

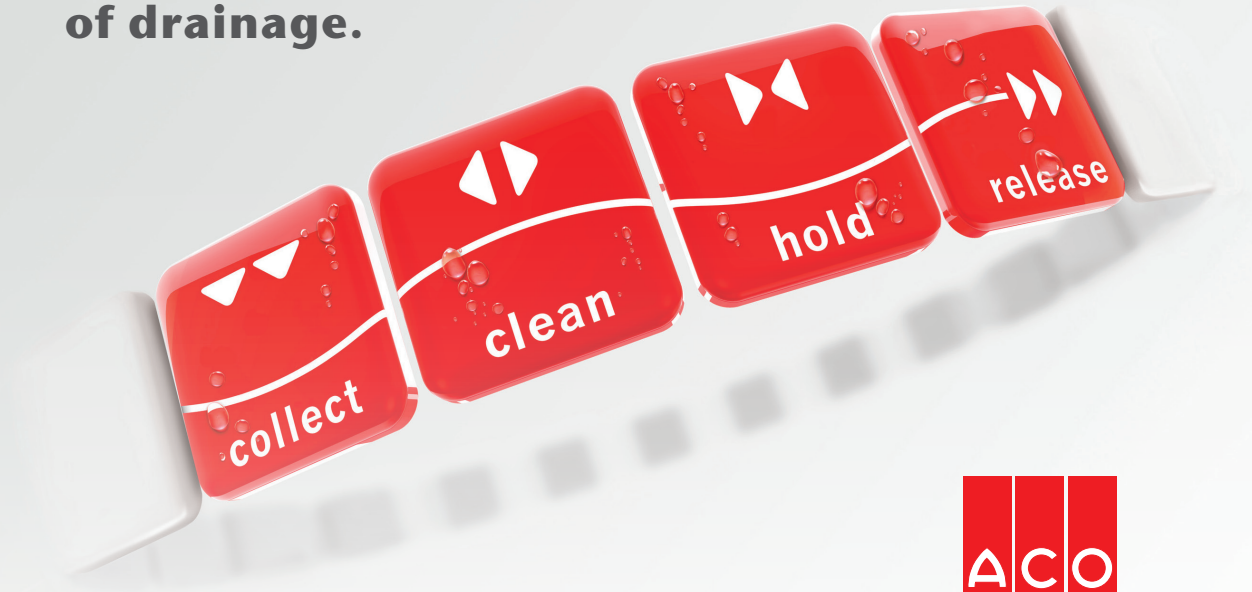


ACO Marine Product Catalogue

ACO Marine Advanced Grease Management



ACO. The future of drainage.



The ACO System Chain provides Drainage Solutions for tomorrow's Environment.

Stricter rules and regulations on board worldwide operating ships require more sophisticated drainage concepts. ACO provides intelligent solutions which perform in two directions. They protect the humans from the water and vice versa. Every ACO product provides within the ACO System Chain the way to economically and ecologically recycle and re-use the water. Within the ACO Group, ACO Marine provides technical solutions for all kinds of ships in the world wide operating maritime industry, from new builds, refits to conversion ship yards.



collect:

Collection and storage

- Scuppers and Channels
- Stainless Steel push fit ACO Pipes
- Galvanised GM-X® push fit pipes
- Black water vacuum pump station
- Grey and black water transfer stations
- Stainless steel waste water collection tanks up to 350m³



clean:

Separation and Treatment

- Grease traps and Biological grease traps
- Grease Separators
- Maripur® advanced waste water treatment system
- Clarimar® biological waste water treatment



hold:

Storage and Buffer

- Sludge holding tank
- Aeration systems
- Stainless Steel water tanks
- Disinfection systems for clean water tanks



release:

Discharge

- Clean water lifting and transfer stations
- UV/CI stations



Grease Separation



Push Fit Pipe Systems



Sewage Treatment Systems

ACO Marine

ACO Marine is within the ACO Group the world wide contact for advanced onboard drainage and innovative waste water treatment systems. Mega Yachts, Cruise Vessels, Ferries, Military Ships, Offshore Platforms and all kinds of Cargo Vessels are equipped and sailing with system solutions, provided by ACO Marine. This includes the advanced waste water treatment system ACO Maripur® and the biological waste water treatment ACO und Clarimar® as well as stainless steel bioreactors up to 350 m³, fresh water tanks, drainage systems including scuppers, penetrations, and ACO Push-Fit Pipes, made of stainless steel or galvanized carbon steel. With its innovative technology and know-how, ACO helps to keep the ocean clean for the next generations.

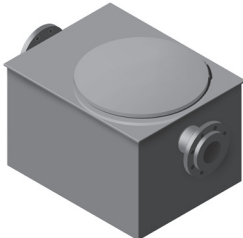
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ACO Marine Grease Management overview

Biological grease traps - FSS

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Biological grease traps - FSP

