

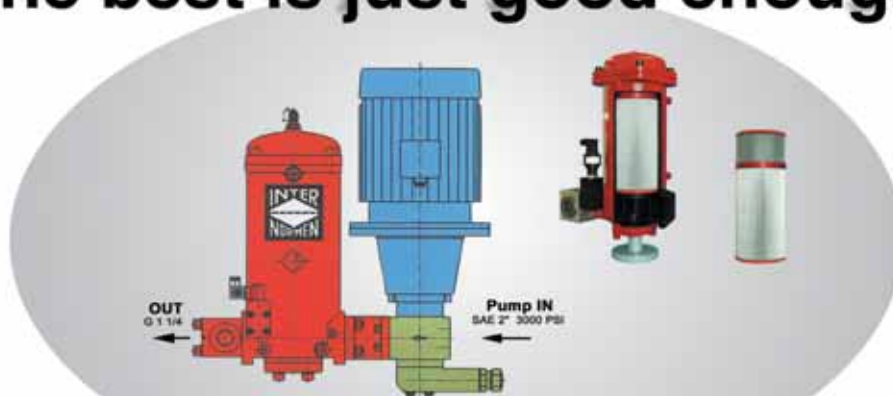
INTERNORMEN

The Twinfil-Filter System



World Wide Competence

The best is just good enough.



The Twinfil-Filter System

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system technology





Experimental trial of the cold start course for a lubrication system of a windpower gear at INTERNORMEN *Technology* GmbH

The lubrication systems for gears in mechanical energy transfer systems have to accomplish the following functions :

- Reliable supply of all lubricating points of the gear
- Low external energy demand of the lubrication system
- Proper reduction of the heat energy generated in the gear
- Reliable filtration of the contamination mainly due to wear by friction within the gear
- Deaeration of the lubrication system, specially during start-up and also during normal operation
- Low noise emission of the lubrication system
- Simple service
- Indication of the state of operation

The essential components of the lubrication systems are:

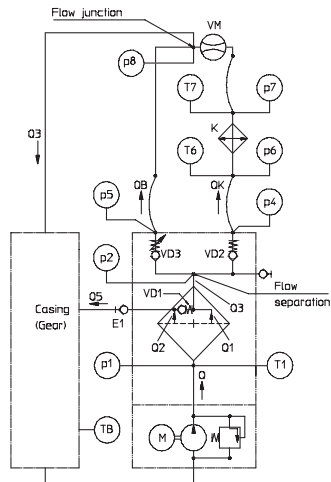
- the generator of the volume flow
- the filter
- the cooler
- the tube system
- the valve system
- and the indication system

The different versions of mechanical energy transfer systems, the loss in performance of the gear and the climatical and environmental conditions have an influence to be considered for the general conception of the lubrication system. A 100 % reliability of the lubrication system under all operation states can only be achieved, if well-proved components which are known in their detailed function are combined to a system. To consider the minimum of cost of the lubrication system in the foreground and to choose components whose special system function is not experimentally proved, would cause the risk of failure cost which are in an unjustifiable proportion to the surplus price of a properly running system.

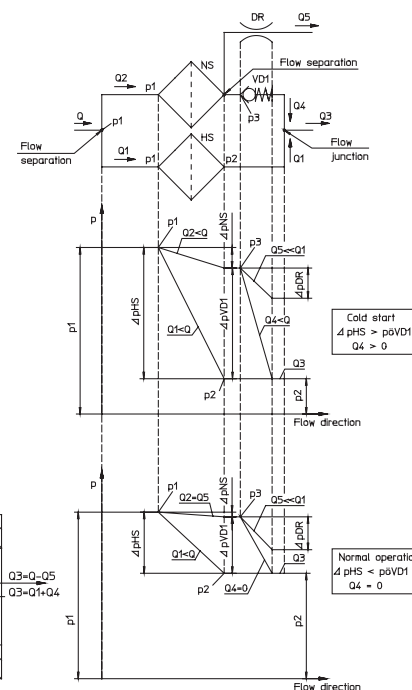
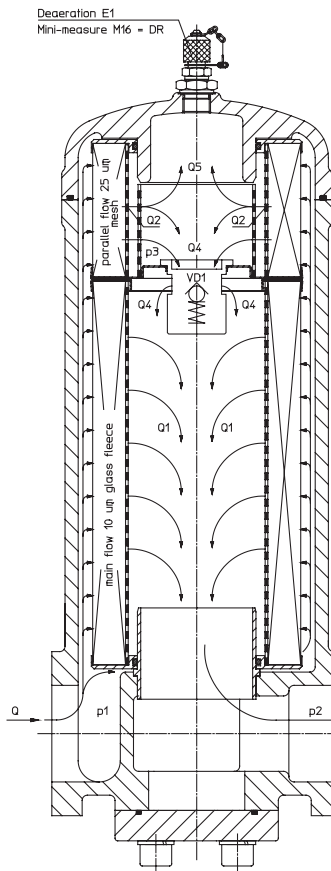
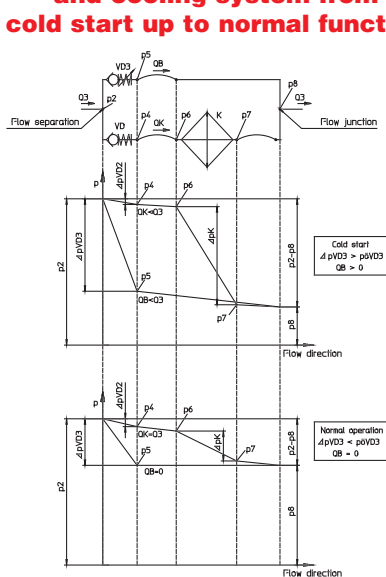
In cooperation with various projects of wind power plants, the gear manufacturer Eickhoff, the pump manufacturer Rickmeier and the cooler manufacturer ASA-Hydraulik, the company *INTERNORMEN Technology* developed a co-ordinated conception for the lubrication system of gears in wind power plants. This conception can be particularly adapted to the special versions and stages of performance of the wind power plants. Uncomplicated components from the manufacturers' standard range which are properly running and easy-to-service are the essential factors for a reliable function of the system and a quick service to be maintained long-term.

