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Grease traps

2

APPLICATION

The main role of a grease trap is to retain solids, fat, oil and grease derived from plants and animals. Excessive amount of wastewater containing FOG discharged directly to the sewage system results in clogging of pipelines and production of unpleasant odours. Moreover, the operation of a wastewater treatment plant is disturbed due to increased oxygen consumption. Grease traps should be used in canteens, bars, meat processing plants etc.

PRINCIPLE OF OPERATION

Grease traps operate by gravity to separate fats, oils and greases lighter than water. They are flow tanks in which flow regulatory devices are used at the outlet and inlet, owing to which grease accumulates on the wastewater surface. Solids and particles are retained in the settling chamber.

DESIGN

Grease traps are vertically-oriented monolithic tanks. They are made of HDPE sheets and structural pipes welded or fusion welded together. Installation of flow regulatory devices at the outlet and at the inlet of the tank results in retention of fats, oil and greases that are lighter than water in the separator, and a sludge chamber is provided for collecting solids. Typically, they are provided with spigots. Due to the specific construction of flow regulatory devices there is no need for an additional ventilation system, as unpleasant odours are directed outside the building provided that the ventilation system in the building works properly. However, the ventilation system may be provided upon request. Manholes in separators are typically provided with plastic covers. The manhole cover may be airtight or the frame and cover may be prepared for loaded areas. In waterlogged areas the tank has an enlarged base so a concrete collar can be performed. The devices are designed in compliance with PN-EN 1825-2.

GREASE TRAP SELECTION

If wastewater contents are difficult to specify, we recommend the following selection method of a grease trap. The method was carried out as per PN-EN 1825-2 requirements.
In order to select the nominal capacity of a grease trap, it is necessary to consider the quality and amount of wastewater i.e.:

- maximum wastewater flow rate
- maximum wastewater temperature
- grease density
- influence of detergents and soaps. If a larger than usual amount of grease is expected, the following solutions may be applied:
- use a grease trap of larger size than calculated
- provide an external grease tank
- empty and clean the grease trap at shorter intervals.

$$NS = Q_s \times f_t \times f_d \times f_r$$

where:

NS - nominal size,
Qs - maximum wastewater flow rate [l/s]
ft - wastewater temperature coefficient
fd - grease density coefficient
fr - detergents and soaps coefficient

After calculating the nominal size NS of the grease trap, it is necessary to check if it meets the following technical requirements:

Nominal size	Minimum grease trap surface area	Minimum volume of the grease trap m³	Minimum grease storage volume m³
NS	0,25 * NS	0,24 * NS	0,04 * NS

The maximum wastewater flow rate Qs should be calculated as follows:

- measuring the actual wastewater volume (a)
- calculations based on the type and number of discharge points (b)
- calculations based on the type of facility producing the wastewater (c)
- calculations for specific clients, approved by the recipient of wastewater (d)

If Qs can be calculated from the relation of the above points (b) and (c), but an engineer is not certain which option to choose, it is necessary to calculate both and assume the higher value of Qs.

1. Calculating the maximum volume of wastewater Qs based on the type of facility

The Qs is calculated according to the following formula:

$$Qs = \frac{VxF}{3600xt}$$

where:
Qs - maximum wastewater flow rate [l/s],
V - average volume of wastewater per day [litre],
F - depending on the type of facility, hourly inequality coefficient,
t - average time of system operation per day [h].

The F coefficient is shown in the table below for various types of kitchens and meat processing plants.

Facility	Type of kitchen
Type of kitchen	
Hotels	5,00
Restaurants	8,50
Hospitals	13,00
Canteens	20,00
24-operating large-size kitchens	22,00
Meat processing plants and slaughterhouses	
Small up to 5 GV per week	30,00
Medium up to 10 GV per week	35,00
Large up to 40 GV per week	40,00
1 GV= 1 cow or 2.5 pig	

If there is manual meat processing, the estimated amount should be Mp ~ 100kg/GV. Extra volume of wastewater per day, e.g. from reception halls or catering facilities should be added when the average volume of wastewater V has been calculated.

V - average volume of wastewater per day

It may be calculated on the basis of used water or according to the following formulas.

