Seafish Standard Design Purification Systems

Operating Manual for the Small Scale Shallow Tank Purification System

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Contents

1. The Development of the Small Scale Shallow Tank System

Historically in the U.K. the purification of oysters and clams was permitted in tanks with mollusc containers stacked three high. The stacking of containers of mussels was not permitted and this resulted in large shallow outdoor purification tanks that were exposed to the elements and over which there was no real control of seawater temperature.

To improve upon this Seafish developed more sophisticated high density multi-layer purification tank systems for high throughput operations, and an improved vertical stack cascade system for smaller-scale operations with high value species. These physically smaller units can be housed in the controlled environment within a building.

To assist in this development work Seafish constructed a number of small shallow tank purification systems, each capable of holding two mollusc containers and using a standard plastic pallet box as the tank. Each operated independently with its own seawater circulation system and ultra violet light (UV) steriliser. These were used during trials at a number of commercial purification centres around the UK and several operators expressed commercial interest in them as being suitable for purifying and holding molluscs on a small scale. A simple shallow tank system, based upon the original test design, was therefore developed and tested by Seafish working with an equipment manufacturer. A larger capacity pallet box than the original test system was used at little additional cost and resulted in a simple and inexpensive purification system for small scale use.

2. How Does a Shallow Tank System Work?

The molluscs are held in mesh type plastic containers placed on battens on the bottom of a shallow tank. Seawater enters via water jets above one end of the tank and flows through the containers of molluscs to a suction pipe or weir across the other end. The tanks are normally constructed of concrete. The water flow rate in this simple design is relatively low and hence the capacity to supply sufficient dissolved oxygen to the molluscs is also low and the permissible loading (i.e. the stacking) of the system is limited.

The seawater is re-circulated via a pump and the flow rate controlled by a valve and flowmeter. The seawater receives microbiological treatment by passing through an enclosed ultra-violet light (UV) sterilisation unit.

The molluscs function naturally in the clean seawater and purge themselves of bacterial contamination. Detritus settles out on the base of the tank.

3. The Approval of Purification Systems

Strict controls under the Food Safety (Live Bivalve Molluscs) Regulations govern the handling of live bivalve molluscs from harvesting through to retail sale. It is essential that before any purification system is set in operation, the local Food Authority is contacted and approval granted.

Premises where purification systems are operated must be issued with an approval number which is given by the Food Authority only if the requirements of the Regulations are complied with. In addition, a "conditions of approval" document is issued for each purification system. This document is obtained by the Food Authority and specifies conditions of usage. In England and Wales this is obtained from the Ministry of Agriculture, Fisheries and Food (MAFF), in Scotland from the Scottish Office Agriculture and Fisheries Department (SOAFD) and in Northern Ireland from the Department of Health and Social Security (DHSS).

Other local requirements must be considered including planning, water discharge and waste disposal. Animal Health Regulations may also apply controls over the re-immersion of shellfish if premises are located in coastal sites and shellfish are not caught locally.

Seafish have no statutory responsibility for the approval of purification systems but are able to give advice on their design and operation to Industry, the Food Authorities and Government Departments, and to assist in any testing of systems.

4. The Standard Design Concept

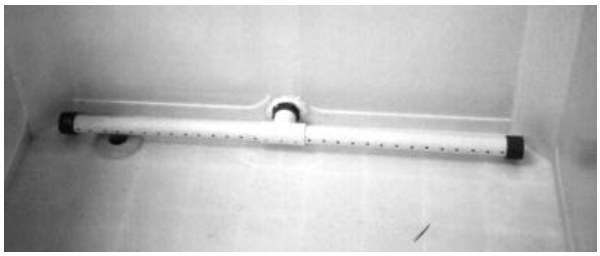
Government Departments are responsible for ensuring that technical requirements for purification systems are met. They will issue "conditions of approval" for a system only if satisfied that it is designed and operated in accordance with basic rules and that there is sufficient evidence to demonstrate that the system will purify bivalve molluscs satisfactorily. This requires them to make a site visit before approval, to carry out a technical inspection, and for a bacteriological test to be carried out. The bacteriological test is the responsibility of the operator of the purification system and can prove time consuming and costly, particularly if repeat testing is required.

The range of standard design purification systems developed by Seafish are built to specified designs that meet the technical requirements and which have been tested extensively in a wide range of conditions. Being proven designs, bacteriological testing is less stringent and consequently they have a more predictable, simplified, less time consuming and less expensive approval procedure.

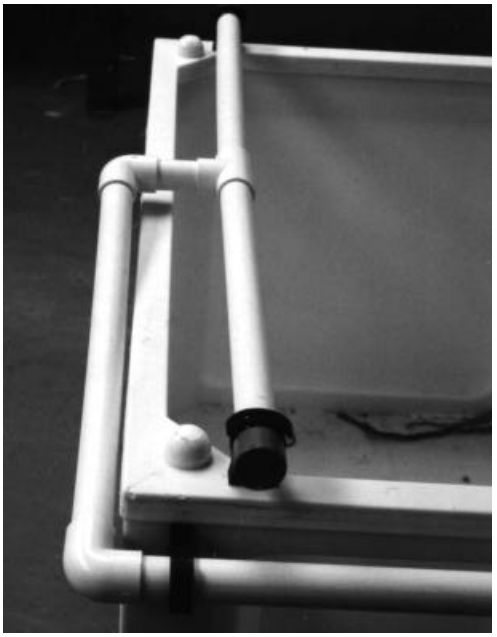
5. The Seafish Standard Design Small Scale Purification System

This uses a 650 litre Allibert Type 21626 plastic pallet box as the tank into which six mesh type plastic containers may be stacked in two columns three high.

