

Vacuum Solutions

Application Support

Service



LEYBOLD VACUUM

GA 01.701/5.02



SERVICE OF VACUUM PUMP SYSTEMS
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For Service Call (610) 625-1505
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EcoDry - M

Oil-free Vacuum Pumps

EcoDry M 15

130 000; 130 001; 130 002; 130 004

EcoDry M 20

130 010; 130 011; 130 012; 130 014

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.

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

Ordering Information

EcoDRY M 15

with three phase motor		Cat. No. 130 000
with single phase motor 115 V 60 Hz	USA	Cat. No. 130 001
with single phase motor 230 V 50/60 Hz	Euro	Cat. No. 130 002
with single phase motor 200 V 50/60 Hz		Cat. No. 130 004

EcoDRY M 20

with three phase motor		Cat. No. 130 010
with single phase motor 115 V 60 Hz	USA	Cat. No. 130 011
with single phase motor 230 V 50/60 Hz	Euro	Cat. No. 130 012
with single phase motor 200 V 50/60 Hz		Cat. No. 130 014

Accessories

Silencer for EcoDRY M 15 - M 20		Cat. No. 130 050
Vibration absorbers for underneath (Set = 4 pieces) for EcoDRY M 15 - M 20		Cat. No. 130 051
Solenoid gas purge kit for EcoDRY M 15 - M 20		Cat. No. 169 50
Vibration absorber kit for EcoDRY M 15 - M 20		Cat. No. 130 052

IMPORTANT SAFETY CONSIDERATIONS

The Leybold EcoDry M, 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 M, 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 pressurised.
- Make sure that the gas flow from the exhaust port is not blocked or restricted in any way.



- The standard version of the EcoDry M 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 (3 phase) 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 M is not suited for pumping of:
 - combustible and explosive gases or vapours
 - radioactive and toxic substances
 - pyrophorous substances.

- The EcoDry M 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 M without a connected intake line or blank flange.

- The location at which the EcoDry M (including its accessories) is operated should be such that angles over 10° from the vertical are avoided.

- The location of the EcoDry M should be such that all controls are easily accessible.



- Under certain ambient conditions the EcoDry M 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 M without gas ballast is ≤ 59 dB(A) with silencer or connected exhaust line. Make sure that suitable protection measures are taken to protect the hearing.

Warning



- Before operating the EcoDry M with atmospheric gas ballast check first compatibility with the pumped media so as to avoid hazardous conditions during operation right from the start.

- Before commissioning the EcoDry M, 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 M with a suitable exhaust line which is properly connected. It must slope down and away from the pump.
 - When moving the EcoDry M 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 vapours that can leave adhesive or high viscosity deposits. Please contact Leybold Sales or Service to select a suitable separator. Also please contact Leybold Sales or Service when planning to pump vapours other than water vapour.
- This pump is suited for pumping water vapour within the specified water vapour tolerance limits.
- Avoid vapours that can condense into liquids upon compression inside the pump, if these substances exceed the vapour tolerance of the pump (> 25 mbar for water vapour).
- Before pumping vapours, the EcoDry M should have attained its operating temperature, and the gas ballast should be set to position I - III (position 0 = closed, position 3 = max. water vapour tolerance, 25 mbar).
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 the lines (exhaust and intake 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 as well as the use of the gas ballast.
- 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 M to other parts of the system we recommend the use of corrugated hoses or compensators on both the intake and the exhaust sides. In case you need any further information please get in touch with Leybold.
- Operate the EcoDry M only in the orientations detailed in the dimensional drawings (see page 8). For the purpose of reducing the transfer of vibrations to the building we also recommend the use of vibration absorbers (see accessories for the EcoDry M).

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 vapour 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 **exhaust pressure (normally atmospheric pressure)**. The EcoDry M is not equipped with any vacuum protection means. Thus you must install a valve in the intake line which automatically seals off the intake port of the EcoDry M when at standstill.

