:
1. Read through this entire procedure before commencing this procedure
2. Make sure the wrasse guard (5) is able to slide up and down unobstructed
3. Attach the 4 bolts to the top section (3) in both sides
4. Blow a little air into the air pin (2) and check that air flows through the air chambers

Attach lifting ring and rope

Attach lifting rope in one of the lifting eyes, use the recommended knot from chapter 1.6. Tread a lifting ring on to the rope, and then attach the rope to the other lifting eye. The rope will appear as an upside-down “V” with approximately 6 feet (2m) in each side, making a so called “Bridle”.

Attach lifting rope to both lifting eyes, and always lift mort cones from both sides at the same time
Lifting eyes are placed on each side of the mort cone

Attach the rope as a two armed “bridle“, each end is attached to one lifting eye

The lifting rope must be attached to the top point of the “bridle“
7 Installing the centre weight

Several types of centre weight may be used, for instance steel chains or concrete weights.

The weight has to be customized to each Mort Collection System, cage and location, based on factors such as depth and currents.

Contact AKVA group for a customized calculation on ballast and centre weight for each cage. Contact information is found in the back of this manual.

See task 11 in chapter 10.1 and task 13 in chapter 10.2 for instructions on how the centre weight should be installed.

Mort cones may only be lifted along the surfaces during the installation process, and may only be lifted higher when lifted out from the boat and over the cage handrail.
8 Attaching the air hose

**Necessary equipment:**
- 3/4” air hose
- 2 ABA hose clamps, 0.78” - 1.26” (20-32mm)
- flat screwdriver
- a piece of layflat hose to cover both hose clamps
- Nitto 51 Tape

**Procedure for attaching the air hose**

1. Read through this entire procedure before commencing this procedure
2. Thread 2 hose clamps on to the air hose
3. Thread the air hose around the air pin
4. Attach and tighten the ABA hose clamps around hose and pin
5. Cover all clamps with a piece of layflat hose and tape generously around it
6. Attach the air hose loosely 2 or 3 times along the helix hose every 5 feet (1.5m) to avoid conflict between air hose and wrasse guard.

*Make sure to attach the air hose loosely. If it is attached too tight, it may fall off when the system starts*

To avoid strangling the layflat hose, only attach the air hose to the helix hose
9 Assembling handrail pipe

After assembling the entire system (upper layflat hose, buoy, lower layflat hose, helix hose, air hose and mort cone), the upper layflat hose may be connected to the handrail pipe.

Optimal length for the entire hose system may first be controlled after start up of the system. Calculate cage radius minus bird net support radius for the upper layflat hose, and add or remove length after start up.
9.1 HP55

**Necessary equipment:**
- 2 x 3/4” (19mm) wrench for tightening the fastening bolts from both sides of the bracket

The HP55 handrail pipe is delivered with assembly kit. This kit is compatible with most steel and plastic cages, please contact AKVA group to find the right one. Contact information is found in the back of this manual.

9.2 HP120

**Necessary equipment:**
- 6mm Hex key

The HP120 handrail pipe is attached to the rail with one hose clamp on each side.
9.3 HP150

The HP150 handrail pipe is hung over the handrail and attached with ropes to make sure that it does not move to the sides, nor tilts back or forward.
10 Installing the system in a cage

The methods:
There are two different methods that may be used when placing the mort cone in the net bottom:

1  Installation with cross rope (chapter 10.1)

2  Installation with snatch blocks (chapter 10.2)

The installation methods demands that the crane reaches as far into the centre of the cage that the mort cone will be kept away from the net during the entire installation process.

Choose only one of these two methods, and follow the instructions for only this method for the entire installation process

The most important safety moments regarding all work with installing the Mort Collection System inside a cage, is to avoid personnel injuries.

All participants of the installation process therefore have to read and understand the contents of this entire manual, especially the safety warnings in chapter 1, prior to commencing the installation process. Site owner and site manager are responsible for that all personnel understands all dangers as well as all safety precautions that must be considered during this process.

Mort cones may only be lifted along the surfaces during the installation process, and may only be lifted higher when lifted out from the boat and over the cage handrail
10.1 Method 1: Installation with cross rope

At least three people must attend the process of installing the Mort Collection System in cages

Use helmet when working around a crane

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

Necessary equipment:
- Service boat with net dragger/winch and crane
- Under water camera with rope
  (length for cable and rope: cage depth + cage radius)
- Steel (lifting) ring
- 2 different ropes:
  - 18mm certified cross rope (length: diameter of the cage + extra length for fixing on the cage edge and net dragger)
  - 18mm lifting rope (length: depth + radius of the cage + extra length for fixing on the cage edge)

Use recommended knot from chapter 1.6 in this manual for fastening ropes during the installation
Procedure for installation with cross rope

Tasks 1-6 in the procedure below are executed on land or indoors in the barge.