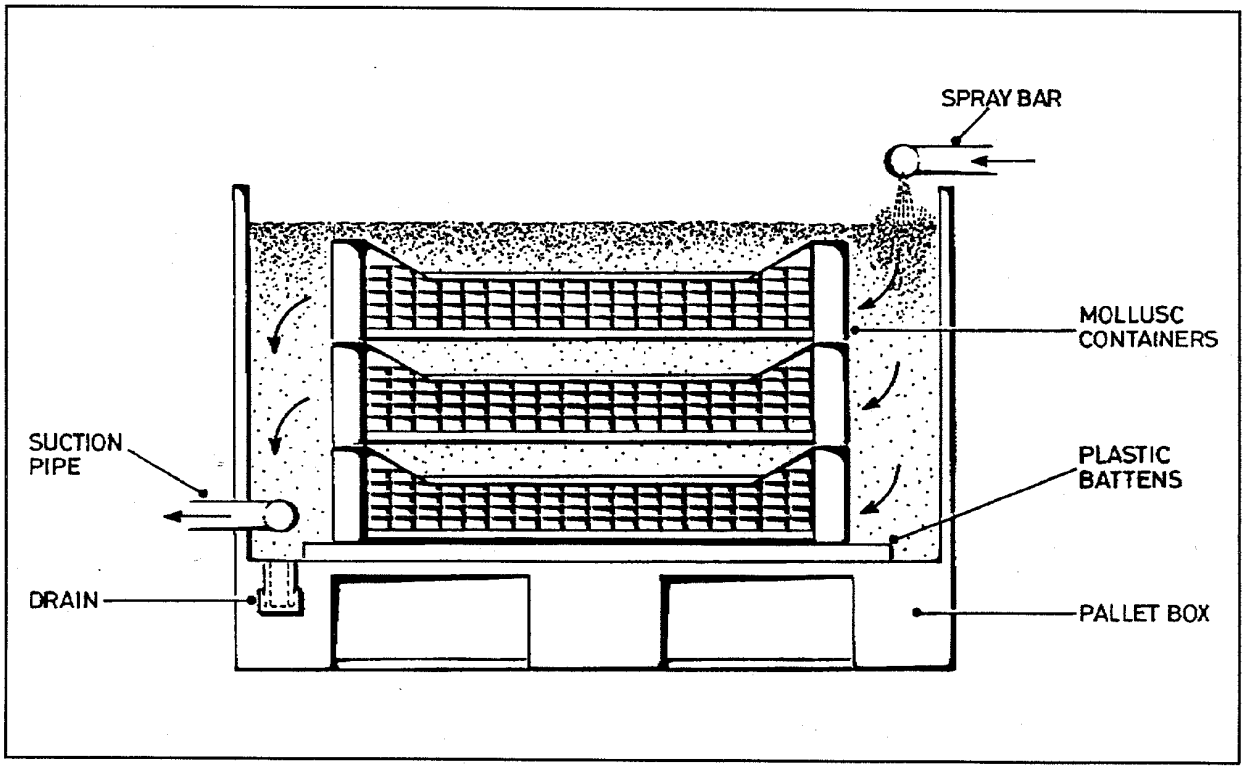
The containers are stacked on top of lengths of plastic pipe battens which keep them clear of the tank floor. Seawater re-circulation equipment consists of a suction pipe, waterproof pump, flow control valve, 25 watt UV water steriliser, flowmeter, perforated spraybar and interconnecting pipework. 'T' pieces either side of the pump provide for seawater filling and emptying. The suction pipe is clear of the tank base, and a drain is fitted in the tank floor for final drainage and cleaning. When fully loaded the system has a nominal capacity of 90 kg. of mussels and requires 550 litres of seawater.



Suction pipe



Spraybar



Side view of shallow tank system

6. Seawater Supply

The seawater must be free from contamination in quantities that may adversely effect the molluscs or be subsequently harmful to the consumer. Either natural or artificial seawater can be used.

Where natural seawater is to be used advice should be sought as to the suitability of the local water from the relevant Government Department (MAFF, SOAFD or DHSS), either directly or via the local Food Authority.

Factors effecting the suitability of seawater are:

- **Turbidity**. The seawater should be clear in appearance as turbidity reduces the efficiency of UV sterilization. Turbidity can be removed by the use of a sand filter or a seawater settling tank. A sand filter should be used for new incoming water only and not be installed as part of the seawater re-circulation system.

- **Salinity**. This must suit the particular species of bivalve mollusc being held and should ideally be similar to the area from which they were harvested.

  Minimum levels of salinity are given in the table below ("conditions of approval" may require higher levels).

Minimum Seawater Salinity

Species	Salinity ‰ (parts per thousand)
Native Oysters	25.0‰
Pacific Oysters	20.5‰
Hard Shell Clam	20.5‰
Mussels	19.0‰
Cockles	20.0‰

- Microbiological Treatment. Initial low levels of microbiological contamination are reduced by UV treatment of the water before it enters the tank.

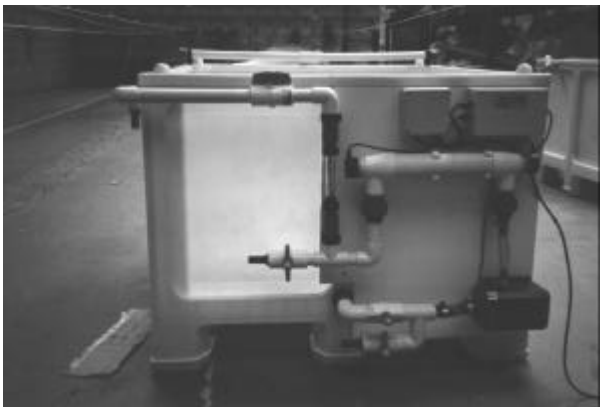
- **Position of seawater intake**. This must not draw in waste from other discharges, it should be sufficiently below the water surface to avoid poor quality surface water and be above the seabed where mud or fine sand are present. The times when suitable seawater may be drawn may be limited by tide and this may require the provision of water storage tanks ashore.

