JetPetroClean automated oil products storage tanks cleaning service for terminals

Dontal LLC provides cleaning service for oil products storage tanks.

Providing the service we use JetPetroClean ™ systems, which is a registered trademark of Dontal LLC.

The main purpose performing cleaning and decontamination via closed loop method - to create safe conditions for cleaning procedure and internal inspection, to determine tank’s technical condition and the amount of necessary repair work.

Circulation time is set depending on the jetting parameters (time of one wash cycle) and degree of pollution of the tank.

The technological basis of JetPetroClean ™ systems is the principle of "closed loop cleaning method ".

Using this method, cleaning agent (water, aqueous solution of detergent) flows in the closed circuit from the tank of washing system through a pressure pump and cleaning jet into the skimmer, then further from it is washed back into the container of washing system.

Simultaneously washed hydrocarbons and contaminants are pumped out from the tank together with the wash water.

During this operation, degassing of the tank is performed. In the skimmer module waste is separated from the washing solution and wash water is pumped forth through a pressure pump and cleaning jet back into the tank.

Below we describe main principles and stages of work for the internal cleaning of stationary tanks (both ground and underground).
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Cleaning and degassing of a storage tank to a safe level consists of the following stages:

1. Residue removal
2. Wash the tank bottom from the product residues, bottom sediments, and sludge
3. Pre-drainage of the internal volume of the reservoir
4. Wash the inner wall surface of the tank
5. The internal ventilation, degassing and drying

At all stages, work is performed using mechanized method and JetPetroClean™ equipment manufactured by Dotal LLC.

**Main modular equipment:**
1. Tank cleaning unit JPC
2. Flush water separator JPC
3. Power module (include 2 steam generators manufactured by DONTAL)
4. Waste tank
5. Air driven jet nozzles
6. Tank shell washing device
7. Mobile steam boiler
8. External pumps
9. Nitro generator (product produced by Third party)

**Portable equipment:**
- external suction pumps
- external circulation pumps
- hoses kit
- pipes kit
- manual jet nozzles
- manual tools and accessories kit

Portable equipment is placed in the container when moving to a new workspace site and will be removed from the container and placed on the job site

Additionally, the system can be equipped with tools and work stands, depending on the main scope of work:

1. Case for detergent jets/hydraulic monitor
2. different types of hydraulic monitors
3. fastening device for a manual hydro monitor on the side of the tank hatch

In agreement with the customer can be manufactured/installed any other device and tools to carry out cleaning work depending on the conditions and objectives
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Work stages

1. Removal of non-usable product residue

This part of work is performed using the diaphragm (Membrane) pumps. Used pumps are electric or pneumatic.

Removal of the residues from the tank is done through all entry points, such as:
- Side hatches
- Drainage (siphon) cranes

Depending on the level of residue, sampling locations may be set inside of the tank on the bottom.

In this case, we use prefabricated parts made from spark-free materials (aluminium, stainless steel etc.)

Pneumatically powered pumps are supplied with compressed air from the air compressor of energy unit

When electrically driven pumps are used, they can be connected to the electricity from a separate sheet or from the main shield of energy unit.

If the tank bottom has a central drain hatch (slope to the centre), and it is equipped with discharge pipe, residues are removed through this point

Pumps, which are used to remove the non-usable product, can work for a long time without the fluid, that allows quickly rebuild the collection system without turning off the pumps.

Diaphragm pumps can be used also at other stages during the cleaning as the main discharge pumps

Flow characteristics of pumps are within 40 ... 50 m³ / h. The working pressure depend on pressure line resistance is from 1 to 8 bar.

All unusable product residues collected in a mobile separate container for its transport and subsequent injection into the treatment tank.

With a significant amount of residue, it can be pumped directly into a pipeline system, if there are connections to the system

If the scope of work is to remove the residue of the product, then we should take into account its quantity and quality

If the unusable residue is very dirty (sludge, mechanical impurities), or the amount is insignificant, it is necessary to conduct the feasibility study this step

The used working scheme for collecting residues is the same for all types of vertical tanks, and only the geometry of pipes and fittings is different
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Work stages

2. Cleaning the tank bottom of the product residues, bottom sediments, and sludge

This step is essential because on the bottom of the reservoir is entire volume of accumulated sludge, solids, and sub products which are degraded and unusable because of the long storage time.

The basis of the bottom surface washing process based on the principle of dynamic effect, where jet washing water penetrates surface at an angle.

Thus hydrocarbons accumulated on the surface detach from the surface with the water, and then the pressure raises them to the top due to the lower density.

To effectively clean the bottom of the tank at least two monitors are used.

Depending on a number of side hatches in the tank more monitors can be used accordingly to this number.

If the tank has a side hatch on the top, then monitor can be installed through this hatch.

For each container size certain pumping JetPetroClean™ modules and the hydro monitors are chosen in such a way that would ensure the length of the working jet at least 2/3 of the tank diameter.

For washing we use technical detergent at a temperature of +40 to +80 ° C, depending on the stored product. Internal heaters of JetPetroClean™ system heat the washing solution.

JetPetroClean™ system has built-in steam heaters for heating washing solution, also to keep the temperature at required level. Additionally, the steam for heating the cleaning solution can be picked up from the terminal. Also, our system is able to produce its own steam-using generator JetPetroClean™.

Water reacts with hydrocarbons in the form of a weak mixture and then emulsion is pumped into separator.

In order to ensure efficiency of the process, washing systems and washing technology is chosen in such a way that provides efficient and fast pumping a mixture of water and hydrocarbons to the skimmer for separation.

To improve the efficiency of the process and accelerating the separation inside the skimmer module, we use special technical detergent JetPetroClean and its water-based solution circulates in a closed loop mode.

