

CENTRAL LUBRICATION SYSTEMS FOR WIND TURBINES

- The single-line system
BEKAWIND SINGLE
- The progressive system
BEKAWIND PRO
- The spray lubrication system
BEKAWIND FLOW

Custom-made
central lubrication systems
for wind turbines

The single-line system BEKAWIND SINGLE can be used for the lubrication of all kinds of bearings of the wind turbine.

The advantages of BEKAWIND SINGLE:

- Electric piston pump with level switch and agitator
- Also available with a follower piston for the installation in the rotor hub
- Pump element with desmodromic actuation for reliable performance
- Single-line distributor with piston control without rubber parts and with high reset force of the metering piston - high permissible system pressure and high operational reliability even with long lines and at low temperatures

System description

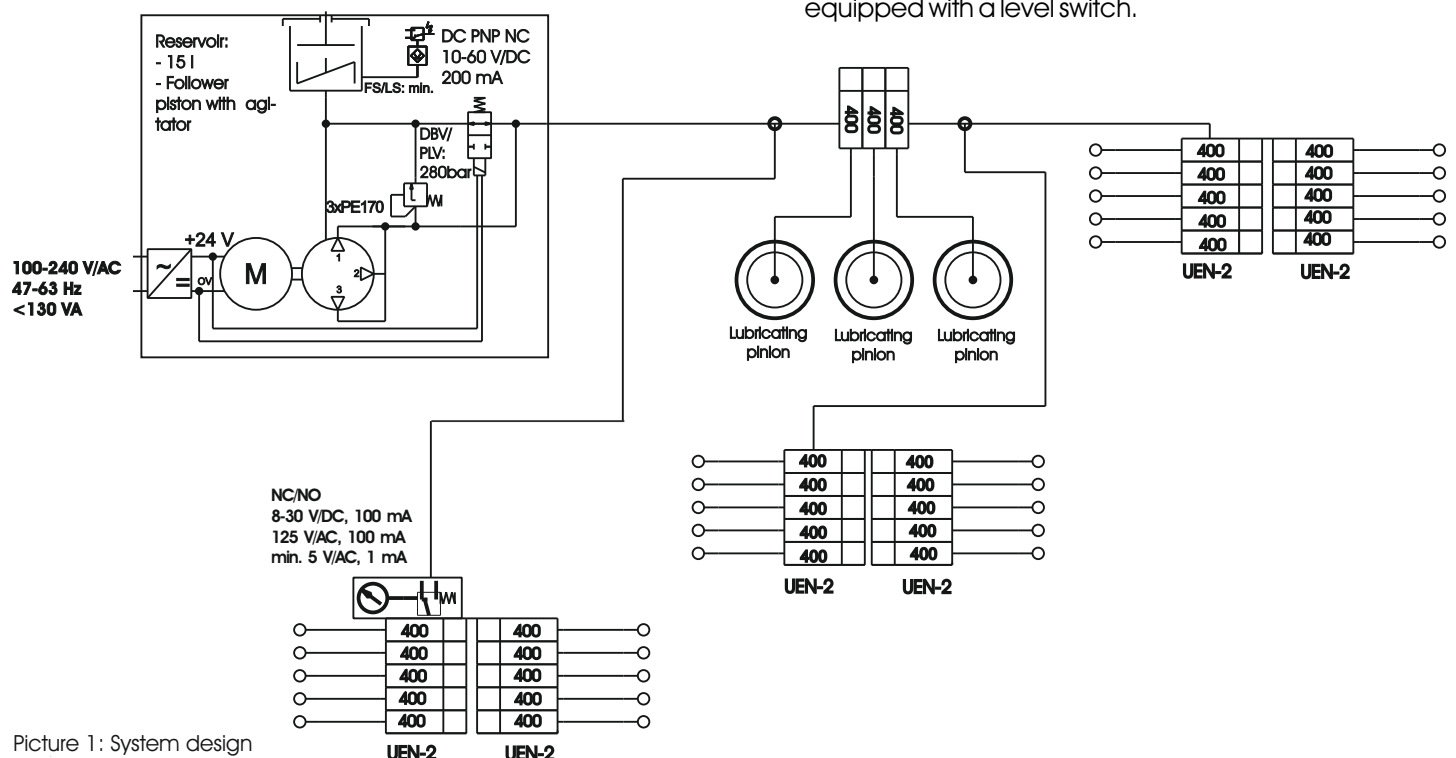
Picture 1 shows the design and the operating principle of a BEKAWIND SINGLE central lubrication system for 3 blade bearings with each 10 lube points and 3 lubricating pinions for the gear rim.

