FARMOCEAN
INTERNATIONAL

Farmocean 3500/4500/6000 Offshore system

General Description

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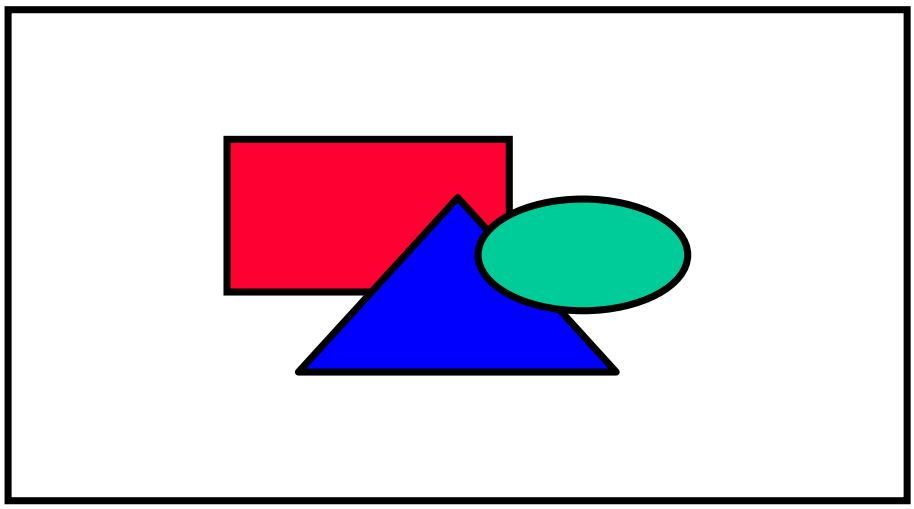
INTRODUCTION

Marine fish farming is growing rapidly all over the world. The expansion cannot take place without giving rise to considerable problems like selfpollution in the farming areas, extreme water temperatures summer and winter, theft of fish in unguarded cages, conflicts with neighbouring land owners etc.

Through the possibility of growing fish where it belongs - in turbulent water further out at sea - FARMOCEAN 4500 brings a solution to these problems. Thus the circulation of water is infinitely better and the water temperature more stable. The farmer competes much less with vacationers and is therefore able to run a more industrialised farming with sufficient yield to allow professionalism in all aspects of the industry. Theft will be made difficult because a strong net also covers the upper parts of the farm.

In order not to create new problems e.g. in connection with storms, the farm has been constructed and dimensioned in accordance with the same rules that are applied by the offshore industry to platform design. The main part of the development work has been done at SSPA, the Centre for Marine Research and Technology in Sweden. With extensive model tests in their large wave laboratory. Further checks and calculations have been made by the classification society Det norske Veritas where the farm concept has been verified for use in semi-exposed coastal waters.



SYSTEM DESCRIPTION

FARMOCEAN 4500, being a so called unmanned farm, not only represents an enclosed volume for fish but also a completely integrated farm with systems for the husbandry, support and handling of the fish.

The system consists of a net cage or bag, attached to a heavy steel construction, as well as of a micro-computer controlled feeder that supplies the fish with the correct quantity of feed regardless of weather, time of day etc. An auxiliary system for the transportation of the feed (palletised dry fish feed) from the boat to the feed silo is also included in a complete system.

In order to facilitate safe boarding of the farm from a boat the farm has a boarding bridge at its outer end supported by a float and at its inner end hinged and rotating around the axis of the construction. The boarding bridge will normally be situated on the lee side of the farm, where boarding can be performed in an easy way.

The farm is anchored to a 3-point buoy system which is uncomplicated and has the advantage of automatically distributing the initial stress equally over the three mooring lines - a very important safety factor. The farm thus encloses the fish in a net bag suspended in the pontoon and upper parts of the steel structure. Enclosed volume is approximately 4 500 m^2, depending on the depth of the net.

The enclosed fish, if attached by parasites, can be treated within the cage by lowering PVC sheeting outside the net bag towards the sinker tube at the bottom of the net bag.

