

Vacuum Solutions

Application Support

Service



LEYBOLD VACUUM

GA 01.700/5.02



## EcoDry-L

Oil-Free Vacuum Pump

Catalogue number 122 97  
123 00  
123 15  
123 20  
139 50  
139 51

150  
Years

Operating Instructions

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## Leybold-Service

If a pump is returned to Leybold, indicate whether the pump is free of substances damaging to health or whether it is contaminated.

If it is contaminated also indicate the nature of the hazard. Leybold must return any pumps without a "Declaration of Contamination" to the sender's address.

**Warning** Indicates procedures that must be strictly observed to prevent hazards to persons.



**Caution** Indicates procedures that must strictly be observed to prevent damage to, or destruction of the equipment.

## Figures

The references to figures, e.g. (1/2) consist of the Fig. No. and the Item No. in that order.

## Note

We reserve the right to modify the design and the specified data. The illustrations are not binding.

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## IMPORTANT SAFETY CONSIDERATIONS

The Leybold EcoDry-L, oil-free vacuum pump is designed for safe and efficient operation when used properly and in accordance with this manual. It is the responsibility of the user to carefully read and strictly observe all safety precautions described in this section and throughout the manual. This product must be operated and maintained by trained personnel only. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to your nearest Leybold Vacuum office.

### Warning



**Failure to observe the following precautions could result in serious personal injury.**



- Before beginning with any maintenance or service work on the EcoDry-L, disconnect the pump from all power supplies.



- Do not operate the pump with any of the covers removed. Serious injury may result.
- If exhaust gases must be collected or contained, do not allow the exhaust line to become pressurized.
- Make sure that the gas flow from the exhaust port is not blocked or restricted in any way.
- The standard version of the EcoDry-L is not suited for operation in explosion hazard areas. Contact us before planning to use the pump under such circumstances.
- Before starting up for the first time, the motor circuit must be equipped with a suitable protective motor switch. Please take note of the information in these Operating Instructions or on the electric motor (wiring diagram).
- The EcoDry-L is not suited for pumping of
  - combustible and explosive gases or vapours
  - radioactive and toxic substances
  - pyrophorous substances.
- The EcoDry-L must be integrated in the system control arrangement so that the pump can not run-up automatically after it has been shut down by the temperature switches in the motor. This applies equally to emergency shut-down arrangements. After having determined the fault cause, the pump should be switched on manually again.
- Avoid exposing any part of the human body to the vacuum.
- Never operate the EcoDry-L without a connected intake line or blank flange.
- The location at which the EcoDry-L (including its accessories) is operated should be such that angles over 10° from the vertical are avoided.
- The location of the EcoDry-L should be such that all controls are easily accessible.
- Under certain ambient conditions the EcoDry-L may attain a temperature of over 80 °C (176 °F). There then exists the danger of receiving burns. Note the symbols on the pump pointing to the hazards, and in the case of a hot pump wear the required protective clothing.

- The noise level produced by the EcoDry-L is about 64 dB(A). Make sure that suitable protection measures are taken to protect the hearing.
- Before operating the EcoDry with atmospheric gas ballast (optional) check first compatibility with the pumped media so as to avoid hazardous conditions during operation right from the start.
- Before commissioning the EcoDry-L, make sure that the media which are to be pumped are compatible with each other so as to avoid hazardous situations. All relevant safety standards and regulations must be observed.
- It is recommended to always operate the EcoDry-L with a suitable exhaust line which is properly connected.
- When moving the EcoDry-L always use the allowed means. A lifting eye is provided as standard on the pump.

## Caution

Failure to observe the following precautions could result in damage to the pump:

- Do not allow the ingestion of small objects (screws, nuts, washers, pieces of wire, etc.) through the inlet port. Always use the screen which is supplied with every pump.
- Do **not** use the pump for applications that produce abrasive or adhesive powders or condensable vapors that can leave adhesive or high viscosity deposits. Please contact Leybold Sales for selecting the right separator.
- Avoid vapors that can condense into liquids upon compression inside the pump, if these substances exceed the vapor tolerance of the pump.
- Before pumping vapors, the EcoDry-L should have attained its operating temperature, and if a gas ballast is available it should be set to position I - III. The pump will have attained its operating temperature about 30 minutes after starting the pump. During this time the pump should be separated from the process, by a valve in the intake line, for example.
- Be sure that roughing lines and other vacuum connections are clean and free of oil. This applies in particular if oil sealed pumps were used before. The conditions must be checked before commissioning, and in the case of deviations you should contact your nearest Leybold Service office.
- In the case of wet processes we recommend the installation of liquid separators upstream and downstream of the pump so as to avoid a massive influx of liquid into the pump.
- The exhaust line should be laid so that it slopes down and away from the pump so as to prevent condensate from backstreaming into the pump.
- In order to prevent the transfer of vibrations from the EcoDry-L to other parts of the system we recommend the use of corrugated hoses or compensators on both the intake and the exhaust sides.

