Instruction and service manual

CE

Rietschle

Vacuum pumps

VLV

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- VLV 40-3
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VLV-2

VLV-3

BE 140

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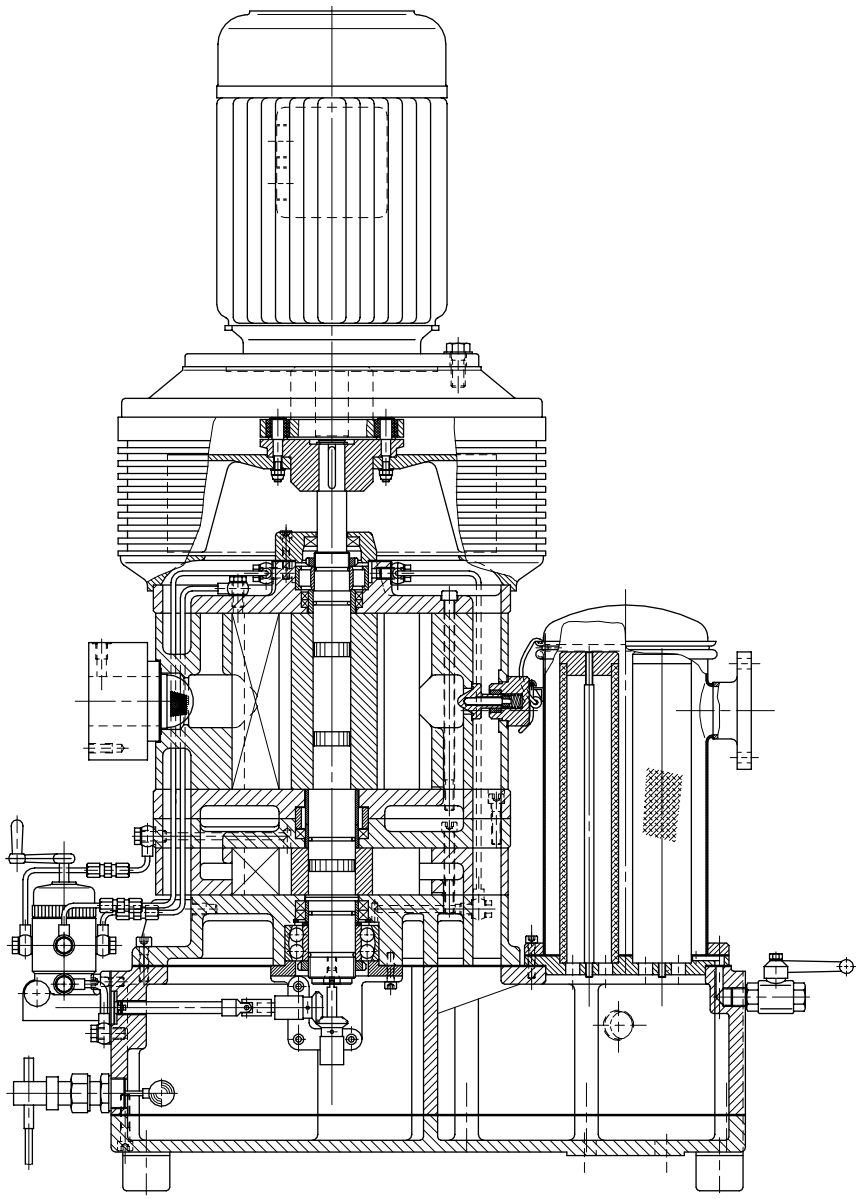

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1. Introduction

In the event of a pump being returned to us, for whatever reason (eg.repair) it must be free of all dangerous and toxic material. A corrosponding certificate has to be presented!

Explosion proof standards for the plant in which the vacuum pump will be installed, are the responsibility of the customer and should have the approval of the appropriate factory inspectorate..

2. Applications

VLV vacuum pumps are available for handling a wide range of gases including those which are extremely moist or aggressive. They can also handle large quantities of water vapour.