Total lubrication system

- Legend
- p1 Pressure filter ON
 - p2 Pressure filter OFF
 - p4 Pressure hose ON
 - p5 Bypass ON
 - p6 Pressure cooler ON
 - p7 Pressure cooler OFF
 - p8 Pressure flow junction
 - TB Temperature casing
 - T1 Temperature filter ON
 - T6 Temperature cooler ON
 - T7 Temperature cooler OFF
 - VM Flow measuring device
 - K Cooler
 - Q Oil flow pump
 - Q1 Oil main flow filter
 - Q2 Oil parallel flow filter
 - Q3 Oil flow to the gear
 - Q5 Deaeration flow
 - OK Oil flow cooler
 - OB Oil flow bypass
 - E1 Permanent deaeration
 - VD1 Valve with filter element 51 PSI
 - VD2 Valve to cooler 7 PSI
 - VD3 Valve to bypass 87 to 174 PSI

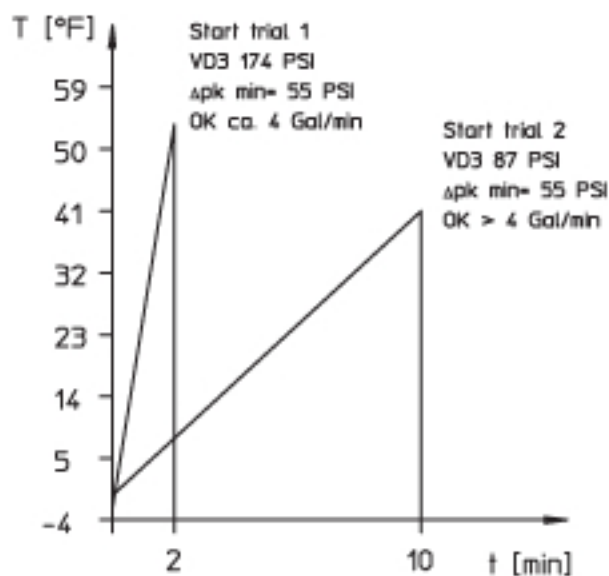


Function course of the valve- and cooling system from cold start up to normal function



Function course of the filter from cold start up to normal function

The lubrication system developed by *INTERNORMEN Technology* and co-ordinated with the users and before-mentioned co-operating partners has proved its general functionality by special experiments. Cold start conditions up to -4°F ambient temperature were simulated, and the special gear oil was used. The oil cross-flow of the air-oil-cooler cooled down to -4°F could be achieved after 2 minutes. The time until an evident increase of temperature T_7 at the cooler outlet, respectively until an oil cross-flow Q_K of about 20% of the total flow Q in the range of set pressures from 87 to 174 PSI and from 10 to 2 minutes could be influenced by an adjustable pressure difference valve VD3. All system components such as the pump, the filter, the valve system of the filters as well as the tube system worked properly from the cold start up to the maximum temperature of 158°F without any negative effects on the total function of the oil supply to the gear. At any time the oil flow Q was filtered 100 %, and the oil flow was conducted in full extent - except of the deaeration flow Q_5 - through the main element HS, filter fineness $10\ \mu\text{m}$ glass fibre fleece at oil viscosities $< 4635\ \text{SUS}$. To indicate the respective states of operation *INTERNORMEN Technology* offers electric, electronic and visual pressure difference indicators which are connected with the filter without any tubes. For the protection of the pump a further combined protective filter with mesh width of 250, respectively $500\ \mu\text{m}$ and a permanent magnet is being prepared as a supplement to the proved lubrication system.



Evaluation of the start trials