Workplace kitchen

The average volume of wastewater is calculated according to the following formula:

$$V = V_m \times m$$

where:
V - volume of wastewater per day
Vm - volume of water used for food preparation, see the table below
m - number of meals per day

Type of kitchen	Volume of water for food preparation Vm [l]
Hotel	100
Restaurant	50
Hospital	20
24-hour operating	10
Canteens and cafeterias	5

Meat processing plants

The average volume of wastewater is calculated according to the following formula:

$$V = M_p \times V_p$$

where:
V - the average volume of wastewater per day [l]
Mp - the weight of meat products per day [kg]
Vp - the volume of water used per 1 kg of meat products, see the table below

Slaughterhouses and meat processing plants	Volume of water per 1 kg of meat products	Weight of meat products per day [kg]
Small up to 5 GV per day	100	Where no other information is available it is assumed that Mp = 100 kg/GV
Medium 6-10 GV per day	50	
Large 11- 40 GV per day	20	
1GV = 1 cow or 2.5 pig		

2. Calculating the maximum volume of wastewater Qs based on the type and number of equipment discharging it

Qs is calculated according to the following formula:

$$Qs = \sum_{i=1}^{m} n x q_i x Z_i(n)$$

where:
Qs - the maximum volume of wastewater
i - equipment count
m - equipment position
n - number of pieces of equipment of the same type (skipped)
q_i - the maximum discharge from a piece of equipment in l/s
$Z_i(n)$ - a coefficient from the table below

Type of equipment	m	q_i [l/s]	Zi(n)				
			n=1	n=2	n=3	n=4	n≥5
Cooking boiler, drain 25 mm 50 mm	1	1,0	0,45	0,31	0,25	0,21	0,20
	2	2,0	0,45	0,31	0,25	0,21	0,20
Tilting cooking boiler, drain 70 mm 100 mm	3	1,0	0,45	0,31	0,25	0,21	0,20
	4	3,0	0,45	0,31	0,25	0,21	0,20
Sink with drain trap 40 mm 50 mm	5	0,8	0,45	0,31	0,25	0,21	0,20
	6	1,5	0,45	0,31	0,25	0,21	0,20
Sink without drain trap 40 mm 50 mm	7	2,5	0,45	0,31	0,25	0,21	0,20
	8	4,0	0,45	0,31	0,25	0,21	0,20
Dishwasher	9	2,0	0,45	0,31	0,25	0,21	0,20
Tilting pan	10	1,0	0,45	0,31	0,25	0,21	0,20
Fixed pan	11	0,1	0,45	0,31	0,25	0,21	0,20
High-pressure washing equipment	12	2,0	0,45	0,31	0,25	0,21	0,20
Peeler	13	1,5	0,45	0,31	0,25	0,21	0,20
Vegetable washer	14	2,0	0,45	0,31	0,25	0,21	0,20

Where 2 or more valves are installed only for washing or they are not connected to any equipment, the volume of wastewater should be calculated according to the following table.

Diameter of points-of-use	m	q_i [l/s]	Zi(n)				
			n=1	n=2	n=3	n=4	n>5
DN 15 / R 1/2	15	0,5	0,45	0,31	0,25	0,21	0,20
DN 20 / R 3/4	16	1,0	0,45	0,31	0,25	0,21	0,20
DN 25/ R 1	17	1,7	0,45	0,31	0,25	0,21	0,20

Note: If the values given by the manufacturer are different from the ones presented above, they should be used.
For any equipment not presented in the above tables, qi [l/s] and Zi(n) should be calculated by test or by reference to manufacturer's information.

3. Temperature coefficient ft

High temperature of wastewater decreases grease trap efficiency, thus it should be lowered before discharging it to the separator. Otherwise the temperature coefficient presented in the following table should be considered.

Wastewater temperature	ft
<60°C	1,0
>60°C	1,3

4. Density coefficient ft

- For wastewater of density ≤0.94 g/cm³, the density coefficient should be fd = 1.0 (for wastewater discharged from kitchens, fish and meat processing plants and slaughterhouses)
- For grease of density > 0,94 g/cm³, it should be fd=1,5

5. Detergent and soap coefficient fr

Detergents including washing liquids and soaps should be carefully selected and used in moderation. They should not inhibit the separation process and produce sludge at the separator outlet. The fr coefficient should be calculated according to the table below.

Use of detergents and soaps	ft
Never	1,0
Always	1,3
In special cases, e.g. hospital	≥1,5

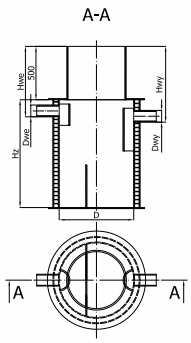
Settling tank selection

In most cases the nominal size of the settling tank should be 100 NS, for slaughterhouses it is 200 NS.