1 Introduction

EcoDry M pump provides a **clean, absolutely oil-free** means of evacuation without the risk of hydrocarbon contamination. The gas compression stages achieve pressures as low as $2 \cdot 10^{-2}$ mbar (15 mTorr, 2 Pa). The very low friction coating on the cylinders and on the pistons allows maintenance-free continuous operation for up to 2 years depending on the kind of application. 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 EcoDry M is equipped with three (M 15) or two (M 20) compression stages which are formed by three pistons.

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. The gas is compressed while the piston ascends and exits the compression chamber through large valves.

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 M drive-unit housing is designed such that blow-by gases are drawn back into the cylinders and exhausted.

Moreover, the entire sealing system of the EcoDry M is so designed that a low leak rate in the order of $< 1 \cdot 10^{-4}$ mbar \cdot l \cdot s⁻¹ is attained. The static seals made of Viton and the PTFE radial shaft seals which are lubricated with a grease which is free of hydrocarbons and which are highly media compatible, reliably prevent the exchange of gas between the EcoDry M and the surrounding 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 a low-friction material. 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 M achieves high compression ratios by using dry multiple-stage compression **instead** of oil sealing, and absolutely no liquid lubricants are used in the compression chambers.

1.2 Specifications

		EcoDry M 15		EcoDry M 20	
Number of cylinders		3		3	
Number of pumping stages		3		2	
Max. pumping speed	- at 50 Hz	$\text{m}^3 \cdot \text{h}^{-1} / \text{cfm}$	14/8.3	19/11.2	
	- at 60 Hz	$\text{m}^3 \cdot \text{h}^{-1} / \text{cfm}$	16/9.4	22/13	
Ultimate pressure (absolute)	- at 50 Hz	mbar/Torr	$3 \cdot 10^{-2} / 2.3 \cdot 10^{-2}$	$5 \cdot 10^{-1} / 3.8 \cdot 10^{-1}$	
	- at 60 Hz	mbar/Torr	$2 \cdot 10^{-2} / 1.5 \cdot 10^{-2}$	$4 \cdot 10^{-1} / 3.0 \cdot 10^{-1}$	
Inlet pressure limit					
- at initial evacuation		mbar		1000	
- in continuous operation		mbar		100	
Water vapour tolerance		$\text{g} \cdot \text{h}^{-1}$	290	400	
			(with gas ballast set to "3")		(with gas ballast set to "3")
Leak rate (integral)		$\text{mbar} \cdot \text{l} \cdot \text{s}^{-1}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	
Motor power requirements					
at inlet pressures < 20 mbar (15 Torr)		W	300	300	
Motor					
Mains voltage, frequency					
3-ph. / 50 Hz		V	220-240/346-415 (-10% to +5%)	220-240/346-415 (-10% to +5%)	
3-ph. / 60 Hz		V	200-277/380-480 (-10% to +5%)	200-277/380-480 (-10% to +5%)	
1-ph. 50 / 60 Hz (Euro)		V	220 - 240 (-10 % to +5 %)	220 - 240 (-10 % to +5 %)	
1-ph. 60 Hz (USA)		V	115 (-10 % to +5 %)	115 (-10 % to +5 %)	
1-ph 50/60 Hz		V	200 (-10 % to +5 %)	200 (-10 % to +5 %)	
Motor speed at 50/60 Hz		rpm.	1000/1200	1000/1200	
Protection		IP	54	54	
Noise level at ultimate pressure ¹⁾		dB(A)	≤ 59	≤ 59	
Permissible ambient temperature		°C/°F	0 - 50 / 32 - 122	0 - 50 / 32 - 122	
Connections / Inlet ports			DN 25 KF or G $\frac{3}{4}$ "		
Connections /Outlet ports			DN 25 KF or G $\frac{3}{4}$ "		
Weight with three phase motor		kg/lbs	38/84	38/84	
Weight with single phase motor		kg/lbs	50/111	50/111	