The net bag can be winched towards the surface by means of a winch attached to the silo and a central lifting rope running between the winch and the centre of the net bag bottom.

The entire net bag can be changed with the assistance of a diver disconnecting the net bag from the sinker tube under the net bag.

The sinker tube is suspended under the bag in six separate ropes attached to the pontoon.

The upper part of the net cage (from -3 m) is fitted with vertical net zippers. When opened, net flaps will be created and access into cage is simple. When the farm is deballasted the upper part of the net can easily be cleaned.

Ballasting and Deballasting

FARMOCEAN 4500 has two different floating levels, one for normal operation and one for service. At the normal level the farm floats like a "semisub" with its pontoon 3 m below the surface where wave motion is greatly reduced.

When needed at f.i. harvesting, inspection or servicing the farm can be emptied of ballast water using compressed air, which raises the pontoon to the surface to float just like a conventional farm. The farm can thus be made more easily accessible and at the same time parts of the farm with marine growth can be cleaned by brushing or using high-pressure washing.

Although categorised as UNMANNED the farm is equipped with many safety features, such as walkways with stantions etc.

ENVIRONMENTAL PARAMETERS

FARMOCEAN 4500 is designed and dimensioned for coastal climates. Since fish farming or biological reasons ought not to be done in too strong current, one should choose anchor sites where the current never exceeds 2-2,5 knots. The wave climate on a coast varies much depending on the actual site chosen, a fact that makes the dimensioning more difficult. Besides, wave data are generally sparse which makes it hard to predict a significant or maximum wave height. Each location will be judged in respect of wind, waves and current.

Anchor depths less than 25 m should be avoided because of risks for selfpollution of the seabed. There is also a risk that the bottom of the bag could touch the seabed at extreme wave situations. At depths more than 100 m the characteristics of the anchoring will be so changed as to require a recalculated dimensioning of the buoys and mooring.

STEEL DESIGN

The steel construction that is part of the farm mainly consists of welded steel tubing.

From a hexagonal pontoon consisting of 6 "Ballast tank" and 6 "Pontoon member" and bolted together with flange joints, 6 "Corner tubes" and 6 "Centre tubes' rise towards a ring shaped central part, called "Top ring". In the Top ring a platform is supported by steel wheels in order, to rotate easily.

Pontoon member (each middle section) is foam filled and corner and centre tubes are pressure tight to improve integrity of the structure in the event of severe damage.

On the pontoon is fastened a gangway with a grating. When the farm floats at its upper level this gangway can be used e.g. at harvesting and servicing.

The top ring supports the feed silo with its automatic feeder, which does not rotate with the platform but is fixed to the steel structure.

NET BAG

The net bag is hexagonal and made up of a bottom, six side panels and six top panels. Each panel has a leech line. Giant Zippers are fitted to the top part of the bag to enable access into the cage during harvest, net change etc. These zippers run from about pontoon level to the top ring. Under the bottom there is a so called sinker tube, the purpose of which is to give weight to the net to avoid excessive deformation which otherwise might occur even at a moderate current. The sinker tube consists of six steel tubes, bolted together into a hexagonal shape.

In the centre of the bottom of the net bag is a net cone to where dead fish can sink. Divers, when inspecting nets and moorings empty it. As an option the farm can be supplied with a central landing net that rests at the bottom of the net bag accumulating dead fish. The landing net can then be hoisted up to the rotating platform and emptied of dead fish.

AUTOMATIC FEEDER

The automatic feeder consists of

⇒ silo

⇒ dispensing device

⇒ rotating brush

⇒ control system

⇒ power system

The silo has an inside volume of about 7 m^3 and is designed for palletised dry feed. To avoid condensation problems and have a non-corrosive light and stiff design the silo is made of laminated glass fibre. There is little risk that the feed can absorb taste and smell substance from the inner laminate as this is manufactured to the same requirements as fresh water tanks.

An inspection hatch and ladder is provided on the silo for inspection, cleaning etc. Safety steps are provided inside silo.