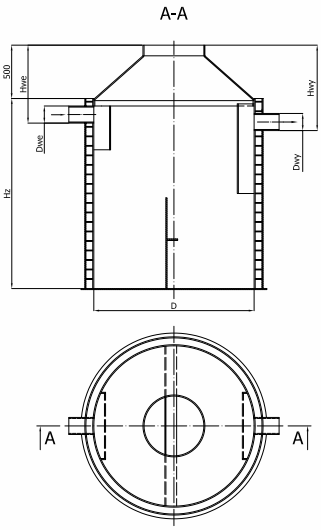
	GT 0,5	GT 1	GT 2	GT 3	GT 4	GT 5	GT 6	GT 7	GT 8	GT 9	GT 10	GT 12	GT 14	GT 15	GT 16	GT 18	GT 20	GT 22	GT 24	GT 25
Nominal flow rate Q [l/s]	0,5	1	2	3	4	5	6	7	8	9	10	12	14	15	16	18	20	22	24	25
Grease trap active A [m^2]	0,28	0,5	0,78	0,78	1,13	1,54	1,54	2,01	2,55	2,55	3,14	3,14	3,8	4,52	4,52	4,9	5,3	6,16	6,16	7,07
Grease trap volume V [m^3]	0,2	0,43	0,88	1,02	1,41	2,2	2,4	3,16	3,49	3,74	4,00	4,5	5,2	5,7	6,2	7,0	7,6	8,8	9,3	10,1
Grease and oil volume Voil [m^3]	0,02	0,05	0,08	0,12	0,17	0,2	0,24	0,28	0,32	0,36	0,4	0,48	0,57	0,62	0,65	0,74	0,8	0,89	0,96	1
Settling tank volume Vset [m^3]	0,05	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1	1,2	1,4	1,5	1,6	1,8	2	2,2	2,4	2,5
Grease trap diameter D [mm]	600	800	1000	1000	1200	1400	1400	1600	1800	1800	2000	2000	2200	2400	2400	2500	2600	2800	2800	3000
Inlet height Hin [mm]	500	660	660	660	730	730	730	730	730	730	770	770	770	795	795	795	820	820	820	820
Outlet height Hout [mm]	550	710	730	730	800	800	800	800	800	800	820	840	840	865	865	865	890	890	890	890
Inlet pipe diameter Din [mm]	110	110	110	110	160	160	160	160	160	160	200	200	200	225	225	225	250	250	250	250
Outlet pipe diameter [mm]	110	110	110	110	160	160	160	160	160	160	200	200	200	225	225	225	250	250	250	250
Tank height Ht [mm]	1250	1010	1280	1680	1680	1680	1780	1780	1580	1680	1520	1770	1720	1645	1745	1795	1820	1820	1900	1820
Grease layer thickness g [mm]	70	100	130	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150

NOTE: The standard height of a vent is 50 cm. We also manufacture grease traps with vents of the height required by the client.

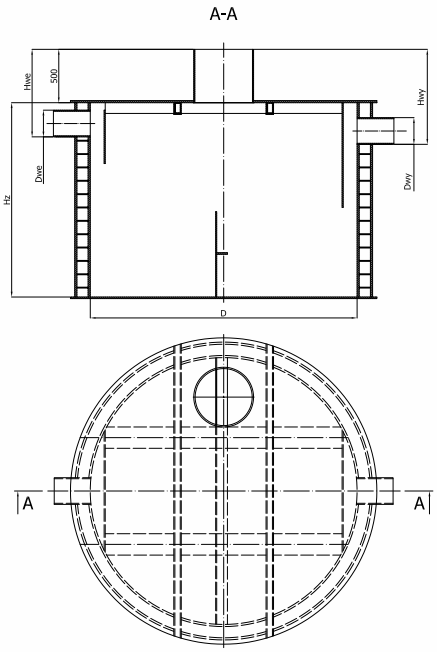
GREASE TRAP OF FLOW RATE Q
FROM 0.5 UP TO 3 l/s



GREASE TRAP OF FLOW RATE Q
FROM 4 UP TO 10 l/s



GREASE TRAP OF FLOW RATE Q
FROM 12 UP TO 20 l/s



BRIEF GUIDELINES FOR GREASE TRAP INSTALLATION

When a tank is to be installed in a dry or moderately wet soil, the following procedures should be carried out:

- the subbase for the tank should be of type 1, 2, 3 (see table 1) and compacted to at least 95% MPD (see table 2),
- set and level the tank along the main pipeline,
- connect the tank to the laid pipeline and to at least one pipe,
- backfill and compact the area around the tank. Compaction should be performed in layers in accordance with applicable regulations and good practice, with the use of material of type 1, 2 or 3 specified in table 1. For tanks located in soft landscaped areas, soil should be compacted to at least 85% MPD. For those located in areas with vehicle traffic, soil should be compacted to 95% MPD,
- drainage of the excavation, if necessary, should be continued until the tank has been stabilised and backfilled so that the buoyancy force of the ground water can be counterbalanced,
- if the tank is to be installed in an area with vehicle traffic or heavy weight goods are to be stored on it or soil surcharge level being above 1 m, a protective reinforced concrete slab should be used with a ring transferring the load away from the separator.

Tabela 1. Sub-base aggregate classification for tank installation.