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Lipator / Lipatomat

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NS2 - NS25 AISI 316



NS4 - NS25 PE-HD

Biological Grease Traps

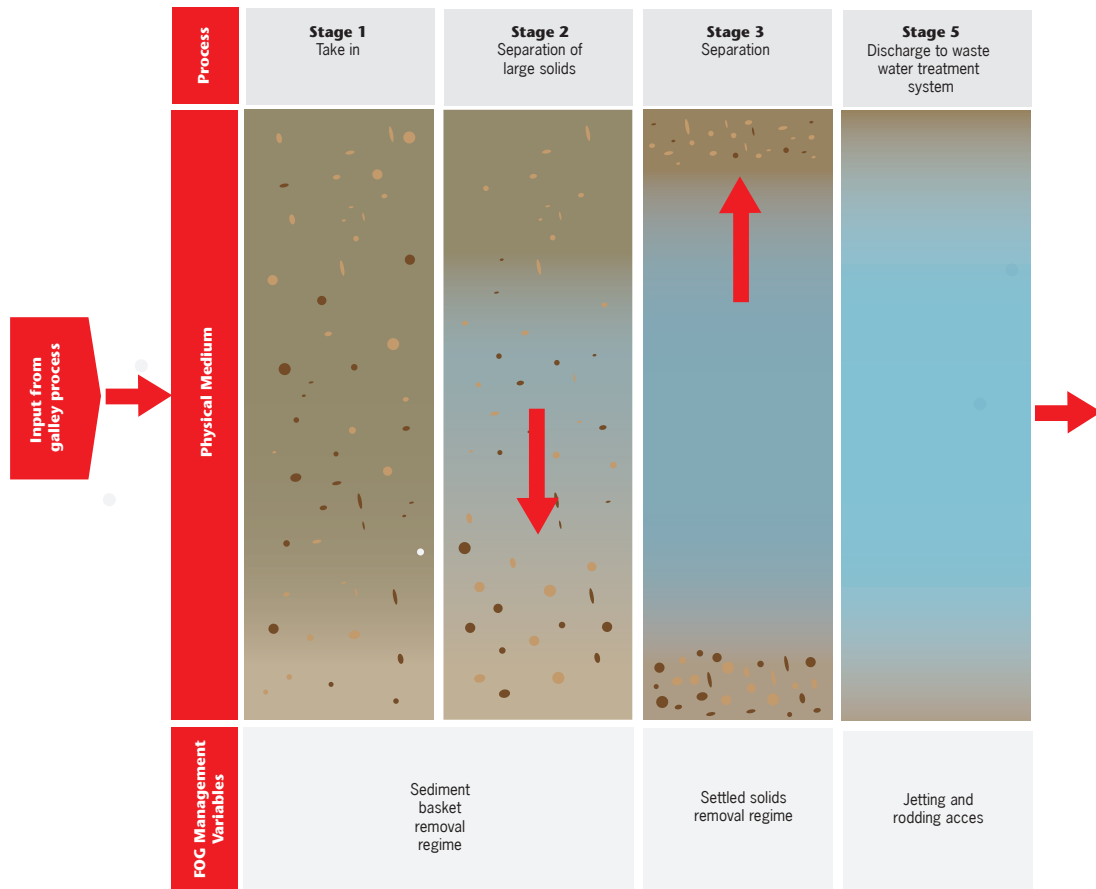
All ACO grease traps work on the same principle of gravity separation.

The mixture of contaminated water and fat, oil and grease (FOG) flows into the device by passing a sediment basket. The sediment basket removes any larger particles that may be present

in the drain waste. It is important to note that the sediment basket volume is limited, therefore any significant amounts of debris should be removed before entering the grease trap or grease separator.

The physical capacity of the trap provides a separation area where relative density differences allow finer solids to settle to the trap floor and less dense FOG's to rise to the surface. Separation occurs relatively quickly, thereby allowing less contaminated water to flow to the outlet drain during periods of intense use.

System components and FOG management variables

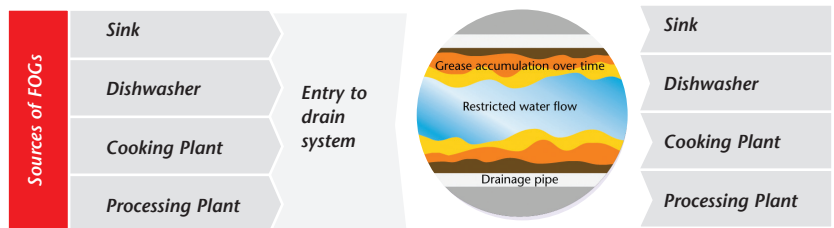


All herein mentioned sizing calculation or based on greasy galley water, but not for water from food waste system. For a specific calculation for food waste reject water, please consult ACO Marine directly.

THE NEED FOR FAT OIL AND GREASE MANAGEMENT

Effects of fats, oils and grease (FOG's)

One of the greatest drainage problems faced in galley drainage systems is the accumulation of fats, oils and greases within the pipework system.



Note: As FOG's cool in the drainage system they can solidify. If untreated, accumulation eventually causes drainage system failure leading to potential health hazards in the food preparation area.

Biological activators

Unlike strong acid or caustic drain cleaners, ACO biological activator works safely, but more slowly. The biological activator can be used to unblock drains and can be used to replace aggressive caustic and acid cleaners.

ACO biological activator works in two distinct ways on the FOG wastes that settle in the drainage pipework and grease trap system:

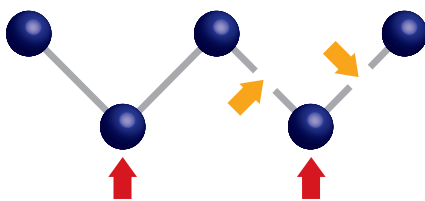
1) The activator introduces an enzyme that assists the natural biological process of breaking down long molecular chain FOG's into a manageable solution to then be discharged safely into the drainage system.

2) The activator introduces other micro-organisms that actively feed on the FOG's present in the solution.

Biological activators will not digest solid residues from the food preparation process quickly, so the sediment basket requires periodic removal for cleaning to ensure efficient operation.

ACO Clear biological activator is available in 5 or 20 litre containers.

ACO activator process



Yellow arrow: Enzymes break long chain molecule FOG's into fluid solutions
Red arrow: Active micro-organisms digest long and short chain components

Depending upon the application, space availability and physical layout of the area, grease traps can be installed in parallel to share the hydraulic load.

Calculation for Grease Trap

Selecting the correct size of grease traps for smaller galley applications is mostly related to the different equipment in the galley and the type and volumes of food being prepared or processed as well as the drainage connection points.