## Note

This information will help the operator to obtain the best performance from the equipment:

- Normal amounts of humidity within the range of the pump's vapor tolerance will not significantly affect pump performance when the gas ballast is active.
- With the pump switched off, the pressure in the pump will rise very slowly to the level of the ambient pressure.

# 1 Introduction

EcoDry-L pump provides a clean, oil-free means of evacuation without the risk of hydrocarbon contamination. Four stages of gas compression achieve pressures as low as  $4 \cdot 10^{-2}$  mbar (30 mTorr, 4 Pa). The very low friction coating on the cylinders combined with special materials and seals on the piston allow maintenance-free continuous operation for up to 2 years. Please note the recommendations as to the applications provided in these Operating Instructions.

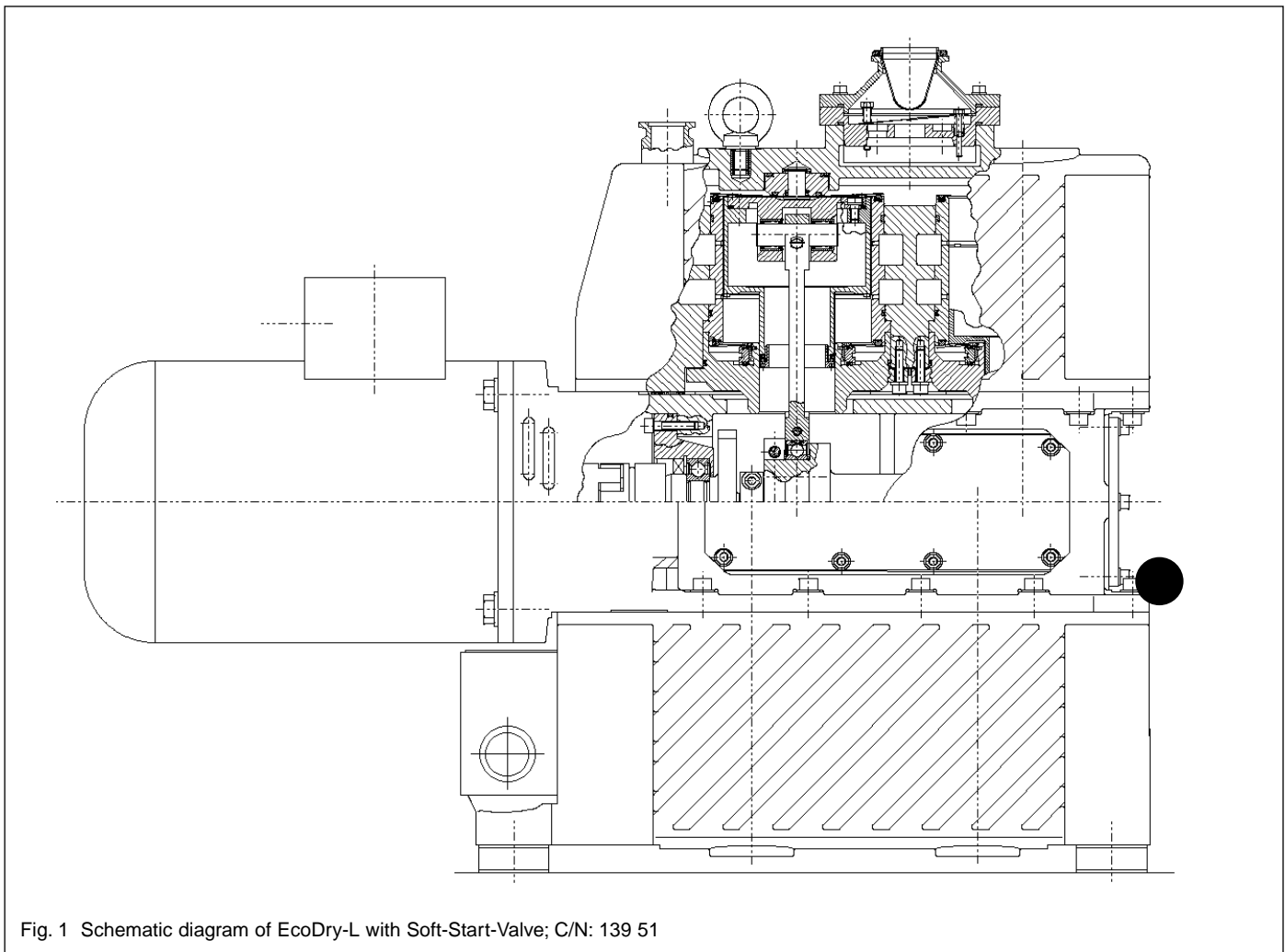
## 1.1 Principles of Operation

### 1.1.1 Stages of Compression

The gas to be pumped reaches the compression space of the cylinder by means of slots formed in the walls of the cylinders. These slots are uncovered by the piston at bottom dead center and then covered again as the piston ascends. Therefore no pressure operated inlet valves are used.

The first two cylinders working in parallel act as the first stage of compression. At the start of evacuation, near atmospheric pressure the exhaust valves in each stage are opened by the pressure generated. As the inlet pressure decreases, an elastomer bumper allows the valve to be operated by the piston itself, moving the gases through the remaining stages of compression. When the piston is at top or bottom dead center in the first stage, gases are at maximum compression in the cylinder. The piston blocks the cylinder intake, and opens the cylinder exhaust valve. As the first stage consists of two pistons, there is one piston at the top and the other at the bottom dead center.

At the same time, in the second stage, the piston is at top or bottom dead center, and in both cases a cylinder intake is opened. The compressed gases exhausted from the first stage are able to enter the second stage cylinder.



When the piston reverses direction, the gases are compressed again in the second stage and exhausted into the third stage. After being compressed again in the third and fourth stage, the gases are exhausted to atmosphere.

In the higher pressure range the pump operates through a single stage.

A valve which is controlled by the intake pressure seals off the 2nd, 3rd and 4th stage and links the 1st stage to the exhaust.

At 200 mbar this valve will open the inlet to the second stage and the EcoDry-L will then operate like a 4-stage pump.