The ambient and suction temperatures may be between 5 and 40° C. For temperatures out of this range please contact your supplier.

Suitable equipment should be fitted to prevent slugs of liquid or solid particles being drawn into the pump.

Handling of explodible gases or vapours only on request with our company.

The standard versions may not be handled in explosion areas. Special Ex-proof versions can be supplied.

For installations that are higher than 1000 m above sea level there will be a loss in capacity. For further advice please contact your supplier.

All applications where an unplanned shut down of the pump could possibly cause harm to persons or installations, then the corresponding safety backup system must be installed.

3. Design and Construction

3.1 Models

The VLV range is available in 5 capacities: 25, 40, 60, 80 and 100 m³/hr

These, in turn, are available in 2-stage and 3-stage versions. 2-stage vacuum pumps reach an ultimate vacuum of 0.5mbar, and 3-stage vacuum pumps 0.02 mbar. Cooling is by a centrifugal fan, between motor and last compressor stage, which draws the cooling air through air ducts in the compressor units.

3.2 Construction of 2- and 3-stage VLV

3.2.1 General construction details

VLV machines are 2- or 3- stage vacuum pumps featuring fresh oil lubrication.

The individual stages are stacked, the rotor shaft being vertical.

The drive motor is situated at the top, above a centrifugal fan which is followed by the LP-stage, MP-stage and HP-stage. The MP-stage is omitted from 2-stage versions.

The entire base unit stands on a combined fresh oil and condensate/used oil reservoir.

A by-pass valve is fitted between LP- and HP-stage, and also between MP- and HP-stage in the 3-stage model, to prevent overcompression at low vacuum (from VLV-40 capacity only).

Condensate discharge channels are provided in the bottom of the compression chambers. Condensate can therefore flow out even when the pump is not running.

3.2.2 By-Pass Valves.

Two spring-loaded by-pass valves are provided between HP-/MP and MP- /LP stages. These valves have the following functions: when the pump is started at atmospheric pressure, the valves open owing to the excess pressure between stages. This excess pressure is due to the greater suction capacity of the LP-stage. The gas now flows directly into the exhaust until the pressure between stages falls below atmospheric pressure owing to the lower suction.

3.2.3 Cooling

The entire VLV range is air-cooled. A centrifugal fan is mounted on the pump driving shaft between drive motor and LP-stage. It draws fresh air between HP-stage and oil reservoir. The air rises through ducts in the casing of the individual stages and is expelled by the fan.

3.2.4 Lubrication

An oil lubricating pump, supplying fresh oil to the compression chambers of the 3 or 2 stages and to the upper rotor bearing, is mounted on the fresh oil reservoir. The VLV-2 oil lubricating pump has 4 lubrication points and the VLV-3 has 6.
The lubricating oil flows from the upper rotor bearing, through orifices in the casing cover and a pipe, to the lower rotor bearing. It then flows into bearing cover B which lubricates the oil pump drive. From this container the oil passes through an overflow orifice, back into the fresh oil reservoir.

3.2.5 Oil separation

The oil-containing exhaust flows from the HP-stage into the used oil and condensate reservoir. A large proportion of the oil separates from the air.
The remaining oil is then separated in the oil mist separator in candle filters which are over 99% effective. Technically pure air is obtained at the outlet.

3.2.6 Sealing of stages

LP- and HP-stages are sealed from the bearing chamber by two respective shaft seals.
Shaft seals which come into contact with the suction medium are made of PTFE, Viton being used elsewhere.
The rotor bearings do not come into contact with the suction medium.