Flow rates of water can be used to assess the size of a grease trap, but our experience shows that in most instances, the actual flow rates from all the various galley appliances and equipment are not known in practice. This can lead to grossly inaccurate assumptions and subsequent error with a

potential cost and performance penalty.

What is known from a galley or food-processing area is the designed maximum volume of food to be produced each day. Examples include the number of meals produced by the galley.

The amount of fats, oils and greases (FOG's) generated in the galley is generally proportional to the food volume produced. Therefore the most reliable and easiest method of sizing is to use the 'meals per day' notation. For the convenience of sizing, 1 meal per day = 1 course of food. For example, a

galley providing three meal sittings on a daily basis for passengers and crew – breakfast (1 course), lunch (3 courses) and dinner (3 courses) yields a maximum total number of courses for each person of 7 'meals per day'. If the vessel has a total number of 40 passengers, then the maximum number of meals per day that could be produced is given by: 7 x 40 = 280 mpd.

Further information may be at hand relating to the number of covers expected at a particular sitting. In this case the simple table below can be used to calculate meals per day.

Example calculation of meals per day - A x B x C = MPD

Sitting	Course 1	Course 2	Course 3	A Total courses	B Number of people possible	Meals per day
Breakfast	1	N/A	N/A	1	40	40
Lunch	1	1	1	3	40	120
Dinner	1	1	1	3	40	120
Meals per day total						280

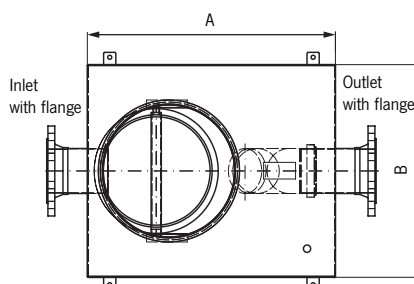
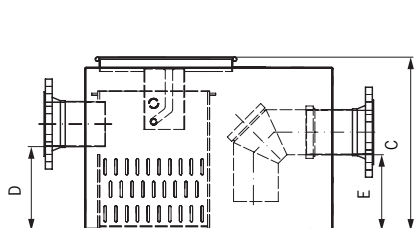
FSS Grease Trap Technical data

Product dimensions

Model Ref	Part No.	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Dry Weight (kg)	Inlet dia (mm)	Outlet dia (mm)	Meals per day
FSS50	411276	810	520	425	261	186	51	DN100	DN100	0-50
FSS150	411277	960	660	525	361	286	65	DN100	DN100	50-150
FSS250	411278	1130	660	525	361	286	81,5	DN100	DN100	150-250

Minimum clear distance above top of grease trap required for service access

Model Ref	Total clear height requirement for grease trap and sediment bucket removal
FSS50	760
FSS150	900
FSS250	900



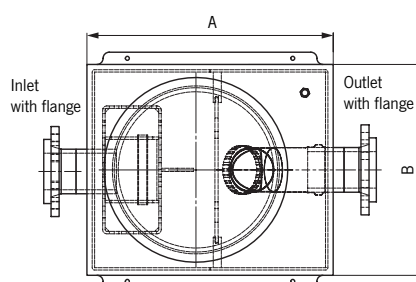
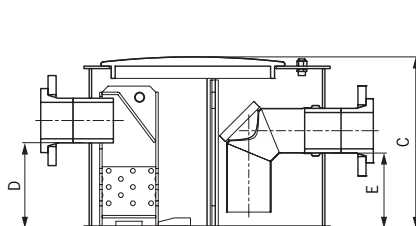
FSP Grease Trap Technical data

Product dimensions

Model Ref	Part No.	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Dry Weight (kg)	Inlet dia (mm)	Outlet dia (mm)	Meals per day
FSP50	411273	824	520	400	260	186	51	DN100	DN100	0-50
FSP150	411274	974	660	500	354	286	65	DN100	DN100	50-150
FSP250	411275	1144	740	500	352	286	81,5	DN100	DN100	150-250

Minimum clear distance above top of grease trap required for service access

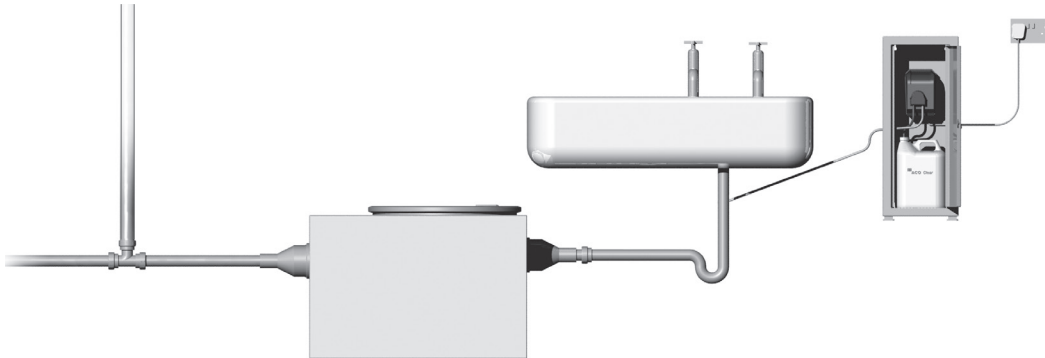
Model Ref	Total clear height requirement for grease trap and sediment bucket removal
FSS50	760
FSS150	930
FSS250	930