TYPE I	Gravel, crushed stone containing stone particle sizes 4-8.4-16.8-12.8-22 mm. Max. 5-20% particles of 2 mm diameter are acceptable. The best material for manhole/tank installation.
TYPE II	Coarse sand and gravel of maximum particle size approx.. 4 mm and other graded sand and gravel of various particle size containing a small percentage of silt. Max. 5-20% particles of 0.2 mm diameter are acceptable. Material of good quality.
TYPE III	Fine-grain sand, clayey gravel, a mixture of fine sand, clayey sand with gravel and loam, silty gravel and mixtures of: gravel - sand - silt, gravel - sand - clay, silty sand – sandy silt. Max. 5% particles of 0.02mm diameter are acceptable. Material of mediocre quality.

Tabela 2. Compaction method applied and layer thickness while compacting backfill material.

Type of compaction method	Weight [kg]	Max. layer thickness before compaction [m]		Min. protective layer thickness above tank [m]	Number of runs at compaction level	
		gravel, sand	clay, loam, silt		do 85% ZMP	do 90% ZMP
Tamping	-	0,10	-	-	1	3
Manual compaction	15	0,15	0,10	0,30	1	3
Vibratory rammer	50-100	0,30	0,2-0,25	0,50	1	3
Vibratory plate compactor with removable plate	50-100	0,20	-	0,50	1	4
Vibratory plate compactor - planar	50-100 100-200 400-600	0,15 0,20 0,40	- - 0,20	0,50 0,40 0,80	1	4

Special recommendations for installation of tanks in waterlogged areas:

- prior to the installation of the tank, a spot footing (concrete or reinforced concrete) with anchor bolts should be made for securing the tank,
- set and level the separator along the main pipeline, connect the grease trap to the laid pipeline,
- stabilize the tank by attaching it to the foundation with tie-down straps for resisting the buoyancy force
- build a formwork for external concrete-encasement of the tank, the height of the anti-buoyancy collar is given by the manufacturer of the grease trap after making relevant calculations
- if the concrete slab is to be reinforced, it should be done prior to the erection of formwork
- pour concrete and allow curing time
- backfilling and compaction of the area around the tank above the concrete collar should be performed in layers, in accordance with applicable regulations and good practice. For tanks located in soft landscaped areas, soil should be compacted to at least 90 % MPD. For those located in areas with vehicle traffic, soil should be compacted to 95% MPD, sand and cement mix (10 parts of sand and 1 part of cement ratio) should be used as backfill,
- drainage of the excavation, if necessary, should be continued until the tank has been stabilised and backfilled so that the buoyancy force of the ground water can be counterbalanced,
- if the tank is to be installed in an area with vehicle traffic or heavy weight goods are to be stored on it, a protective reinforced concrete slab should be used with a ring transferring the load away from the separator.

TRANSPORT

Grease traps should be carried on lorries or trailers with appropriate protective measures against transport-induced damage. Ropes or non-metal straps should be used for loading and unloading. It is prohibited to lift the separator by the pipes.

OPERATION AND MAINTENANCE

The SZAGRU grease traps are made of high-density polyethylene HDPE, which makes them completely watertight and non-corrosive. The material does not require maintenance. Grease traps are maintenance free, they should only be periodically inspected and emptied. In order for the separators to work properly, it is necessary to follow instructions provided by SZAGRU:

- the sludge chamber in the grease trap must be cleaned regularly so that the level of solids settled in it does not reach half of the tank,
- the intervals at which the sludge chamber is cleaned depend on the amount of solids in the wastewater flowing into the separator,
- the maximum layer of oil and grease should be 15 cm,
- prior to emptying the separator the floating layer of separated fats, oil and grease should be pumped out first,
- while cleaning the separator, it is necessary to clean the closing unit and inspect its condition
- any work on the tank should be preceded by ventilating the tank for at least 15 minutes,
- maintenance procedures which require man-entry into the tank must be performed by authorised personnel only. A person carrying out work inside the tank should be insured by at least 2 persons,
- contaminants in the separator should be removed with a specialist vehicle conforming to applicable regulations,
- contaminants removed from the separator must be disposed of in accordance with the guidelines of relevant authorities for environmental protection.

GREASE TRAP USAGE LIMITATIONS

Sanitary sewage, stormwater sewage or wastewater containing hydrocarbons must not be fed into grease traps.

LOCATION

Grease traps should be located as close to the source of wastewater as possible, but locations such as closed spaces, pavements and warehouses should be avoided. Due to unpleasant odours while emptying, they should not be placed near windows and places where people live. They should be installed in such a way that they do not freeze and must be easily accessible by a service vehicle.

MANUFACTURER'S WARRANTY

We ensure a 12-month warranty period for our products and we ensure that the delivered goods are free of manufacturing flaws. If such defects are identified by our staff, we replace the defective elements free of charge except for costs that are not the manufacturer's fault.

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