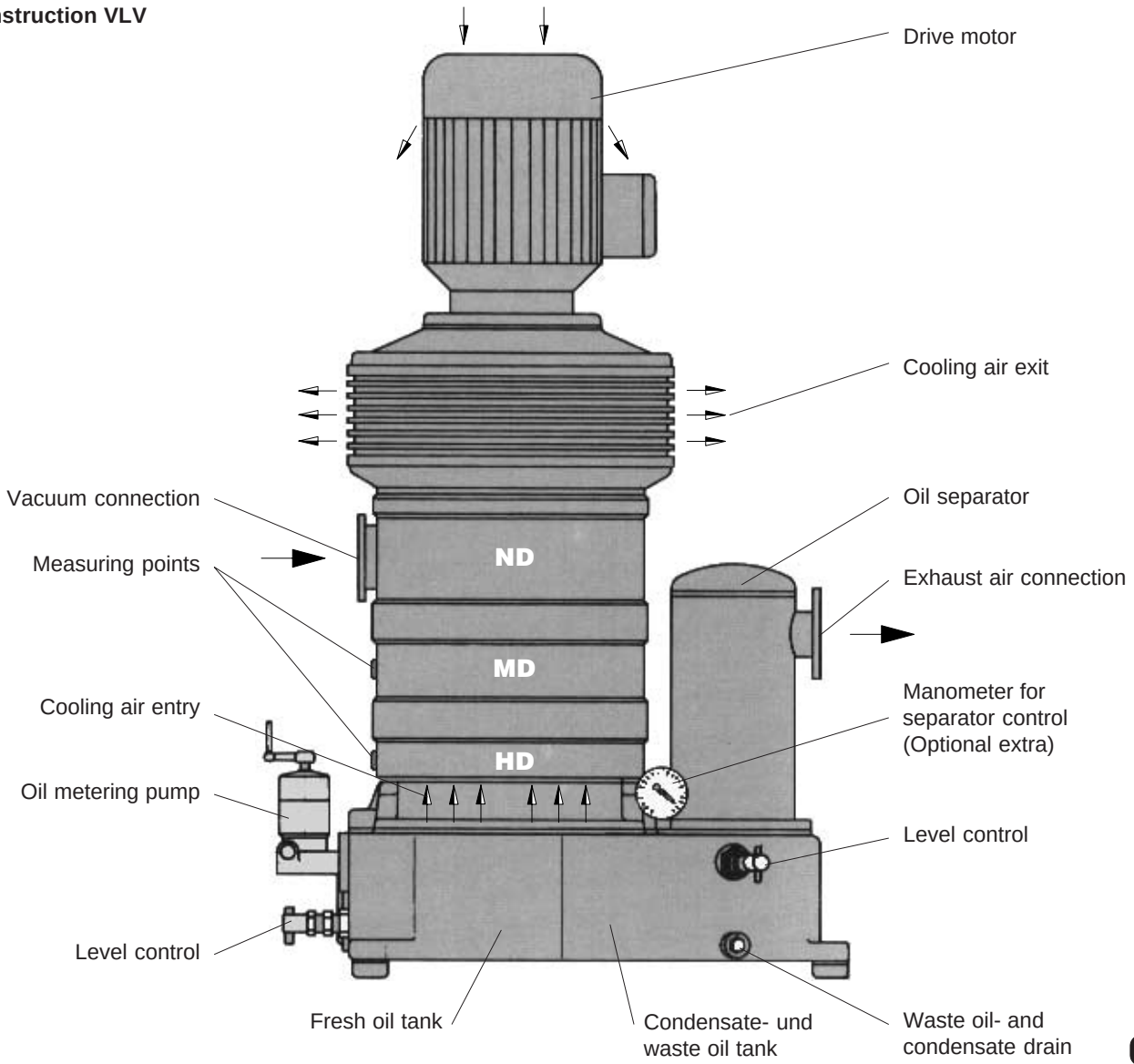
3.2.7 Drive

The drive is transmitted from the motor to the compressor stages directly by a flexible coupling.