The system consists of an electrical piston pump, 4 UEN-2 distributor assemblies, 3 lubricating pinions, a pressure switch with manometer and the necessary tubes and fittings.

The lubrication system (pump and 3/2-way solenoid valve) is controlled and monitored by the central controller of the wind turbine. The lubricant is supplied into the main line until the switching pressure of the pressure switch, which is situated at the end of the longest feed line, is reached.

To achieve the switching-over of the distributor, the pump and the 3/2-way solenoid valve are switched off to release the pressure line. The single-line distributor now supplies the lubricant to the lube points.

The lubricating system is protected by a pressure relief valve with return flow to the reservoir. The reservoir is equipped with a level switch.



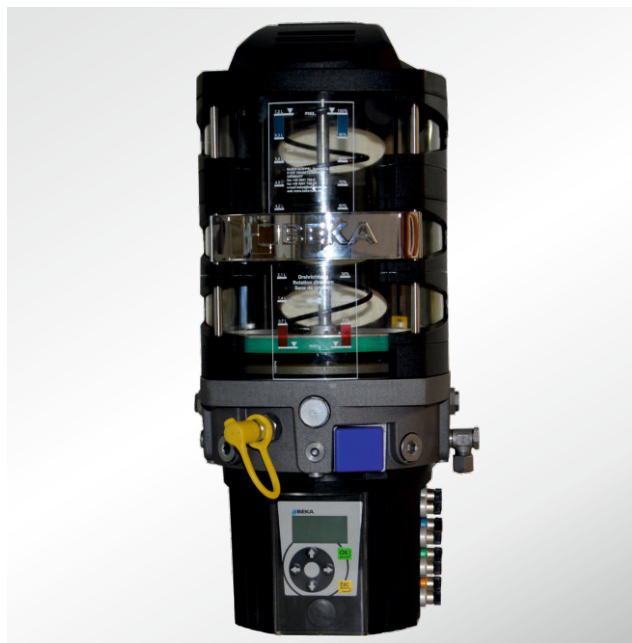
Picture 1: System design

Electrical piston pump GIGA and GIGA PLUS

Electrical piston pump GIGA/GIGA PLUS enables the variable combination (GIGA) and internal linking (GIGA PLUS) of pump elements. The pump can be controlled externally or by an integrated control unit.

In both versions, the lubricant flows through the non-return valve which is integrated into the pump element. The reservoir is equipped with an agitator, in order to ensure fault-free aspiration of the lubricant. This agitator presses the medium into the suction chamber. A wiper attached to the agitator enables visual control of the available grease volume in the reservoir.

The pumps can also be equipped with an electronic level control to show minimal level. For GIGA PLUS, a solenoid valve, a pressure limiting valve (internal) and pressure switch (optional) are already installed into the pump with the single-line function.



Picture 2: Grease lubrication pump GIGA

Single-line distributor UEN-2

The single-line distributors UEN-2 are piston accumulators with a pressure-controlled inlet and outlet valve. The UEN-2 distributors can be extended up to 32 outlets by means of connecting elements.

Due to the inlet and outlet valve according to piston design, high system pressures are possible. Because of the restoring force of the metering piston, high operational safety is given at large line lengths or at cold temperatures.

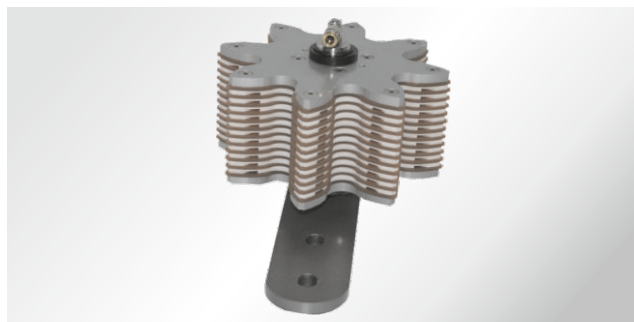
Optionally, the UEN-2 distributors can be provided with grease nipple for emergency lubrication and for filling of distributor and lines.



Picture 3: Single-line distributor UEN-2

Lubricating pinion

The lubricating pinion serves to supply a gear rim regularly. The toothing of the lubricating pinion corresponds to the module of the gear rim. Technical details like module, number of teeth, installation plate and lubricating direction have to be defined individually.



