



WPL DAF

OPERATION AND MAINTENANCE MANUAL

Site name:

Reference number:

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07/07/2021	New front and back page	RT		B

UF30 DAF

1. SAFETY

It is extremely important that maintenance procedures in this document are followed. Any deviation from this could cause serious injury or have a detrimental effect on the filter and its operation.

1.1 Health and safety at work act 1974:

Section 6a of this act requires manufacturers to advise their customers on safety and handling precautions to be observed when operating, maintaining and servicing their products.

The user's attention should be drawn to the following:

- All sections of this manual should be read before undertaking work on the equipment.
- Suitably trained personnel must carry out the installation.
- Normal safety precautions must be taken and appropriate procedures observed to avoid accidents.
- Refer to WPL Ltd for further technical advice or product information.

1.2 General health and safety:

The layout of the plant has been laid out to ensure that health and safety on site is optimised. It will be vital that the routes to all of the equipment are laid out in a proper manner and they are followed implicitly. Lone working in the plant should be prohibited.

1.3 Leptospirosis:

The following is extracted from a health warning card issued to WPL Ltd's staff. It is the client's responsibility to ensure that the relevant Personal Protective Equipment (PPE) is available and used.

There are two types of Leptospirosis that effect people in the UK and they are as follows:

1. Weil's disease, which is a serious infection transmitted to humans by contact with soil, water or sewage that has become contaminated with urine from infected rats.
2. Hardjo-type Leptospirosis, which is transmitted from cattle to humans.

The typical symptoms for both diseases start with a flu like illness, with a persistent and severe headache, muscle pains and vomiting. Jaundice generally appears on the fourth day of the illness.

The bacteria can enter your body through cuts and scratches or through the lining of the mouth, throat and eyes.

1.4 Sensible precautions:

After working with contaminated fluid or other materials it is important that hands and forearms are washed thoroughly with soap and water. If your clothing or boots become contaminated then they should also be washed immediately after use.

Immediate action should be taken, so that any cuts scratches or abrasions are washed thoroughly with clean water, prior to applying any protective covering (plaster or bandage).

Do not handle food, drink or smoking material without first washing your hands. If you display any of the symptoms described after coming in to contact with sewage; report to your doctor immediately advising them of the circumstances.

1.5 Vaccinations:

To avoid the possibility of illness it is recommended that all site personnel have the following vaccinations. WPL Ltd also recommends that you that you consult your doctor for any additional vaccinations that you may require. The general vaccinations WPL use for all personnel are as follows:

- Hepatitis A
- Hepatitis B
- Polio
- Tetanus
- Typhoid/cholera – probably carried out as a child.

2. Warranty:

WPL Ltd will provide the following warranty to the items listed below:

2.1 DAF tank enclosures:

WPL Ltd will provide a 2 year warranty period for the external structure of the (DAF) tank.

Note: warranty period will be active from the day, from which the tanks are positioned on the base slab, or passes on to the customer's premises/construction site. A Handover document will be sent to the customer for sign off

2.2 Pumps:

(Where applicable), the pumps are covered by a two year standard manufacturer's guarantee.

2.3 Container:

The Container is covered by a 12 month warranty.

2.4 Warranty limitations and exemptions:

WPL Ltd shall not be liable for any labour involved for the removal or replacement of its equipment or the subsequent transportation, handling or packaging of any part or parts thereof. In no case will WPL Ltd be liable for loss incurred because of interruption of service or for consequential damages, labour or expense required to repair defective units, nor shall this constitute a cause for the cancellation of the contract of purchase and sale. Specifically exempt from this warranty are limited life of consumable components subject to normal wear and tear, such as air pump vanes, diaphragms and filters.

2.5 Chargeable non warranty work:

Service charges will be incurred (including parts and labour), due to the following:

- Unauthorised alteration.
- Accidental damage, caused by plant or movement on site outside of WPL's control.
- Improper use.
- Abuse.
- Tampering.
- Failure to follow installation instructions or failure to follow operating and maintenance procedures.

The above will not be covered by this warranty. All service visits for non-warranty work are chargeable at the standard engineer day rate plus mobilisation. This warranty gives specific additional benefits. Statutory rights are unaffected.

Note: WPL LTD will not uphold the guarantee on the purchased equipment if the routine maintenance has not been performed and documented.

WPL LTD strongly recommends that the installation of the purchased product is carried out by a qualified and experienced installer. Dependent on the site a qualified civil engineer may need to be consulted for the construction of suitable base slab to support the imposed load.

3. Normal Operation:

Your way of working must always be correct and safe. Take care that the machine only operates in a safe and functional condition.

Operate the machine / system only when all protective and safety-related equipment's (e.g. detachable protective devices, emergency equipment, sound insulation, extraction facilities) are in place and in working order.

3.1 Terminology:

- **Flotation** – A process in which tiny bubbles of air (30-50µm) dispersed in water stick to dirt particles, create lifting effect needed for carrying the particles to the surface.
- **Flotation unit** – A facility for waste water pre-treatment on the basis of flotation.
- **Separation** - Separating process.
- **Intensification** – Intensification process.
- **Dispersion** – A mixture of substances one of which is finely dispersed in the other one.
- **Emulsion** – Two immiscible liquids one of which is finely dispersed in the other one.