Artificial seawater has higher initial cost but can offer considerable advantages where systems are to be operated inland or local supplies of natural seawater are considered unsuitable. Advice on the production and use of artificial seawater is given in Seafish Technical Information Sheet No. 1994/25/FT.

7. System Installation

Tank location should avoid direct sunlight. The tank must be levelled such that the tank floor slopes to its drain valve.

The seawater re-circulation system was dis-assembled to reduce the chance of damage during transport and requires re-assembly onto the panel attached to one end of the tank in accordance with the manufacturers instructions. The circuit diagram is shown on Page 5.



Panel mounted seawater recirculation equipment

The standard layout of pipework and equipment is such that it can all be drained when the system is emptied, to avoid leaving areas of stagnant water. If there is a need to change this layout care should be taken to maintain this total drainage. It may be necessary to install means of draining specific pipework and equipment.

The flowmeter and UV end caps must remain visible and valves be accessible. Access for maintenance is important, particularly to the UV sterilization unit which will require periodic cleaning and tube replacement.

The tank is usually filled and emptied via the circulation pump which has double valves on its suction and delivery sides to re-direct input from tank re-circulation to seawater supply, for filling, and to re-direct output from re-circulation to emptying. Flow rate is controlled by the valve on the delivery side.

If artificial seawater is to be used, or if the seawater is to be re-used, a separate reservoir will have to be installed. This must be suitable for seawater use, have a drain at its lowest point for flushing out waste and an operating outlet pipe clear of the base. This must be accessible for inspection and cleaning and if outdoors must be covered. A capacity of at least 600 litres will be needed. A single reservoir can serve several purification tanks used in sequence.

Connection to a single phase power supply is required for the UV sterilisation unit and pump.

All connections and switches used within the working area where the system is installed must be hoseproof. IP66 classification is recommended. Cables must not be left trailing on the floor.

8. Initial Testing

A new system must be run firstly filled with seawater only, to check that the water circulation system will operate correctly and that there are no leaking joints, and then be left to run overnight. The filling procedure is given in Section 9.5. Leaks will probably be a result of joints being inadequately tightened. The system must be able to operate at the required water flow of 20 litres/minute. Check the operation of the water spray bar. Water must jet vertically down into the area between the tank wall and containers. The UV lamp must operate correctly. After draining down, the tank should be cleaned as described in Section 10.3.

9. System Operation

When used for purification, the operating requirements specified in the "conditions of approval" must be followed. Although the instructions given in this manual are in line with established practices, the "conditions of approval" apply to each individual system and may incorporate special conditions depending on the particular circumstances of operation.

Purification is a batch process. Firstly the tank is loaded with molluscs, then the tank is filled with seawater and water circulation commences. After the requisite period the seawater is emptied from the tank and then the purified molluscs can be removed. The system must not be disturbed (i.e. molluscs added or removed) during the period of immersion.

Batches of molluscs from different sources must be kept separate for documentation purposes, enabling the tracing of molluscs back to source, but different batches from the same category of harvesting area can be held in the same tank. The Regulations prohibit the mixing of species in a tank. The mixing of species would be harmful if the tank conditions did not suit all the species concerned. In multiple tank installations the re-circulating seawater must not be shared during purification by tanks at different stages of the purification cycle.

9.1 Mollusc Supply

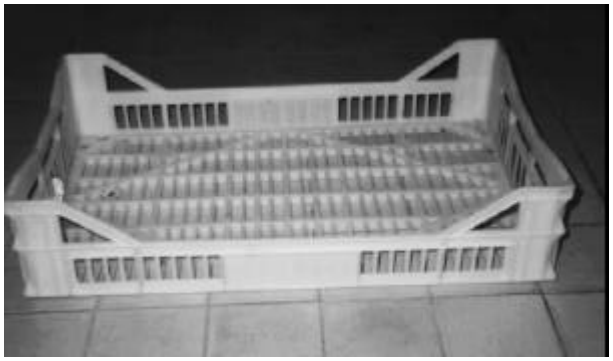
It is often forgotten when handling live bivalve molluscs that they are a live animal and even though encased in a hard shell they are easily damaged and physically or thermally shocked. Molluscs must be in good intrinsic condition if they are to be active when re-immersed and it is advisable, therefore, that the handling history between harvesting and arrival at the purification or dispatch centre is known and acceptable.

Depending upon species and harvesting techniques, damage to a few molluscs may be inevitable. However, if more than a few molluscs are dead, gaping or showing signs of excessive shell damage then the batch should be rejected. The time from harvesting should be known as molluscs should not be out of seawater for more than a few days before re-immersion. For some species, such as those grown in sub-littoral areas and not used to being out of water, this time period must be short. For cockles a maximum of 6 hours is recommended. When out of seawater a raw material storage temperature of between 2^{o}C and 10^{o}C is generally recommended although native oysters should not be held at less than 4^{o}C and mussels can be iced.

When approaching their spawning season bivalve molluscs are more susceptible to shock, and great care needs to be taken if spawning in the tank is to be avoided. Molluscs are weakened by spawning and often they are not harvested until they have sufficiently recovered.

9.2 Mollusc Containers

The containers used for stacking inside the purification tank must have suitable open mesh sides to allow water flow, and open mesh bottom to permit faeces, silt, sand, etc to settle out. There are two container types currently in use for the small-scale system.