Picture 4: Lubricating pinion

Disposal container

Lubricant collectors can be installed at the old grease outlets of the bearing. The collectors can be installed in each position. The used grease is collected therein.



Picture 5: Disposal container

The progressive lubrication system BEKAWIND PRO can be used for the lubrication of all kinds of bearings of the wind turbine.

The advantages of BEKAWIND PRO:

- Electric piston pump with level switch and agitator
- Also available with the follower piston for the installation in the rotor hub
- Pump element with desmodromic actuation for reliable performance
- Progressive distributor system for high operational reliability even with long lines and low temperatures

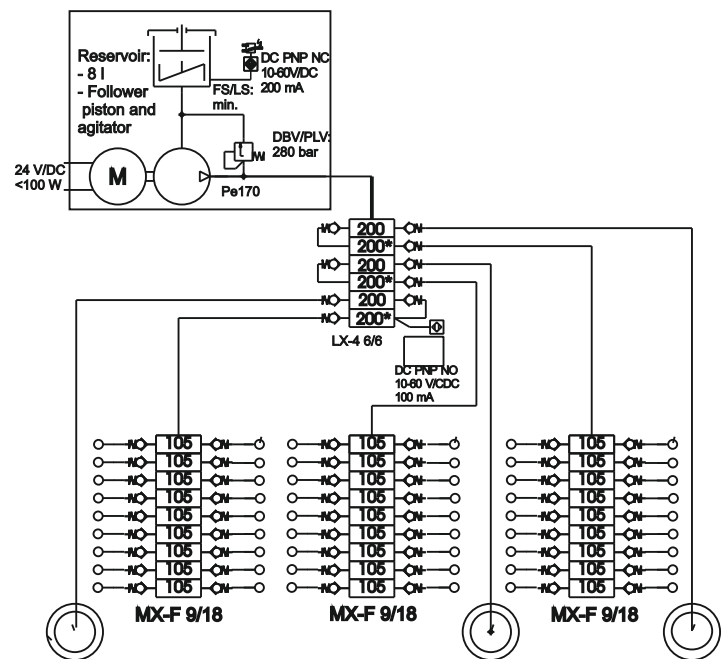
System description

Picture 6 shows the design and the operating principle of a BEKAWIND PRO central lubrication system for 3 blade bearings with each 18 lube points and 3 lubricating pinions for the gear rim.

The lubrication system consists of an electric piston pump, a main distributor and 3 secondary distributors with corresponding fittings.

The lubrication system is controlled by the central controller of the wind turbine. The lubrication pump is operated until the main distributor has passed the necessary number of cycles. The number of cycles and the monitoring of the distributor is made by a proximity switch which is integrated at the main distributor.

The system is protected by a pressure relief valve with return flow to the reservoir. The lubricant level in the reservoir is monitored by a level switch.



Picture 6: System design of BEKAWIND PRO

Electric piston pump FKGGM-EPR

The electric piston pump FKGGM-EPR (picture 7) was designed especially for the operation in wind turbines. Because of the follower plate in the reservoir, the pump can be installed in each position, even in any rotating environment.

The pump element with desmodromic drive and the agitator in the reservoir guarantee an ideal suction performance even under difficult circumstances. The pump can also be delivered without follower piston for non-rotating applications (FKGGM-EP).



Picture 7: Central lubrication pump FKGGM-EPR

Progressive distributor MX-F/LX-4

The progressive distributors from the MX-F/LX-4 series (picture 8) are designed to be adapted easily to the number of lube points required to be serviced.

Because of the modular design, different delivery rates can be designed into your system. The delivery rate of each distributor disk is determined by the diameter of the piston. Each distributor needs at least 3 piston elements for correct function.



Picture 8: Progressive distributor LX-4

Monitoring of the distributor

Progressive distributors have an hydraulic sequence control. The pistons of the distributor are regulated by the incoming lubricant in an inevitable and consecutive way. If there is a disturbance in the flow, e. g. if a lube point or a line is blocked, the whole distributor stops working. The pressure relief valve activates and the lubricant returns to the reservoir.