Inside the silo close above its exit to the dispensing device a SS-steel cone is installed. Its purpose is to maintain an even flow in the silo as it is being emptied. The dispensing device is of the so called “Positive displacement” type, which implies that the dispensed volume is equal at any dispensing, regardless of pellet size and the amount of feed in the silo. This means high accuracy and good reliability.

The dispenser brush is mounted directly under the lower valve. Shortly before the dispenser opens, the electric motor is started by the control system in order to achieve correct speed of the brush. The pellets are then distributed by the brush over an area limited by an inner radius of 1 m and an outer of about 6, and the feed is thus evenly spread over a relatively large area.

The control system includes a microcomputer that can be programmed to control the feeding according to a predetermined pattern. The day can be split into a number of intervals within which feeding may be varied. Sensor input e.g. temperature data to the computer adjusts feeding, correspondingly. In this way overfeeding at low temperatures is avoided and equally an increase in water temperature is exploited for

an increase in feed volumes. The program will compensate and increase the feed as fish grow and demand more food.

FEED TRANSPORT SYSTEM

Since huge amounts of feed are needed even at a moderate sized fish farm, Farmocean has developed a pneumatic transport system for dry feed.

The system transfers 3 tons of feed from the supply boat to the silo on the farm in about 40 min. The system consists of a suction and pressure fan or blower, rotary valve feeder and comes complete with a tube and hose system. A hydraulic transmission system transfers power from the main engine of the boat to the fan and feeder. The transmission system is furnished with a control valve that keeps system from overloading e.g. at a sudden revving of the main engine. The system can be used for spray feeding of fish in conventional cages. The pneumatic transport system can also be supplied with a small petrol engine as a prime mover in cages where a boats main engine can not be utilised.

MOORING SYSTEM

At the dimensioning and design of the mooring system very high priority has been given to:

⇒ soft and flexible mooring especially vertically

⇒ simplicity and as few parts and connections as possible

⇒ safety

⇒ choice of material

⇒ good economy

⇒ little maintenance

⇒ possibility to inspect vital parts from the surface

FARMOCEAN 4500 is therefore moored with a soft mooring system with an angle of 120º between each anchor/concrete block and about 40 m distance from resp. buoy to the centre of the farm.

This system corresponds in principle to the requirements of DnV for safety against breakage even under extreme circumstances.

MANUFACTURING/CORROSION PROTECTION

The manufacturing of a complete FARMOCEAN 4500 must necessarily be done at several workshops/yards.

During the whole manufacturing process quality checks are frequently made by Farmocean's own inspectors. The manufacturing of the steel construction is done according to the same principles as an offshore structure and includes in addition to visual inspection non-destructive tests (NDT) of the welds.

Like most ships and boats FARMOCEAN 4500 is mainly made of steel and a full corrosion protection is provided

A certain continuous maintenance is required where the surface protection has been removed through mechanical wear. The anodes are changed regularly every 2nd year (seawater, 25 ‰ salt) or more often if required.

ASSEMBLY

The steel structure of the FARMOCEAN 4500 is made in jigs. Therefore no extensive adjustments are required during final assembly and launching.

The farm can, if circumstances prevent assembly in one piece, be assembled in separate parts e.g. at a pier, since all parts float.

TRANSPORT

The FARMOCEAN offshore cage is normally delivered by three 40' trailers open top containers or on three 40' flats. It can also be transported on trailers and combo rails

WINTERING IN ICY CONDITIONS

Through its relatively simple and uncomplicated mooring system the farm can be re-anchored in winter. In case of cold weather the cage can be re-moored in a sheltered bay where the sheering forces of the ice are limited. If possible, mooring should be done with wires or chain directly to land.

The farm should always be kept in service position in the winter and as high as possible to benefit from the shelter of the pontoon.

During operation, maximum snow and ice loads is 2000 kg (~25-30 mm ice thickness). In case of heavy ice on top net, loosen it from upper net bracket, tighten ft together with a Ø 20 mm rope and let it fall to the surface.

Approximate temperature range is from +80º to -15º, but in cold weather, ice problems can occur.