GPG C1479

Allibert 41042

Container types in current use

Manufacturer Type	External Size (mm)	No. for Tank
Allibert 41042	760 x 450 x 165	6
GPG C1479	762 x 457 x 140	6

Only one type can be used at any time as they are not interstackable.

9.3 Loading the Containers with Molluscs

The molluscs must have been thoroughly washed with clean water to remove silt, sand and weed before being put into the purification tank, and care taken not to roughly handle them. Any dead or damaged molluscs should be removed. Molluscs can be washed in the containers but not when the containers are stacked.

Container Loading

Species	Allibert 41042/GPG C1479	
	Depth	Nom. Amount
Mussels	80 mm	15 kg
Pacific Oysters	Double Layer	125 Oysters
Native Oysters	Single over-lapping layer	125 Oysters
Clams	80 mm	21 kg
Cockles	80 mm	15 kg

The molluscs must be placed in the containers at depths no greater than those specified in the table above. The nominal weight (or number in the case of oysters) is only a guide and will vary with season, harvesting area and size.

9.4 Loading the Tank with Containers

The plastic pipe battens provided (two to each side) must first be positioned on the tank floor, aligned with the direction of water flow. The containers of molluscs must then be placed on top of these taking care that the containers stack correctly on top of one another and are centrally positioned so that they are not directly against the suction pipe nor beneath the spraybar. Although the containers will fit either along or across the tank they should be positioned along the tank with their narrow ends to the spraybar and suction pipe. This minimises the gap between the containers and the tank sides so that the water flows through the molluscs.

9.5 Filling the Tank with Seawater

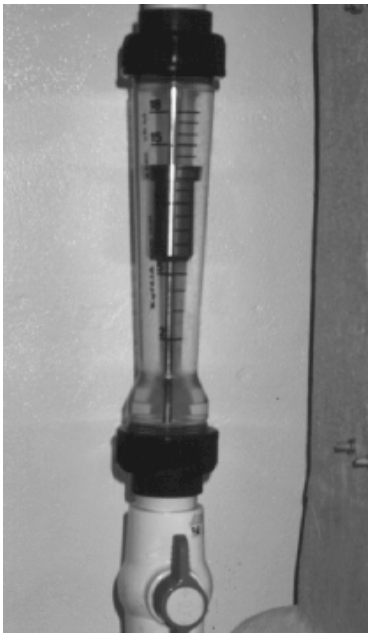
Before filling, the UV treatment unit must be switched on and care taken to ensure that the tube is functioning correctly. This is usually indicated by an annular ring of green/blue light at the end caps. If the light flickers, is dull or is not on refer to Section 11.4.

For systems operating with a seawater reservoir the system is filled from the reservoir via the circulation pump, and with the valves open or shut as indicated in the sea water circulation diagram. Valves must be correctly set to ensure seawater enters the tank via the UV steriliser and not the suction pipework.

When the seawater level is at the top surface of the containers the valves are operated as shown in the diagram for circulation.

When a single reservoir is used to serve more than one purification tank, particular care must be taken with valve settings to ensure that seawater is not directed into the wrong tank.

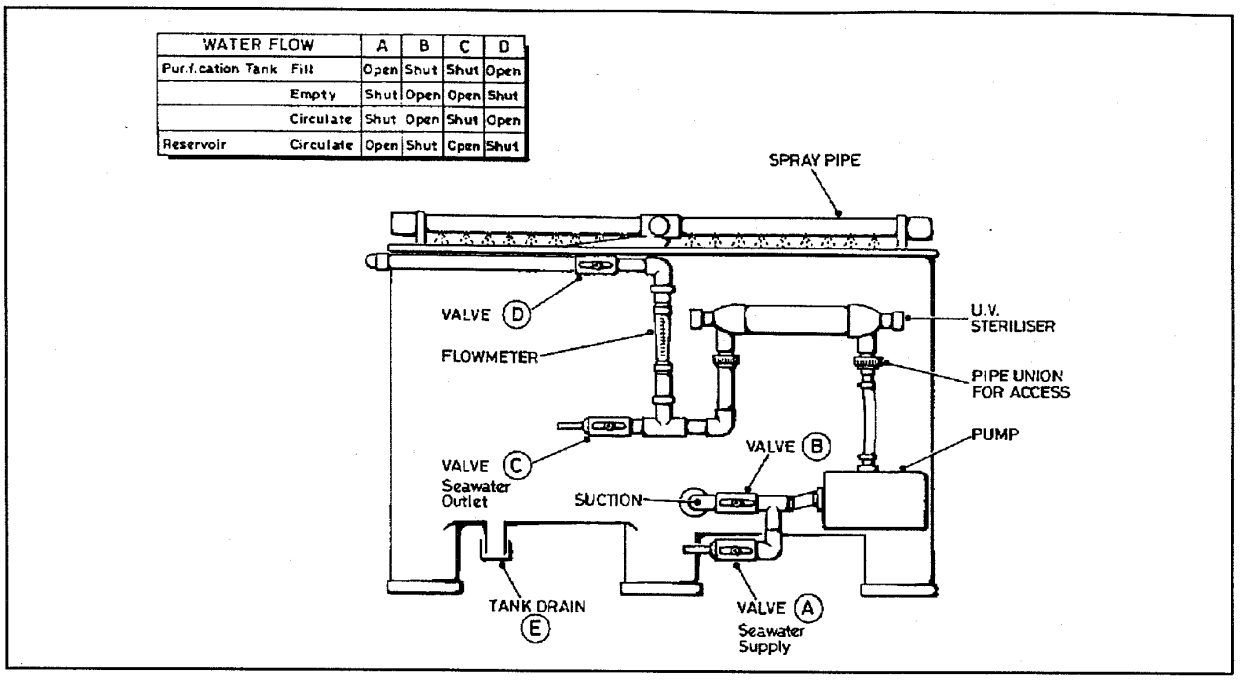
The flow control valve D should now be set to maintain the required water flow of 20 litres/minute. If this cannot be achieved refer to Section 11.3. The flowmeter is of the in-line flow-through type and fitted as an integral part of the pipework system. The flow is read from the widest part of the indicator.If no reservoir is used and seawater is supplied directly it must still enter the tank via the UV unit. However, the circulation pump fitted is not of a self priming type and cannot be used to draw water from a level below it. In this case a separate pump will have to be used. This pump should deliver water at about the



In-line flowmeter

specified system flow rate to maintain effective UV treatment. The seals on the UV unit may burst if pressure in the pipework is excessive.