Hydro monitors (jets) are installed and secured on special work stands. They are attached to the two-stage hinge carriage, which allows angle changing in the required direction.

The module is rigidly fixed on the flange of the open side of the hatch. Due to the fixed construction of the monitor is not required to hold it by hand and the maximum pressure of the wash water can be used.
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Work stages

2. Cleaning the tank bottom of the product residues, bottom sediments, and sludge

Cleaning the tank bottom is made as long as there will be totally free from product residues and sludge all the bottom panels, all pipe fittings, located at the bottom (product pipe heating systems, fence pipe, etc.), all drain holes and relief valves.

The lower panel of a vertical wall of the tank must be washed at least half of its height from the bottom.

If complete degassing is impossible due the presence of residues on the wall of the tank, then degassing will be conducted to a level which allows working on the tank using a class A1 respirators at least 1 hour.

The automatic hydro monitor allows washing also only a certain segment/part of the wall.
It is possible to direct multiple monitors on one particular section of the wall, which will greatly enhance the quality of cleaning.

During the cleaning process, the washed hydrocarbons will flow down, together with wash water at the bottom, and residue is timely pumped into the separator.

When the bottom is completely clean and nothing prevents wash water flowing to the bottom, it is possible to organize a continuous cycle of jetting.

It is possible to use a manual jetting through the side hatch drains on direction from the wall towards the discharge pumps.

The process is carried out without entry of workers into the tank (non man entry method) until the completion of the cleaning and start of degassing process.

If at the bottom some spots are contaminated with highly viscous asphalt deposits, which cannot be removed by this method, they will be removed manually and processed separately.

For this work people allowed entering into the tank after degassing is completed.

Each monitor has two nozzles, which are able to move in required directions: vertical and horizontal.

In the vertical direction nozzle can be raised and lowered in the range of 90 degree, in the horizontal direction nozzle can be rotated from 45 to 360 degree.

The movement of the nozzle is controlled by a pneumatic control device, which allows motion in both directions.
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Work stages

3. Wall washing

This stage is performed in several sequences to provide the necessary quality.

The time required to wash the wall depends on the diameter of the tank, as the large diameter (60m+) lower the jet pressure on the wall. In this case, automatic hydro monitor will be not used and the work will be performed within the tank after degassing is completed to a safe level.

Inside the tank at the bottom we will set on special carriages manual hydro monitors, and they will be used to scour and cleaning the bottom from residues and sediments.

Monitors will be installed in a way that during cleaning process a hazard to workers from pressure jets is prevented.

The walls will be washed using the installed monitors; each monitor operates by one worker, for channelling a jet a washing station can be used.

These scheme is suitable for con roof, floating roof and internal pontoon equipped tanks.
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Work stages

4. The internal ventilation, degassing and drying

Pressure fans are used for ventilation and degassing

Final decontamination is carried out after the cleaning of the bottom and the walls is completed

A gas analyser checks degassing quality, and the analyser readings must comply with the safety standards adopted on the terminal

To reduce emissions of oil vaporization to the atmosphere a filtration unit can be used for air purification from hydrocarbon vapours

In this case, the time required for degassing can be doubled.

Jet nozzle
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Additional processing steps

Nitrating the inner tank space
The nitrogen generator is used to create the explosion and fire safe atmosphere inside the tank while the cleaning process is underway.

All the generated nitrogen is fed into the tank at atmospheric pressure to displace oxygen from the interior atmosphere of the tank and to create a safe concentration of oxygen in the tank at which no ignition of the product and its vapours

The essence of this step is that an inert gas is pumped into the inner space of the tank.

Gas does not support combustion. In this case, nitrogen is used as inert gas.

The amount of nitrogen is selected accordingly - replace atmospheric oxygen to a level at which it is impossible to fire stored hydrocarbons in a tank.

For light and volatile hydrocarbons (gasoline, diesel) the oxygen limit content on the air in which combustion is possible is 12%.

For heavier hydrocarbons, this value is 14%. Nitrating tank allows working with the heavy erosion of the bottom residue using petroleum as diluents.

For the production of nitrogen we use mobile nitrogen generators (produced by third party) It can be installed on site in a separate container or in the container power unit.

Waste treatment
During tank cleaning process all presented hydrocarbons will be removed. In this case created substance is mixed with bottom sediments and sludge.

In the JetPetroClean wash system module hydrocarbon will be separated from water and solids. For a more complete separation of water and solids from the hydrocarbon and for bringing product to the trademark quality hydrocarbon can be processed in special devices: a centrifugal separator or a decanter.

Hydrocarbon is separated from the mechanical impurities and residues of water by the centrifuge depending on its configuration (two-phase or three-phase).

In addition to a centrifugal separator and a centrifuge is possible to use simple mesh filters for purification. Filters can be used as a single filter unit.

The use of a centrifugal separator, decanters and sieves is an optional process and its purpose is to recover the product from residues.

This final quality of the reconstituted product depends on its quality before recovering. The process of product/sludge recovering may be applied in the case of the economic feasibility of the operation.
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Schedule

The time of work depends on many different factors and conditions, mainly on the amount and quality of the residue in the tank, which cannot be removed by regular means (pump).

The influence of various factors may be different for the same identical conditions of the terminal.

When planning the execution of works it is necessary to take into account all possible influencing factors, as well as to plan a reserve time in case of unforeseen circumstances, such as:
- heavier solid deposits that can not be observed during the prior inspection of the reservoir;
- changes in the properties of the product residues during their prolonged detention.

After receiving preliminary information about the scope of the work based on our questionnaire, we can propose estimated time for executing the project.