3.2.8 Standard VLV design

- Flange connections according to DIN 28404
- Stainless steel oil mist separator
- Brass level switch (fresh oil reservoir)
- Stainless steel level switch (condensate and used oil reservoir)
- Grey cast iron condensate and used oil reservoir
- Exhaust connection in 3 different directions is possible (see D 140 and D 141)

Construction VLV



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3.2.9 Optional extras

Suction side:

- Non-return valve
- Bleed valve
- Solid/liquid separator

Exhaust side:

- Halar-coated oil mist separator

General:

- Electric control system with pre-run and post-run
- Flushing system
- Auxiliary oil reservoir
- Automatic condensate outlet
- Gauge for separator monitoring

3.2.10 Typical applications

- Vacuum for printed circuit board production
- Carbonisation in drink production
- Vacuum packaging of moist products
- Vacuum cooling of foods
- Vacuum filtration
- Vacuum drying
- Vacuum crystallisation
- Thickening of liquids, juices and extracts

3.2.11 VLV pumps with Roots blowers

VLV machines may be used as auxiliary pumps in conjunction with Roots blowers.
Suction capacities of up to 1,500 m^3/hr and final pressures of up to 1 x 10^{-4} mbar (abs). are achieved according to size and number of Roots blowers.

3.2.12 Advantages of the VLV range

- Simple installation, no water supply, low motor power
- consumables, no coolant required
- minimum problems of disposal due to minimum consumables
- environment-friendly oil mist separator

3.2.13 Conditions for use of VLV vacuum pumps

- suction medium should be free from liquids and solids
- pump should be installed, if possible with intake and delivery pipe draining away from the pump. This prevents condensate returning to the pump.
- Pre-run and post-run of the pump always necessary when handling aggressive media. Pre-run and post-run require closed suction valve but open bleed valve at about 80 mbar intake pressure. The pump is brought to operating temperature to avoid condensation in the cold pump (pre-run).
- After the process, aggressive residues are flushed out by the injected fresh oil, and the pump is purged before a stoppage (post-run). The pre-run and post-run last about 20 to 30 minutes.
- Adequate pump cooling must be provided (see 4.1.1 Installation).
- Check whether ambient air is aggressive as aluminium and brass parts may be corroded (avoided by coating and special steel parts).

3.2.14 VLV capability

Use of this pump is generally restricted by the following criteria:

1. Intake temperatures:
   - 60°C (low vacuum > 10 mbar)
   - 100°C (high vacuum < 10 mbar)
2. Intake pressures
3. Suction capacity
4. Product restrictions:
   - pump corrosion
   - reaction product - oil
   - reaction product - metal

4. Installation and Commissioning

4.1 Mechanical installation

4.1.1 Installation

Pumps that have reached operating temperature may have a surface temperature of more than 70°C depending on a set temperature at the thermostat. WARNING! Do Not Touch.

VLV vacuum pumps do not vibrate and do not require special floor fixings. Care should be taken to align the pump correctly during installation. Cooling air inlet and outlet must be at least 0.5 m from the nearest wall. The ambient temperature in the installation area should not exceed 35°C. The pump should be easily accessible for maintenance and repairs.

The VLV pumps can only be operated reliably if they are installed vertically.

For operating and installation follow any relevant national standards that are in operation.

4.1.2 Suction side

Connect suction pipe to A (see D 140 and D 141) (standard ISO flange). This pipe should be as short as possible. If it is longer than about 5 m, it must have a greater nominal width than the pump flange. Pumps must not be stressed during installation (intermediate expansion joints may be fitted). Appropriate separators should be installed on the suction side for protection against solids and liquids (accessories).

Solid particles of more than 5 µm and liquid slugs are able to destroy the compressor stages.

4.1.3 Exhaust

The exhaust resistance within the pipework should not exceed 0.3 bar overpressure.

4.2 Electrical installation

4.2.1 General

Compare the electrical data of the motor and control system with available mains supply (type of current, voltage, supply frequency, permitted amperage) (see data plate (N) in D 140 and D 141). Connect pumps via a motor starter to protect the motor, and standards relating to strain relief of the connecting cable should be complied with.
We recommend the use of motor starter with thermal and magnetic overload protection. A temporary overload may occur during a cold start.