3.2 Maintaining the machine:

The machine must be checked at least once per shift on externally discernible damages and defects. All changes must be reported immediately (including the operational behaviour). If applicable turn off the machine immediately and secure it.

In case of malfunctions turn off the machine immediately and secure it. The errors must be resolved promptly.

Switching on and off process and the control signals should be followed in accordance with the operations manual.

Before you start the machine make sure that nobody will be endangered. Adjustable, maintenance and inspection activities as well as information of the exchange of parts / part equipment must be observed, like they are specified in the operating manual. Only qualified personnel are allowed to carry out such activities. Inform the operating personnel before starting maintenance work. Designate supervisors.

For any work related to the operation, the production adjustment, upgrading or setting the machine and its safety-related equipment as well as inspection, maintenance and repair, you have to note switching on and off operations in accordance with the operations manual and instructions for maintenance instructions.

If the machine is completely turned off during maintenance and repair work, you have to secure it against unexpected restart.

4. Unit Description:

Main parts of flotation unit: (See Appendix 1)

4.1 Flotation tank –

This is designed to allow for optimisation of the following characteristics:

- Maintaining the waste in the flotation area for as long a possible
- Flotation apparatus surface loading with suspended solids
- Volume loading

The tank is divided into 3 sections. 1) Inlet section, 2) flotation and sedimentation Section, 3) Trough for flotation scum withdrawal and outlet part. See image Fig. 1.

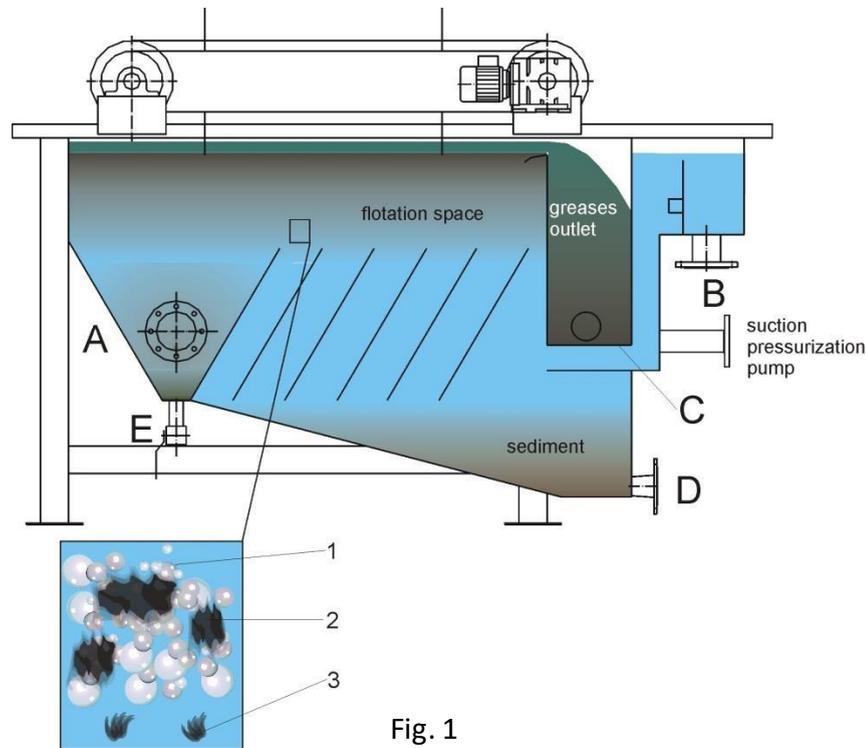


Fig. 1

4.2 Scraper Drive -

This wipes the flotation scum off the flotation tank surface into the off take trough. The plastic scrappers (43) are screwed to the steel brackets (42, 44) fastened to plastic chains (40).

The skimmer position against the chain is shown by plastic rings (45), they are fixed by shaped washers (46) and stirrup rings (45). The chains are then pulled taut between the two plastic chain-wheels (38) embedded into bearing bodies (39) through primary (36) driven (37) shaft. To facilitate the chain movements they are led through removable plastic moulding's (41). The unit is driven by an electrical gearbox (33), torque is transmitted by lever (34) and rubber block (35).

4.2 Recirculation Circuit -

The recirculation circuit circulates part of the flotation tank content feeding thus the circulated waste water with air. The circuit consists of a recirculation pump (2), suction (6) and delivery pipe. A check valve (10) and ball valve (12) are inserted into the delivery pipe; there is a compressed air connection through a ball valve (15). The delivery part also contains a pressure vessel (4) with a pressure gauge (14), blow off rubber hose (18/2) and distribution hoses (18/1). The hoses distribute the circulated aerated water into the flotation tank area.

4.3 Air circuit -

Provides air supply of required pressure and flow into the pump discharge part. It consists of inlet rubber hose (19) connected to the pressure air source (a compressor, existing distribution system within the plant), solenoid valve (22), pressure regulator (25), float flow meter (29) and an air check valve (32).

Built-in laminated blocks seated inside the flotation tank optimize the sedimentation process and help to define the flotation and sedimentation area.

5. Operation principle

5.1 PHYSICAL FLOTATION:

The physical flotation can be used only for the kind of waste water able to create the following levels by the means of the air dispersion: floated matter pre-treated water sediment.