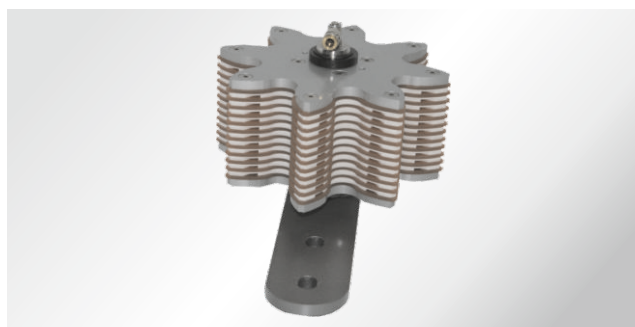
For the monitoring of the whole system or for the cycle control, the distributors can be equipped with a proximity switch (picture 9).



Picture 9: Proximity switch

Lubricating pinion

The lubricating pinion serves to supply a gear rim regularly. The toothing of the lubricating pinion corresponds to the module of the gear rim. Technical details like module, number of teeth, installation plate and lubricating direction have to be defined individually.



Picture 10: Lubricating pinion

Disposal container

Lubricant collectors can be installed at the old grease outlets of the bearing. The collectors can be installed in each position. The used grease is collected therein.



Picture 11: Disposal container

The spray lubrication system BEKAWIND FLOW can be used for the lubrication of all open toothings and friction points of wind turbines.

The advantages of BEKAWIND FLOW:

- Precise application of the lubricant
- Lubricant supply between the gear wheels even during intermeshing and standstill
- Only the friction points are lubricated
- No need for blade or yaw movements for lubricating
- Very low lubricant consumption
- No over lubrication and therefore no pollution
- Exact monitoring of the lubricant use

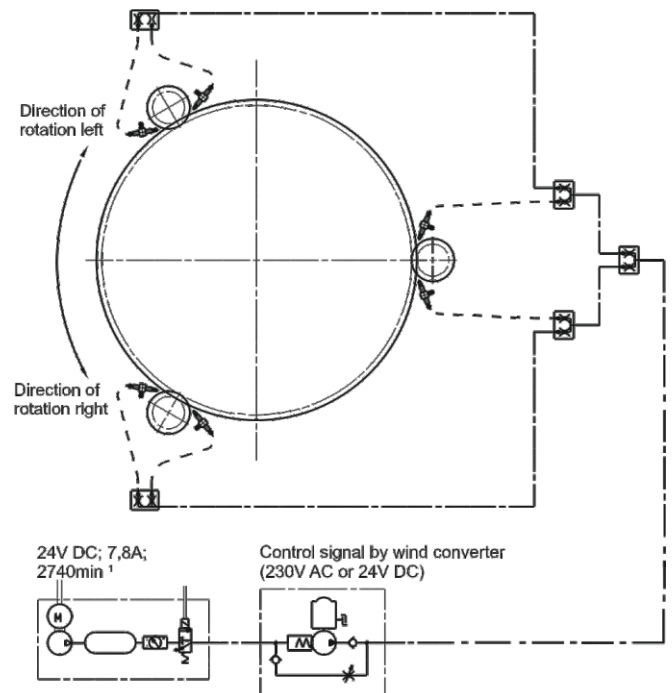
System description

Picture 12 shows an exemplary design and the operating principle of a BEKAWIND FLOW spray lubrication system for the lubrication of yaw drive and pitch drive.

The system consists of a compressor unit (compressor, pressure vessel, controller), pneumatic pump, 3/2-way solenoid valve, mixing distributor and spray nozzles.

The compressed air produced by the compressor is stored in a pressure vessel. If required, the pneumatic pump is actuated by the compressed air. The pump generates the spray mixture, which is distributed evenly by the mixing distributors to the connected spray nozzles.

For the lubrication of the pitch gear a rotating duct is necessary. If it is not available and cannot be retrofitted, it is possible to install a rotating compressor unit.



Picture 12: System design BEKAWIND FLOW

Compressor station

The compressor (picture 13) generates compressed air and keeps it in the pressure vessel at the necessary pressure. If the system is activated, e. g. if the motors of the yaw drive start working, compressed air is applied to the pneumatic pump.

The lubrication system can be controlled and monitored either by an integrated controller or by the control system of the wind turbine.



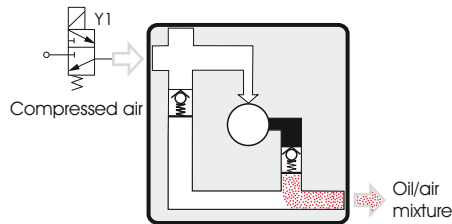
Picture 13: Compressor station

Pneumatic pump

The pneumatic pump (picture 15) is triggered and actuated by a 3/2-way solenoid valve Y1 (picture 14).