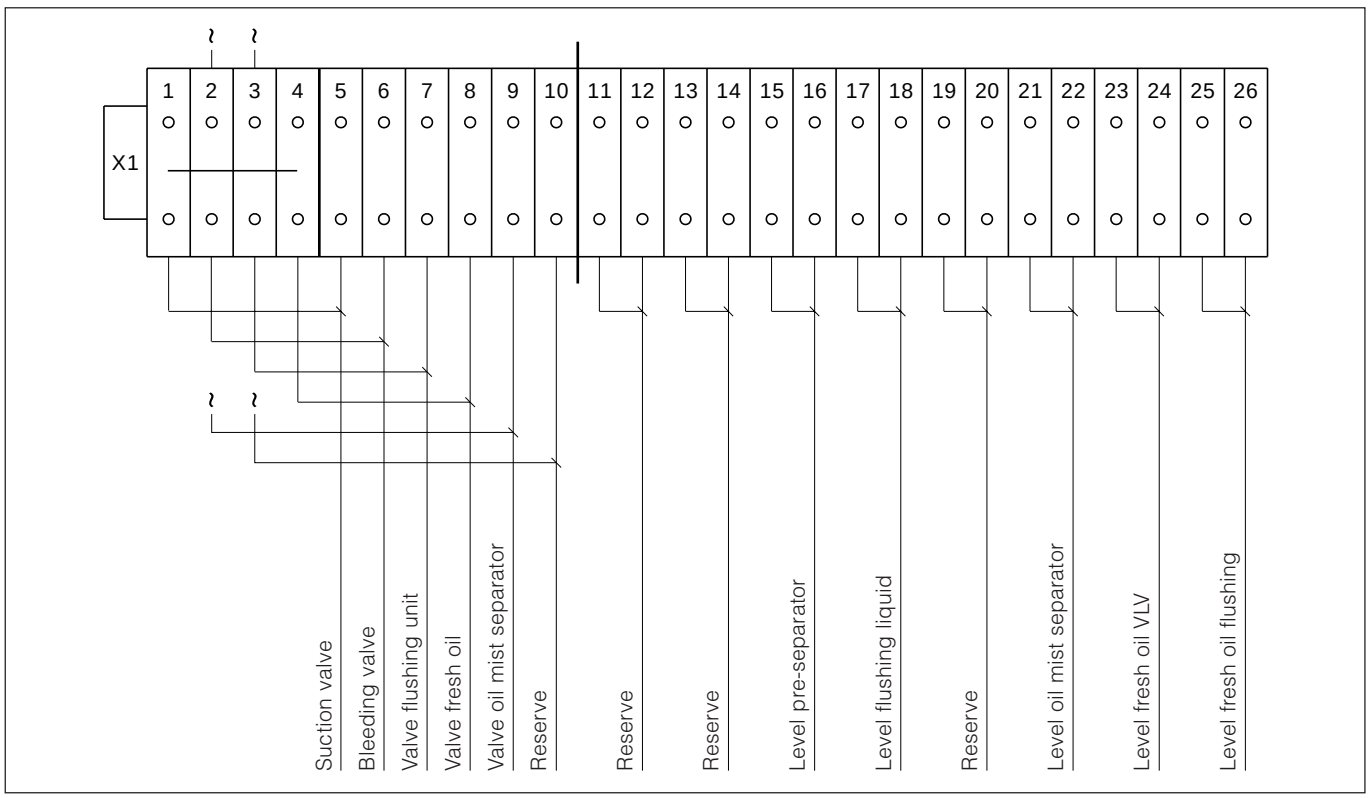
The electrical installation may only be made by a qualified electrician under the observance of EN 60204. The main switch must be planned through the operator.

The approximate values for setting motor overload protection should be obtained from the motor manufacturer or motor nameplate.