The flotation process is not intensified by any chemical agent in this case. The flotation unit is in service condition, i.e. the flotation tank is filled with clean water, circulation pump runs, the pump discharge is aerates. The pressure vessel pressure ranges between 4 and 6 bar. The air dispersion is cerating. The pre-treated waste water on the rotary screen is going in the DAF.

The recirculated aerated waste water stream is taken from the pressure vessel by hoses to the inlet sockets. The sockets lead into the inlet part (A) or the flotation area. The air contained in the waste water is released in the inlet part due to pressure change in a form of very small bubbles (sizes of 30-50 μ m). Fine air dispersion is gradually created over the whole inlet part, size and process of physical flotation occurs, i.e. tiny air bubbles (1) stick to dirt particles (2) and the lifting force carries the particles onto the flotation tank surface. High number of the bubbles make the process extremely intensive and consequently a layer of floated sludge is created on the surface.

Water, cleared from the dirt particles, flows through laminated blocks. The blocks facilitate the non-floatable dirt particle sedimentation process (3). Sediment then settles on the bottom of the flotation tank (D).

The pre-treated water (by flotation and sedimentation) having floated through the laminated blocks overflows into the outlet trough (B) and flows out of the flotation unit through the discharge pipe.

Flotation scum is stirred from the flotation tank surface by a scraper into the discharge trough (C) and the container.

The sediment is then emptied through the sediment collection tray. The sediment particles in the inlet part (A) are withdrawn through the ball valve (E).

FOR YOUR ATTENTION

The DAF can be operated without any chemical addition only if the waste water is able to be treated by the physical DAF that means the pre-treatment insures that the residual value of suspended solids cannot damage the recirculation pump.

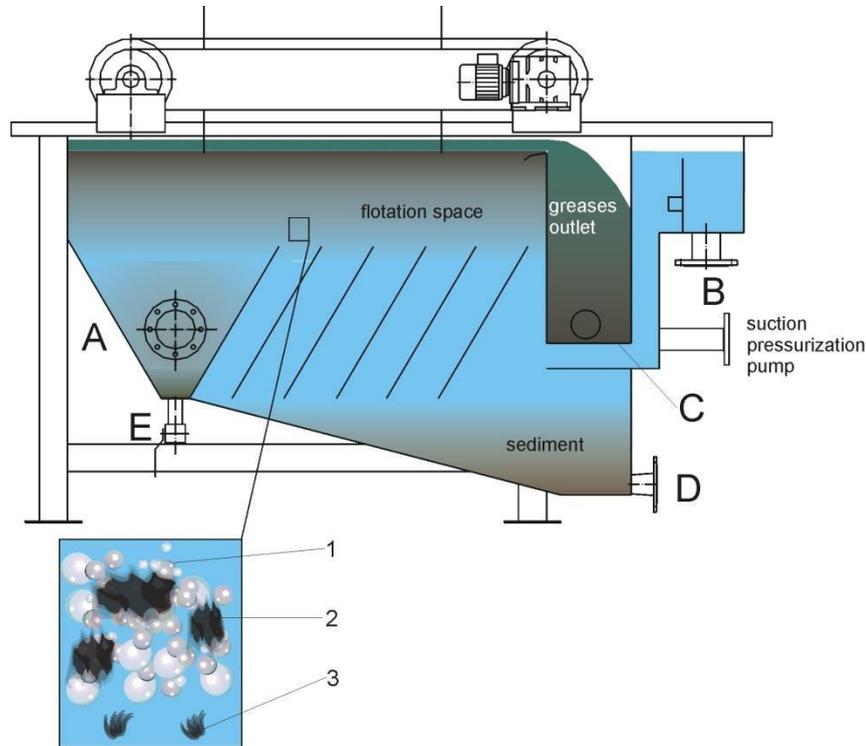


Fig.1

5.2 CHEMICAL-PHYSICAL FLOTATION:

In this case the flotation process is intensified by dosing a suitable amount of flocculent or coagulant.

