

APFELBAUM

# WIND TURBINE

Gearbox oil changers

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WTOCH-B | WTOCH-SL





# WTOCH-B



Finally, almost the plug and play solution for the Oil Changes in the Wind Turbines without any hassles. Easy to operate, designed for easy Oil handling and process during the changes: oil draining, Gearbox Re-flushing and cleaning with special oil flushing, cleaning the oil to be delivered, Oil heating capabilities is to make the delivery easy. At any point the unit is accessible for inspection and servicing. To comply with environment control policies, the Oil Changer include the Emergency Oil Spill collection mode; the unit is fully mobile, built on a two axle trailer. A box with convenient roller doors and shutters for the unit operation and control installed on the trailer platform. Two tanks, 950 liter each, are installed for collection of the used oil and for transportation and heating the clean oil. Two motorized reel hoses are installed for simple operation and quick hose handling. The equipment is power independent because it is equipped with a Power Generator. The unit can be towed by wind farm for service team vehicle.

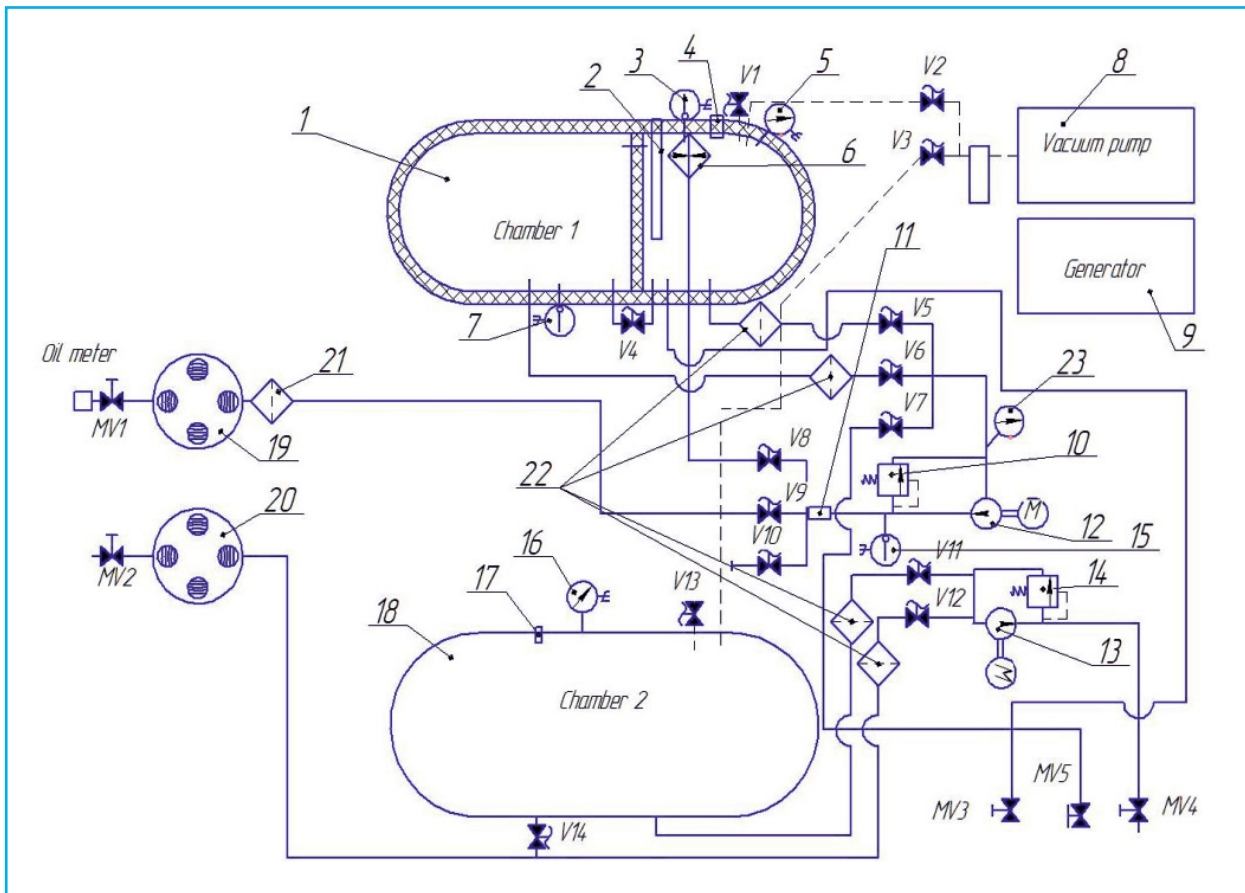
## The box is divided into compartments:

1. Generator compartment. DJ 1200 BG-TE three phase, 10 kW, 3 1. 80V gasoline generator. The generator facilitates independence from shore power.
2. Equipment compartment. This compartment contains: an electrically driven HYDROMAX used oil gear pump, an electrically driven HYDROMAX clean oil gear pump and an electrically driven 10-520 vacuum pump to evacuate tanks; the pumps are connected by piping with electrically driven valves.
3. Control compartment. A 7" touch screen panel facilitates control of the Mitsubishi PLC software. The compartment includes valve switchgear.
4. A storage compartment for accessories and spare parts.

The clean oil tank is equipped with a heater, which allows to prepare the oil even before arriving on site. The gearbox oil is thick, and preliminary heating reduces its viscosity to increase the rate of filling the gearbox with fresh oil.

# WTOCH-B

## Flow diagram



**WTOCH-B Flow diagram:** 1- clean oil tank, 2 - level sensor, 3 - temperature sensor, 4 - critical level sensor, 5 - critical level sensor, 6 - heater, 7 - temperature sensor, 8 - vacuum pump, 9 - generator, 10 - retaining valve, 11 - Flow switch, 12 - delivery pump, 13 - used oil drain pump, 14 - retaining valve, 15 - temperature sensor, 16 - vacuum sensor, 17 - critical level sensor, 18 - used oil tank, 19 - clean oil hose reel, 20 - used oil hose reel, 21 - Filter 12 um, sensor, 22 - mesh Filter, 23 - pressure sensor.

### The unit's functions:

- Used oil drain;
- Clean oil delivery;
- Oil heating mode;
- Emergency oil spill collection mode;
- Gearbox cleaning (with special flushing oil);

**Used oil extraction:** in this mode, the vacuum pump extracts used oil from the wind turbine gearbox into the used oil tank.

**Clean oil delivery:** the gear pump delivers the oil from the clean oil tank to the required height. The oil is filtered through 3 and 25 um filters in the process.

**Emergency oil spill collection mode:** the vacuum pump collects spilled oil from the wind turbine nacelle into the used oil tank.

**Gearbox cleaning with flushing oil:** the gear pump delivers oil to the required height and creates up to 5 bar pressure, washing away the remaining used oil and particulate matter.

Any point of the unit is accessible for inspection and servicing. The box is made of aluminum sheets, the clean oil tank is insulated and coated with an aluminum jacket.

# WTOCH-B

## Flow diagram

On customer request, the cladding of the control compartment and the tanks can be designed for cold or tropical climates. Hose length may vary from 40 to 230 meters, depending on the height of the wind turbine towers at the wind farm.

The process of wind turbine gearbox oil change with the **WTOCH-B** unit is as follows:

1. The «WTOCH-B» is filled with clean oil at an oil storage facility. If necessary, heating is
2. engaged to preheat the oil before servicing wind turbines. The unit is towed to the site by
3. the service team vehicle.
4. The site is prepared for servicing the wind turbine.
5. Workers, materials and tools are lifted to the turbine.
6. Hoses are lifted by the electric hoist installed on the turbine nacelle frame.
7. Oil and oil filters of the gearbox are changed.
8. Hoses are lowered from the wind turbine.
9. Workers, materials and tools descend from the wind turbine tower.

