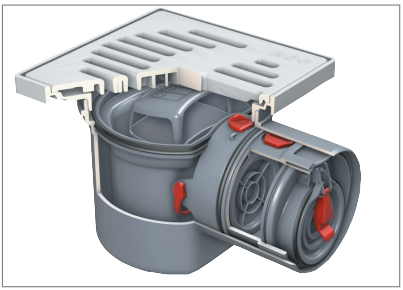
5. Products and Applications

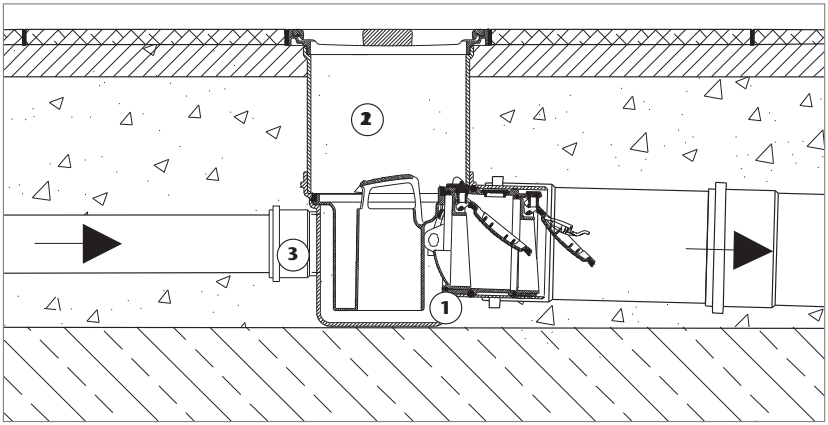
5.1 ACO JUNIOR cellar drain with backflow safety device



Fields of application:
Building refurbishment and new construction of cellar rooms in privately used single-family houses.

Standards/regulations
EN 13564-1 — Backflow stops for buildings (requirements)
EN 13564-2 — Backflow stops for buildings (test processes)

Suggested installation



Products

Item	Article description	Art. no.	Catalogue chapter
1	ACO JUNIOR cellar drain with backflow safety device, type 5	2130.00.77	Drainage/backflow stops/ cellar drains with backflow safety devices
2	Extension element	2040.00.06	
3	Inlet socket DN 50	2410.00.04	

Installation instructions

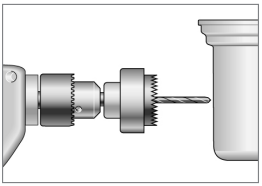
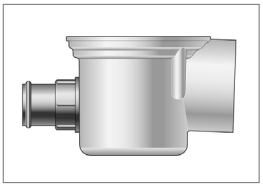
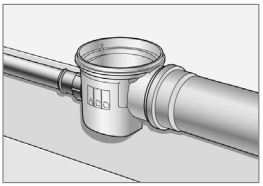
Installation of the body

Because of its small dimensions, ACO JUNIOR is an excellent solution for building refurbishment. The first step involves removing the already installed drain.
Then install the JUNIOR. The size of the rebate required is 275 x 200 mm, and the height of the body is 170 mm.



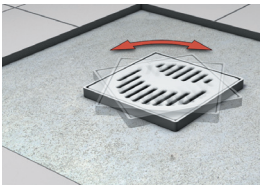
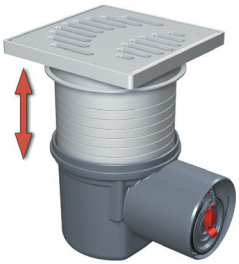
Attaching a lateral inlet

An inlet to the cellar drain can be installed in situ. The first step is to use a DN 50 saw bell (external diameter: 60 mm) to cut the right sized hole in the smooth side of the drain body. Then screw the DN 50 inlet socket onto the body. The inlet pipe can then be connected to the socket.

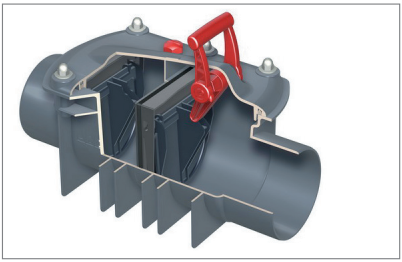
Assembling an extension element

Deeper installations can be easily realised using the optional extension element. The extension element is installed between the top section and the body of the drain. The extension element can be shortened with a saw in situ if required.
The top section can also be rotated to ensure optimal alignment of the grating with the tiles.

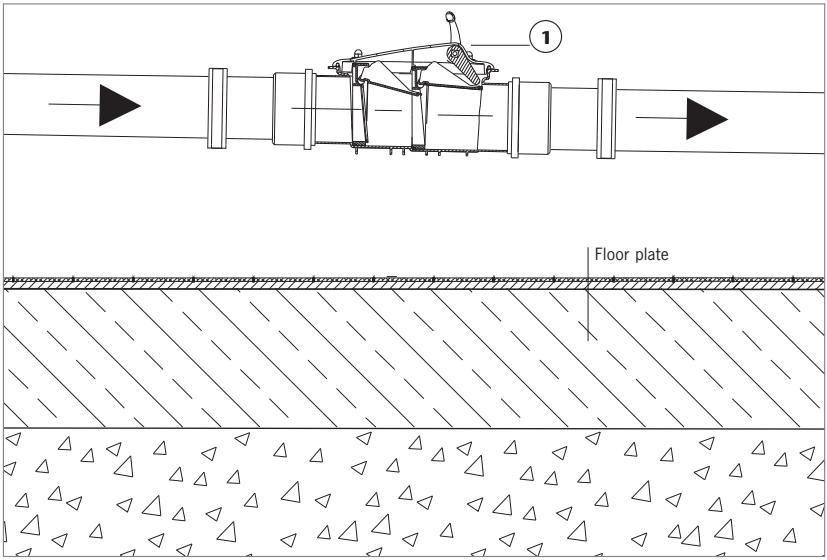
5.2 ACO TRIPLEX-K backflow stop for wastewater free of faeces

Fields of application
Rooms in single-family houses below the backflow level in which only drainage objects without faeces incidence have to be protected against backflow.



Standards/regulations
EN 13564-1 — Backflow stops for buildings (requirements)
EN 13564-2 — Backflow stops for buildings (test processes)

Suggested installation



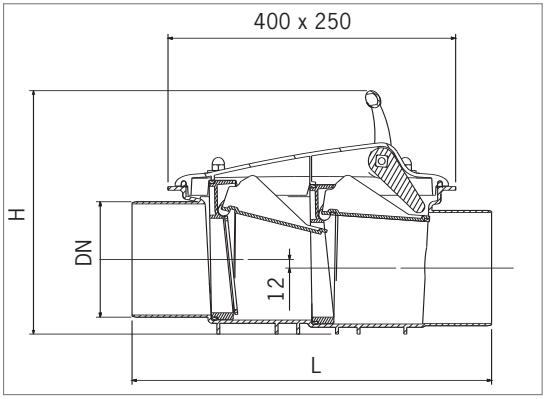
Products

Item	Article description	Art. no.	Catalogue chapter
1	ACO TRIPLEX DN 100, type 2	620364	Drainage/ backflow stops

Installation instructions

Pipe connection

The inlets and outlets have to be created in situ using coupling sockets. Note that there is a drop in gradient of 12mm between the inlet and the outlet.



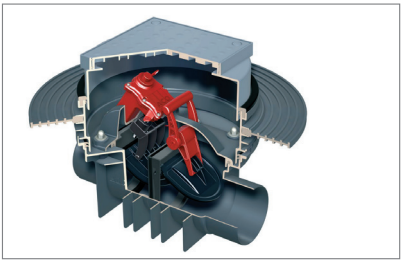
DN	External diameter (mm)	Length (L in mm)	Height (H in mm)
100	110	460	338
150	160	500	338

Retrofitting possibilities

The TRIPLEX backflow stop for wastewater free of faeces can be retrofitted with a conversion kit for wastewater containing faeces.
The conversion kit contains a cover, two flaps, a switch and a motor.

Conversion kit for wastewater containing faeces

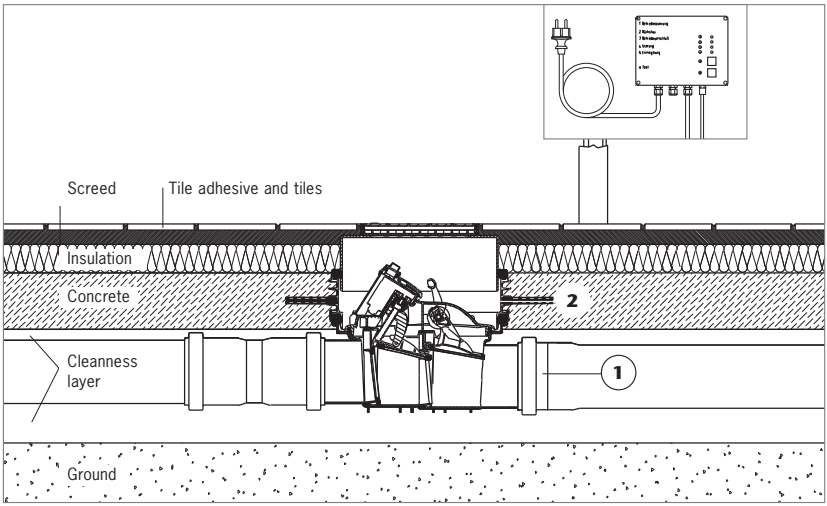
5.3 ACO QUATRIX-K automatic backflow safety plant for wastewater containing faeces with shaft system



Fields of application
Rooms in single-family houses below the backflow level in which, among others, a urinal or a toilet have to be protected against backflow. A second toilet must be at the users' disposal above the backflow level.