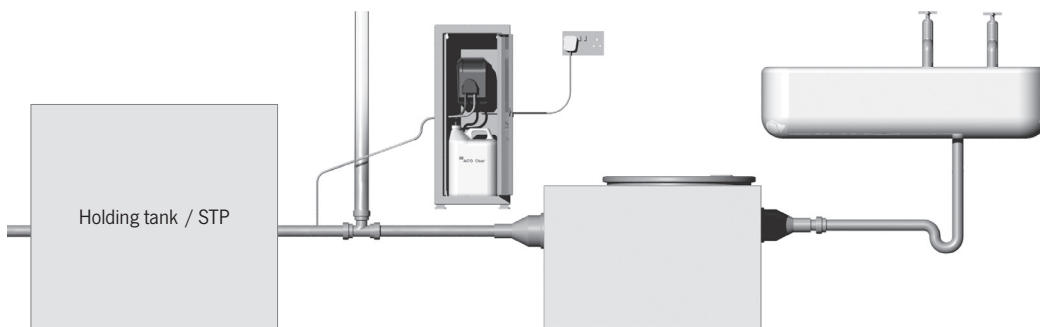
Installation

Installation of the system

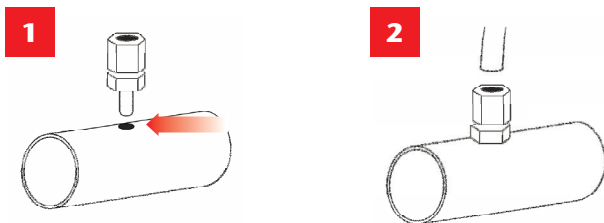
Dosing point 1 - Protection of piping system



Dosing point 2 - Protection of Holding Tank(s) or STP against residual grease



Installing the pipe injector



- 1 Drill a 14mm hole in the top of your intended waste pipe.
- 2 For added security it is recommended to use Silicone Sealant (not-supplied) in-between the Pipe Injector and the drilled hole (as shown above). Slowly wind in the Pipe Injector until tight, it is not necessary to over tighten with tools as this may damage the threading on the injector.
- 3 Now connect the delivery tubing to the Pipe Injector, turning the compression nut clockwise until hand tight.

Do...

Place trap close to wastewater source to avoid grease build up in pipe.

Place trap to ensure adequate access to sediment basket and rodding points.

Connect outlet pipe to vent pipe. In some cases a vacuum breaker may be required to prevent siphoning.

Connect incoming pipe to vent pipe to prevent pressure build up during biological process if required.

Don't...

Don't connect to outlets from macerators, toilets or washbasins.

Don't use smaller outlet pipe or converter accessory diameter than that of the inlet pipe.

Don't place trap in areas of temperature extremes.

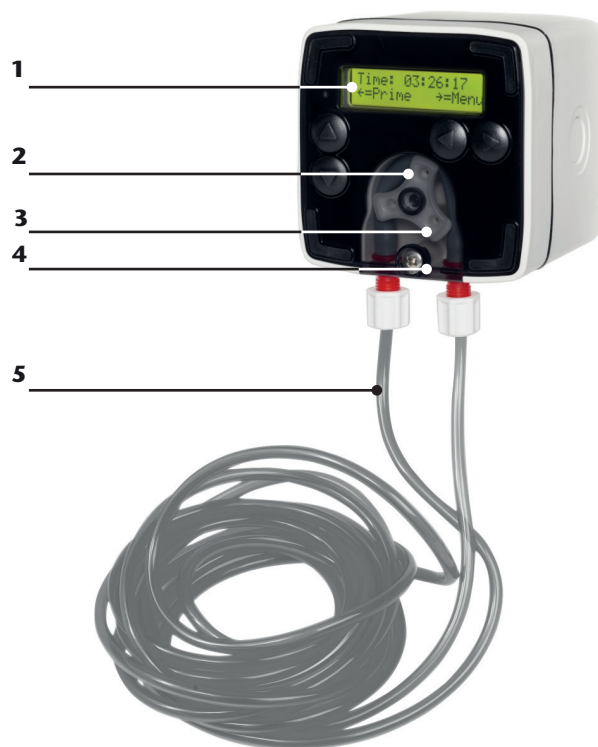


Dosing System components

Features and benefits

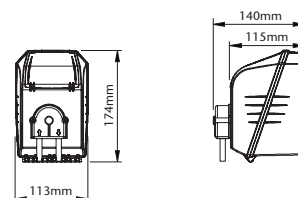
Mains operated dosing unit (MODD) enables maximum operational efficiency of grease management system to be established quickly.

- 1** Microprocessor controlled dosing is programmed via convenient LCD display for easy set up and programming.
- 2** Water resistant enclosure conforms to IP 65M for water and dust ingress prevention.
- 3** Dosing unit delivers 100ml per minute of biological activator, The unit is programmable to match user requirements and supplied complete with PVC tubing, tube connectors and operating instructions.
- 4** The unit incorporates battery timeclock back up in case of power failure.
- 5** Precise delivery extends activator economy significantly over “manual dosing” methods.



MODD Mains Operated Drain Dosing Unit

Description	Part No.	Pump spread ml/min	Power supply
MODD	M01656	100	100/240V AC



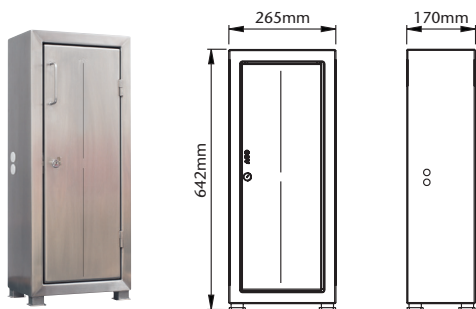
Mounting frame

- 1** Manufactured in brushed grade 316 stainless steel.
- 2** Houses 5 litres of activator. Not 20 litres barrel.
- 3** Versatile unit can be floor or wall mounted and has reversible door for right hand or left hand opening.
- 4** Pre-drilled apertures for mains feed and biological activator feed are supplied with blanking grommets.
- 5** Pre-drilled for wall mounting and dosing unit fixing.