### **1.1.2 Sealing**

At initially high pressures, gases may leak past the piston from the compression chamber and into the drive-unit housing (called "blow-by"). However, the EcoDry-L drive-unit housing is designed such that blow-by gases are drawn back into the four cylinders and exhausted.

The design of the sealing system prevents atmospheric gases from leaking into the pump, thus increasing efficiency. The double-seal also effectively avoids any exchange of gases between the pump and atmosphere.

To avoid internal leakage reducing the pump performance, the cylinder and piston are manufactured to very close tolerances, leaving almost no gap between them. Additional sealing collars are provided towards the drive-unit housing. Towards the outside the chamber of the shaft is sealed off by a radial shaft seal.

### **1.1.3 Lubrication**

The pistons are covered with reinforced polytetrafluorethylene (PTFE). The low friction coefficient of the PTFE lets it serve as a bearing and seal without additional liquid lubricants.

Moreover, all rolling bearings are lubricated with a grease which is free of hydrocarbons and they are separated by a dry seal from the vacuum chamber within the pump.

### **1.1.4 Friction and Cooling**

Due to the selection of the pump materials, the friction (and therefore the heat generated) is kept very low. No additional cooling is needed in normal applications.

#### **Caution**

When installing the pump in an enclosure make sure that there is an adequate flow of cooling air.

### **1.1.5 Eliminating Hydrocarbon Contamination**

The risk of contamination by hydrocarbons is a major concern with mechanical oil-sealed pumps because liquid lubricants can stream back into the chamber to be evacuated. The EcoDry-L achieves high compression ratios by using multiple-stage compression **instead** of oil sealing, and absolutely no liquid lubricants are used.

## 1.2 Specifications

		<b>EcoDry-L</b>
<b>Max. Pumping Speed</b>	m <sup>3</sup> · h <sup>-1</sup>	48 (at 60 Hz) - 38 (at 50 Hz)
<b>Ultimate pressure</b>	mbar	3·10 <sup>-2</sup> (60 Hz) - 4·10 <sup>-2</sup> (50 Hz)
<b>Inlet pressure limit</b> – at initial evacuation – in continuous operation	mbar mbar	1,000 30 (optional 1000 mbar with 2.2 kW motor)
<b>Supply voltages and frequencies</b>		3-phase AC 190 – 210 V, 50 Hz 3-phase AC 190 – 250 V, 60 Hz 3-phase AC 380 – 420 V, 50 Hz 3-phase AC 380 – 500 V, 60 Hz
<b>Motor power requirements</b>	W	500 at ultimate pressure
<b>Max. surface temperature**</b> in operation (at 20°C room temperature)	°C	~ 60
<b>Ambient temperature</b>	°C	< 50 (122 °F)
<b>Nominal speed</b>	rpm	1,100 (at 60 Hz) - 900 (at 50 Hz)
<b>Enclosure</b>	IP	54
<b>Weight</b>	kg	~ 95
<b>Noise level</b>	dB (A)	64
<b>Port fittings</b> Inlet port Exhaust port	DN DN	40 KF 25 KF