It is essential that at the start of the purification cycle the molluscs are covered with seawater by at least 80mm for mussels and 30mm for other species.



Seawater circulation system and valve control positions

During immersion molluscs should open their shells slightly to permit respiratory/filter feeding activity and will tend to move up within the container, effectively reducing the depth of water above them. Also the molluscs may have lost intervalvular fluid during storage and replenish it as their shells open. The molluscs must remain covered during purification.

9.6 Seawater Salinity

Seawater salinity should be checked whilst the tank is being filled.

The seawater salinity must be within the range required for the species as given in Section 6, and can be measured using a hydrometer as described in Section 13.2. If the reading shows the salinity to be too low or high it should be re-checked and if still incorrect the water must not be used.

Salinity can be too high if an incorrect mix of artificial seawater has been used or evaporation has occurred over a period of re-use.

Salinity that is too low can result from an incorrect artificial seawater mix or, in the case of natural seawater, too much dilution from a natural freshwater source. For natural seawater supply it may be possible to wait for a change in tidal condition.

The salinity of artificial seawater can be adjusted by dilution with tap water or adding extra salt. Care must be taken to maintain the correct mixture of salts.

9.7 Seawater Temperature

Mollusc activity is dependent upon seawater temperature and adequate dissolved oxygen levels. Minimum seawater temperatures are stipulated for the purification of each species to ensure adequate mollusc filtration activity. A maximum seawater temperature is sometimes stipulated for mussels which have a high oxygen demand. In addition, if seawater temperature is too high all molluscs will weaken, spawn or die and so maximum temperatures are recommended for all species. These depend upon species, growing conditions and season. The temperatures normally required for purification are shown below.

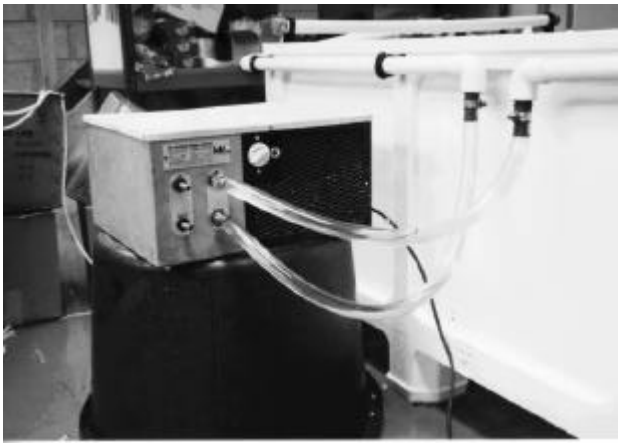
Seawater Temperatures

Species	Minimum	Maximum
Mussels	5°C	15°C
Native Oysters	5°C	15°C
Pacific Oysters	8°C	18°C
Clams	12°C	20°C
Cockles	7°C	16°C

Large temperature differentials between molluscs and seawater when filling the purification system should be avoided as they may reduce mollusc activity, induce spawning or even cause mortality. To avoid this, molluscs should be allowed to reach the required temperature slowly.

If suitable minimum seawater temperatures cannot be maintained the system must not be used for purification.

Seawater chillers and heaters can be obtained to operate with these systems. These must be installed and operated such that the water flow is not disrupted or local hot or cold spots created in the part of the tank where the molluscs are held. Further information should be obtained from the tank manufacturer and from Seafish, and approval sought from the local Food Authority before use (Section 12).



In-line seawater chiller

9.8 Mollusc Activity

When the molluscs are immersed in seawater they should exhibit signs of activity by slightly opening their shell halves. Often air bubbles will be seen rising to the water surface as entrapped air is released. After a few hours the shell halves should be more open and, depending upon species, mantles or syphons should be visible. Some species are more active than others. Mussels are often active within minutes whereas hard shell clams exhibit intermittent activity. After the first overnight period the molluscs should be active and the seawater clear (tank bottom visible). If not, the system should be drained down and the reason sought. Inactive molluscs will not purify satisfactorily. (Section 11.6).

Surface foaming

Foaming on the water surface is created as a result of the build up of dissolved waste excreted by molluscs. The amount of foam will depend upon species, level of activity and the extent of re-use of seawater. It is not normally a problem but if foaming is excessive it will flow over the tank sides and will reduce the seawater level such that the molluscs are not adequately covered. In this case, action must be taken to reduce foaming (Section 11.5).

9.9 Immersion Time

For purification the "conditions of approval" will specify the minimum immersion time required, which will usually be 42 hours. The immersion period can be extended prior to draining down if it is desired to store the full load of molluscs in the system, but extended storage is not recommended for cockles as they become exhausted and die.

If during a purification cycle the system should stop operating, the time lost must be made up to ensure the required purification time has been achieved. If the system has been stopped or operating at a reduced flow for

more than a few hours the molluscs may have been weakened. If they show signs of weakness such as gaping, or even mortality, the molluscs must not be consigned for human consumption.