4.2.2 Electrical connections for motor and control of monitoring systems

All electrical connections for the motor and for the control of the monitoring systems are housed in terminal boxes. Each conductor terminal is numbered, and all connections for motor and monitoring elements are allocated a specific number (see circuit diagram). Connection numbers must be observed during refitting or repair work to simplify detection of causes of faults.

4.2.3 Terminal box Connections



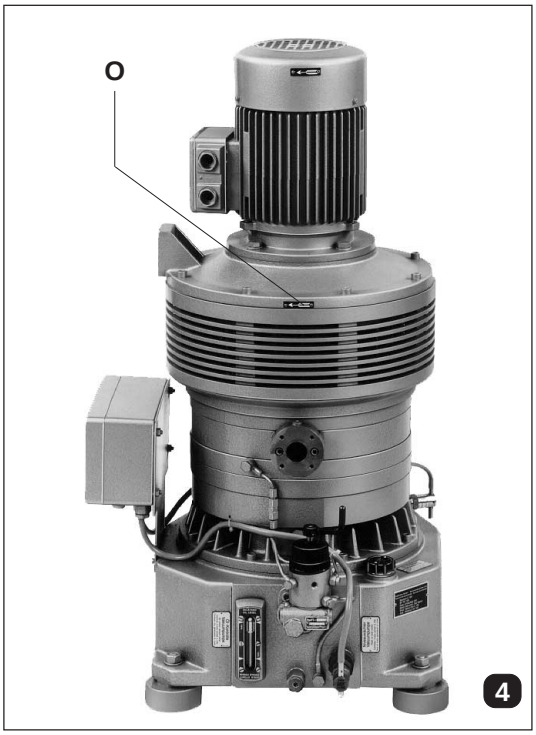
4.3 Initial Operation

Warning –> Start-up with pipework

At start-up, severe damage may occur if there is debris in the pipework. We therefore recommend a vacuum tight inlet filter of 5 micron rating is installed for start-up.

Start the pump briefly to check the direction of rotation (see arrow (**O**)).

Warning. When handling moist and aggressive media, the vacuum pump must be operated against the closed suction side but open bleed valve (accessory) before and after the process. Pre-run and post-run last about 20 to 30 minutes. The pump is brought to operating temperature during the pre-run to prevent condensation of moist media inside the pump. Residues are flushed out by the post-run and are purged before stoppage. Pre-run and post-run take place automatically when the selector switch is set accordingly.



5. Lubrication

5.1 Oil lubrication

The pump is despatched, normally, with full oil reservoirs, but the oil level should be checked as a precaution. The reservoir is full when the oil reaches the top of the gauge.
An oil level switch is normally fitted for the fresh oil reservoir. It automatically switches off the vacuum pump when the minimum oil level is reached. The vacuum pump can be started again once the reservoir has been filled to the top of the gauge.
If an auxiliary oil reservoir is fitted, the appropriate gauge on the auxiliary reservoir should be checked.
We recommend the following oil brands: Bechem VBL 100, BP Energol RC 100, Esso rotary oil 100, Mobil vacuum pump oil heavy, Shell Tellus oil C 100 or Aral Motanol HK 100. Other lubricants may only be used after consulting the supplier.

Old and used oil must be disposed of corresponding with the relevant health, safety and environmental laws.

If the oil brand is changed. The old oil must be drained completely from the tank and the oil cooler.