\* depending on number of cycles/h

\*\* measured at ● see Fig. 1 page 6

## 1.3 Operating Modes

### Caution

We recommend to keep to the following limits:

- In the case of cyclic operation the volume of the vacuum chamber should not exceed 100 l, at a number of cycles of < 10 cycles/h. The product of volume (l) and cycles should be less than 1000.
- At a rated motor power of 1.5 kW, the max. volume should be < 100 l. With the 2.2 kW motor there are no restrictions as to the volume which can be pumped.
- The max. intake pressure during continuous operation (and with a 1.5 kW motor) should be < 30 mbar.

## 1.4 Ordering Information

	<b>Cat. No.</b>
EcoDry L, 1.5 kW motor with Hirschmann plug	122 97
EcoDry L, 2.2 kW motor	123 00
EcoDry L, 1.5 kW motor with gas ballast valve	123 15
EcoDry L, 2.2 kW motor with Hirschmann plug	123 20
EcoDry L, 1.5 kW motor	139 50
EcoDry L, 1.5 kW motor with soft start valve	139 51
Cart for EcoDry L	139 52
Silencing hood for EcoDry L (retro-fit kit) only for EcoDry L with 1.5 kW motor (139 50/122 97)	139 54
Roots adapter for EcoDry L + RUVAC WS/WSU 251	139 55
Soft start valve (retro-fit kit)	122 99
Gas ballast valve (retro-fit kit)	123 05
Solenoid gas ballast valve	169 50