Standards/regulations
EN 13564-1 — Backflow stops for buildings (requirements)
EN 13564-2 — Backflow stops for buildings (test processes)

Suggested installation



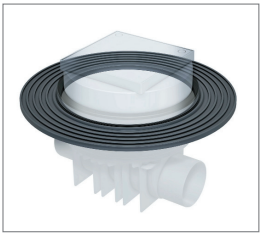
Products

Item	Article description	Art. no.	Catalogue chapter
1	ACO QUATRIX automatic backflow safety plant with shaft system DN 100, type 3 F	620370	Drainage/backflow stops
2	Sealing flange	620382	Drainage/backflow stops

Installation instructions

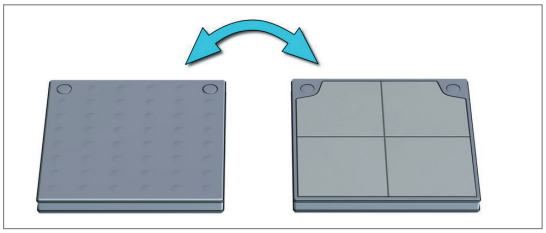
Sealing flange for pressurised water

If the floor plate needs to be protected against pressurised water, it is possible to equip the shaft system with an optional sealing flange. This flange provides reliable protection to keep ground moisture out of the cellar. The height of the flange is infinitely adjustable for easy adaptation to the level of the floor plate.



Cover design

Use either side of the cover as required. The uniform side is a plastic cover. If tiles are laid in the installation room, turn the cover round and use the side which is recessed to accommodate the matching tiles.



Emergency seal

The ACO QUATRIX-K also has an emergency seal which can be operated manually. The flap can be moved into three positions:

Position 1: Flap closed, no wastewater can flow out
Position 2: Flap open, wastewater can flow out but the operating seal will close automatically if there is backflow
Position 3: Flap swings, the automatic flap functions like a simple backflow stop. This is required during the construction phase before installation of the motor and the control device.

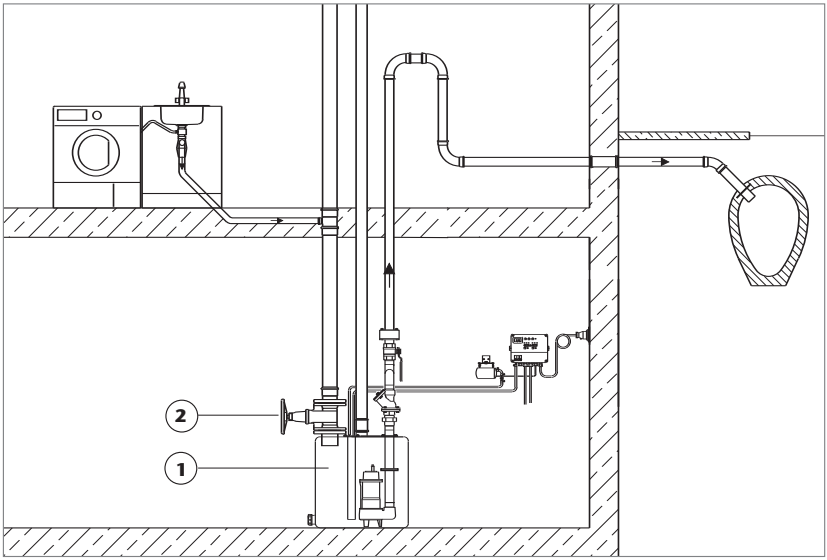
5.4 ACO MULI-MINI lifting plant for wastewater free of faeces

Fields of application
For drainage of wastewaters free of faeces stemming from single-family houses and multiplex houses or basement apartments.
The lifting plant can also drain wastewater from dish-washers in commercial establishments.

Standards/regulations

DIN EN 12056-4	— Gravity drainage plants inside buildings
Wastewater lifting plants	— Planning and dimensioning

Suggested installation



Products

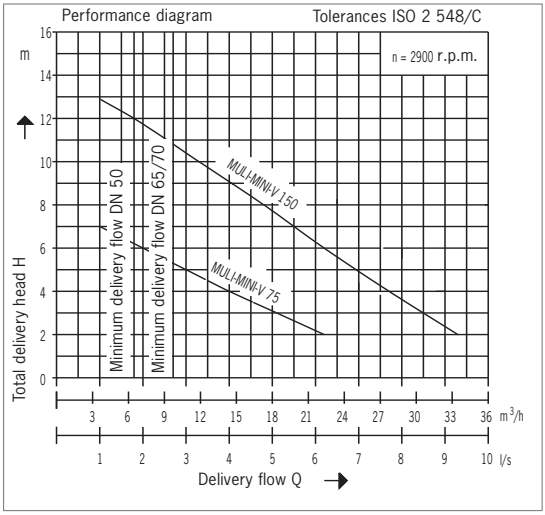
Item	Article description	Art. no.	Catalogue chapter
1	MULI-MINI V 75 – mono	0175.08.40	Pumps/wastewater lifting plants
2	Inlet slide DN 100 of PVC	0175.13.84	Pumps/wastewater lifting plants

Installation instructions

Pneumatic control

The pneumatic control pipe (supplied as standard with 4 metres of tube) must be laid with a constant gradient between the control unit and the lifting plant. It is also important that it is free of folds which may block the pipe.

Performance data



Product versions

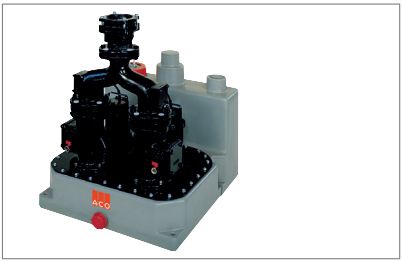
The MULI-MINI lifting plant comes in two versions: a single plant called “mono”; and a twin plant called “duo”.

An additional inlet can be built into both versions in situ by cutting a hole for a DN 50 connection socket (Article number 0175.09.27).

5.5 ACO MULI-PE lifting plant for wastewater containing faeces

Fields of application

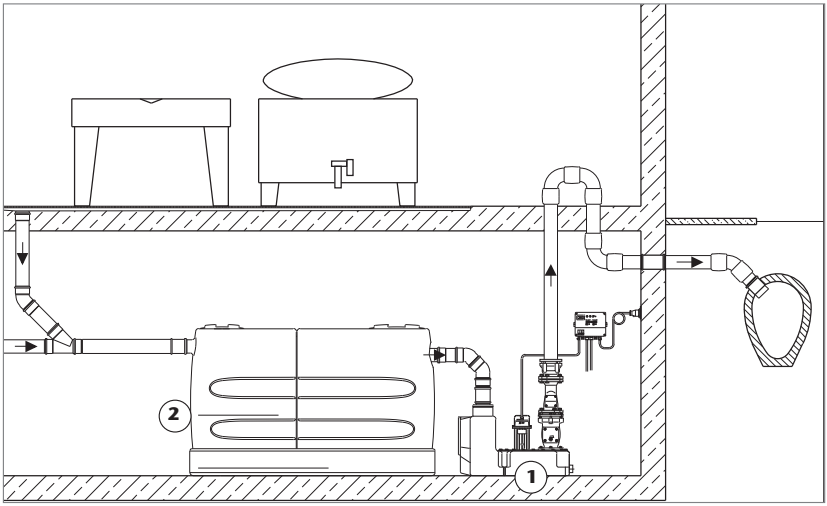
For draining wastewater from toilet units, washing and shower rooms as well as bathrooms in multiplex houses and office buildings.
MULI-PE duo lifting plants can be installed downstream of grease separator plants NS 1, 2 or 4.