Most items below refer to previous chapters in this manual, and these will be marked with **bold letters** instead of using the -symbol.

1. Read through this entire procedure before commencing the installation process.

2. Process supervisor is responsible for that everyone participating in the installation process have read this installation manual, and that they understand all dangers that may occur during the process as well as all safety procedures that must be followed during the process.

3. Attach the top of the mort cone to the bottom section as described in **chapter 6**

   ![Remember O-ring between top and bottom parts](image)
4  Attach the 5 meter long spiral hose to the fixed hose joiner in the mort cone as instructed in chapter 5

5  Attach the air hose to the pin on top of the mort cone and attach the air hose to the spiral hose as instructed in chapter 8

6  Thread a lifting ring into the crows foot rope and attach the crows foot rope to the mort cone lifting eyes as instructed in chapter 6

7  Attach the lower layflat hose to helix hose and buoy as described in chapter 4

8  Bring the entire system to the cage for installation

9  Attach lifting rope to lifting ring (already attached to crows foot) in one end, and to net dragger 1 in the other end

10 Attach one end of the cross rope to net dragger 2

11 Thread the other end through the lifting ring and bring the cross rope over to the opposite side of the cage and attach it properly to the cage edge

   Make sure that the rope goes underneath other ropes and equipment inside the cage (rotor spreader, cameras, feed pipes)

12 If centre weight is being used in this cage, attach the lifting ring to the crane, and lift the mort cone just enough that the centre weight can be attached to the lug in the mort cone bottom

   Mort cone may only be lifted along the surfaces during the installation process, and may only be lifted higher when lifted out from the boat and over the cage handrail
13 Transport the mort cone in to the cage and tighten the lifting rope

14 Hang up the layflat hose roll as seen in the image to the left, and keep the air hose separated from the layflat hose to ensure that the hoses do not twirl during the installation process.

15 Release the crane and release the lifting rope slowly from net dragger 1. The mort cone will slide across the cross rope towards the centre of the cage.

16 Use a safety hook to attach a surveillance camera to the rope next to the mort cone. This camera provides full control of the process, and minimized risks of conflict between Mort Collection System components and net.

17 Run the crane as close to the cage’s centre as possible, while releasing the lifting rope from net dragger 1.

18 Lower the mort cone slowly until it stands in the centre of the cage net bottom. Use the camera to check that the mort cone stands vertically. As the mort cone is being lowered slowly in to the bottom of the cage, we recommend having 3 installation participants as followed:
   - **Person 1** slowly slacks the cross rope
   - **Person 2** controls the hoses
   - **Person 3** follows the process through the surveillance camera attached to the mort cone

19 Attach the handrail pipe to the handrail as described in chapter 9 (make sure to use correct method for the specific handrail pipe).
20 Find correct length for the upper layflat hose, cut and attach it to the handrail pipe. Use the same method explained in chapter 4

Length upper layflat hose
= cage radius - bird net support radius

21 Connect the air hose to the air supply unit (compressor)

22 Release the lifting rope from net dragger 1 and attach it properly to the cage edge. Bring the cross rope for Mort Collection System installation in the next cages

23 The system is now ready to be connected to the de-waterer, and removing morts from the cage is now possible

24 First time start up of the system will show whether the hose length needs adjusting. Optimal hose length is when the hose breaks the surface just outside the bird net support during operation. Cut off or splice on further length for optimizing the length

25 If any twists appear in the hoses in the system, release hose from handrail pipe, release the twist and re-attach to handrail pipe.

Best practice is to check that the system works as it should directly after installation, as the service boat is available. If anything wrong has happened during the installation, or anything has been damaged and needs to be brought back up from the net bottom. Instructions for controlling the system is found in chapter 12.
10.2 Method 2: Installation using snatch blocks

At least three people must attend the process of installing the Mort Collection System in cages

Use helmet when working around a crane

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

Necessary equipment:
- Service boat with net dragger/winch and crane
- 18mm certified lifting rope (length = depth + cage radius)
- 18mm certified rope; “rope 1” (length: 2*cage diameter + extra length for attaching)
- 18mm certified rope to connect snatch block 1 to the crane
- 2 snatch blocks (snatch block 1 and snatch block 2)
- Under water camera with fastening rope (length for cable and rope: cage depth + cage radius)

Use recommended knot from chapter 1.6 in this manual for fastening ropes during the installation
Tasks 1-6 in the procedure below are executed on land or indoors in the barge.

Most items below refer to previous chapters in this manual, and these will be marked with **bold letters** instead of using the ➔-symbol.

## Procedure for installation with snatch blocks

1. Read through this entire procedure before commencing the installation process.

2. Process supervisor is responsible for that everyone participating in the installation process have read this installation manual, and that they understand all dangers that may occur during the process as well as all safety procedures that must be followed during the process.