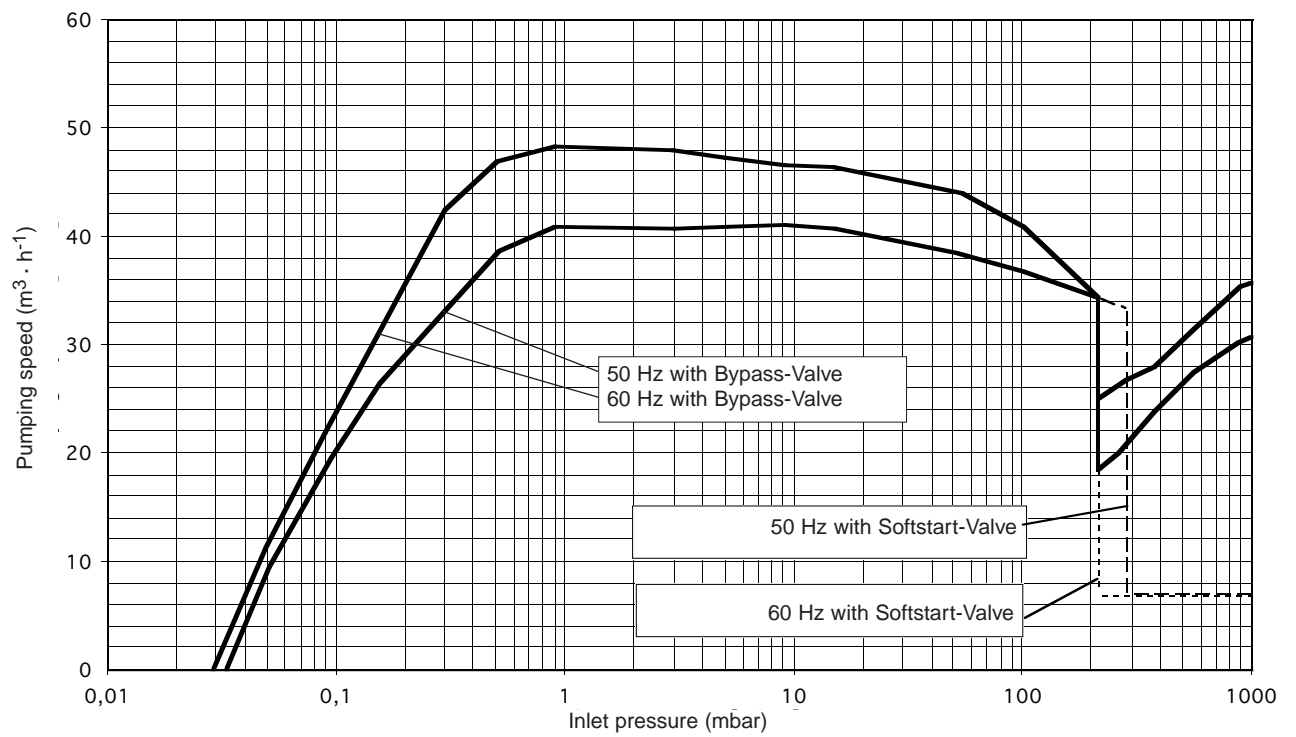


Fig. 2 EcoDry-L pumping characteristics as a function of the inlet pressure

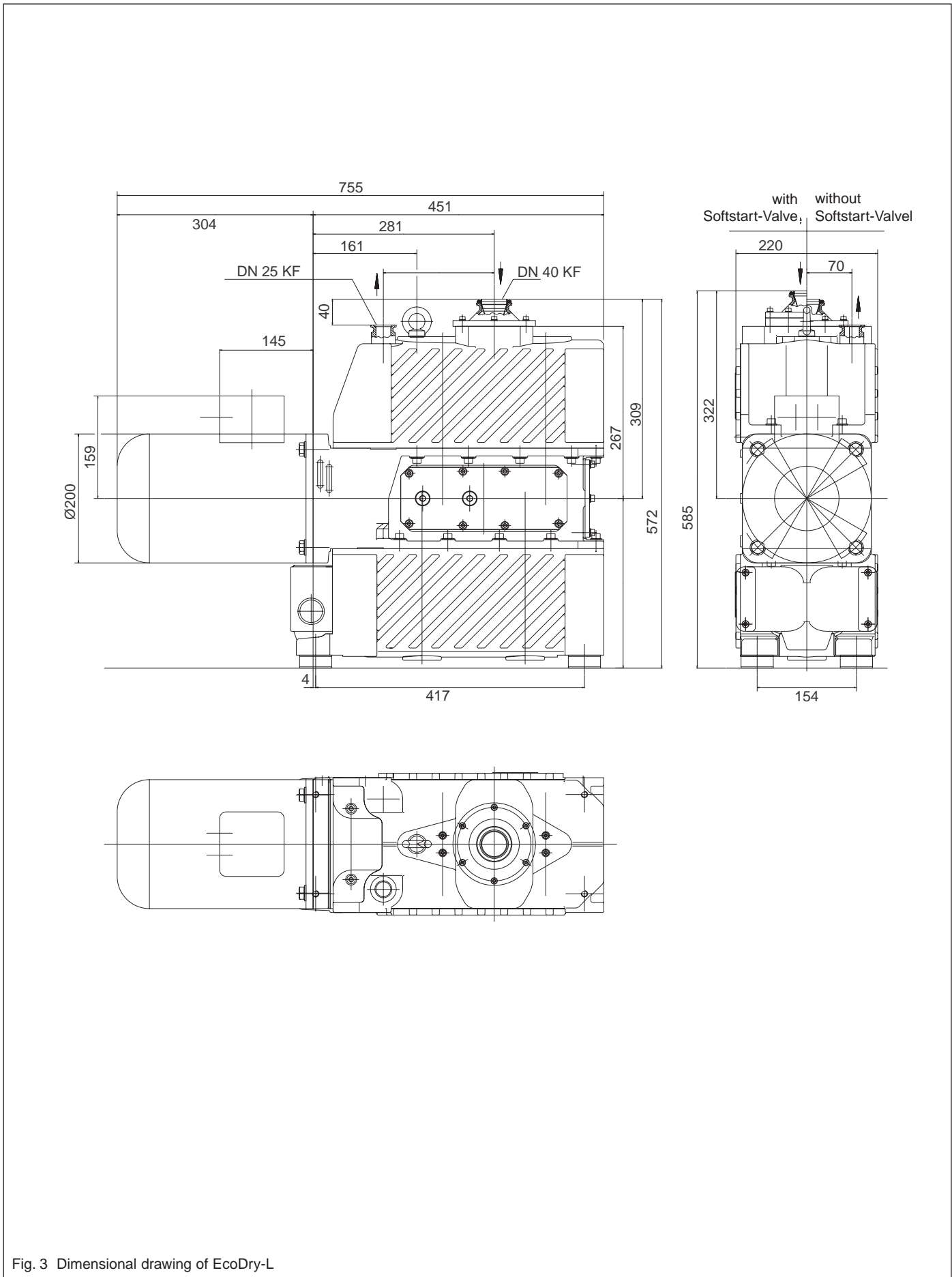


Fig. 3 Dimensional drawing of EcoDry-L

## 2 Installation and Operation

### 2.1 Unpacking the Pump

Leybold Vacuum inspects each EcoDry-L pump before shipping and packs each pump carefully to avoid damage from improper handling.