Standards/regulations

DIN EN 12056-4 — Gravity drainage plants inside buildings
Wastewater lifting plants — Planning and dimensioning

Suggested installation



Products

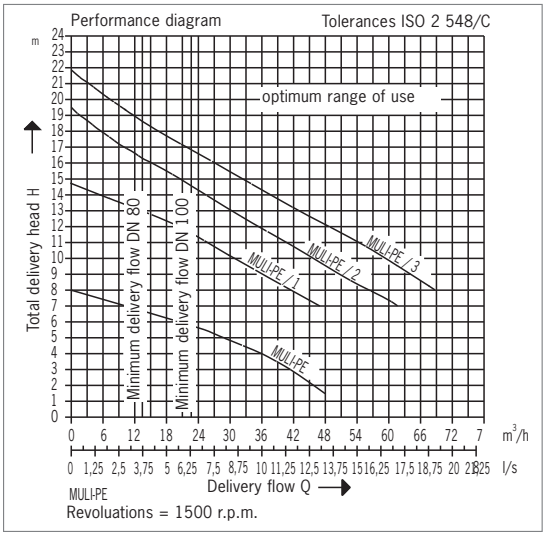
Item	Article description	Art. no.	Catalogue chapter
1	MULI-PE-duo lifting plant	0159.04.17	Pumps/wastewater lifting plants
2	ECO-JET-G grease separator NS 4	3804.00.00	Separators/grease separators free-standing installation

Installation instructions

Pneumatic control

The pneumatic control pipe (supplied as standard with 4 metres of tube) must be laid with a constant gradient between the control unit and the lifting plant. It is also important that it is free of folds which may block the pipe.

Performance data



Tank volumes depending on inlet heights

Mono plants:

Inlet DN 100,	inlet height 180 mm	=	30 litres
Inlet DN 100,	inlet height 250 mm	=	55 litres
Inlet DN 100,	inlet height 400 mm	=	70 litres
Inlet DN 100/150,	inlet height 650 mm	=	70 litres

Duo plants:

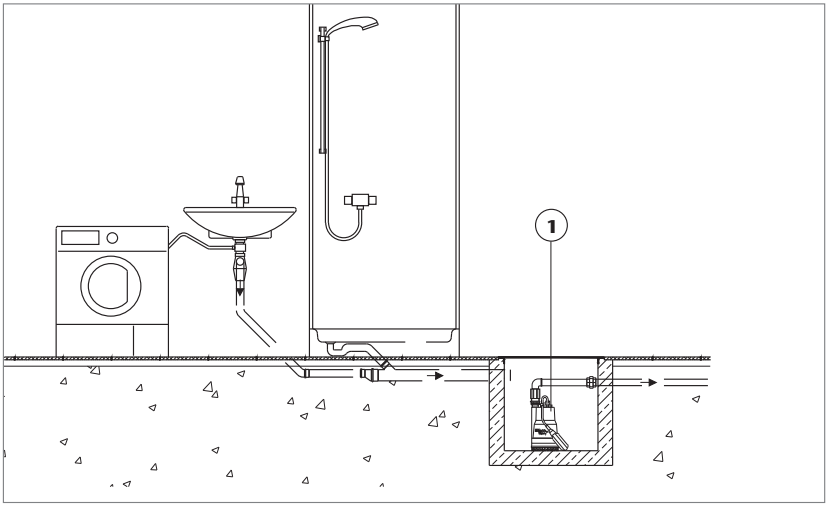
Inlet DN 100/150,	inlet height 250 mm	=	80 litres
Inlet DN 100/150,	inlet height 400 mm	=	100 litres
Inlet DN 100/150,	inlet height 650 mm	=	100 litres

5.6 ACO UST-330 WS/WT submersible pump for wastewater free of faeces

Fields of application
For drainage of cellar rooms and to pump empty swimming pools up to a submersion depth of 5 metres.
Admissible liquid temperature of 40°C.
Can be used up to max 80°C for 3 minutes.
Grain size max. 10 mm.

Standards/regulations
DIN EN 12056-4 — Gravity drainage plants inside buildings
Wastewater lifting plants; Planning and dimensioning

Suggested installation



Products

Item	Article description	Art. no.	Catalogue chapter
1	UST 330 WS submersible pump	0175.08.04	Pumps/submersible pumps

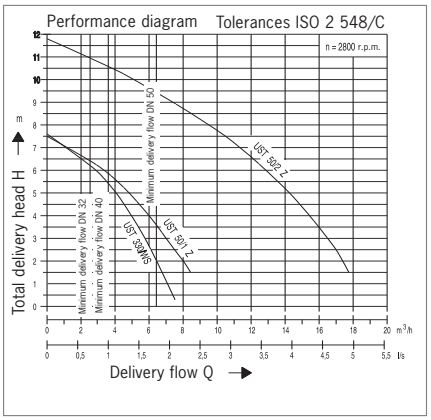
Installation instructions

Shaft and sump dimensions

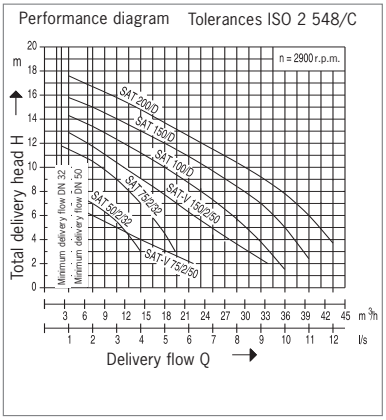
If the pump is to be installed in a sump or shaft, the shaft dimensions must be at least 450 x 450 x 450 mm. The suction basket must not be blocked with sludge and/or fibrous media.

The float switch assembled in the pump must be able to move freely. The ON and OFF positions of the float can be adjusted by moving the float cable in the fastening lugs. The float can be moved up and down to test that it is functioning properly.

Performance data:



UST-330 WS/WT



UST 50/1-Z-WS und 50/2-Z-WS

5.7 ACO SAT-V 75 + 150 submersible pump for wastewater free of faeces

Fields of application

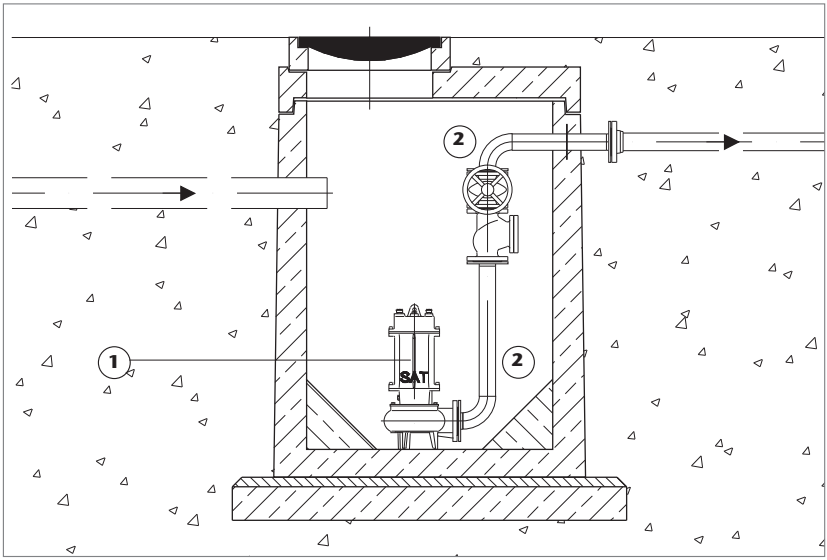
On industrial, municipal and private sector for

- shaft and cavity drainage
- backflow safety in the case of floods
- seepage shafts drainage

Standards/regulations

DIN EN 752-6 — Drainage systems outside buildings
Pump plants

Suggested installation



Products

Item	Article description	Art. no.	Catalogue chapter
1	SAT-V 75/2/50/WS submersible pump	0159.06.71	Pumps/submersible pumps
2	Accessories for assembly	—	Pumps/submersible pumps

Installation instructions

Construction regulations

The minimum working volume of the shaft must be big enough to ensure that the permissible switching frequency of the pump is not exceeded.

The pressure pipe can consist of a hose or a rigid pipe. A backflow valve and a shut-off valve must be installed in the pressure pipe.

A blank pipe must be laid into the shaft for the electric cables and the water level switching devices.

The submersible motor pump is factory-fitted with a threaded connection or a flange connection depending on the type. If the pump is to be installed in the shaft with a stand, the first step is to install the guide piece including the shaped seal in the pump. The chain to lower and raise the pump must be fastened to the handle or the lug on the pump.

The pump must never be lowered by holding the electric cable. The cable could be damaged in this way (not necessarily visible) and cause a total failure after a short period of operation.

Assembling the stand

- The stand should be positioned and fastened to the floor in situ using the supplied plugs and screws
- The guide pipe should be shortened if required
- The guide pipe is pushed or screwed onto the stand
- The upper pipe bracket is positioned and fastened to the wall of the shaft
- The stand with the female thread for screwing in the guide pipe can be assembled without any upper pipe fastenings if its length does not exceed 1m.

Assembling the water level switch

The pumps and float switches should be installed in accordance with the accompanying wiring diagrams.

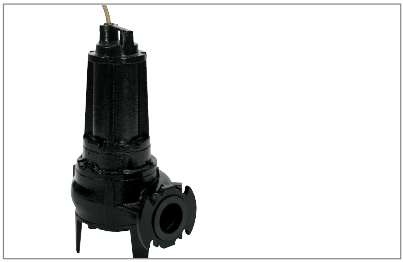
The float switch should be assembled opposite the inflow at a distance of 250 mm from the wall of the shaft. The upper float switch should be installed at the ON position so that the pump switches on when the water level reaches its maximum height beneath the inlet.