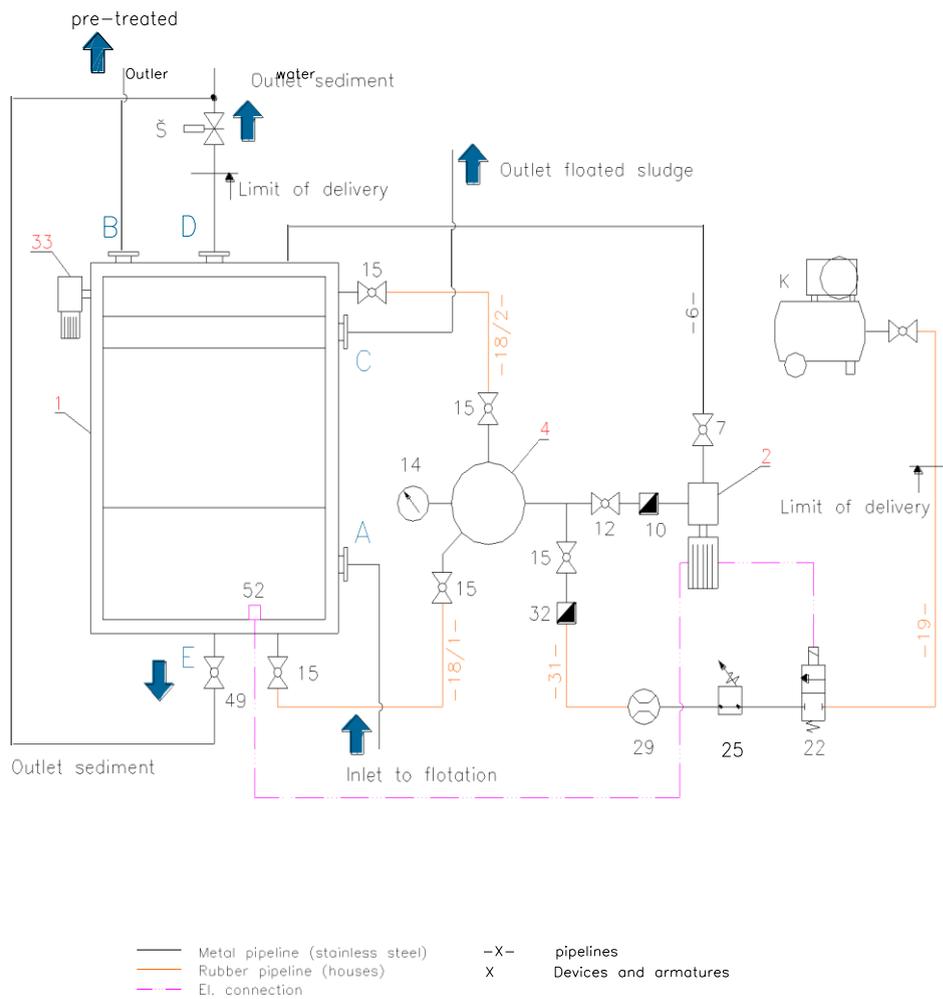
For this purpose the chemical units, i.e. dissolving and collecting tanks for chemical solution preparation are added to the flotation unit. Furthermore, the flotation unit is supplied with a tubular blender which is inserted into the flotation unit piping and is used for mixing the incoming waste water with the chemical solution. These chemicals induce precipitation of the emulsified dirt, the sludge flocs are then easily separated by flotation.

The chemical agents and their dosing rates are specified for each chemical on the basis of contamination type and concentration of the raw effluent.

6. Flotation unit wiring diagram

The flotation unit connection is described in Part 2. Its function also requires wiring of the recirculation pump (2) with the solenoid valve (22) and floating switch (52) so that the pump is stopped and the solenoid valve closed in case the floating switch disconnects – see Fig. 2.

This guarantees that in case of the surface drop under the pump suction level (given by the floating switch position in the flotation tank) the pump shall not operate when the tank is empty and the air circuit closes at the same time.



LEGEND

Fig. 2

The manufacturer also recommends to provide an automatic sediment removal (D) in controlled time intervals which is possible using e.g. a slide valve (Š) with electric or pneumatic actuation. Optimal time intervals may be determined under specific operation conditions. The inflow notch (E) sludging may be inserted after the slide valve.

7. Application

The flotation unit is a facility designed for pre-treatment of concentrated waste water originating in e.g. food processing industry. Excellent results can be reached in meat processing plants, slaughter houses, poultry processing plants, fish processing plants, dairy works, etc.

Flotation effectively reduces mainly extractable contamination (fats), and also the reduction of organic contamination indicators BOD₅ and COD.

The general contamination reductions are as follows:

Indicator	Physical flotation	Chemical-physical flotation
FoG	75%	90%
SS	75%	90%
BOD ₅	40%	65%
COD	40%	65%

The shown values are of information purposes. They have been established on the basis of experience from installed flotation units or evaluation of static tests.

The structural part mainly includes the object where the technological unit is to be installed, levelling and pump sumps, sewer connections, chemical resources management areas.

The technological unit includes installation of individual technological units, i.e. pump, mixer, facility for primary waste water pre-treatment (rotary screen, skimmed trashracks), flotation unit, dissolving and storage tanks for chemicals, containers for screenings and flotation sludge, presses, conveyors, etc.

Recommendation: Any typical or otherwise problematic possibilities of flotation unit installations should always be consulted with the manufacture

8. Technical Characteristics

The flotation unit is manufactured and supplied in the basic model range (Fig. 3):

		UF3,6	UF-5	UF-10	UF-20	UF-30	UF-40	UF-50
Q max	m ³ /hod	3,6	5	10	20	30	40	50
Total volume Surface	m ³ m ²	1,5	2	2,5	4,5	6	11	12
Weight empty	kg	1	1,8	2,7	5,4	4,7	4,7	9
Weight in operation	kg	400	500	800	1000	1400	1600	1800
Power Length L Width B	kW m	1900	2500	3300	5500	7400	11100	13300
Height H Inlet A	m	5,12	5,12	5,12	7,62	7,62	11,12	11,18
Outlet water B	m	2,0	2,7	2,7	3,9	3,3	4,4	5,5
Outlet floated matter C		1,4	1,5	1,7	2,2	2,2	2,2	2,2
Outlet sediment D								

		UF-60	UF-80	UF-100	UF125	UF150	UF200	UF250
Q max	m ³ /hod	60	80	100	125	150	200	250
Total volume Surface	m ³ m ²	13	15	18	22	39	46	46
Weight empty	kg	10	11	14	16	22	22	36
Weight in operation	kg	2000	2600	3000	3300	4500	7000	7500
Power Length L Width B	kW m	14000	19600	27000	25300	43500	53000	53500
Height H Inlet A	m	11,18	15,18	15,18	15,18	15,18	15,18	15,36
Outlet water B	m	6,0	6,5	8,0	9,0	7,8	7,8	11,2
Outlet floated matter C		2,2	2,2	2,2	2,2	3,7	3,7	3,7
Outlet sediment D								

* Inflow notch (E) sludging in all cases through a ball valve 2".