3. Attach the top of the mort cone to the bottom section as described in **chapter 6**

   ! Remember O-ring between top and bottom parts
4 Attach the 5 meter long helix hose to the fixed hose joiner in the mort cone as instructed in chapter 5

5 Attach the air hose to the pin on top of the mort cone and attach the air hose to the helix hose as instructed in chapter 8

6 Thread a lifting ring into the crows foot rope and attach the crows foot rope to the mort cone lifting eyes as instructed in chapter 6

7 Attach the lower layflat hose to helix hose and buoy as described in chapter 4

8 Bring the entire system to the cage for installation

9 Hang up the layflat hose roll as seen in the image to the left, and keep the air hose separated from the layflat hose to ensure that the hoses do not twirl during the installation process

10 Attach snatch block 1 and buoy to each other with a safety hook, and attach the buoy to the crane

11 Attach lifting rope:
   a One end to the crows foot lifting ring
   b Thread through snatch block 1
   c Attach to net dragger 1

12 Attach snatch block 2 to the handrail on the other side of the cage (from the boat)
13 Attach rope 1:
   a  To snatch block 1
   b  Draw rope 1 through snatch block 2
   c  Draw rope back to the boat and attach the end to net dragger 1

14 If centre weight is being used in this cage, attach the lifting ring to the crane, and lift the mort cone just enough that the centre weight can be attached to the lug in the bottom of the mort cone

Mort cones may only be lifted along the surfaces during the installation process, and may only be lifted higher when lifted out from the boat and over the cage handrail

15 Tighten the lifting rope with net dragger 1

16 Use a safety hook to attach a surveillance camera to the rope next to the mort cone

17 Run the crane as far into the centre of the cage as possible, Run the crane as close to the cage’s centre as possible while releasing the Lifting rope with net dragger 1 and tightening rope 1 with net dragger 2

18 When the mort cone is being lowered down to the bottom centre of the cage net, we recommend three people as followed:

- **Person 1** slowly slacks the Lifting rope with net dragger 1
- **Person 2** controls the hoses
- **Person 3** follows the process through the surveillance camera attached to the mort cone
19  Stop rope 1 from net dragger 2 and slowly lower the mort cone down to the centre of the cage net bottom, while releasing the Lifting rope from net dragger 1. Follow the process through the camera to make sure that the mort cone stands straight when placed.

20  Attach the handrail pipe to the handrail as described in chapter 9 (make sure to use correct method for the specific handrail pipe).

21  Fasten the upper layflat hose to the handrail pipe as explained in chapter 4.

Length upper layflat hose
= cage radius - bird net support radius

22  Loosen snatch block 2 from the crane, release lifting rope from net dragger 1 and attach it properly to the cage edge.

23  Release rope 1 from snatch block 1 and net dragger 2.

24  Release snatch block 2 and bring this plus rope 1 for Mort Collection System installations in the next cages.

25  Connect the air hose to the air supply unit (compressor).

26  First time start up of the system will show wether the hose length needs adjusting. Optimal hose length is when the hose breaks the surface just outside the bird net support during operation. Cut off or splice on further length for optimizing the length.

27  If any twists appear in the hoses in the system, release hose from handrail pipe, release the twist and re-attach to handrail pipe.
Best practice is to check that the system works as it should directly after installation, as the service boat is available. If anything wrong has happened during the installation, or anything has been damaged and needs to be brought back up from the net bottom. Instructions for controlling the system is found in chapter 11.
11 Controlling and running the system

It is best practice to control that the system functions as it should directly after installation, when the service boat is still available, in case something wrong has happened during the installation or if something has been damaged and must be brought back up from the net bottom.

This procedure must also be followed when collecting morts, and must be performed as a part of the daily routines.

Procedure:

1. Read through this entire procedure before commencing the control process

2. Make sure that the air vent is closed

3. Start the compressor and let it run idle for around 10 minutes. Control the air supply system for leakages. Even the smallest leakage may have great impact to the systems efficiency, so it should be 100% air tight. Make sure that the compressor has been running for about 10 minutes, and that the pressure is set to maximum running pressure

4. Attach a strainer installation to the open end of the handrail pipe

5. If there are no signs of leakages, the air vent may be opened. Start by opening the vent to about 20%, and let the water slowly work its way up to the strainer

6. Check the hose system have any twists or bends. If there are any such blockages in the hose system, turn off the compressor, loosen the upper layflat hose from the handrail pipe, spin the hose and re-attach the hose to the handrail pipe
7. When tasks 1-5 are checked and found to be ok, the system is ready to be operated. Open the air valve to 30% to start with normal operation of the system. The water stream is then constant.