In the case of twin plants, the second float switch should be positioned for switching on approx. 100 mm below the first float switch. The lower float switch should be positioned at the OFF position to ensure that the pump is switched off when the volute is still submerged.

Construction regulations

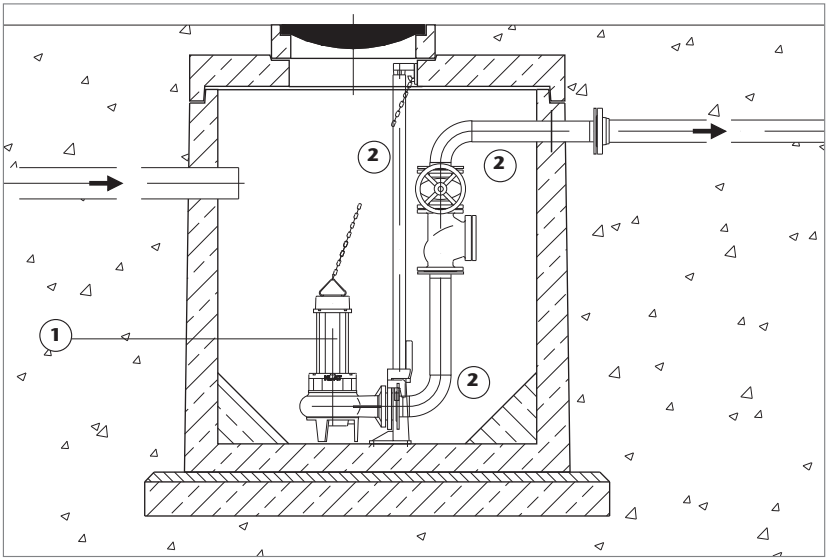
5.8 ACO KL-AT-M submersible pump for wastewater containing faeces

Fields of application
For stationary or mobile use to drain wastewater from industrial, municipal and public sector.



Standards/regulations
DIN EN 752-6 — Drainage systems outside buildings
Pump plants

Suggested installation



Products

Item	Article description	Art. no.	Catalogue chapter
1	KL-AT-M 200/4/80 ex submersible pump	0159.30.18	Pumps/submersible pumps
2	Accessories for assembly	–	Pumps/submersible pumps

Installation instructions

The minimum working volume of the shaft must be big enough to ensure that the permissible switching frequency of the pump is not exceeded.
The pressure pipe can consist of a hose or a rigid pipe. A backflow valve and a shut-off valve must be installed in the pressure pipe.
A blank pipe must be laid into the shaft for the electric cables and the water level switching devices.
The submersible motor pump is factory-fitted with a threaded connection or a flange connection depending on the type. If the pump is to be installed in the shaft with a stand, the first step is to install the guide piece including the shaped seal in the pump. The chain to lower and raise the pump must be fastened to the handle or the lug on the pump.
The pump must never be lowered by holding the electric cable. The cable could be damaged in this way (not necessarily visible) and cause a total failure after a short period of operation.

Assembling the stand

- The stand should be positioned and fastened to the floor in situ using the supplied plugs and screws
- The guide pipe should be shortened if required
- The guide pipe is pushed or screwed onto the stand
- The upper pipe bracket is positioned and fastened to the wall of the shaft
- The stand with the female thread for screwing in the guide pipe can be assembled without any upper pipe fastenings if its length does not exceed 1m.

Assembling the water level switch

The pumps and float switches should be installed in accordance with the accompanying wiring diagrams.
The float switch should be assembled opposite the inflow at a distance of 250 mm from the wall of the shaft. The upper float switch should be installed at the ON position so that the pump switches on when the water level reaches its maximum height beneath the inlet.
In the case of twin plants, the second float switch should be positioned for switching on approx. 100 mm below the first float switch. The lower float switch should be positioned at the OFF position to ensure that the pump is switched off when the volute is still submerged.

Excavation of the construction pit

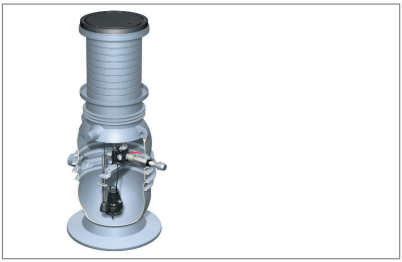
The height of the shaft (which depends on the top sections) is between 1800 and 3000 mm. The con-

5.9 ACO MULI-MAX-F plastic pump station

Fields of application

For drainage of surfaces and low level objects from the private and commercial sector, e. g.

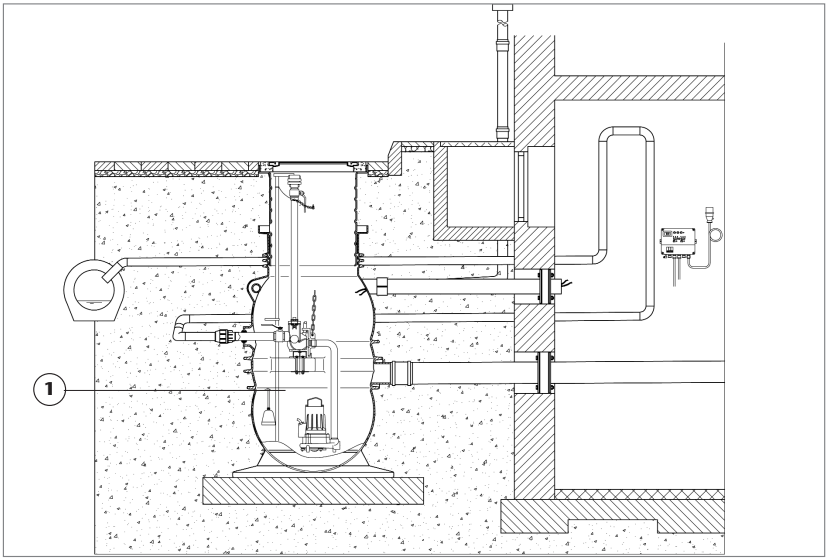
- yard drainage
- underground garage drainage
- drainage of wastewater from office and industrial buildings



Standards/regulations

EN 12056-4 — Wastewater lifting plants - planning and dimensioning
EN 752 — Drainage systems outside buildings

Suggested installation



Products

Item	Article description	Art. no.	Catalogue chapter
1	Pump station MULI-MAX-F	–	Pumps/prefabricated pump stations

Installation instructions

struction pit must be excavated to a depth corresponding to the height of the shaft. The soil at the floor of the pit should not contain any particles with a grain size > 32mm. The ground forming the base of the pit must have a stiffness Ev^2 > 45 MN/m^2. If the soil is strongly binding and has a soft or sludgy consistency pursuant to national standards, a base must be constructed using an adequate thickness of loose load-bearing aggregate to comply with stiffness Ev^2 > 45 MN/m^2. As an alternative, a grouted binding soil layer > 30 cm must be laid.

Filling the excavation

To ensure that the shaft stays in position after filling, the filling must be poured in layer by layer round the whole circumference of the shaft. Each layer of fill must be compacted with a percussion hammer or another light manually operated compaction tool to less than 95% simple Proctor density pursuant to national standards. The filling must only be compacted up to > 30 cm from the plastic shaft. The height of each filling layer should not exceed 30 cm. The construction materials and construction methods should not cause any deformation or damage to the shaft or exert excess loads on the shaft.

The construction pit should only be filled with loose soil, sand or compactable soil with a stiff to semi-solid consistency. If the soil in place is binding and only slightly permeable to water, use binding soil in the upper metres of the fill to prevent the direct percolation of larger amounts of water around the shaft compared to the neighbouring surfaces.

The information sheet on filling instruction pits specifies that the grain size of the fill should not exceed 20 mm. The soil should not contain any angular constituents such as broken stones, construction debris or similar materials.

Retention of greasy wastewater

1. Principles

1.1 Applications for grease separators

Many commercial and industrial operations involving food processing and production, produce wastewater contaminated with animal or vegetable oil. This applies especially to big kitchens in restaurants and canteens, and to slaughterhouses. It is illegal to discharge this wastewater into public sewers without prior treatment. DIN 1986-100, Section 6.2.4 stipulates that grease separators pursuant to DIN EN 1825 and DIN 4040-100 must be installed in all commercial and industrial operations generating greasy wastewater.

Typical applications for grease separators

Meat processing operations

e.g.
- Butchers
- Slaughterhouses
- Sausage factories
- Fish processing factories [1)]

Kitchens for food preparation

e.g.
- Restaurants
- Refectories
- Senior citizens homes

Businesses producing vegetable foodstuffs

e.g.
- Oil mills
- Cooking oil refineries
- Margarine factories

Grease separators are only capable of physically separating animal and vegetable fats and oils. These grease separators are not capable of separating milk and water emulsions such as produced by dairies[2)] or food preparation operations. This requires more advanced water treatment systems.
The same applies to wastewater generated by the paint production and processing industries. Wastewater containing sugar can also negatively affect the function of grease separators. Their use is therefore not recommended in the confectionary industry.
Starch separators[3)] pursuant to DIN 1986-100 Section 9.1.3 are used by the potato processing industry. It is important to note here that it is illegal to discharge greasy wastewater into starch separators – only water containing starch should be allowed to enter such separators.
Wastewater contaminated with petroleum oils or light-oils (for instance at filling stations, car parks, car washes) must be equipped with light-oil separators. The layout and installation must comply with DIN EN 858 and DIN 1999-100.