Mounting frame

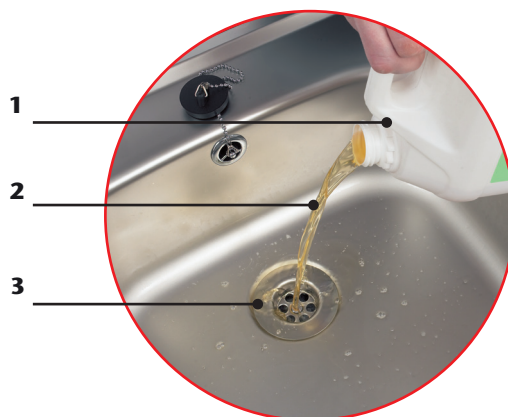
Description	Part No.	Weight (kg)
MF	402637	4,0



Accessories

Biological Activator ACO Clear

- 1 ACO Clear biological activator introduces an enzyme that assists in breaking down fat, oil and grease deposits. Micro-organisms actively feed on fats present in the drainage system or grease trap.
- 2 The activator can be applied manually, pouring a prescribed amount into the drain directly, or as recommended, via MODD or dosing unit.
- 3 Available in 5 or 20 litres containers.



ACO Clear biological activator

Description	Part No.	Volume (l)	Weight (kg)
ACO Clear 5 litres	49020	5	5
ACO Clear 20 litres	49022	20	20



Operation and Maintenance

Biological dosing regimes

Once installed, grease trap performance can be optimised by using the following procedure:

1. Establish total dosing time using table 1 opposite, referring to section “Grease Trap Sizing” to arrive at ‘meals per day’. Then convert the dosing times to seconds for the MODD or dosing unit (Table 1).
2. Establish hourly load by considering daily average patterns for all facilities connected to the trap. Table 2 below gives an example of a sixteen hour period with a total capacity of 500 meals per day. Load percentages are shown in row A, row B multiplies load percentage by total dosing 11am time for a MODD unit in order to arrive at the time to be entered into dosing unit programme at the start of that period. For example the unit should be programmed for 45 seconds running at 11am, 1:30 at 2pm and so on. Programme the unit accordingly.
3. Alternatively, where the load on the grease trap is variable, the dosing can be programmed at the end of the working period, preferably when the trap will not be used for a few hours.

Table 1 - dosing times

Meals per day	ACO Clear (ml)	Dosing times as seen on MODD display
50	50	0:30
100	100	1:00
150	150	1:30
200	200	2:00
250	250	2:30
300	300	3:00
350	350	3:30
400	400	4:00
500	500	5:00
600	600	6:00
700	700	7:00
800	800	8:00
900	900	9:00
1000	1000	10:00

Table 2 - An example of dosing periods for 500 meals per day

D1 (mm)	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Total
Percentage Load					15%			30%				20%			35%			100%
ACO Clear (ml)					75			150				100			175			500 ml
Dosing Time (s)					0:45			1:30				1:00			1:45			5:00

4. Shock dosing of the grease trap is an important element to start the biological process. To rapidly establish a biomass within the grease trap, dose the system with 3 or 4 days of maintenance activator to begin the process, either by pouring ACO Clear activator directly through a sink during a quiet period of the working day when there is no drainage activity or by running the dosing pump in priming mode as per the instructions supplied with the pump.

Operation during first 2 weeks

1. Inspect sediment basket daily at first to establish how often the bucket needs to be emptied. If the basket fills rapidly (less than 2 weeks, for example), then it is necessary to provide additional filtration upstream of the trap.

Note: Do not connect macerators to the trap.

2. Inspect the contents of the trap, increasing the dosing frequency and period if:
 - a. solidified grease is apparent on the surface and/or near the walls of the trap.
 - b. significant pools of oil are present on the surface
 - c. flow is impaired at the outlet pipe. This can be established by removing the access point cap.

Ongoing operation

1. Adjust dosing period and frequency for known seasonal variations - establish regular sediment basket removal regime.
2. Drain, clean and inspect the trap twice annually or at more regular intervals if silt build up at the base of the trap exceeds 5 cm.

Trouble Shooting

Once ongoing operation is established ACO Biological Grease Traps should provide excellent service. Should problems become apparent, check the following variables.

- 1.) MODD operation, electricity supply and programming.
- 2.) Pipelines from dosing unit.
- 3.) Load on trap in meals per day.
- 4.) Dosing period and frequency.
- 5.) Influent temperature and temperature within trap.

Basic calculation for all ACO Marine Grease Separator installations

Example: Cruise Ship with 1.100 persons on board

Based on different sizes of ships and different design criteria, three grease trap and grease separation methods are used:

Method 1: Calculation based on Customers Specification

In some installations the customer requires to treat a specific volume in specified time, based on experiences on similar ships in the fleet. If these knowledge is available, ACO Marine needs the information about the daily volume of greasy water and operating hours per day. In this case a sizing calculation is:

How to calculate:

For Example:

$$\frac{\text{Volume to be treated per day}}{\text{Operation hours} \times 3600} = \frac{\text{Nominal Size of grease separator.}}{\text{350 m}^3} = \frac{\text{Nominal Size}}{12 \text{ hrs} \times 3600} = \frac{\text{Nominal Size}}{8,1 \text{ ltr/sec} = \text{NS 10}}$$

Method 2: Through Flow Calculation

$$\frac{\text{Persons onboard} \times \text{Meals per day} \times \text{Waste Water per meal} \times \text{Peak Load Factor}}{\text{Operation Time in Hours} \times 3,600 \text{ seconds}} = \text{Through Flow in litre per second}$$

$$\frac{1.100 \times 4 \times 10 \times 22}{24 \times 3.600 \text{ seconds}} = \text{Through Flow in litre per second}$$

$$\frac{968.000}{86.400} = \text{Through Flow in litre per second}$$

11,2 = Through Flow in litre per second

Lipatomat/Lipator - Grease Separator System AISI 316 or PE-HD

ACO Marine Grease Separators are proven products for Fats, Oil and Greases (FOG) removal from Galley water. Galley water must first pass through a Grease Separator unit before entering any membrane wastewater treatment plant as FOG's can have an adverse effect on membrane performance and life expectancy.