#### 2.1.1 Receiving Conditions

Inspect shipping crate for external damage.

If damaged:

- Refuse the shipment.
- Notify Leybold Vacuum immediately.

#### 2.1.2 Unpacking the Pump

1. Open the top of the shipping crate.
2. Remove any packing materials.
3. The pump is equipped with a lifting eye, and should **only** be lifted with this device.
4. The pump in its crate is designed for easy transport on a hauling cart.

#### 2.1.3 Inspecting the Pump

Inspect the pump for damage.

If damaged:

- Notify Leybold Vacuum immediately.
- Retain the original shipping and packing materials.
- Wait for return authorization from Leybold Vacuum.
- Return the pump in the original crate via the original shipper.

### 2.2 Installation

The EcoDry-L pump is installed upright on the anti-vibration mounts provided.

Make sure that there is a clearance of at least 100 mm to other components or pumps at every side to allow an adequate air flow for cooling.

The EcoDry-L pump is a complete unit. Listed below are several optional accessories that will lead to more efficient operation and prolong the useful life of the pump.

- Dust filter, liquid separator for the inlet
- Cart including arrestable feet
- Cart with enclosure including arrestable feet
- Adapter for Roots pump (RUVAC WS/WSU 251)
- Gas ballast - inert gas kit
- Solenoid gas ballast valve

#### 2.2.1 Suggested Installation Procedure

##### Warning



Please accurately observe the following safety information given in these Operating Instructions.

1. Install in an open area with an ambient temperature below 50°C (122 °F). If the pump must be installed in an enclosed area, air-circulating fans may be necessary to ensure adequate cooling.
2. Connect the chamber to be evacuated to the inlet flange of the EcoDry-L pump.
3. Use flexible stainless steel bellows in piping to reduce transmission of vibration during operation.
4. Make sure pipe lines are adequately supported to reduce stress on joints.
5. Install a vacuum gauge in the inlet line with a vacuum-quality valve upstream of the gauge. This allows the pump to be isolated from the system to monitor its proper performance.
6. Install the stainless steel screen provided over the inlet port to prevent the ingestion of small objects that can damage the pump. The flow rate may be somewhat reduced by the screen, but the protection it provides will prolong the life of the pump.
7. Make sure that the exhaust port is clear and unobstructed.

**Caution**

Roughing lines and other vacuum connections must be clean, especially if previously evacuated by oil-sealed mechanical pumps.

**Warning**

Make sure that the gas flow at the exhaust port is not blocked or restricted in any way.

If the exhaust gases must be contained or collected, do not allow the exhaust line to become pressurized.

**2.3 Operation of the Pump**

**Warning**



Make sure that the mains supply is turned off when cables are connected.

The electrical connection should only be performed by staff qualified in accordance with VDE 0105 and following the guidelines of VDE 0100.



**2.3.1 Electrical Connection**

The EcoDry-L is equipped as standard with a three-phase motor.

The EcoDry-L pump can be connected to different mains supply voltages and frequencies (see Section 1.2, Specifications).

If necessary, change the jumper configuration in the motor terminal box to adjust the pump to the available supply voltage (see Fig. 4).

Connect the pump to mains via a suitable protective motor switch (see name plate), but do not turn on the pump until all electrical and vacuum lines are connected.

In the case of the EcoDry L with Hirschmann plug - Cat. No. 122 97 / 123 20 - the plug is factory wired to Y (Star) 400 V.