¹⁾ without gas ballast, with silencer (accessory) or connected exhaust line

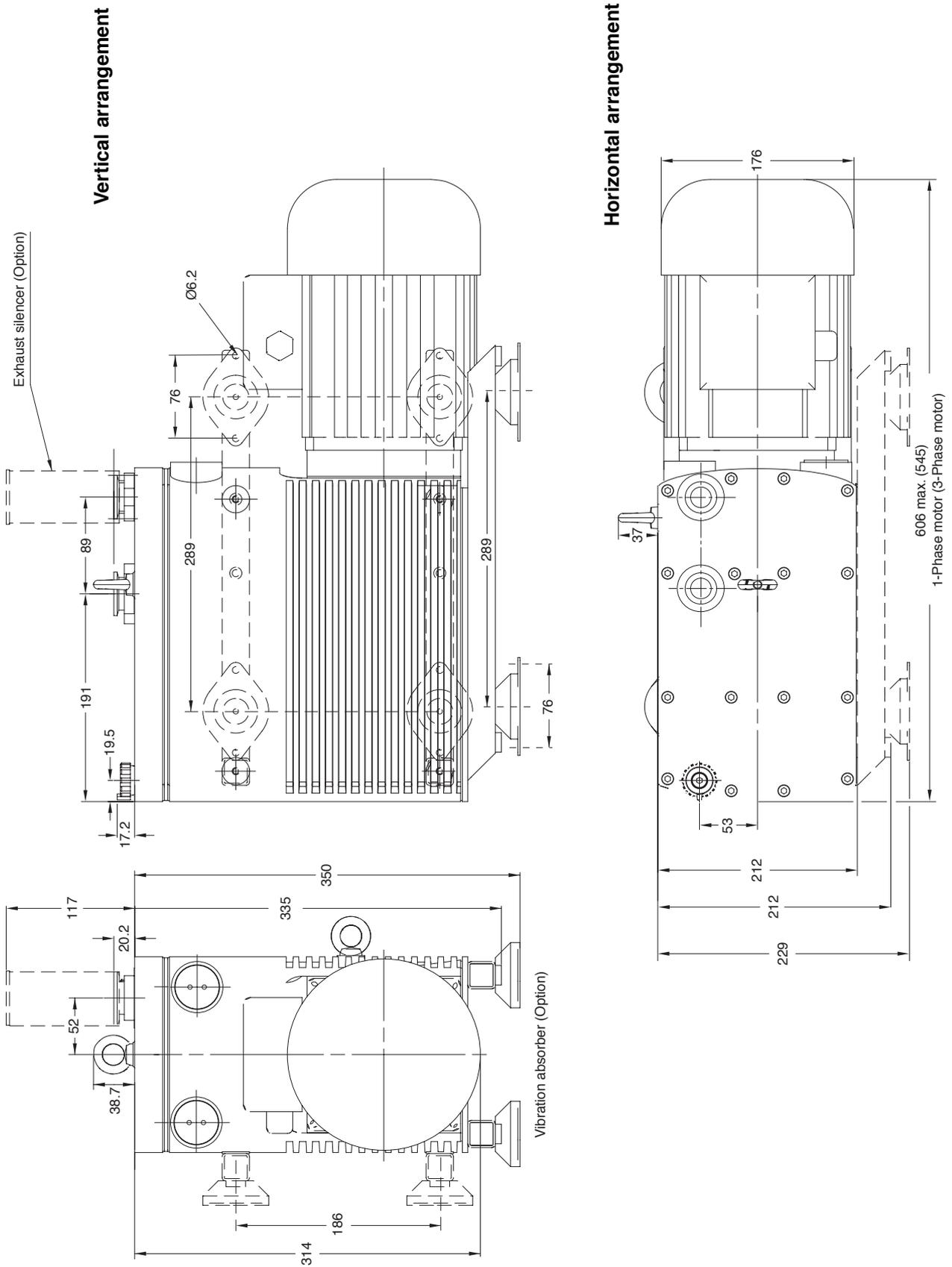


Fig. 1 Dimensional drawing of the EcoDry M with 3-phase motor

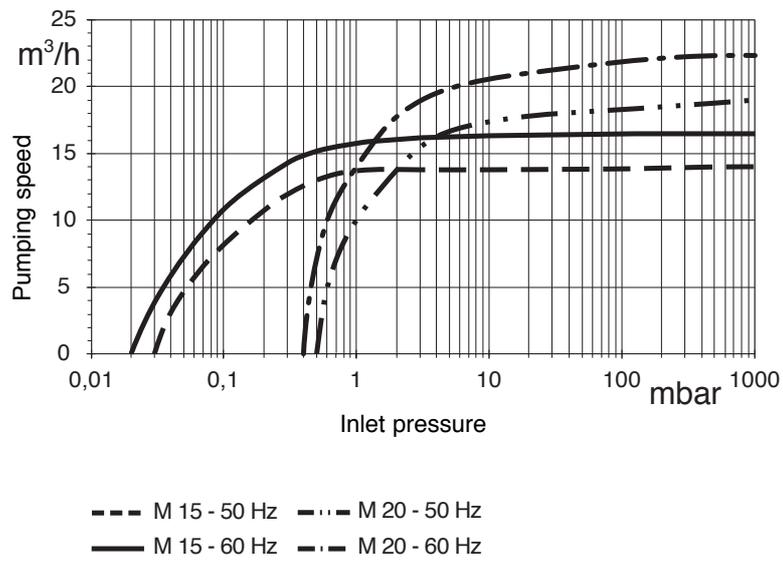


Fig. 2 Pumping speed vs. inlet pressure for the EcoDry M 15 / M 20 (50/60 Hz operation)

Connecting flanges on top, DN 25 KF

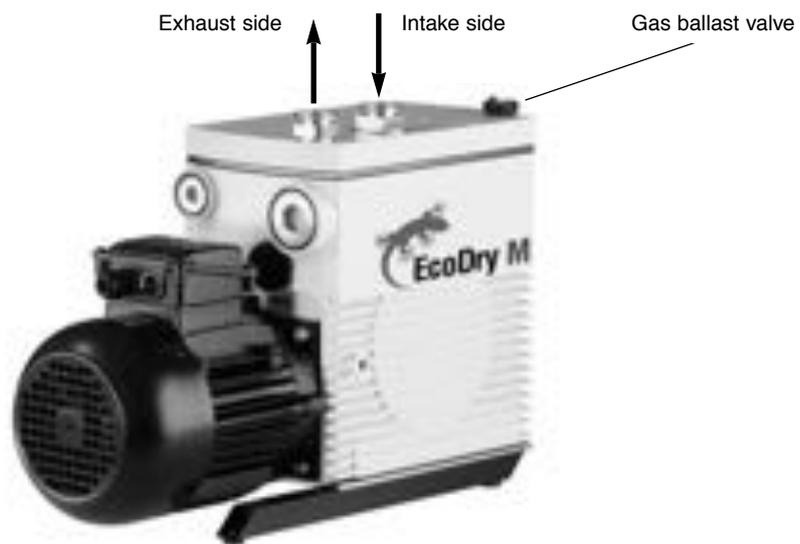


Fig. 3 Connection for the intake and exhaust flanges

2 Installation and Operation

2.1 Unpacking the Pump

Leybold Vacuum inspects each EcoDry M 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.

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 authorisation from Leybold Vacuum.
- Return the pump in the original package via the original shipper.

2.1.4 Supplied Equipment

The EcoDry M is supplied with the following basic items:

- Pump with motor
- Separate dirt collecting sieve (dirt trap)
- Operating Instructions
- "Declaration of Contamination" form

The connection ports are sealed off before shipping with sealing caps.

EcoDry M pumps equipped with a single phase AC motor have a 1.8 m long mains cord and may be connected to the mains direct via the plug.

The AC motors are equipped with a built-in thermal motor overload circuit breaker and a mains cord (1.8 m long).

Country specific plugs USA, Japan, Euro are included. In the case of the three-phase motors suitable motor overload protection and the connection to the mains power supply must be installed resp. provided by the customer.