* Flotation unit max. flow (output) is an informative value; it differs case to case according to contamination type and concentration.

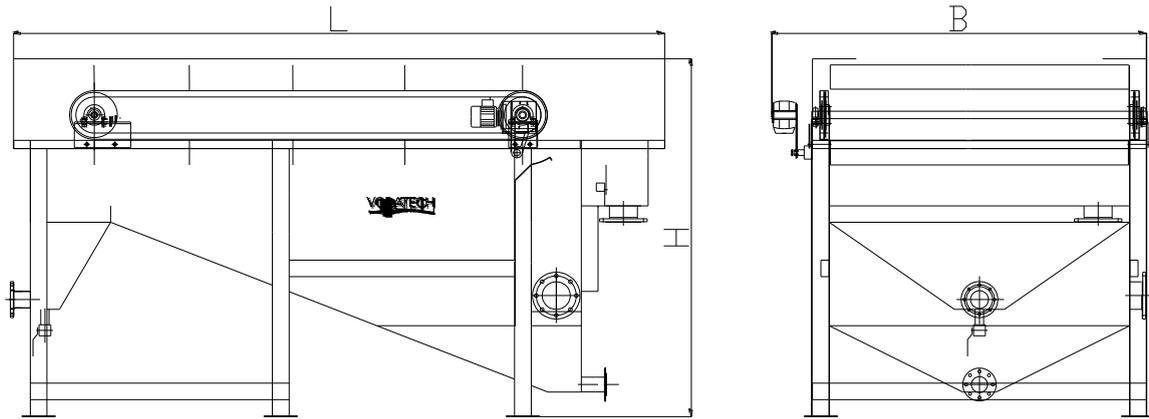


Fig. 3

9. Inspection and Testing

All DAF's are thoroughly quality checked during assembling. After this, the unit is water tested.

Operation test:

- Quality and accuracy of stirring is checked;
- The circulation circuit is tested with the unit loaded, i.e. tightness of all joints under the service pressure, and air dispersion creation.

10. Design

The flotation tank is made of 3mm stainless steel sheets. The flotation unit legs and braces are typically of 100x100mm or 100x50mm Stainless steel. The recirculation piping and other profiles used are of stainless steel (1.4301).

The flotation unit external and internal surfaces are impregnated and consequently inactivated. Both impregnation and inactivation agents are thoroughly washed down.

The skimming chains, chain wheels, cam chain guides, skimming blades and laminated blocks are made of plastic.

11. Acceptance and delivery

The flotation unit recirculation circuit is always removed for transportation; its parts are individually packaged. The manufacturer is responsible for the unit quality and completeness. The customer carries out the acceptance procedure focused to quality and completeness.

- O&M manual for flotation unit
- O&M manual for circulation pump
- O&M manual for electric gearbox
- O&M manual for compressor (in case it is part of the delivery)
- Quality certificate

12. Assembly

Assembly is carried out by the supplier following a project upon order and contract.

Should the customer decide to carry out assembly on their own, we recommend to consult its overall concept with the supplier.

General rules for the flotation unit assembly:

- The unit may be reliably operated if it is protected from weather conditions and the ambient temperature never drops below 0°C.
- The unit must be in horizontal position.
- The recommended minimum space between the unit and wall is 600mm. There must be a space for handling of the container with the floated sludge and access to control elements on the scum outlet trough and air nozzle side.
- The building recommended height is 1000 mm over the unit maximum height.
- A valve must be inserted into the waste water inflow pipe to allow regulation of inflowing water, and a check valve to stop flow-off when the sludge pump is switched off.
- We recommend installation of a platform enabling checking of the flotation tank level and pre-treated water overflow.
- The DAF must be ventilated.
- The DAF interior must be illuminated.
- The DAF must be equipped with a water supply and hot water source.

13. Operating instructions for Commissioning

1. Fill the flotation tank with clean water, minimum level must be over the recirculation pump suction point. The recirculation pump must not be operated if the water level in the flotation tank drops below the suction point.

Recirculation pump is not destined for the pumping of the polluted water so it is strictly necessary to adhere to the rules of the start-up of the DAF and only clean with water.

2. Before the tank filling check if the valve on the sediment removal pipe is closed.

3. The operating height of the flotation tank surface is given by the overflow wall level which is set so that the surface reached the lower area into the trough for floated sludge removal (Fig 4).