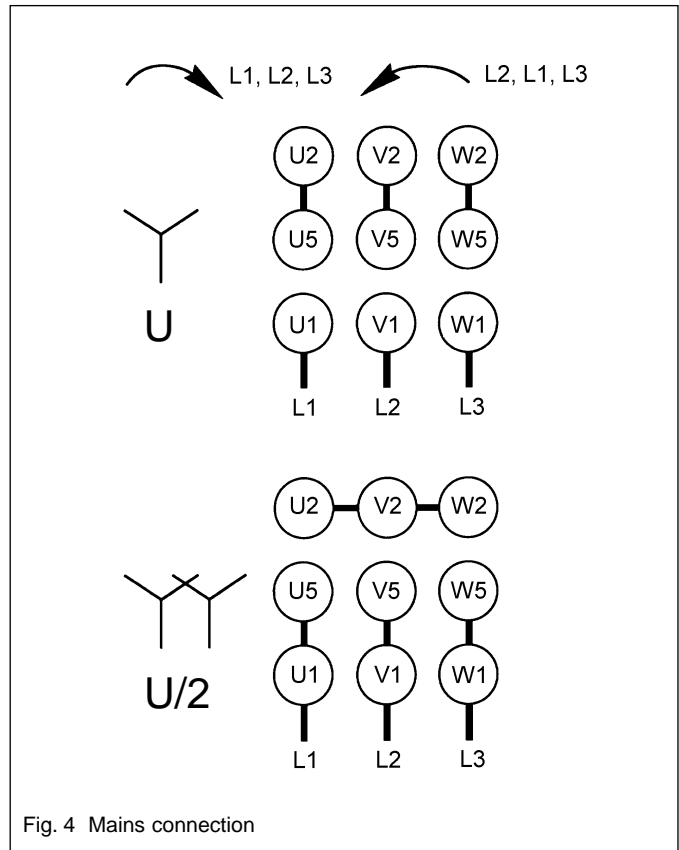


Fig. 4 Mains connection

**Notes for setting the motor protection switch**

**EcoDry L with 1.5 kW motor**

50 Hz: 190-210 / 380-420 V; 8.1 / 4.05 A  
 60 Hz: 190-250 / 380-500 V; 7.4 / 3.7 A

We recommend using a motor protection switch in accordance with IEC 947, EN 60947, DIN VDE, UL 508, CSA C22.1, for example: Klöckner-Moeller Model PKZMO-6,3 for 400 V (Star) or Klöckner-Moeller Model PKZMO-10 for 200 V (Double Star).

**EcoDry L with 2.2 kW-Motor**

50 Hz: 190-220 / 380-440 V; 12.0 / 6.0 A  
 60 Hz: 190-250 / 380-500 V; 11.7 / 5.8 A

We recommend using a motor protection switch in accordance with IEC 947, EN 60947, DIN VDE, UL 508, CSA C22.1, for example: Klöckner-Moeller Model PKZMO-6,3 for 400 V (Star) or Klöckner-Moeller Model PKZMO-16 for 200 V (Double Star).

## 3 Application Notes

### 3.1 General Application

The EcoDry-L is ideal for applications that require the achievement of pressures as low as  $3 \cdot 10^{-2}$  mbar (4 Pa, 30 mTorr) at 60 Hz without the risk of contamination from liquid lubricants. The pump may be operated intermittently as needed, or continuously for as long as 2 years without maintenance. With increased product purity and no compromise in performance, the EcoDry-L replaces single-stage oil-sealed rotary pumps in many applications.

#### Caution

Do not use the pump for applications that produce abrasive or adhesive powders or condensable vapors that can leave adhesive or high viscosity deposits.

### 3.2 EcoDry-L Pumps for Backing of High-Vacuum Pumps

#### 3.2.1 Turbopumps and Compound Pumps

The EcoDry-L is an oil-free dry compressing vacuum pump for safe operation of turbomolecular pumps which require a forevacuum pressure of  $p > 3 \cdot 4 \cdot 10^{-2}$  mbar.

The design of the pump permits the EcoDry-L to be operated in connection with classic and magnetically levitated turbomolecular pumps as well as compound pumps.

#### 3.2.2 Roots Pumps

- An oil-free pump is preferred.
- Size and cut-in pressure of the Roots pump must match the requirements of the EcoDry-L (see pumping speed characteristic).
- The grading between Roots pump and EcoDry-L must not exceed the generally accepted ratio of 10:1. We recommend that you get in touch with our Sales Department.
- A generally preferred combination is:  
An EcoDry-L with a size 251 Roots pump (e.g. RUVAC WS/WSU 251).

### 3.3 Condensable Vapors & Liquids

#### Caution

The EcoDry-L pump is not intended for pumping large amounts of condensable vapors, however there is a limited tolerance during normal operation (gas ballast operation). Pumping of liquids shall be avoided and will damage the pump.

- Normal amounts of water vapor in atmospheric air will not affect pump performance.
- As an option there is available from Leybold a gas ballast facility.

### 3.4 Use on Wet Processes

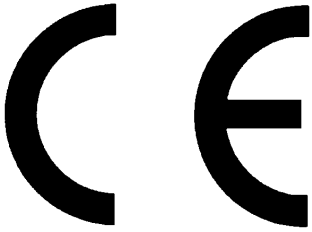
#### Caution

Do not allow direct ingestion of liquids into the pump.