The time required to change the oil in a wind turbine gearbox takes from 2 to 4 hours from the beginning of site preparation to restarting the turbine. Process duration depends on:

1. Wind turbine tower height.
2. Amount of oil changed.
3. Ambient temperature.

### Advantages of the WTOCH-B unit:

1. Numerous intermediate filling and refilling is eliminated.
2. One load of oil in the unit is sufficient to change oil in two 420 liter wind turbine gearboxes.
3. At least two wind turbines can be serviced in one shift.
4. Man hours saving.
5. Oil change is performed by 3-4 workers.
6. High reliability and quality of service (minimum probability of oil spillage and minimum contact of new oil with the environment).
7. The WTOCH-B is equipped with a discharge nozzle and an oil meter to control oil change volume.
8. Minimum wind turbine down time.

### «WTOCH-B» Specifications

Parameter	Value
Used oil extraction rate, m <sup>3</sup> /hour, not less than	0,3*
Clean oil delivery rate, m <sup>3</sup> /hour, not less than	0,4*
Oil temperature in heating mode, Δt °C (max)	70
<b>Electric power (basic):</b>	
Voltage (3 phases), V	440-480
Frequency, Hz	60
<b>*Note: power supply is customizable</b>	
Max power consumption with basic options, kW	8
Oil heater power, kW	3,6
Dimensions, m, max	
length with trailer	5
width with trailer	2,4
height with trailer	1,5
Weight, kg, with trailer (oil tanks empty)	2500

0,3\* - oil temperature 40 °C

0,4\* - oil temperature 45 °C

# WTOCH-SL

gear oil change unit



The unit is fully mobile and is built on a one axle trailer. The unit is transported by the wind farm service team vehicle. The trailer's platform supports a box with convenient doors for easy servicing and control; any point of the unit is fully accessible for inspection and maintenance. The unit is equipped with motorized hose reels for rapid hose deployment and retraction.

## The box is divided into compartments:

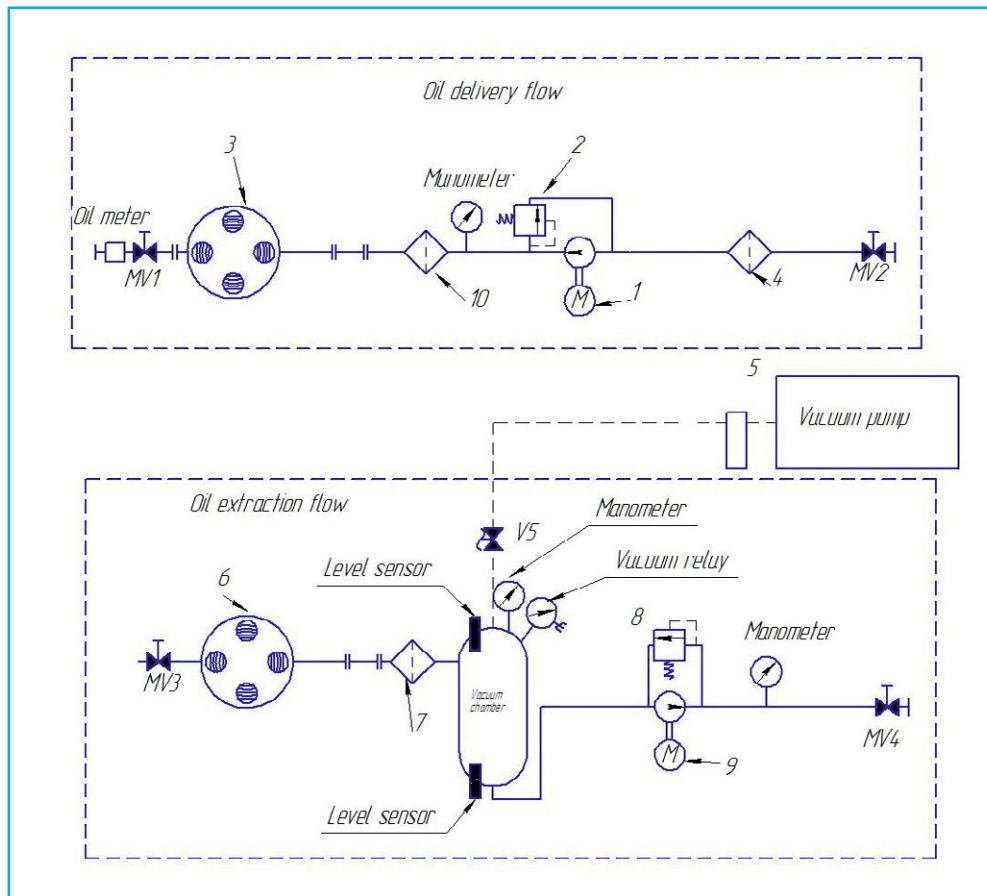
1. Equipment compartment. This compartment contains an electrically driven HYDROMAX gear pump for used oil extraction, an electrically driven HYDROMAX gear pump for clean oil delivery, a CP 10-520 vacuum pump with electric drive to create vacuum in the intermediary tank to accelerate the process; the pumps are connected by piping.
2. Control compartment, contains electric motor switchgear.
3. Accessory and spare parts storage compartment.