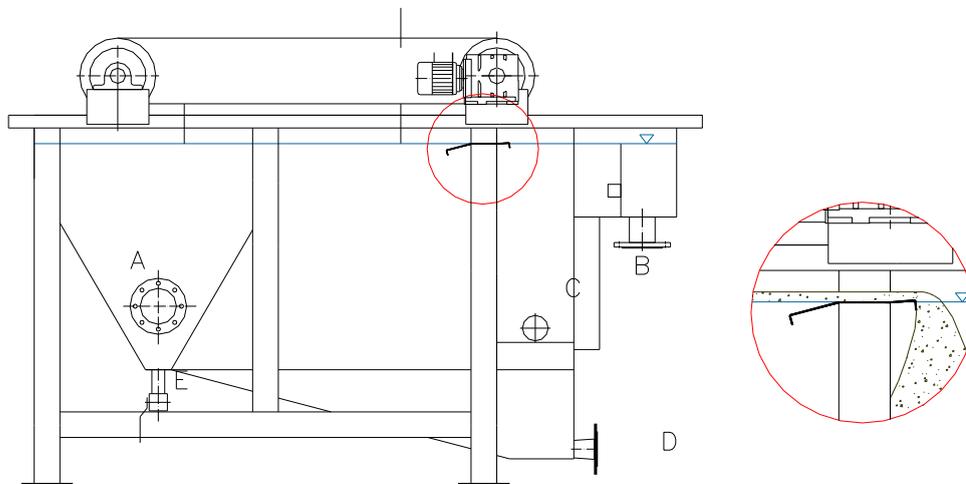


Fig. 4

4. The pressure vessel valves are in a fully open position.

5. The recirculation pump valves at suction and discharge are fully open.

6. Start the recirculation pump and compressor.

7. Regulate the airflow to the level shown by the flow indicator, and the air pressure to the level 1 bar higher than shown on the pressure vessel.

8. The pressure vessel pressure ranges between 4 and 6 bar, fine air dispersion is created in the unit inflow part under these conditions – water is white, the white colour is gradually spreading all over the surface. See the document Start-up of the DAF unit.

9. Run the flotation unit for min. 10 mins.

10. Then open the supply line valve and start the sludge pump.

11. Start scraping (the gearbox wiring should allow cyclic scraping operation, e.g. 5 mins idle, 1 min scraping).

13.1 Checking after setting the DAF into service:

1. Carry out periodic (once a day) check of pressure in the recirculation circuit and amount and pressure of the inlet air. In case of deviation from the optimal values make the necessary adjustments.
2. Carry out periodic checks of the flotation tank level whether the flotation scum is created and skimmed, the level height is properly set and pre-treated water flows over into the overflow.
3. Every 2 hours remove the sludge from the sedimentation area, time for the opening of the sludge removal pipe is 1 min, 5 seconds.
4. After the sedimentation area sludging, check if the sealing flap is tight, if loose this results in the flotation tank level dropping.

Recirculation pump is not destined to pump of the polluted water. It is strictly necessary when operating the D.A.F to avoid:

- Suction of the sediment when the frequency of the sludge removal is incorrect
- Suction of the floated matter when the frequency of the scraping is incorrect
- Suction of the floated matter when the dosing quantity of chemical agents is incorrect.

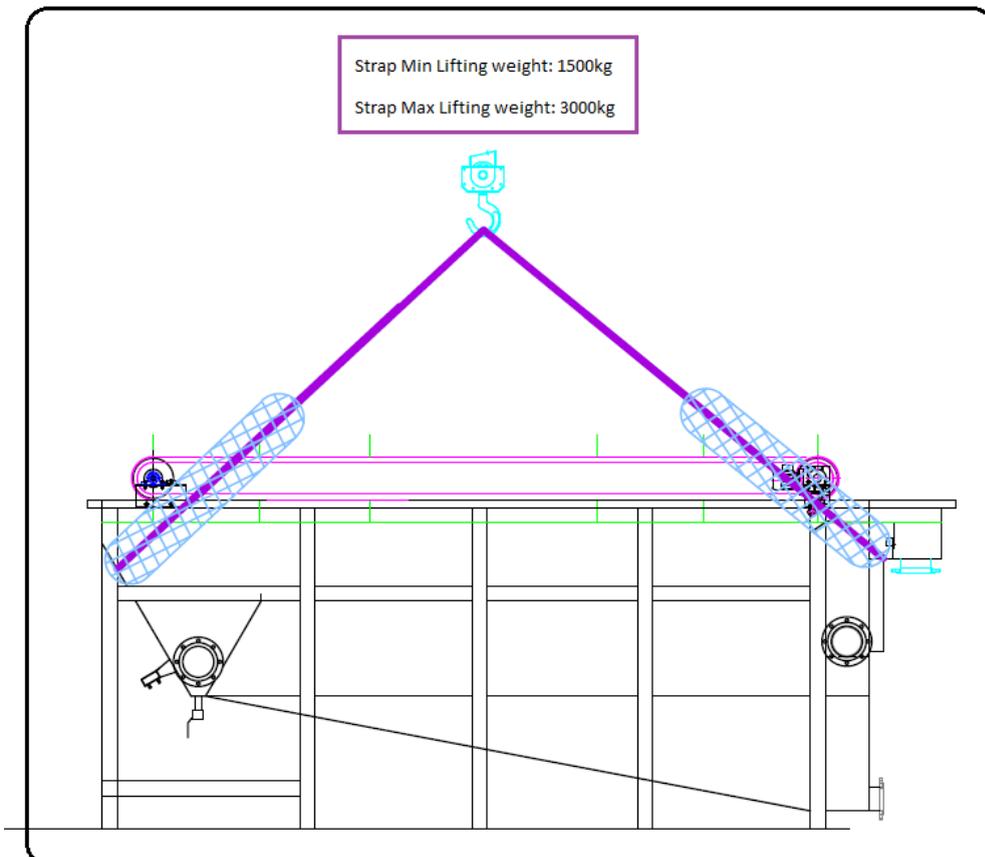
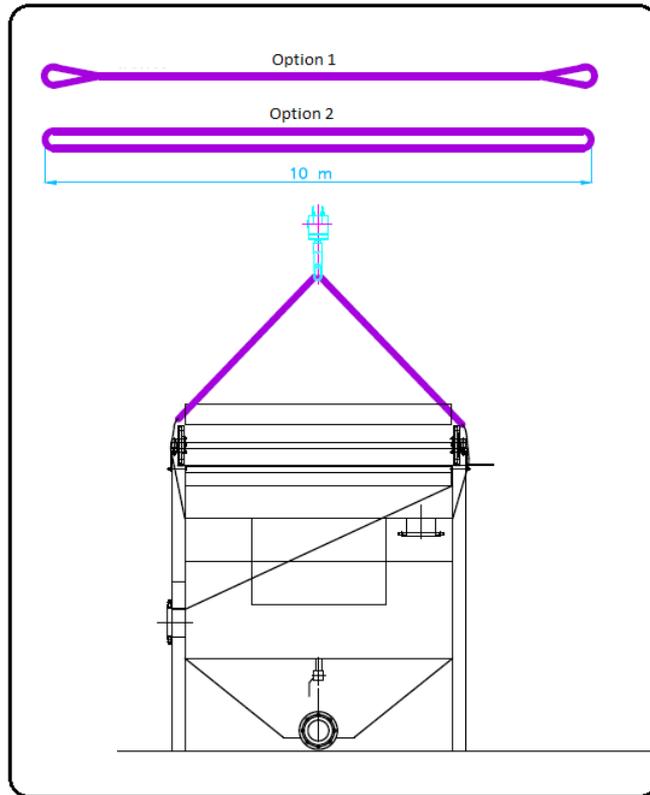
Flotation unit turn off:

1. Stop the sludge pump.
2. Stop the recirculation pump, compressor, sludging, scraping.

Check after flotation unit turn off:

Carry out visual checks of the flotation tank level; in case the level drops it means that the valve in the sediment removal pipe or the check valve in the supply line is not tight.

14. Lifting - Loading & Uploading



15. Maintenance

The unit is reliable and requires minimal maintenance. Operators carry out daily visual control of all connections.

Other routine maintenance operations:

- Fortnightly check, check the function of the recirculation circuit, i.e. clearness of all the valves in the pressure vessel, hoses and valves in the flotation tank. The check is carried out during the flotation unit is in operation, successively for every single hose:

a) Close both valves by the hose being checked and release one of the hose ends.

b) Open the valve and check it and the hose for clearness (water should be taken into a suitable container).

c) Open the other valve and check its clearness.

Carry out the above operation with all the valves and hoses in the circulation circuit. In case the valves and hoses get frequently blocked, the pressure vessel to be removed and cleaned. The removal operation should be carried out by the manufacturer.

- 3 times a day, open the inlet notch sludging (30s) valve.

- Weekly, drain the flotation tank down to the inflow socket levels and rinse the sockets by high pressure water (warm water is recommended).

- Fortnightly, before the DAF is shut down for more than three days, drain the whole flotation tank (ensure slow drainage so as not to flood the sediment tank). Clean the sediment collection tank before this operation to make sure the sedimentation sludge is not washed back to the filling tank. Rinse the flotation tank and inflow sockets interiors with warm water. Make sure the water temperature does not damage the built-in laminated blocks.

When servicing the circulation pump follow the manufacturer's instructions. Copies of the service and maintenance instructions are included with the flotation unit documentation.

Yearly Checks

Carry out all of the above checks with the addition of the following:

- Test all of the control panel functionality, ensuring that all of the safety features work correctly.
- Simulate faults and ensure that they can be re-set and brought in to operation

16. POSSIBLE PROBLEMS AND THEIR ELIMINATION

Problem) - water overflows to the trough for floated sludge removal

- the overflow wall, which regulate the level in the flotation tank is set too high
- lower the overflow wall

Problem) - scraping blades “do not touch “the floated sludge, low level in the flotation tank

- The overflow wall is set too low
- set the overflow wall higher
- Waste water feeding pump is out of service - no upheaval of the level
- Set the overflow wall higher
- Switch on the waste water feeding pump
- Leakages on the sludge removal valve
- check the sealing of the sludge removal valve
- Waste water feeding pump was not running for a long period and the drop is caused by the overflow of the excessing air quantity
- switch on the waste water feeding pump and fill the missing volume

Problem) - on the surface in the flotation tank do not appears the floated sludge (foam)

- no inlet of the air – the ball in the flowmeter is on the zero value
- check the function of the solenoid valve
- check the pressure of the incoming air, it must be 1bar higher than the pressure on the manometer of the pressure vessel
- check the function of the compressor