[1)] See page 202
[2)] See page 203
[3)] See page 203 onwards

1.2 The impact of greasy wastewater on wastewater pipes and sewers

1.2.1 Pipe blockage

Greasy wastewater containing animal or vegetable fat and oil cause greasy deposits to build up on the insides of discharge pipes. These deposits gradually cause a noticeable reduction in the pipe cross sections which leads to a reduction in outflow volume and speed. In extreme cases, these build ups can even block the pipes and give rise to considerable water damage and repair costs.

1.2.2 Corrosion and smells

Greasy deposits in pipe systems gradually decompose over time as a result of chemical and biochemical processes, and generate aggressive fatty acids. These produce very bad smells and corrosion in pipe systems.

1.2.3 Malfunction of public sewage works

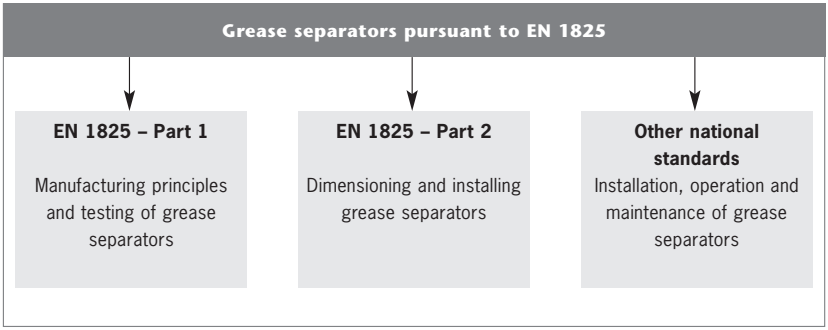
If animal and vegetable oil and fat enter public sewage works, they can contaminate the activated sludge. This considerably diminishes the very important oxygen exchange required in sewage works. Enormous amounts of public money may be necessary to restore the proper functioning of the works. In addition, pump works in sewage treatment facilities can also be damaged by the build up of greasy deposits.

1.3 Legal regulations and standards

As discussed previously, public sewers and sewage works are particularly affected by damage caused by greasy wastewater. Local authorities (civil engineering and water management agencies, etc.) therefore stipulate the installation of grease separators pursuant to EN 1825 or national standards for all commercial and industrial operations generating such water.

1.3.1 Standards

European standard EN 1825 combined with national standards form the basis for laying out grease separators in Germany. These standards DO NOT specify an obligation to install grease separators: they recommend the use of grease separators. The decision to use a grease separator or not is made normally by the responsible local authorities.



Relevant standards for the manufacture, layout and operation of grease separators.

2. Planning

2.1 Dimensioning of grease separators

Determining the dimensioning of grease separators for each specific installation can be undertaken in several ways pursuant to EN 1825-2.

In kitchens, dimensioning based on the kitchen equipment (dishwashers, tilting frying pans, etc.) can also be supplemented by dimensioning based on the number of food portions prepared.
In the case of meat processing operations, dimensioning can be based on the number of animals processed per week. If the meat is only butchered and not processed at the site, the calculation is only based on the amount of grey water generated during cleaning.

Attention!
The OLD German DIN 4040 calculation methods cannot be used on grease separators manufactured in accordance with EN 1825. There are enormous differences between inflow, sludge trap and separation space which makes comparable dimensioning impossible.
→ If a grease separator is dimensioned according to DIN 4040, a grease separator must be selected which was manufactured according to the principles of DIN 4040!

The following presents and discusses some calculation examples for the calculation methods applicable to EN 1825-2.

2.1.1 Dimensioning as per kitchen equipment

Example:
A new grease separator is required for a hospital. In the kitchen is the following equipment units:

10 off boiler outlet 25 mm
15 off boiler outlet 50 mm
4 off tilting boiler outlet 70 mm
5 off tilting boiler 100 mm
8 off wash basin without odour seal, 50 mm
6 off dishwasher
4 off tilting frying pan
2 off high-pressure cleaner
3 off vegetable wash unit
8 off outlet valve DN 20
6 off outlet valve DN 25

Dimensioning of the required grease separator is carried out by means of the following dimensioning sheet.

m	Equipment units	Number n	qi l/s	(n x qi)
1	Boiler outflow 25 mm	 x	1	= ..... l/s
2	Boiler outflow 50 mm	 x	2	= ..... l/s
3	Tilting boiler outflow 70 mm	 x	1	= ..... l/s
4	Tilting boiler outflow 100 mm	 x	3	= ..... l/s
5	Rinsing with odour seal, 40 mm	 x	0.8	= ..... l/s
6	Rinsing with odour seal, 50 mm	 x	1.5	= ..... l/s
7	Riinsing without odour seal, 40 mm	 x	2.5	= ..... l/s
8	Rinsing without odour seal, 50 mm	 x	4	= ..... l/s
9	Dish washer	 x	2	= ..... l/s
10	Tilting frying pan	 x	1	= ..... l/s
11	Frying pan	 x	0.1	= ..... l/s
12	High pressure / steam jet appliance	 x	2	= ..... l/s
13	Peeling unit	 x	1.5	= ..... l/s
14	Vegetable wash unit	 x	2	= ..... l/s
	Outlet valves Nominal diameter/threaded connection according to DIN ISO 228-1			
15	DN 15 R 1/2	 x	0.5	= ..... l/s
16	DN 20 R 3/4	 x	1	= ..... l/s
17	DN 25 R 1	 x	1.7	= ..... l/s

Difficulty factor				
Density (fd)	up to 0.94 g/cm^3	= fd 1.0	Density above 0.94 g/cm^3	= fd 1.5
Inlet temperature (ft)	up to 60°C	= ft 1.0	above 60°C	= ft 1.3
Cleaning agents (fr)	no	= fr 1.0	yes	= fr 1.3/ fr 1.5 or higher in hc

Nominal size NS = Q_S x fd x ft x fr

NS = ☐ x ☐ x ☐ x ☐ =

Simultaneity factor Zi (n)					Wastewater Q_S
for off	for 2 off	for 3 off	for 4 off	for $\geq$ 5 off	
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.60	x 0.50	x 0.40	x 0.34	x 0.30	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
0.45	x 0.31	x 0.25	x 0.21	x 0.20	.... l/s
					Sum total Q_S .... l/s

s

Explanation

m = Indenture number of unit
n = Number of equipment units
qi = the maximum wastewater outflow in l/s
Zi (n) = the factor of simultaneity of use

Chosen: NS ....

Dimensioning of the max. grey water inflow (QS)

Equipment unit	Number	qi l/s	(n x qi)	Simultaneity factor Zi (n)	Grey water Qs
Boiler outlet 25 mm	10	1	10 l/s	0.20	2
Boiler outlet 50 mm	15	2	30 l/s	0.20	6
Tilting boiler outlet 70 mm	4	1	4 l/s	0.21	0.84
Tilting boiler 100 mm	5	3	15 l/s	0.20	3
Wash basin without odour seal, 50 mm	8	1.5	12 l/s	0.20	2.4
Dishwasher	6	2	12 l/s	0.30	3.6
Tilting frying pan	4	1	4 l/s	0.21	0.84
High-pressure cleaner	2	2	4 l/s	0.31	1.24
Vegetable wash units	3	2	6 l/s	0.25	1.5
Outlet valve DN 20	8	1	8 l/s	0.20	1.6
Outlet valve DN 25	6	1.7	10.2 l/s	0.20	2.04
					Sum Qs 25.06 l/s

Determining the difficulty factors
fd (density): no data available, fd = 1.0
ft (inlet temperature): less than 60°, ft = 1.0
fr (cleaning agents): hospital, fr = 1.5

Determining the nominal size (NS)
Nominal size is determined by multiplying the max. grey water inflow by the difficulty factors.

Qs x fd x fr x ft = NS
25.06 x 1.0 x 1.0 x 1.5 = 37.59

Based on the value calculated, the grease separator is dimensioned according to the next higher NS. In this case, a grease separator of NS 40 mit 4000 litres sludge trap has to be chosen.

Such large plants consisting of one container only are normally not available for free-standing installation; parallel plants can be carried out (e. g. 2 x NS 20) and the wastewater must flow in via distribution structures at equal parts.

2.1.2 Dimensioning based on meals per day

Example:
A restaurant is open every day from 17.00 to 02.00 h, and provides hot meals throughout this period. The kitchen is similar to a normal hotel kitchen.
According to the manager, max. 250 meals are prepared every evening. Cleaning products are used to clean the kitchen appliances. The new dishwasher cleans dishes at 90°C.

The dimensions of the grease separator which needs to be installed are calculated from the dimensioning form shown below.