2.2 Installation

The EcoDry M pump is installed upright or horizontally 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 M 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
- Vibration absorbers
- Exhaust silencer
- Inert gas connection

2.2.1 Suggested Installation Procedure

Caution The EcoDry M must only be operated in such orientations where the axis of the pump (crankshaft) runs horizontally.

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. Before connecting the EcoDry M to the intake and exhaust lines please remove the shipping seals on the pump's intake and exhaust flanges. Connect the chamber to be evacuated to the inlet flange of the EcoDry M pump.
3. Use flexible stainless steel bellows in the piping to reduce transmission of vibrations 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 (dirt trap) 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 clean 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 pressurised.

2.3 Operation of the Pump

Please note the safety information given on page 4 and the subsequent pages.

Warning The pump must only be started up after having fully assembled it.



The exhaust line should be laid so that it slopes down and away from the pump in order to prevent condensed vapours from flowing back into the pump.

During operation, the exhaust side must always be open. Check any valves which may be present in the exhaust line. The max. exhaust backpressure must never exceed 1200 mbar abs.

2.4 Electrical Connection

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.

The EcoDry M pump can be connected to different mains supply voltages and frequencies (see Section 1.2, Specifications) as well as page 12.

If necessary, change the jumper configuration in the motor terminal box (3ph) to adjust the pump to the available supply voltage.

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.

2.4.1 EcoDry M with Single-Phase Motor

The EcoDry M may be connected directly to the mains supply via the plug.

Caution The cross section of the mains power supply cables should amount to at least 1.5 mm².

In the case of the single phase AC motors the direction of rotation is fixed and will therefore not need to be checked separately.