5.2 Oil metering Pump

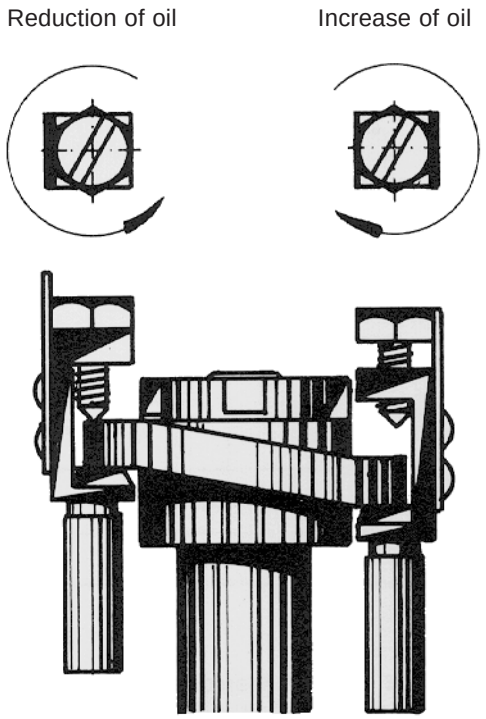
The oil metering pump is set to necessary output at the factory.

This rate can only be changed on request to our Company.

This rate can only be changed on request to our Company by turning the regulating screw. The capacity will be changed about $^1/_3$ per revolution. Reduce oil counter-clockwise, increase oil clockwise.

Oil must be pumped into the pipes by the crank (about 150 to 200 revolutions) at first start-up, after a stoppage of more than 1 week, after exchange of stages, after cleaning of the oil pump and after work on the oil pipes.

Oil metering pump



Oil Consumption for VLV: **l/hr**
Oil Consumption for VLV + Roots booster on request

VLV	25-2	25-3	40-2	40-3	60-2	60-3	80-2	80-3	100-2	100-3
50 Hz	0.065	0.097	0.065	0.097	0.065	0.195	0.065	0.195	0.065	0.195
60 Hz	0.078	0.117	0.078	0.117	0.078	0.234	0.078	0.234	0.078	0.234

6. Maintenance

When maintaining these units and having such situations where personnel could be hurt by moving parts or by live electrical parts the pump must be isolated by totally disconnecting the electrical supply. It is imperative that the unit cannot be re-started during the maintenance operation.
Do not maintain a pump that is at its normal operating temperature as there is a danger from hot parts or hot lubricant. Hazardous substances must be removed before serving. Maintenance personnel should be informed regarding the presence of anything harmful and also be informed about all relevant safety regulations before carrying out any work.

6.1 Oil lubricating pump

Special maintenance of the oil lubricating pump is not necessary during operation. Please ensure that there is always sufficient fresh oil in the reservoir to prevent air being pumped into the pipes. Should this occur, pipes which deliver against pressure should be released at the lubricating point and should not be reconnected until the discharged oil is free from air bubbles. Petrol or petroleum products must be pumped through the lubricating pump at least once a year, and the pipes must be cleaned. The fresh oil reservoir must also be flushed out. The lubricating pump should be cleaned if it is not used immediately after delivery or has not run for several months (see storage procedure on page 7). Oil residues in the ports may have solidified and adversely affect operation of the pump.

6.2 Oil mist separator

(Exhaust side accessory)

Oil mist separators are flanged directly onto the vacuum pump exhaust flange. Separation invariably takes place in two stages:

- separation of liquid droplets in the condensate receiver.
- separation of aerosols in the candle filters.

Oil mist separators are available in three different materials for the chemical-pharmaceutical industry.