Calculation of the max. grey water inflow (QS)
The operating conditions described above mean that this situation can be classified as a hotel kitchen. The number of meals per day (250 meals) and the operating hours of the kitchen (9 hours) are therefore entered in the hotel kitchens line in the form. This gives the following grey water inflow:
Determination of the nominal size (NS)

(M x V x F)	**/ T x 3600 sec**	**= Qs**
(250 x 100 l x 5)	**/ (9 x 3600)**	**= 3.0864 l/s**

The nominal size is determined by multiplying the maximum grey water inflow by the complication factors. The value fd (density) is assigned a “1”. Because the grease separator will be installed directly adjacent to the source of the greasy water (kitchen), it can be assumed that the inflow temperature at the grease separator will exceed 60°C. Factor ft (inflow temperature) = “1.3” is therefore assigned. Because detergents are used, the cleaning product factor fr is assigned a “1.3”. Based on the calculated figure, the grease separator is dimensioned according to the next highest NS.

Qs	x	fd	x	ft	x	fr	=	NS
3.0864	x	1.0	x	1.3	x	1.3	=	5.22

In this case, a grease separator complying with NS 7, i.e. 700 litres sludge trap is selected.

Commercial kitchens	M = meals (number) monthly average of daily prepared warm meals	VM = unit-specific water amount per warm meal
Hotel kitchen	..... meals / daily	x = 100 l = ...
Speciality restaurant	..... meals / daily	x = 50 l = ...
Works' kitchen/students' refect.	..... meals / daily	x = 5 l = ...
Hospitals	..... meals / daily	x = 20 l = ...
All day large scale kitchen	..... meals / daily	x = 10 l = ...

Difficulty factor						
	fd 1	=	Density up to 0.94 g/cm³	ft 1.0	=	inlet temperature up to 60°
	fd 1.5	=	Density above 0.94 g/cm³	ft 1.3	=	inlet temperature above 60°

Nominal size **NS** = Q_S x **fd** x **ft** x **fr**

NS = ☐ x ☐ x ☐ x ☐ =

F = sporadic load factor as a function of operating conditions	t = daily operating hours in which separator is fed with waste-water	Q_S = maximum wastewater inflow
x 5 (sporadic factor)	= ..... litres / ..... oper. hours x 3600 sec.	= ..... l/s
x 8.5 (sporadic factor)	= ..... litres / ..... oper. hours x 3600 sec.	= ..... l/s
x 20 (sporadic factor)	= ..... litres / ..... oper. hours x 3600 sec.	= ..... l/s
x 13 (sporadic factor)	= ..... litres / ..... oper. hours x 3600 sec.	= ..... l/s
x 22 (sporadic factor)	= ..... litres / ..... oper. hours x 3600 sec.	= ..... l/s

fr 1.0 = cleaning agents / no
fr 1.3 = cleaning agents / yes
fr 1.5 = or higher in hospitals

Chosen: NS .....

2.1.3 Dimensioning based on number of slaughtered animals

Example:
A cattle slaughterhouse requires a new grease separator. Dimensioning is carried out pursuant to EN 1825-2. The working day at the slaughterhouse is 8 hours, and during this time 2 cattle are slaughtered and processed to produce sausages.

The calculations for dimensioning the grease separator are carried out using the dimensioning form shown on pages 192-193.

Calculating the maximum grey water inflow (QS)

The slaughterhouse in our example is directly linked to a sausage production operation, i.e. meat processing. It is therefore not a pure butchering business where the dimensioning of the grease separator is purely based on subsequent cleaning of the equipment.

The weight which needs to be input into the form corresponding to the daily sausage production can be calculated on the basis of the following rule:
Per pig = 40 kg sausage products
Per cattle = 100 kg sausage products

In the example here with two cattle per day, the corresponding sausage production is calculated at 200 kg per day. This corresponds to a medium sized meat processing operation. The grey water inflow is therefore calculated in the appropriate line in the form as follows:

(M x Vp x f) / (T x 3600 sec)	**= Qs**
(200 x 15 l x 35) / (8 x 3600)	**= 3.645 l/s**

Determining the nominal size (NS)
Calculating a nominal size is carried out by multiplying the maximum grey water inflow with the complication factors. The value fd (density) and ft (inflow temperature) are each assigned a “1”. Because detergents are used, the cleaning product factor fr is assigned a “1.3”.

Qs	**x**	**fd**	**x**	**ft**	**x**	**fr**	**=**	**NS**
3.645	**x**	**1.0**	**x**	**1.0**	**x**	**1.3**	**=**	**4.73**

The grease separator required corresponds to the next highest NS to the figure calculated. In this case, an NS 7 grease separator is required.
Because a slaughterhouse is involved, the grease separator also needs a double-sized sludge trap (in this case 1400 litres).

Sausage production	Size of meat processing estabiishment	Heavy lifestock units slaughterings per week	M = Sausage production in kgs / daily	Vp = unit-wate per k prod
	Small Sausage production up to 100 kgs daily	with slaughering up to 5 beefs or 12.5 pigs per week	..... kgs / daily	x = 20
	Medium Sausage production 101 kgs to 200 kgs daily	with slaughtering up to 10 beefs or 25 pigs per week	..... kgs / daily	x = 15
	Large Sausage production 201 kgs to 800 kgs daily	with slaughtering up to 40 beefs or 100 pigs per week	..... kgs / daily	x = 10

Meat cutting up plants without meat and sausage produ

Wastewater incidence mainly during cleaning

Cutting up plants	m	Equipment units	Number n	qi l/s	(n x qi)
	15	DN 15	 x	0.5	= ..... l/s
	16	DN 20	 x	1	= ..... l/s
	17	DN 25	 x	1.7	= ..... l/s
	12	High pressure / steam jet appliance	 x	2	= ..... l/s

Difficulty factor		
Density (fd)	up to 0.94 g/cm^3 = fd 1.0	Density above 0.94 g/cm^3 = fd 1.5
Inlet temperature (ft)	up to 60° = ft 1.0	above 60° = ft 1.3
Cleaning agents (fr)	no = fr 1.0	yes = fr 1.3

Nominal size NS = Q_S x fd x ft x fr

NS = [ ] x [ ] x [ ] x [ ] =

ific antity ausage on	F = sporadic load factor as a function of operating conditions	t = daily operating hours, in which separator is fed with wastewater	*Q_S = maximum wastewater inflow
.....	x 30 (sporadic factor)	= ..... litres / ..... oper. hours x 3600 sec.	= Q_S ..... l/s
.....	x 35 (sporadic factor)	= ..... litres / ..... oper. hours x 3600 sec.	= Q_S ..... l/s
.....	x 40 (sporadic factor)	= ..... litres / ..... oper. hours x 3600 sec.	= Q_S ..... l/s

on

$$*Q_S = \frac{M_P \times V_P \times F}{t \times 3600}$$

Simultaneity factor Zi (n)					Wastewater Q_S
for 1 off	for 2 off	for 3 off	for 4 off	for ≥ 5 off	
x 0.45	x 0.31	x 0.25	x 0.21	x 0.20	..... l/s
x 0.45	x 0.31	x 0.25	x 0.21	x 0.20	..... l/s
x 0.45	x 0.31	x 0.25	x 0.21	x 0.20	..... l/s
x 0.45	x 0.31	x 0.25	x 0.21	x 0.20	..... l/s
					Sum total Q_S ..... l/s

Explanation:
Mp = kgs / daily, Vp = l/kgs sausage prod. F = sporadic factor
= daily operating hours, m = indenture number of equipment
= number of outlet valves and high-pressure appliances
qi = the maximum wastewater outflow in l/s
Zi (n) = the factor of simultaneity of use

Chosen: NS .....

2.2 Installation site

There are two types of installation possible for grease separators: free-standing or ground installation. An easily accessible location is essential for simple disposal, maintenance and cleaning of the grease separator. It is also important that the piping between the source of the greasy water and the grease separator are kept as short as possible. In addition, the installation must never be installed in unventilated rooms or beneath surfaces affected by vehicular traffic or storage areas. The grease separators should also not be installed near rooms in which people work or live.

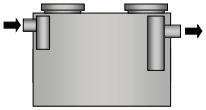
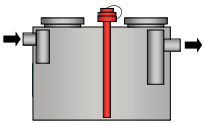
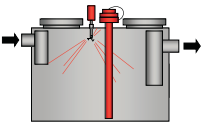
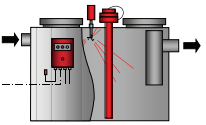
The most important criteria when deciding between free-standing or ground installation are discussed in the following.

2.2.1 Free-standing

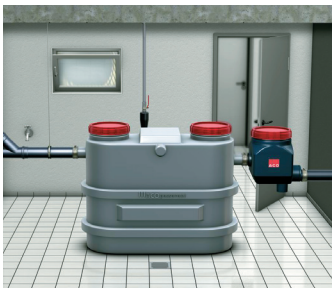
Free-standing grease separators are installed in frost-free rooms. They can be constructed on a modular basis as shown in the following diagram based on the ACO system. These grease separators can be upgraded at any time with supplementary components which enables the grease separators to be upgraded in various stages until they become fully automatic. This combines optimal cleaning with easy disposal.