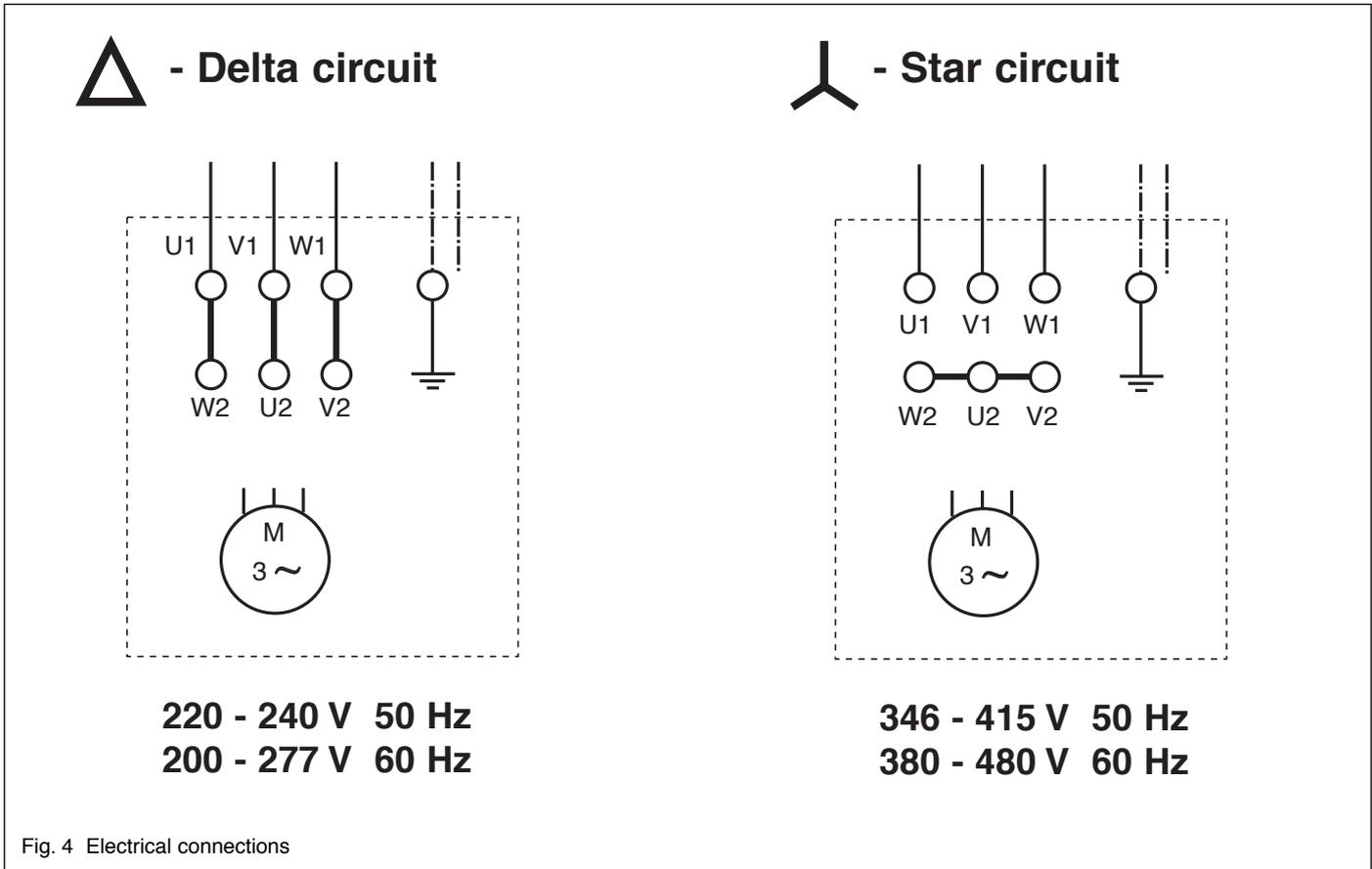
2.4.2 EcoDry M with Three-Phase Motor

Because of the principle of operation employed by the pump the direction of rotation is not relevant.

Warning If the thermal motor overload circuit breaker of the pump has responded, the motor will switch itself on automatically after the temperature has dropped back to permissible levels.



2.4.3 EcoDry - M with 3 phase motor



Warning Electrical Connection



Before beginning with any electrical work, ensure that the units have been disconnected from the mains power first.

The electrical connections must only be provided by an electrician in consideration of the requirements in accordance with DIN EN 60204 Part 1.



The motor must be connected to the mains power as indicated in the drawing.

Before applying the mains power, double check the way in which the wires have been connected to the terminals.

Fusing must be provided by the customer by means of suitable motor protection switches (Klöckner-Möller PKZMO, for example).

The setting of the motor protection switch must correspond to the current rating stated on the motor's name plate.

3 Application Notes

Warning Please also note the information provided on potential hazards given on pages 4, 5 and the subsequent pages.



3.1 General Application

The EcoDry M is ideal for applications that require the achievement of pressures as low as $2 \cdot 10^{-2}$ mbar (2 Pa, 15 mTorr) 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. Owing to its freedom from hydrocarbons and no compromise in performance, the EcoDry M replaces single-stage oil-sealed rotary pumps in many applications.

Caution Do **not** use the pump for applications that produce abrasive or adhesive substances or condensable vapours that can leave adhesive or high viscosity deposits. Also the formation of thicker deposits should be avoided since these too may form adhesive or high viscosity deposits.

3.2 EcoDry M Pumps for Backing of High-Vacuum Pumps

3.2.1 Turbopumps and Wide Range Turbo Pumps

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

The design of the pump permits the EcoDry M to be operated in connection with classic and wide range turbomolecular pumps.

3.3 Condensable Vapours & Liquids

Caution The EcoDry M pump is **not** suited for prolonged pumping of condensable vapours above the specified water vapour tolerance. Pumping of liquids is to be avoided and will damage the pump.

- Normal amounts of water vapour in atmospheric air will not affect pump performance.

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.

4 Maintenance

Under the operating conditions detailed, the EcoDry M is capable of operating continuously for a period of two years without any maintenance.

Since no operating means other than electric power are required for operation of the EcoDry M, any maintenance regarding operating agents and consumption is **not** required.