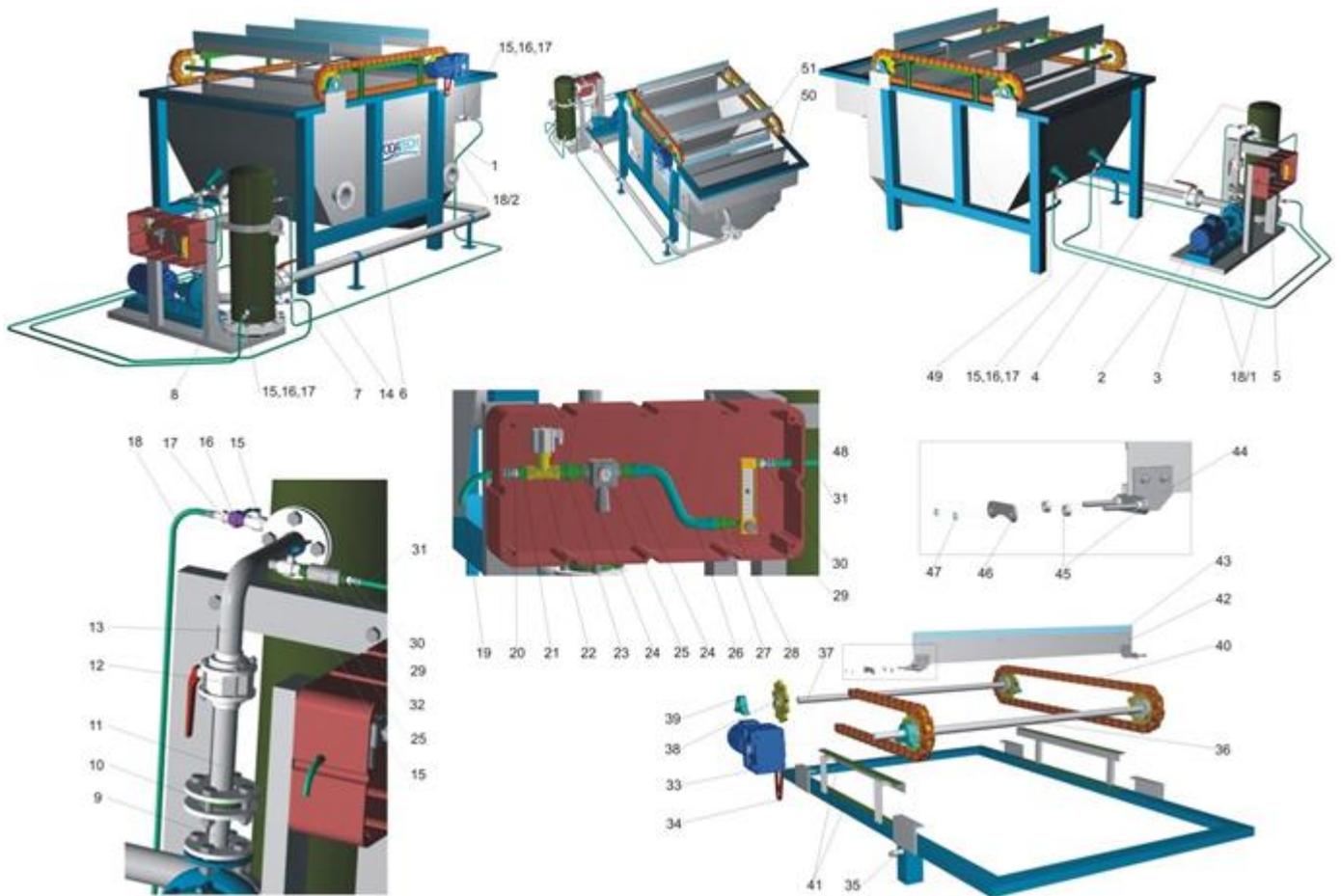
Problem) - on the surface in the flotation tank, at the inlet part appear big bubbles

- Pressure vessel is full of the air
- open the ball valve of the overflow of the exceeding air, after the deflation turn down the valve, reduce the quantity of the incoming air on the flow meter.

17. Appendix 1 -

1	Tank of the DAF	27	reduction
2	Pressurisation pump	28	Elbow
3	Support of the pump	29	Flowmeter air
4	Pressure vessel	30	Hose adapter
5	Support of the vessel	31	PVC inlet air in discharge
6	Suction of the pump	32	non-return valve air
7	Ball valve at suction line	33	Gear box
8	Suction line with reduction	34	lever of the gear box
9	Discharge of the pump	35	Rubber block
10	Non return valve	36	Primary shaft
11	Discharge pipe 1	37	Driven shaft
12	Ball valve at discharge line	38	Teeth wheel
13	Discharge pipe 2	39	Bearings
14	manometer	40	Plastic chain
15	Ball valve	41	Plastic moldings for
16	Fitting	42	Steel support of the
17	Hose adapter	43	Plastic scraper
18/1	PVC hoses saturated	44	Steel bracket
18/2	PVC hose overflow	45	Stirrup ring
19	PVC hose inlet air	46	Forme bracket
20	Hose adapter	47	Clips
21	reduction	48	Plastic panel
22	Solenoid valve	49	Ball valve
23	Fitting	50	Overflow wall
24	Threated adaptor	51	Lamela pack
25	Ball valve	52	float
26	PVC hose		

UF30 Operation & Maintenance Manual



WPL
Unit 1 Aston Road
Waterlooville
Hampshire
PO7 7UX
United Kingdom

Tel: +44 (0)23 9224 2600
Email: enquiries@wpl.co.uk
Web: wplinternational.com

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