The basic model as well as the already supplied supplementary extension stages (or converted grease separators) can also be upgraded further. In another words, extension stage 1 can be easily converted to extension stage 2 or 3; or extension stage 2 can be easily converted to extension stage 3.
It is not possible for the disposal trucks to suck out the contents of grease separators above a geodetic suction height of 6 metres. For heights exceeding 6 metres, a disposal pump has to be built into the grease separator to lift the contents onto the disposal truck. Extension-stage-2-and-3 grease separators can therefore be further upgraded with the installation of a disposal pump (with optional remote control). It is very important that the surface on which the grease separator is installed is completely level and horizontal to ensure the problem-free function of the grease separator. The position and precise height of the inflow pipes must be known before installing the grease separator.
The ideal temperature in the room in which the grease separator is installed is approx. 20° Celsius because significantly higher or lower temperatures have a negative impact on its function.
To enable maintenance to be carried out properly, it is important that a gap of at least 50 cm is present above the grease separator. The room in which it is installed should also be equipped with a good ventilation and venting system.
Care is already required during the planning phase to ensure that doors and other openings are big enough to allow a grease separator to be transported into the room.

ACO Haustechnik supplies a large number of grease separators in optimised or segmented models for this application. It is also possible for the grease separators to be dismantled and welded together again in situ when access to the installation room makes no other options available.

Design	Scope of supply	Odour generation
Basic design	 Fully functioning basic design, retrofittable to the extension stages shown below.	During disposal and cleaning
Extension stage 1	 – Connection for direct suction	During cleaning
Extension stage 2	 – Connection for direct suction – High-pressure cleaning and manual control (semi automatic) – Disposal pump optional	No odour generation (covers remain closed)
Extension stage 3	 – Connection for direct suction – High-pressure cleaning and automatic control (fully automatic) – Disposal pump and remote control optional	No odour generation (covers remain closed)

ACO Haustechnik extension stages for full disposal – the higher the extension stage, the more comfortable and easier is the disposal carried out.



Checklist when selecting a grease separator for free-standing installation:

1) Level erection surface available?
2) Inlet height checked?
3) Room temperature okay?
4) At least 50 cm free space above the grease separator?
5) Room aeration available?
6) Bringing-in of grease separator possible through doors?

2.2.2 Ground installation

Grease separators are installed in the ground outside of buildings. Four main aspects need to be clarified when selecting a grease separator for ground installation.

a) Position of the installation with respect to disposal and maintenance aspects

Because disposal is associated with bad smells, installation of a grease separator is not recommended in heavily frequented courtyards or pedestrian areas.

b) Position of the installation site with respect to traffic

Grease separators can be installed in the ground beneath lawns or beneath paved courtyards or car parks. The load classes associated with the type of traffic needs to be taken into consideration. Grease separators are therefore supplied with manhole covers corresponding to the load class. DIN EN 124 differentiates between three load classes:

Load class	Load up to	Fields of application
A15	1.5 tons	Green surfaces
B125	12.5 tons	Access routes, if possible outside the area driven over
D400	40 tons	Carriageways

Load classes pursuant to DIN EN 124

When installing the separators beneath green spaces, care must be taken that the access route for the disposal truck is strong enough to handle the weight of the vehicle, because lawns etc. can otherwise be damaged during disposal.

c) Inflow depth

All of the inflow pipes must be protected from frost. For example, the frost-free depth in Germany varies from region to region between 80 to 120 cm. The pipe inflow depth must therefore be at or deeper than the specified frost-free depths.

d) Groundwater

Analysis is required to determine whether the grease separator tank can be negatively influenced by ground water after installation. If there is a groundwater risk, this has a crucial influence on the selection of construction materials or even on additional measures to be implemented at the site to prevent the tank from being forced upwards by the groundwater.

Checklist for selecting a ground-installed grease separator:

1) Is the installation site of the grease separator located an adequate distance away from inhabited buildings? (smell problem)
2) Which load class is required?
3) Which inflow pipe depth is required?
4) Is the installation site below the groundwater table?

2.3 Material selection

Grease separators are manufactured from Polyethylene (PE), V4A stainless steel (1.4571) or reinforced concrete.

V4A stainless steel	Polyethylene	Reinforced concrete
– no fire risk – high temperature resistance – hygienic material – absolute UV resistance	– easy handling – low heat conduction – high resistance to chemical influences – disposal-friendly surface – easy after-treatment locally	– permanently highly loadable statically and dynamically – highest shape stability towards inside and outside – nearly any installation depths
Use exclusively for free-standing installation	**Use for free-standing and ground installation**	**Use exclusively for ground installation**

Material characteristics of PE, V4A and reinforced concrete.

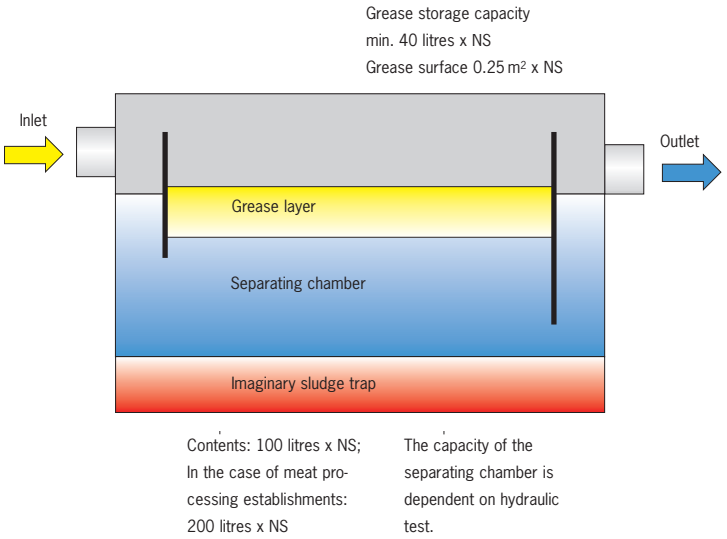
2.4. Backflow level – use of lifting plant or pump stations downstream of grease separators

If the static water level of a grease separator lies beneath the backflow level (definition page 135), EN 1825-2 stipulates the use of lifting plant to drain the grease separator.
It is of no consequence whether or not there is a continuous slope to the public sewers. The use of passive backflow safety valves is illegal in this case.
It is essential that this is taken into consideration when installing free-standing grease separators in buildings even if the risk of backflow is considered minimal.
Because there must be no interruption to the outflow of wastewater from a grease separator, twin lifting units must be installed downstream of grease separators.

HYDROJET-OAE NS 4 grease separator with downstream MULI-PE duo lifting plant.

3. Function

Pursuant to EN 1825, every grease separator consists of an inlet, an outlet, a grease storage compartment and a sludge trap. The required volumina, as e. g. grease storage capacity and sludge trap, are defined in the standard as a function of the nominal size.



Layout of a grease separator as per EN 1825
For the most common nominal sizes, the following minimum values must be kept by a grease separator accordig to DIN EN 1825:

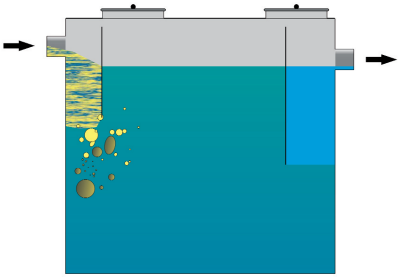
NS	Sludge trap	Grease storage	Grease surface
1	100 litres	40 litres	0.25 m²
2	200 litres	80 litres	0.50 m²
3	300 litres	120 litres	0.75 m²
4	400 litres	160 litres	1.00 m²
7	700 litres	280 litres	1.75 m²
10	1000 litres	400 litres	2.50 m²
15	1500 litres	600 litres	3.75 m²
20	2000 litres	800 litres	5.00 m²
25	2500 litres	1000 litres	6.25 m²

Minimum volumes for common grease separator nominal sizes

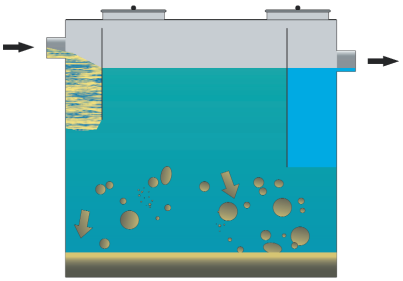
3.1 Modus operandi of grease separators for complete disposal

Grease separators function purely physically by harnessing the force of gravity (density differences between water and grease), i.e. substances heavier than water in the wastewater (sludge) sink to the floor of the grease separator tank, whilst materials lighter than water (e.g. animal fats and oils) float to the top of the grease separator. The complete contents of the grease separator, i.e. grease/oil, water and sludge, must be completely disposed of at regular intervals. After cleaning the grease separator, it must be completely refilled with water (e.g. drinking water, process water, treated wastewater) in accordance with the local discharge regulations.