- stainless steel 1.4541
- stainless steel 1.4541, halar-coated

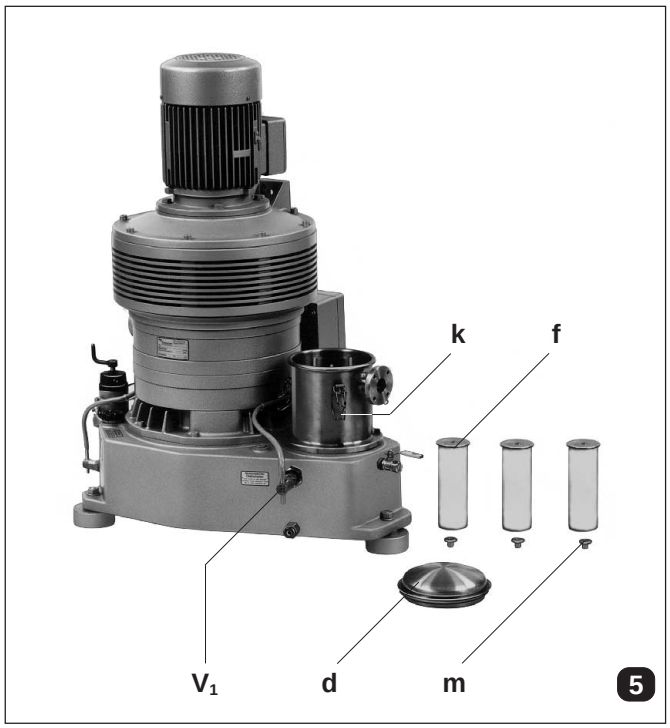
The candle filters are made of Teflon to guarantee complete resistance to solvents and partial resistance to acids.

Note. It is not advisable to employ this method of separation with products which polymerise or become resinous. The filters clog rapidly and necessitate intensive maintenance and costly exchange of filters.

6.2.1 Maintenance of oil mist separators (fig. 5)

Increased power consumption by the drive motor owing to higher filter resistance of the oil mist separator necessitates exchange of candle filters and cleaning of reservoirs.

Exchange of candle filters: oil reservoir cap (d) and O-ring may be removed by opening. Release retaining cap (m), exchange candle filters (f) and check for correct fitting. The condensate and oil mixture formed should also be discharged regularly, manually or automatically, during operation of the pump. A level monitor (V_1) is normally fitted, to switch off the pump automatically at the appropriate level.



7. Fault finding

7.1 Pump overload

1. Measurement of delivery pipe back-pressure and exchange of candle filters if necessary.
2. Checking of mechanical rotation of compressor stages at motor fan. The pump should be dismantled and cleaned if excessive resistance occurs (possibly product-induced).

7.2. Loss of vacuum

- Check vacuum at suction flange, clean screen if necessary.
- Check excess pressure in delivery pipe (back pressure should not exceed 0.3 bar).
- If the ultimate vacuum is not attained, proceed as follows:

  Remove and clean screen in suction flange.

  Check vacuum between LP-, MP- and HP-stages (remove screw plug and measure vacuum). If the same vacuum is measured at the suction flange and the MP-vacuum measuring point, the LP-stage is defective. If the pressure measured at the MP-vacuum measuring point, the MP-stage is close to the value at the HP-vacuum measuring point, the MP-stage is defective. If the pressure measured at the HP-vacuum measuring point is close to atmospheric pressure, the HP-stage is defective (see Fig. 2, page 4).

7.3. High oil consumption

Excessive oil consumption by the fresh oil lubrication system will necessitate replacement of the check valves in the oil pipes.

8 Instructions for storing fresh oil lubricated rotary vane vacuum pumps

Introduction

Start-up of all pumps delivered by Rietschle should be made within 3 months. If this is not possible, please observe the following details, the guarantee given by Rietschle may be invalidated if not followed.

a. Storing of pumps

The store room for the pumps must be dry and free of all corrosive materials. The ambient temperature should be constant and above 10°C.

b. Condition of Stored Pumps

The suction and discharge ports of the pumps should be sealed with blank flanges. All lubricating and sealing oil reservoirs should be filled, in accordance with the instruction manual.

c. Maintenance during Storage

The pumps should be operated once a month for about 2 hours to prevent any kind of corrosion within the pump. Please pay attention to the fact, that the blank flange from the discharge side is to be removed before operation and installed again afterwards. The blank flange of the suction side should not be removed, since end vacuum should be reached.

d. Setting Pumps into Operation

A technical service made by Rietschle will be necessary for all pumps stored longer than 3 months. You will be responsible for the costs of the inspection and test run. Further, all costs occurring from improper storage or handling will be charged.