9.10 Draining the Tank and Unloading Molluscs

At no time whilst they are immersed must molluscs be disturbed or removed as this can cause re-suspension and ingestion of settled out material. The tank must be drained before removing the molluscs.

To drain the tank the seawater is diverted away from the spraybar to waste or reservoir by operating the valves as shown in the seawater circulation diagram. This continues the same direction and rate of water flow in the tank, thereby reducing the chance of any re-suspension of material. Once pump suction is lost the water flow will stop and pump and UV can be switched off. Some water will be left in the bottom of the tank but it will be below the containers and is run to waste with the detrius by opening the final main tank drain valve. (E).

Unloading of containers is carried out manually after the water has been drained. Once unloaded the molluscs must be washed with clean water and the required sorting and packing operations carried out. As the finished product must be alive, this should be done with care to minimise shock and damage. Packaging must be clean and labels attached as instructed by the local Food Authority. A product storage temperature of 2°C to 5°C is generally recommended although native oysters should not be held at less than 4°C and mussels can be iced.

The containers and tank should be washed whilst wet before silt, etc. dries on. With the drain valve (E) open the sediment in the bottom of the tank can be flushed out to waste.

If only some of the molluscs are to be packed after purification and the system is to be used for immersed storage of the remainder, the system must still be emptied and washed out. Containers of molluscs that are to be put back into the system must first be hosed down.

The position of the suction pipe in the tank is such that about 40 litres drain to waste and if the seawater is to be re-used, this will have to be replenished with new seawater as necessary. Also in warm weather there may be a need to make up evaporative losses.

9.11 Monitoring the System Operation

For a purification centre details of molluscs received, start and finish times of purification and details of subsequent consignment must be recorded and checks of seawater salinity, temperature and UV lamp life made. These details are best recorded in tabular form using a log sheet such as that shown at the end of the manual. The source column could include movement document number. It is recommended that seawater temperature is measured at the start, middle and end of purification. If a time recorder is not fitted to the UV sterilization unit then hours switched on should be recorded cumulatively to give an indication as to when the lamps need replacement (Section 10.2). The comment column can be used to note anything that occurred during purification such as a power cut or pump failure and subsequent action taken. The dates also allow a check on seawater re-usage.

If more than one purification system is used each should have its own log sheet to avoid confusion.

Log sheets must be filled in legibly and be kept somewhere dry, such as an office, and not be left lying around in the purification or dispatch centre. It is a good idea to keep basic system details of start and finish time, salinity and temperature on a chalk or pen board mounted on a wall. This serves as a daily reminder of status and can be transferred to the log book on a weekly basis.

9.12 Seawater Re-use

The "conditions of approval" prescribe conditions under which seawater can be re-used for each purification system, and generally permit re-use over a specified period of time. However, this period is prescribed as the maximum limit of water usage and the operator of a purification system must satisfy himself at each successive re-use within the period that the water quality is adequate. If molluscs appear inactive when immersed (see section 11.6) and water quality is suspected, new seawater should be used. If seawater quality was the cause, molluscs will usually become active when re-immersed in the new seawater.

The re-use of seawater for successive purification cycles can result in dissolved waste from the molluscs accumulating in the seawater to a level which may inhibit purification. This depends upon the species of molluscs, their intrinsic condition, the loading of the purification system and the seawater temperature.

When re-using seawater the salinity will increase as a result of evaporation, particularly when temperatures are high, and care must be taken to ensure it does not go beyond the prescribed level.

Further advice on the re-use of seawater should be sought from Seafish.

9.13 Microbiological Sampling
Operators of purification systems are required to carry out microbiological testing on samples of molluscs. Guidance on the frequency of sampling and on competent laboratories to which samples can be taken should be sought from the local Food Authority. Sampling frequency will be based upon the standards of operation at the purification centre including the degree of supervision and control and adherence to industry good practice guidelines (14.1). The laboratory must carry out a prescribed microbiological analysis procedure.

A sample of molluscs must contain sufficient shellfish flesh for a test to be carried out. 10-15 molluscs would normally be taken as a sample. With large molluscs it may be possible to use less (although never less than 6). Dead or gaping molluscs should not be used. The laboratory will advise if sample size is inadequate and sometimes will not accept samples below a certain number, so it is advisable to check.

The sample molluscs should be put into a clean plastic bag and be kept in cool conditions, ideally at 4°C (an insulated picnic box containing freezer packs is the method normally used) and be delivered to the laboratory within 24 hours. Molluscs must not be frozen. The samples must be labelled to enable identification.

The microbiological results must show that the purified molluscs contain less than 300 faecal coliforms or 230 *E.coli*/100 gm. to meet the product standard requirements. Samples must not contain Salmonella in 25 gm of mollusc flesh. If these standards are not met then the local Food Authority must be contacted for further advice.