# WTOCH-SL

## Flow diagram



**The process flow includes:** 1 - delivery pump, 2 - retaining valve, 3 - clean oil hose reel, 4 - strainer, 5 - vacuum pump, 6 - used oil extraction hose reel, 7 - strainer, 8 - retaining valve, 9 - used oil extraction pump, 10 - 12 µm Filter.

Process parameters and valve control are managed by the controller.  
The outlet of the delivery hose is equipped with a filling nozzle and an oil meter.

### The unit's functions:

- Used oil drain;
- Clean oil delivery;
- Collection of emergency oil spills;

**Used oil extraction:** the vacuum pump extracts used oil from the gearbox into an external vessel.

**Clean oil delivery:** the gear pump delivers new oil to the required height. The oil is filtered by 3 and 25 µm in the process.

**Collection of emergency oil spills:** the vacuum pump collects oil spilled into the wind turbine nacelle.

# WTOCH-SL

## Flow diagram

The process of wind turbine gearbox oil change with the **WTOCH-SL** unit is as follows:

1. The unit is towed to the site by the service team vehicle.
2. The site is prepared for servicing the wind turbine.
3. Workers, materials and tools are lifted to the turbine.
4. Hoses are lifted by the electric hoist installed on the turbine nacelle frame.
5. Oil and oil filters of the gearbox are changed, oil is extracted into an external vessel. New oil for delivery is also taken from an external container.
6. Hoses are lowered from the wind turbine.
7. Workers, materials and tools descend from the wind turbine tower.
8. Transportation of used oil and empty containers from the wind turbine.

### Advantages of the WTOCH-SL unit:

1. Numerous intermediate filling and refilling is eliminated.
2. The process is not bound by filling tanks. Saving man hours.
3. Oil change is performed by 3-4 workers.
4. High reliability and quality of service (minimum probability of oil spillage and minimum contact of new oil with the environment).
5. The **WTOCH-SL** is equipped with a discharge nozzle and a meter to control oil change volume.
6. Minimum wind turbine down time.

### «WTOCH-SL» Specifications

Parameter	Value
Used oil extraction rate, m <sup>3</sup> /hour, not less than	0,3*
Clean oil delivery rate, m <sup>3</sup> /hour, not less than	0,4*
Oil temperature in heating mode, Δt °C (max)	70
<b>Electric power (basic):</b>	
Voltage (3 phases), V	440-480
Frequency, Hz	60
<b>*Note: power supply is customizable</b>	
Max power consumption with basic options, kW	5
Dimensions, m, max	
length with trailer	3,5
width with trailer	2
height with trailer	1,4
Weight, kg, with trailer (oil tanks empty)	950

0,3\* - oil temperature 40 °C

0,4\* - oil temperature 45 °C

The **WTOCH-B** and **WTOCH-SL** gearbox oil changers for wind turbine servicing are manufactured with highly reliable, tested and tried component parts. Each unit undergoes trials to test its compliance with specifications and operation of all components



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