Operating principles:

By locating the inlet and outlets slightly above the separation chamber the resulting small hydrostatic pressure makes Lipator and Lipatomat Grease Separators the only units of their kind whose separation efficiency is completely unaffected by vessels movement and vibration. The grease accumulates in the upper cone whilst the sediment drops to the lower cone.

The heating element located in the upper cone ensures the grease remains liquid. Clean water passes freely and continuously through the grease separator.

Accumulated sediment and grease is drained to independent collecting barrels fitted with level sensors which provide indication to the operator when they need to be emptied or replaced with exchange units.

Grease and Sediment lift pumps as well as treated water lift station, can also be integrated into the system depending on installation requirements aboard the vessel.



Advantages

- Small hydrostatic pressure with no free surface ensures that the separation process is unaffected by vessel movement and vibration.
- The ACO patented internal design ensures flow velocity profiles through the separation chamber produce effective separation of grease and sediments even during periods of high demand.
- Grease and sediment removal is fully automated on the Lipatomat range (manual on the Lipator).
- No operator contact with grease and sediments.
- Grease and sediment removal occurs without interrupting separator operation. No process down-time.
- The separation technology ensures the greases and sediments are highly concentrated, only grease and sediments are disposed of with no surplus water; so often the case in conventional static systems.
- Effective heating and short residence time within the separation chamber ensures that no grease is deposited on the chamber walls. Internal maintenance and cleaning is therefore reduced to an annual inspection only.
- Resistant to high temperatures
- Hygienic material Stainless steel 316 or PE-HD
- Rigid construction to withstand vessel movement and vibration
- Resistant to organic solvents

Lipatomat/Lipator - Grease Separator System NS2 - NS25 AISI 316

Product Information:

ACO product advantages

- Demand-actuated disposal possible
- Reduction of disposal costs through targeted drawing-off of grease and sludge
- Class A1 material (stainless steel grade 316) and thus not flammable

- Fresh grease separator system as per DIN EN 1825 and DIN 4040
- For installation in frost-free environment
- With integrated sludge trap
- Housing and lower section made of stainless steel, material grade 316
- Heating cartridge
- Manual ball valve DN 50 for grease and sludge draw-off
- Barrels for grease and sediment sludge - Contents: 60 l
- Cover includes hose attachment
- Agitating device with 1-phase alternating current motor in lower housing
- Control of agitating device
- Measuring of drum filling level
- Programme control with group fault reporting for central technical supervision

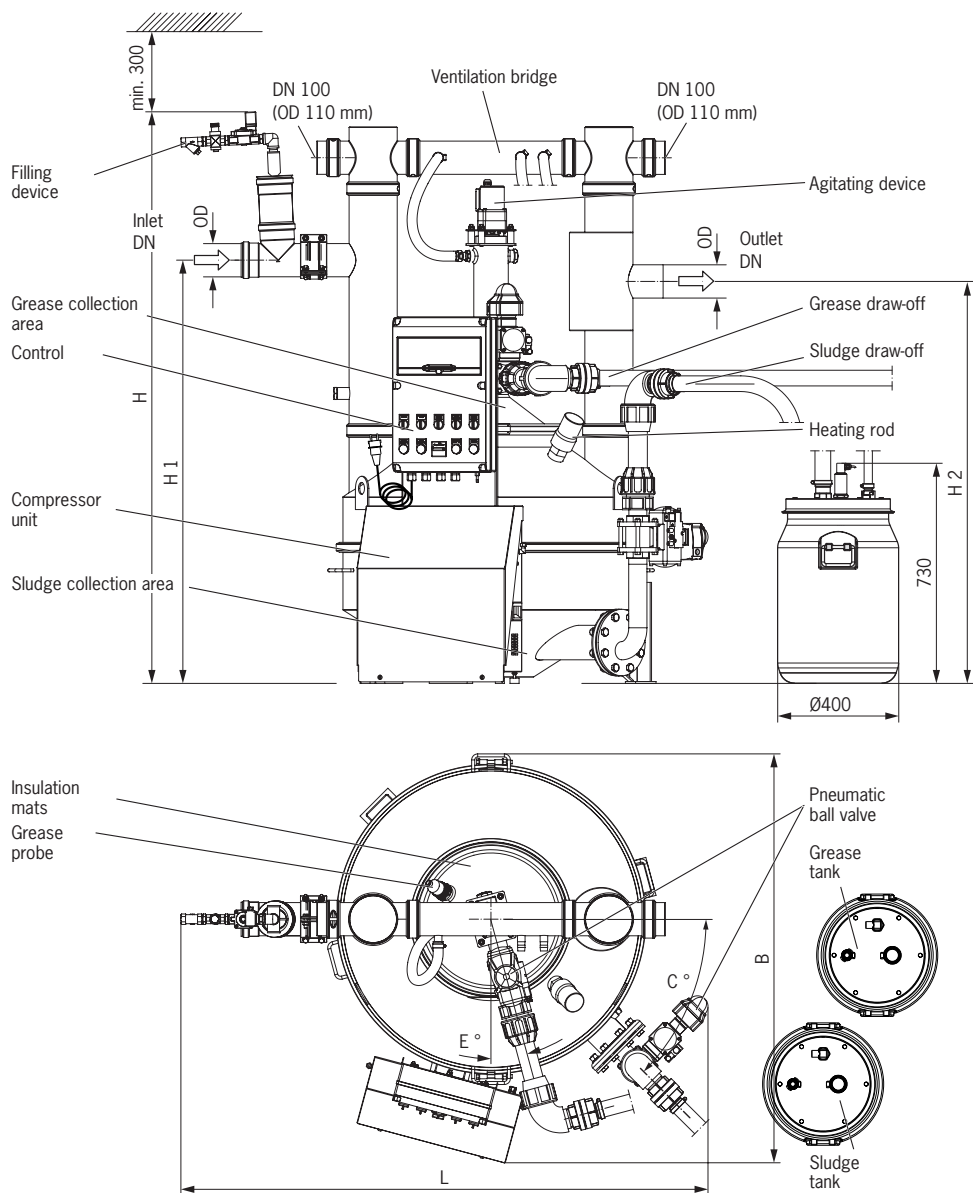
Additional for Lipatomat:

- Pneumatic ball valve DN 50 for grease and sludge draw-off
- Measuring of grease layer thickness
- Filling device with magnetic valve to assist with sludge and grease discharge
- Compressor or alternative use of ship compressed air



Lipatomat/Lipator - Grease Separator System NS2 - NS25 AISI 316

Drawing:



Order information

Nominal capacity (NS)	Nominal diameter DN	OD [mm]	L [mm]	B [mm]	H [mm]	H1 [mm]	H2 [mm]	Total content [l]	Largest single component		Total Weight	
									Diameter x Height [mm]	Heaviest component [kg]	Empty [kg]	Full [kg]
NS 2	100	110	1650	970	1800	1300	1230	220	750 x 880	50	220	440
NS 4	100	110	1750	1350	1900	1400	1330	480	980 x 445	45	260	760
NS 10	150	160	2200	1850	2320	1800	1730	1400	1500 x 650	95	370	1770
NS 20	200	200	2450	2100	2560	1900	1830	2020	1750 x 775	120	430	2450
NS 25	200	200	2450	2100	2560	2000	1930	2260	1750 x 775	120	430	2690

Lipatomat/Lipator - Grease Separator System NS4 - NS25 PE-HD

Product Information:

ACO product advantages

- Demand-actuated disposal possible
- Reduction of disposal costs through targeted drawing-off of grease and sludge

- Fresh grease separator system as per DIN EN 1825 and DIN 4040
- For installation in frost-free environment
- With integrated sludge trap
- Housing and lower section made of PE-HD
- Heating cartridge
- Manual ball valve DN 50 for grease and sludge draw-off
- Barrels for grease and sediment sludge - Contents: 60 l
- Cover includes hose attachment
- Agitating device with 1-phase alternating current motor in lower housing
- Control of agitating device
- Measuring of drum filling level
- Programme control with group fault reporting for central technical supervision

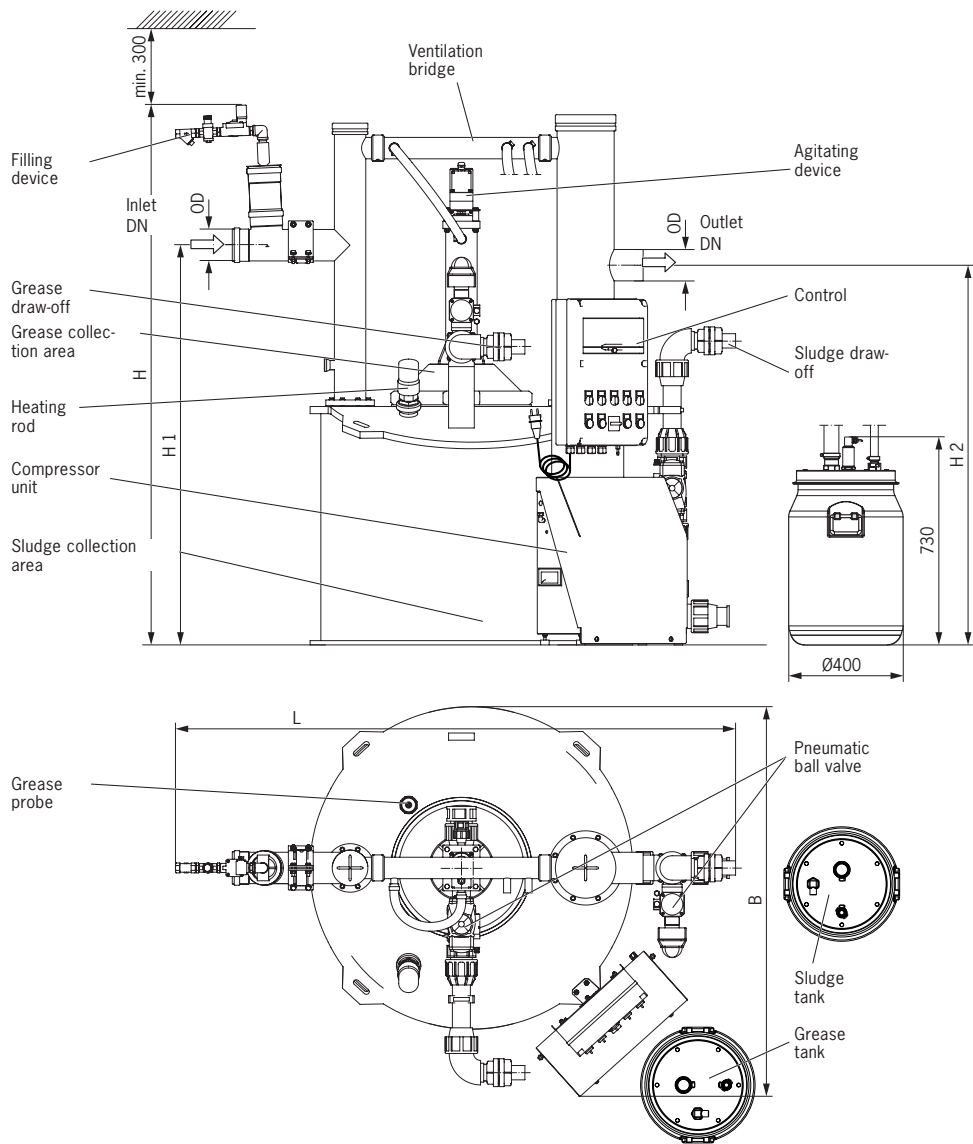
Additional for Lipatomat:

- Pneumatic ball valve DN 50 for grease and sludge draw-off
- Measuring of grease layer thickness
- Filling device with magnetic valve to assist with sludge and grease discharge
- Compressor or alternative use of ship compressed air



Lipatomat/Lipator - Grease Separator System NS4 - NS25 PE-HD

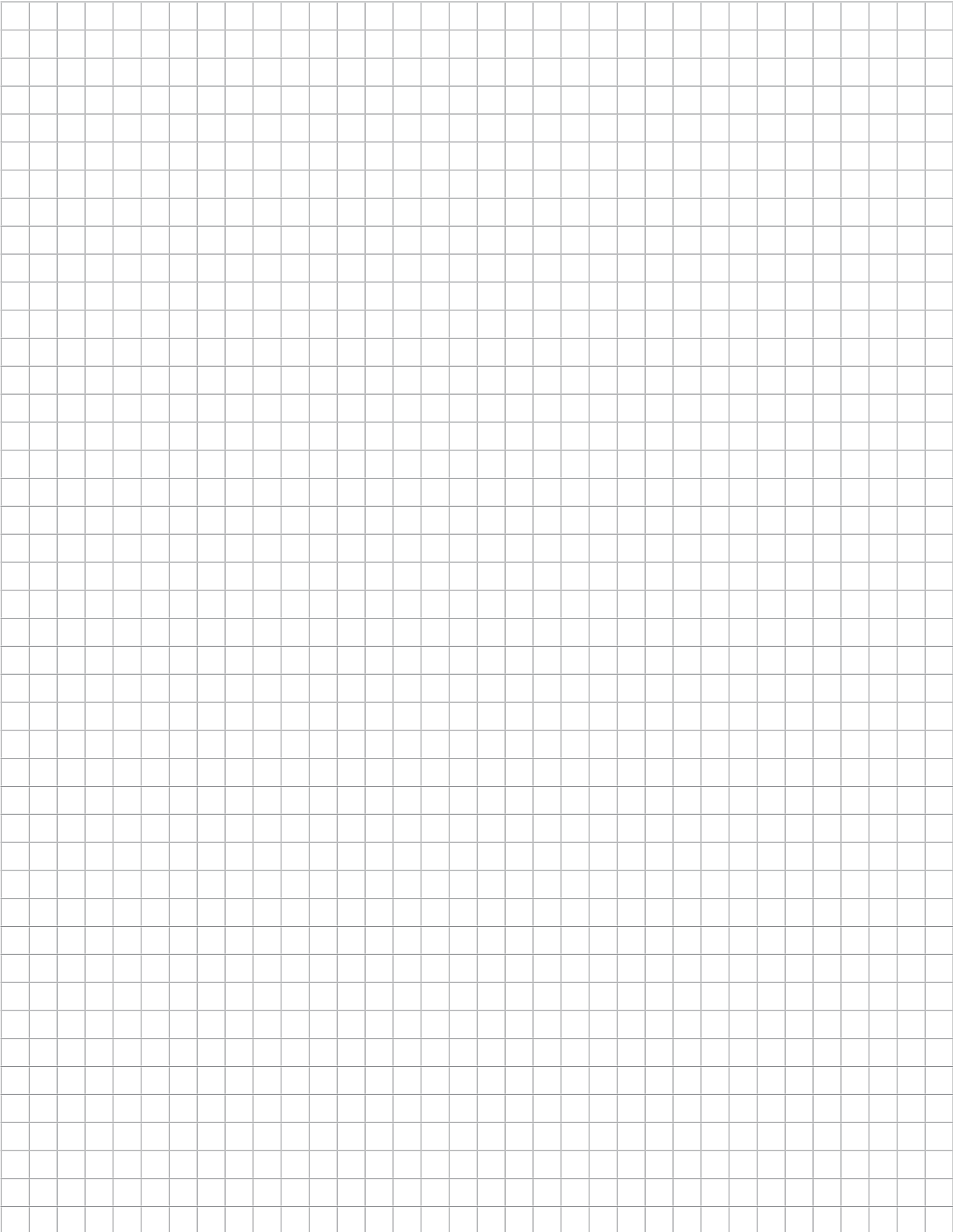
Drawing:



Order information

Nominal capacity (NS)	Nominal diameter DN	OD [mm]	L [mm]	B [mm]	H [mm]	H1 [mm]	H2 [mm]	Total content [l]	Largest single component		Total Weight	
									Diameter x Height [mm]	Heaviest component [kg]	Empty [kg]	Full [kg]
NS 4	100	110	1950	1350	1850	1400	1330	570	1130 x 835	80	240	810
NS 10	150	160	2500	1850	2320	1800	1730	1570	1660 x 630	120	380	1950
NS 20	200	200	2750	2050	2560	1900	1830	2250	1920 x 700	160	440	2690
NS 25	200	200	2750	2050	2660	2000	1930	2500	1920 x 700	160	470	2970

Notes



A large grid of graph paper for taking notes, consisting of 30 columns and 40 rows of small squares.

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