If in spite of this any unexpected maintenance becomes necessary within this period, please get in touch with the local Leybold Service.

When returning equipment to our Service please fill in **completely** the "Declaration of Contamination" form.

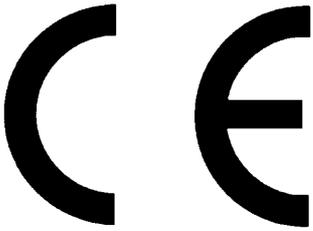
Caution If no such declaration is available to the Service, any processing will not be possible and the pump will possibly be returned to the sender.

Warning The EcoDry M must be packaged in such a way that the pump can not be damaged during shipping and so that no hazardous substances may escape from the package.



5 Troubleshooting

Fault	Possible cause	Remedy	Repair
Pump does not start up.	Faulty wiring. Motor protection switch not set correctly (three-phase motors only). Power supply voltage does not match the rating of the motor. Motor faulty. Pump has seized. Links in the terminal box.	Check the wiring and repair it. Properly set up the motor protection switch. Exchange the motor. Exchange the motor. Repair the pump. Check the wiring acc. to wiring diagram.	Electrician Electrician Service Service Service Electrician
Pump does not attain its ultimate pressure.	Method of measurement or measuring instrument not suitable. External leak. Degassing through water residues. Process caused strong pollution of the pump. Defective shaft sealing ring. Exhaust pipe dirty. Caution: Roughing lines and other vacuum lines must be clean. Especially if previously evacuated by oil-sealed pumps the lines must be cleaned first. Exhaust pressure too high (Pabs =>1200 mbar). Pump temperature too low.	Use the right method of measurement or measuring instrument. Measure the pressure directly at the intake port of the pump. Repair the pump. Pump must be run for 30 min in gas ballast position 1 / check the process. Disassemble and clean the pump. Change shaft sealing ring. Clean the exhaust pipe and then run the pump in gas ballast position 1. Optimise cross section of the exhaust pipe. Warm up the pump (>1h).	Service Service Service
Pumping speed of the pump is too low.	Dirt trap in the intake line is clogged. Connection lines too narrow or too long. Exhaust counter-pressure too high. Nom. pumping speed of pump is too low.	Clean the dirt trap. Use sufficiently wide and short intake lines. (see application information). Preventive action:: Install a dust filter in the intake line. Exchange the filter element. Optimise cross section of the exhaust pipe. Check the application.	
After switching the pump off, the pressure in the system increases too fast.	System has a leak. Missing valve for blocking intake (automatic or at pump standstill). Valve at the intake is not closed. Exhaust valve leaky (loud noise from the exhaust system at ultimate pressure).	Check the system. Fit a valve that seals off the inlet (see application information). Close the valve for inlet. Repair the pump.	Service
Pump gets hotter than previously observed.	Supply of cooling air is obstructed. Ambient temperature is too high. Process gas is too hot. Deviation of the mains voltage. Exhaust pressure too high.	Install the pump properly (10 cm clearance around the pump). Install the pump properly (<50°C). Change the process, if needed cool down to max. inlet temperature = 50°C. Check the motor-supply voltage and mains voltage. Optimise cross sectional area exhaust pipe.	Electrician
The pump is extremely loud.	Faulty bearing. Thick particulate deposits. Silencer defective. High gas throughput with open exhaust port.	Repair the pump. Repair the pump. Repair silencer. Install exhaust line or a silencer	Service Service



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 EC 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.

Product designation: Oil-free vacuum pump

Models:	Cat. No.
EcoDry - M 15	130 000
	130 001
	130 002
	130 004
EcoDry - M 20	130 010
	130 011
	130 012
	130 014

The product meets the requirements of the following directives:

- EC Directive on Machinery (98/37/EG)
- EC Directive on Low-Voltages (73/23)+(93/68/EWG)
- EC Directive on Electromagnetic Compatibility (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 |
|--------------|------------|

Cologne, July 02, 2001

K. Kilian, Business Area Manager LPV
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