10. Cleaning and Maintenance

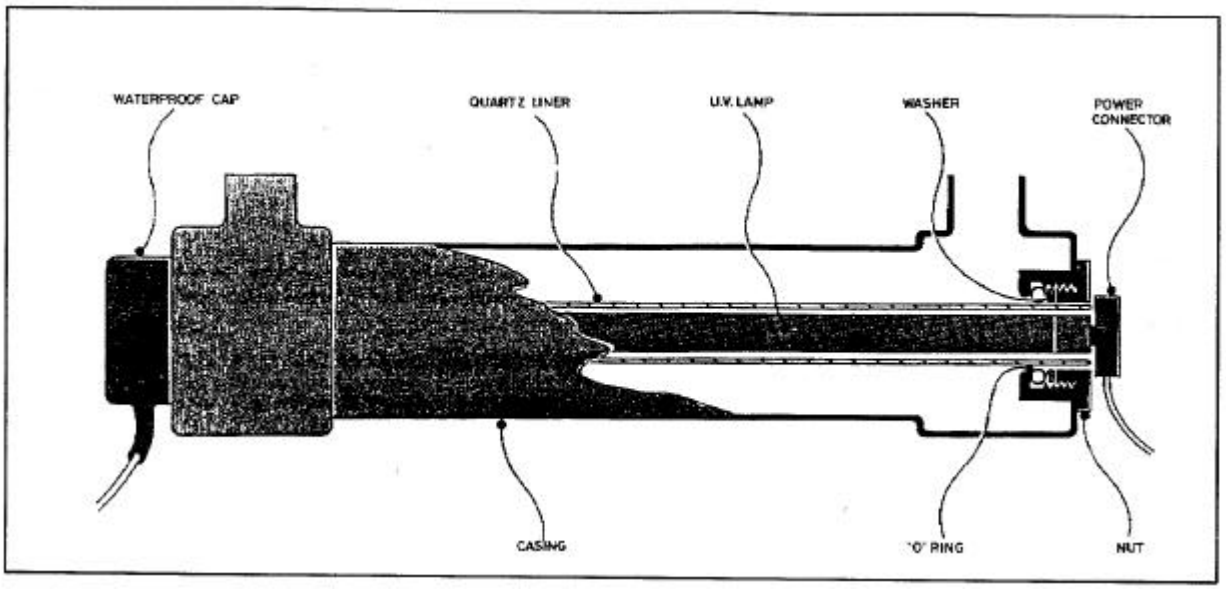
10.1 Pump
With the pump switched off the pump suction end cap is easily uncoupled by turning it by ¼ turn. Any byssus or pieces of shell can then be removed from inside the pump. If the tank is full of water valve B will have to be closed. The suction pipe cover can be replaced after first ensuring that the sealing ring and housing face are clear of any shell or debris. The cap should be tightened firmly.

10.2 Ultra Violet Light (UV) Sterilization Unit
Safety: UV light is dangerous to the eyes and skin and the lamp must never be operated outside its housing. A green/blue glow can be seen from each tube at the ends of the unit to indicate that it is on in normal use. Before any cleaning or maintenance is carried out the electrical power must be switched off.

Lamp Replacement: The lamps gradually deteriorate in use and must be changed as specified in the "conditions of approval". This may be based upon the intervals specified by the lamp manufacturer in terms of hours of use although a calender time interval may be given instead.

To replace a lamp:
- switch off the power
- carefully pull off the lamp connectors and covers from either end, supporting the tube if mounted vertically
- gently slide the lamp out of the quartz sleeve

fit the new lamp in the reverse procedure.



UV steriliser unit

Cleaning: The quartz sleeve may need cleaning occasionally as a result of sediment building up on its outer surface. The accumulation up of sediment will depend upon the clarity of the water supply and it is recommended that the sleeve is checked after a few weeks to give a guide to the frequency of cleaning required.

To remove the quartz sleeve:

- switch off the power and remove the UV lamp as described above
- make sure the water has been drained out of the unit
- unscrew the end nuts and remove the "O" ring seals and washers (this is sometimes difficult). The tube will need support at the bottom of the unit if mounted vertically to prevent it falling out
- withdraw the quartz sleeve, taking care to handle it at the ends only, and inspect it carefully. If cracked the sleeve must be replaced. The sleeve should be cleaned with soapy water and gentle brushing if necessary. The sleeves discolour after many years of use and if badly stained should be replaced
- rinse and dry the sleeve and replace it in the unit. Inserting a clean wooden dowel into the sleeve can assist in this and reduce the chance of breakage
- replace "O" rings and washers and tighten the nuts with hand pressure only and, if necessary, re-connect to the plumbing system
- turn on the water and check for leaks
- replace the lamp.

25 watt UV lamp unit

10.3 Purification System Cleaning

After each purification cycle the purification tank should be thoroughly flushed out with clean water to remove silt and shell debris. Containers should be hosed down.

To prevent accumulation of slime and dirt the tank and pipework should periodically be cleaned with a suitable cleaning agent. Hypochlorite solution (as found in household bleach) is recommended. The empty containers

should be loaded into the tank, the system filled with tap water and the hypochlorite added (with care, following manufacturers instructions). It should then be switched on and left for a few hours, preferably overnight. After cleaning the system must be thoroughly flushed through with clean water to remove any traces of residual chlorine which will harm molluscs.

Cleaning agents must be stored in a safe place away from the mollusc handling and purification areas.

10.4 Sand Filter
If a sand filter is used for seawater supply (it must not be fitted such that it forms part of seawater re-circulation), care must be taken to follow the manufacturers operating instructions. In particular the pressure gauge should be checked as excess pressure indicates the filter is becoming saturated and requires back flushing.

11. Possible Problems and Answers

Occasionally things can go wrong due to equipment failure, poor handling, poor seawater quality or poor intrinsic quality of the molluscs, or simply incorrect operating procedure. The following gives some of the more likely problems and answers but by no means covers every possibility. If the cause of a problem cannot be found, further advice should be sought by contacting Seafish.

11.1 Difficulty in Filling the Tank with Seawater
- Water level in reservoir too low (below pump).
- Air lock in supply pipework.
- Valves incorrectly set.
- Pump filter partly blocked.

11.2 Water Flow Stopped
- Power supply off (if circuit trip in control box will not re-set, contact electrician).
- Pump failure.
- Valve turned off .
- Pump blocked.
- Water level in tank below suction pipe.

11.3 Water will not Flow at Required Rate
- Pump filter partly blocked.
- Pipework fouled with marine growth (in particular spray or suction bar or flowmeter).
- Air leak on pump suction. When this occurs air can be seen passing through the sight tube of the flowmeter.
- Valves partly blocked or incorrectly set.
- Worn pump.