The pneumatic piston is pressed by a spring into the upper position and draws the lubricant into the ring chamber. The pump is designed to deliver lubricants with high solids contents.

The compressed air presses the piston down and the lubricant in the ring chamber is delivered to the outlet.



Picture 14: Pneumatic diagram



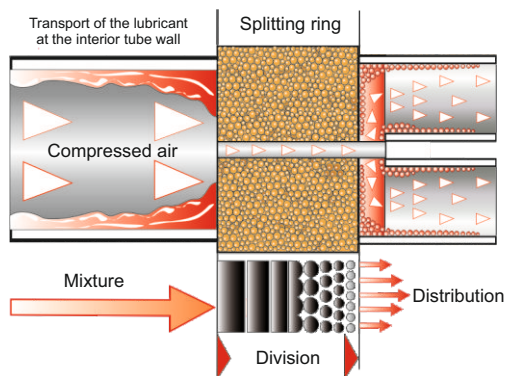
Picture 15: Pneumatic pump

Mixing distributor

The lubricant is transported with compressed air along the interior tube walls (picture 16).

The patented splitting insert of the mixing distributor (picture 17) divides the lubricant. A porous insert collects the liquid particles, splits them up to tiny droplets (0,15 mm or less) and distributes them like a drizzle to the airstream.

This principle guarantees a homogeneous mixing ratio even with several spray nozzles.



Picture 16: Transport and distribution of the lubricant



Picture 17: Mixing distributor

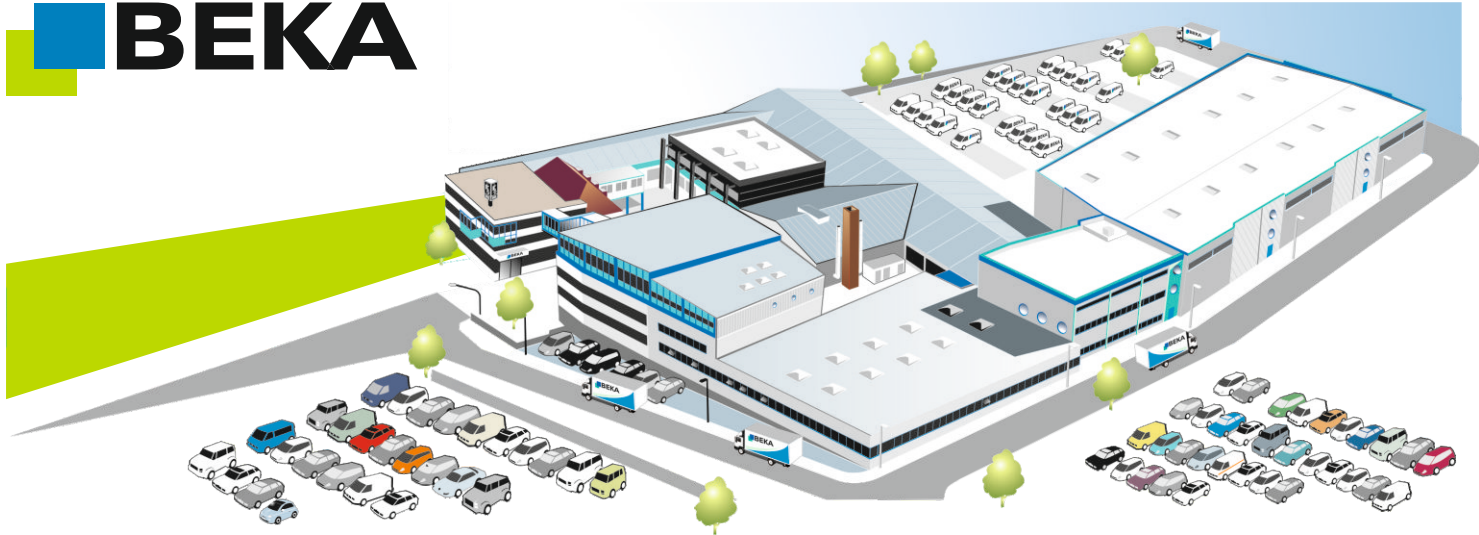
Spray nozzles

The spray nozzles (picture 18) precisely apply the lubricant onto the gear rim without polluting other components.

Size and spray form of the spray nozzles depend on the application.



Picture 18: Straight and angled spray nozzles



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