8. During periods with higher mortality, or when larger fish are dying, it may be necessary to close the air vent during use, letting the pressure build up in the compressor to increase the effect: Open the air vent to 100% for about 10 seconds, then turn it back down to 30% to create a shock-effect that can help bring up morts.

   ! This method may stress the hose system, and thus increase risk of hose damage

9. After the system is empty of morts, close the air vent (use the underwater camera to see if there are more fish around the mort cone) and de-attach the de-waterer if fitted. Secure the air vent to make sure that it will not open by accident during bad weather or other occasions.

10. Use the underwater camera to see if there are any more morts surrounding the mort cone.

   When the Mort Collection System is operating, the hose course should be similar to the green line in the illustration to the left.

   The grey hose in the illustration will be too short, and may cause disconnection between the hose and the mort cone. This may lead to dangerous situations and damages to the net, and worst case fish escaping. This must be avoided by all means.
12 Bringing up the mort cone using snatch block

This method is for when the system is already installed inside the cage, and is being moved or is being brought up for repairs, service or other maintenance and for bringing the system up for storage.

The most important safety factor for when working with bringing up the Akvasmart Mort Collection System, is personnel safety and avoiding personnel injuries. It is therefore strictly forbidden to lift the mort cone over where personnel reside.

If the Akvasmart Mort Collection System is being relocated, it is required to disinfect all of the belonging parts, inside and out. After disinfecting, all equipment must be rinsed off with fresh water to avoid corrosion and other damages caused by the strong chemicals from disinfecting fluids.

- The mort cone can only be lifted across the water surface, and may only be lifted above the surface when lifted over the handrail and up to the serviceboat deck
- At least three persons must attend the process of bringing up the Akvasmart Mort Collection System
- Wear helmet when working in area where cran is used
- When staying and working on or around cage edge, it is mandatory to wear personal safety garments, such as safety vest and antiskid footwear
- All parts of the system must be disinfected before moving it to a new location
Sketch of suspension for the floating the system:

Necessary equipment:
- 2 snatch blocks (Snatch block 1 and Snatch block 2)
- Service boat with 2 net drags (Net drag 1 and Net drag 2) and crane
- 1 lifting rope (attached to the cage edge and mort cone)
- 1 rope (Rope 1)
- 1 buoy

Procedure:
1. All participants must read through this entire procedure before commencing the process
2. Empty the Mort Collection System entirely
3. Use the underwater camera to control that the system is empty
4. If the system is brought up for moving to another location, also bring up the centre weight (attached to the mort cone)
5 Attach snatch block 1 to the buoy, and attach one end of rope 1 to snatch block 1

6 Loosen the lifting rope from the cage edge, tread it through snatch block 1 and attach it to net drag 1

7 Attach snatch block 2 to the handrail on the opposite side of the cage (from the service boat) and pull rope 1 from snatch block 1 through snatch block 2 and back. Attach the loose end of rope 1 to net drag 2

8 Pull rope 1 with net drag 2 so that the buoy by snatch block 1 lies in the centre of the cage

9 Pull the lifting rope in by net drag 1, and pull the mort cone up from the cage net bottom

10 If the system is just going to be adjusted inside the cage, do this by running net drag 2 in- or outwards

11 If the system is taken out from the cage, use crane and lift the mort cone just over the water surface and transport it along the surface to the cage edge

12 Make sure that noone resides in the area and lift the mort cone over the edge and back to the surface, and transport it up to the boat deck

13 Remove the center weight if this is installed

14 Place the mort cone on the storage base, personnel on board assists crane driver to place it correctly

15 To drain all water from the hose system, attach a strap on the middle of the hose system, and attach the strap to the crane. Lift the hose and empty out all of the water. If necessary, move the rope and repeat until all water is out.
13 Maintenance

As a part of the maintenance routines, the Mort Collection System should be activated every day (and at least every three days) regardless of morts in the mort cone or not. This is important in order to keep the mort cone basin clean and to prevent clogging.

The system must be activated as soon as possible after storms and bad weather. Every time the system is activated, it must be checked visually. Damages must be repaired immediately.

Every time the system is brought up, hoses and hose clamp protections must be checked. All plastic parts must be checked for damages. Also check that the wrasse guard may be opened and closed unhindered.

Air distribution:

- Compressor: see user manual from compressor manufacturer

Completed production cycle:

- Change hoses, hose clamps and lifting rope before re-using the system
- Clean and disinfect all parts
- Control all parts for damages, change if necessary

13.1 Regular maintenance

When taking out the system:

- check all hoses
- check protection around hose clamps
- control all plastic parts for damages
- make sure that the grind moves unhindered
## 13.2 Registration form for maintenance of Mort Collection System

*Make copies of this form before filling anything out*

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Appendix B - Deviation form

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