11.4 UV Lamp Unit not on or Flickering
If the green/blue light does not appear at the ends of the unit when switched on, or the lamp flickers, the unit is not operating correctly.

- UV lamp faulty and requires replacement.
- Starter unit in control box faulty.
- Corrosion on terminal ends.

11.5 Excessive Foaming
- Water flow greater than that prescribed.
- Water re-use. With seawater re-use there can be a gradual build up of the dissolved waste that causes foaming, particularly with mussels and at higher seawater temperatures. More frequent water replacement may be necessary.

11.6 Molluscs appear Inactive whilst Immersed
- Incorrect salinity.
- Seawater temperatures too low or too high.
- Seawater quality poor (re-used too often).

- Molluscs in weakened condition as a result of poor handling and/or delays between harvesting and re-immersion.
- Molluscs in seasonally weak condition (post spawning).
- Thermal shock. Molluscs subjected to too great a temperature change when re-immersed.

11.7 Seawater becomes Cloudy
If during purification or immersed storage the seawater becomes clouded (usually a milky colour) the molluscs have probably spawned and if held in the system will die. Spawning does occur naturally but can be precipitated by shock and high water temperatures. The clouding of the water should not be confused with the slight turbidity that can sometimes occur when molluscs are initially immersed. This can be caused by mud and silt not removed completely by washing and should disappear within a few hours.

11.8 Molluscs Die or appear Weak
Molluscs generally gape when dead or are in a weakened condition, and will not close their shell halves at all or only close them slowly when disturbed.
- Molluscs have spawned.
- Molluscs in a weakened condition (see 11.6).
- Water temperature too high.
- Too long a period of immersion.
- Molluscs stressed following a period with no water flow.

12. Modifications to Purification System

Modifications to the system or its method of operation should not be made without first contacting Seafish. The design flow conditions in the system must be maintained if it is to operate effectively and modification may disrupt this. The local Food Authority must approve of any changes made.

13. Measurement of Seawater Salinity and Temperature

13.1 Temperature
A hand held digital electronic probe thermometer is recommended. A robust and water resistant type should be used and its calibration checked at intervals (for example in a container of clean, iced, fresh water). Glass thermometers are prone to breakage and if used to measure seawater temperature this should not be directly in the purification system but in a suitable container (as used for salinity measurement) filled from the tank.

The continuous monitoring of seawater temperature is possible using special sealed units that can be positioned in the purification system. Further information can be obtained from Seafish.

Salinity Conversion Chart not available

13.2 Salinity
Seawater salinity should be checked using an hydrometer. These are usually made of glass so care must be taken and measurement made in a suitable container filled from the tank. The container must be clean and be deep and wide enough to allow the hydrometer to float without touching the sides or bottom (a soft drink bottle with the top cut off can be used).

The hydrometer will usually give a reading of specific gravity (SG). From this and seawater temperature the conversion chart is used to obtain a salinity reading.

Some hydrometers can give a direct reading of salinity with built in temperature compensation. For this type the salinity conversion chart is not required.

Using the traditional type hydrometer:

1. Fill the container with seawater, place on a bench at eye level and let any air settle out.
2. Insert the hydrometer (ensuring it is clean) and let it settle making sure it is afloat and not touching the container sides.
3. Read the hydrometer scale level with the water surface ignoring the surface tension meniscus around the hydrometer stem. The scale is usually between 1.000 and 1.050 and is a reading of specific gravity (SG).
4. After use, wash the hydrometer and container with tap water.

14. Further Information

14.1 Industry Guidelines
Seafish, in collaboration with the Trade, Local Food Authorities and relevant Government Departments are publishing comprehensive Guidelines covering the harvesting, handling and distribution of bivalve molluscs. Recommendations are based upon good practice but include legal requirements. The current document deals with facilities and equipment and includes purification and the use of purification facilities for conditioning and immersed storage.

14.2 Other Operating Manuals
Seafish are producing a series of these operating manuals for the range of standard design purification systems available. These include multi-layer, vertical stack and bulk bin systems. There is also a manual for those who wish to operate a system constructed to their own design.

Manual Ref. No.	**Title**
95/31/FT	Operating Manual for the Medium Scale Multi-Layer System
95/32/FT	Operating Manual for the Vertical Stack System
95/33/FT	Operating Manual for the Large Scale Multi-Layer System
95/34/FT	Operating Manual for the Small Scale Shallow Tank System
95/35/FT	Operating Manual for the Bulk Bin System for Mussels
95/36/FT	General Operating Manual for Purification Systms on Non-Standard Design.

14.3 Seafish Advisory and Consultancy Service
Seafish offer a general advisory role to Industry, Local Food Authorities and Government Departments. General advice, usually given by post or telephone, is provided free of charge. More detailed involvement on behalf of a particular business is charged for. Further details are given in Seafish Technical Information Service Sheet No. L94/27/FT.

14.4 Artificial Seawater
Advice on the production and use of artificial seawater is given in Seafish Technical Information Service Sheet No. 1994/25/FT.

14.5 Seafish Technical Reports
A range of Technical Reports describing much of the work upon which the Standard Design Systems have been developed can be obtained from Seafish.

Further information on the operation of the Small Scale Shallow Tank Purification System or any of the above mentioned publications can be obtained from:

The Fish Technology Department
Sea Fish Industry Authority
St Andrews Dock
HULL
HU3 4QE
Telephone: (01482) 327837 Fax: (01482) 223310

Purification System Log Sheet

Species	Amount	Source	Start		Finish		Seawater				UV Hours	Consignment	Comment
			Date	*Time*	*Date*	*Time*	*Sal*	*Temp*	*Temp*	*Temp*			