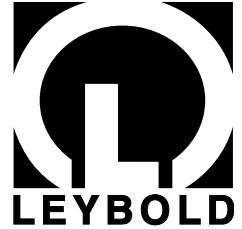
Note the vapour tolerance levels which apply to this pump. In case of any questions in this matter do not hesitate to get in touch with Leybold Vacuum.

#### Generally the following applies:

- The lines connected to the pump should be so rated that no liquids can suddenly enter the pump.
- The chambers should only contain liquids having a low vapour pressure.
- Note the safety information provided in these Operating Instructions.



## EC Declaration of Conformity



We – LEYBOLD VACUUM GmbH – herewith declare that the products defined below meet the basic requirements regarding safety and health of the relevant EEC directives by design, type and the versions which are brought in to circulation by us.

In case of any products changes made without our approval, this declaration will be void.

### **The products conform to the following directives:**

- EC Directive on Machinery (98/37/EG)
- EC Directive on Low-Voltages (73/23)+(93/68/EWG)
- EC EMC Directive (89/336/EWG) (91/263/EWG) + (92/31/EWG) + (93/68/EWG)

### **Applied harmonised standards:**

- DIN EN 292 Part 1 11.91
- DIN EN 292 Part 2 06.95
- DIN EN 1012 Part 2 07.96
- DIN EN 60 204 Part 1 11.98

### **Applied national standards and technical specifications:**

- DIN 31 001 April 1983

Designation of the products: Oil-free vacuum pump

Model: EcoDry L with 1.5 kW motor

Cat. No.: **139 50**

Model: EcoDry L with 1.5 kW motor and with soft start valve

Cat. No.: **139 51**

Model: EcoDry L with 1.5 kW motor and with Hirschmann plug

Cat. No.: **122 97**

Model: EcoDry L with 2.2 kW motor

Cat. No.: **123 00**

Model: EcoDry L with 1.5 kW motor and with gas ballast valve

Cat. No.: **123 15**

Model: EcoDry L with 2.2 kW-Motor and with Hirschmann plug

Cat. No.: **123 20**

Cologne, July 02, 2001

K. Kilian, Business Area Manager LPV  
Division Industrial

Cologne, July 02, 2001

Dr. Bahnen, Head of R&D LPV  
Division Industrial



## Declaration of Contamination of Compressors, Vacuum Pumps and Components

The repair and / or servicing of compressors, vacuum pumps and components will be carried out only if a correctly completed declaration has been submitted. Non-completion will result in delay. The manufacturer can refuse to accept any equipment without a declaration. A separate declaration has to be completed for every single component.

This declaration may be completed and signed only by authorised and qualified staff.

Copies: Page 1 (white) to manufacturer or representative – Page 2 (yellow) attach to consignment packaging securely – Page 3 (blue) copy for file of sender

**Customer/Dep./Institute:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**Person to contact:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_ **Fax:** \_\_\_\_\_  
**Order number of customer:** \_\_\_\_\_

**Reason for returning the item/s**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### A. Description of the equipment (machine or component)

**Type:** \_\_\_\_\_  
**Catalogue number:** \_\_\_\_\_  
**Serial number:** \_\_\_\_\_  
**Type of oil used:** \_\_\_\_\_

**Ancillary equipment**

\_\_\_\_\_

\_\_\_\_\_

### B. Condition of the equipment (machine or component)

	Yes	No	Not known
1. Has the equipment been used	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Drained (product/service fluid)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. All openings sealed airtight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Purged: Cleaning agent: _____ Method of cleaning: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### C. Description of processes / substances (Please fill in absolutely)

1. What substances have come into contact with the equipment:  
 Trade name, chemical name of liquids and substances processed, properties of the substances according to safety data sheet (toxic, inflammable, corrosive, radioactive)

	Trade name:	Chemical name:	Properties:
a)			
b)			
c)			
d)			

2. Are these substances harmful? Yes  No  Not known   
 3. Dangerous decomposition products when thermally loaded Yes  No  Not known   
 Which: \_\_\_\_\_

Components contaminated by micro biological, explosive or radioactive products will not be accepted without written evidence of decontamination.

### D. Legally binding declaration

I/we hereby declare that the information supplied on this form is accurate and sufficient to judge any contamination level.

Name of authorised person (block letters): \_\_\_\_\_

\_\_\_\_\_ date \_\_\_\_\_ signature of authorised person \_\_\_\_\_ firm stamp

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## ASIA

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