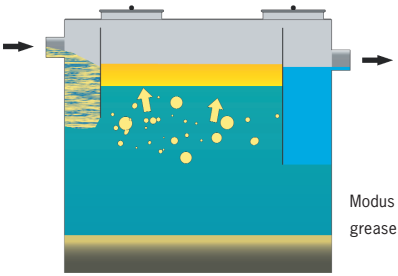
Greasy wastewater containing sediments flows into the separator.



Substances heavier than water settle at the bottom of the sludge trap.



Substances (fats and oils) lighter than water rise to the top and settle between both baffles as grease layer[4].



Modus operandi of a grease separator plant

[4] Emulsified and soluble particles as well as suspended substances cannot be retained by a normal gravity separator. Here, an additional wastewater treatment plant (for example ACO BIOJET– refer to page 214) has to be planned.

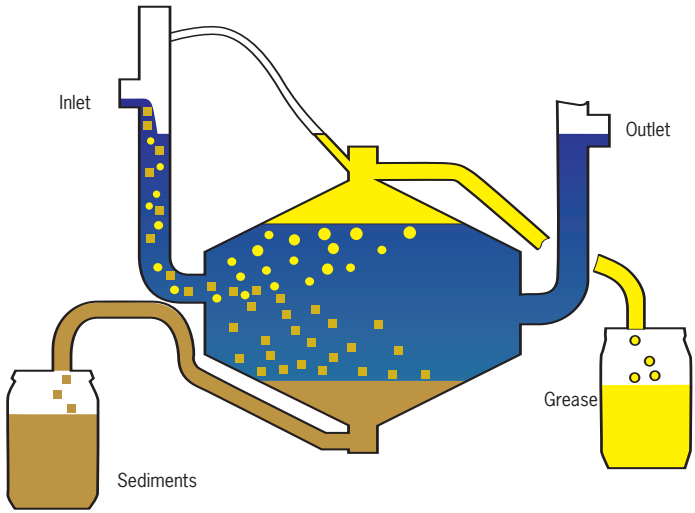
The stay of the greasy wastewater, a fact which particularly influences separating efficiency, depends on the size of the separator. A higher nominal size thus results in longer stay.

3.2 Modus operandi of grease separators for partial disposal (fresh grease separators)
Fresh grease separators also work by gravity. The sediments collect at the base of the grease separator (sludge trap) whilst the lighter oils and fat collect in the upper part. A heater ensures that the grease stays liquid.

Unlike complete disposal grease separators, partial disposal grease separators do not have the complete wastewater contents removed. The separated materials are drained off once a day into collecting barrels depending on the amount of grease/oil and sludge which collects. Once the barrels are full, they are collected by a disposal company.

The advantage of this system is that only the wastewater portion (grease/oil and sludge) is disposed of in fresh grease separators while the remaining water proportion (approx. 90% of the tank contents) remain in the grease separator. The disposal costs are therefore lower.

Grease separators for partial disposal (fresh grease separators) are always used when it is difficult for disposal trucks to directly empty the grease separator. For instance on ships or mountain restaurants.



Modus operandi of partial disposal (fresh grease separator): sludge and grease particles are collected in separate containers. The remaining water which is harmless to the sewer system remains in the separator.

3.3 Separating effect and influencing factors

Wastewater leaving grease separators must comply with the following limits[5] to avoid serious pollution fines:

General parameters	
Temperature:	35°C
ph value:	minimum 6.5, maximum 10.0
Settleable substances:	unlimited – if sludge separation is specified to protect the proper functioning of the public sewers, limitations may be specified ranging from 1-10 ml/l after 0.5 hours settling time: lower limits may be specified in special cases.
Organic substances	
Low volatile lipophilic substances total	300 mg/l[6]

Limits for wastewater containing organic oil or vegetable oil.

If the grease separator is operated under the relevant application and installation conditions (DIN 4040-100, Appendix A), the limit for lipophilic substances is around 300 mg/l.

Influencing factors on the function of grease separators and the quality of the wastewater downstream of grease separators:

Equipment + time:	If the flushing time of the cleaning equipment is increased by approx. 5 minutes, there is an increase in turbulence and the amount of energy supplied to the wastewater. With respect to the theoretical volume of separable materials, approx. 40% less oil and grease is separated out because more stable emulsions form and the wastewater becomes milky.
Temperature:	The temperature of the cleaning water also has an effect on the formation of emulsions. Reducing the cleaning temperature from 65°C to 30°C has almost no effect on the degree of separation (when no cleaning products are used). The separation rate drops by about 30% if the operating temperature in the separator lies at 35°C to 45°C, compared to 25°C to 35°C (without using cleaning products). The temperature of the wastewater in the separator drops in proportion to the amount of time it is in the separator.
Chemistry:	The degree of separation is reduced by at least 30% if cleaning products and washing up liquid are used.
Kitchen staff:	If all food leftovers are thoroughly cleaned off manually before dishes etc, are washed, this significantly reduces the amount of material which needs to be separated from the wastewater.

[5] Taken from DWA manual, information sheet DWA-M 115-2, which is specified by most wastewater associations

[6] Please ask the responsible authority.

Sweeteners in wastewater	Wastewater with high sugar concentrations (for instance caffeinated lemonade) significantly inhibits the separation process. Also take care to prevent the wastewater from espresso machines etc. entering the separators.
pH value:	The pH in the separator becomes more acid if fatty acids are allowed to form in grease separators. However, the cleaning products which may also be in the wastewater push the pH in the other direction to make the water more alkaline. The pH in the grease separators therefore fluctuates so much that it is sometimes not possible to permanently comply with the specified limits.

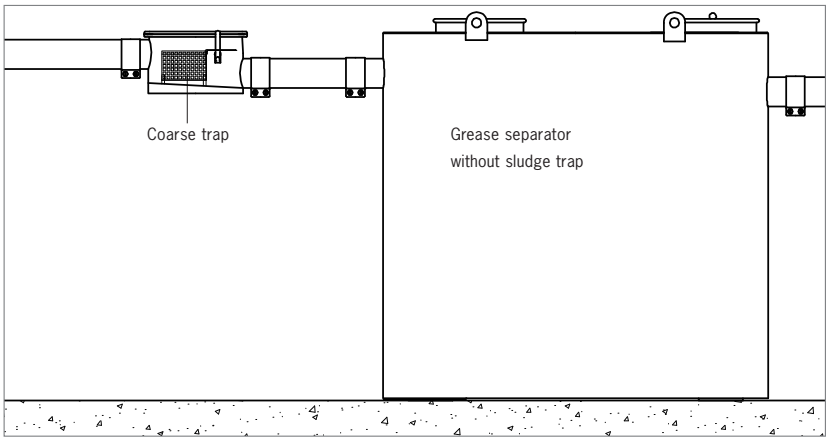
3.4 Special waste

3.4.1 Fish processing

The fish processing industry generates rapidly decomposing waste products. If these substances enter grease separators they significantly inhibit the separation process within the equipment. The efficiency of the plant will be significantly reduced. The decomposition processes which then take place in the grease separator lead to the growth of bacteria and significant nuisance from smells.

The fish processing industry is therefore only allowed to use grease separators which fulfil the following criteria pursuant to EN 1825-2, Section 4:

- Grease separators must have no sludge trap – neither integrated nor separate
- A properly dimensioned coarse trap must be installed upstream of the grease separator to separately collect the organic sludge components. The coarse trap should be emptied frequently – depending on the amount of trapped material.



Grease separator with an upstream coarse trap – no sludge forms in the separator pursuant to EN 1825

3.4.2 Dairies

Grease separators are only of limited use to treat emulsified wastewater generated by dairies. Special treatment plant is required to handle emulsified wastewater and to reduce the oily portion of the water.

3.4.3 Starch separators

Applications

Wastewater containing starch is usually generated by operations which process potatoes, e.g. manufacturing potato salad, croquette potatoes, chips and crisps.
The starch from the potatoes mainly enters the water during the peeling process: starch enters the process water when industrial peeling machines are used. Starch can therefore enter the sewers and build up deposits and block pipes.

Planning

For example, German standard DIN 1986-100 stipulates in its "Retention of damaging substances" chapter: "Starch separators must be installed in operations which generate wastewater with high concentrations of starch." Because there is still no European standard, the calculation and dimensioning of starch separators still has to be based on manufacturer's standards.

- Starch separators are sediment separators in which the potato starch settles out at the base of the separator.
- A starch separator content of 700 litres per 1 l/s through flow is required for good starch separation.
- Starch separators should be connected to the grey water sewers.
- Greasy grey water and wastewater containing faeces must not be fed into a starch separator.

Starch separators can be free-standing or buried. They are made of either plastic, stainless steel or reinforced concrete. Starch separators only work properly if they are regularly emptied (max. fill volume = 50% of the total volume) and regularly serviced.

Dimensioning

Any one of the following criteria can be used to dimension starch separators:

- Dimensioning according to peeling machine capacity (kg/batch)
- Dimensioning according to number of hot meals (number/day)
- Dimensioning according to peel volume (kg/day)

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