

## Vacuum Pump Operating Instructions

### 真空泵使用说明书



The high quality vacuum pump, which has high reliable, high ultimate vacuum and low noise, is regarded as the highest honor by the VALUE . Creating value for the customers is our core idea; satisfy customers' requirements is our research base; with this commitment to innovation, quality, and service, VALUE design a high reliable vacuum pump called " VRD " for the customers all around the world.

New " VRD " series vacuum pump design was a huge project. At very beginning, we positioned the product. more than 1200 questionnaire surveys has been sent to the market; then we communicated with customers whom from 30 different countries, discussed the advantages and disadvantages of the products in the market right now; furthermore, we combined the requests for the terminal customers, and finally decided to design a high reliable vacuum pump with high ultimate vacuum and low noise. From the conception to screening to the final decision, more than 10 schemes has been researched and discussed. The ABB Group (Switzerland)'s manufacturing experts, the Valeo (France)'s quality management experts, the Shell (England)'s lubricating oil experts, and our company's vacuum technology manufacturing experts jointed development completes.

In order to make sure the " VRD " series pump can achieve high quality, our company imported OKUMA vertical machining center (Japan), WENZEL 3D measuring machine (Germany) to build a constant temperature and humidity assembly shop. At the same time, lean production mode was introduced to ensure the process, measurement and assembly were perfect accuracy. " VRD " series vacuum pump had a whole body structure, forced lubrication and hydraulic control system. The pump oil (special ordered from SHELL) could make sure the vacuum pump chamber with extremely high precision and good lubrication performance. The oil seal and the fluorine rubber sealing ring were imported to insure the high sealability and longer life. The NSK bearing made in Japan and the SANDVIK exhaust valve made in Swiss can guarantee 10 billion times operating life.

长久以来，VALUE飞越一直把创造卓越品质的高极限真空度、低噪音、高可靠性真空泵视为最高荣誉。秉着为客户创造价值为核心理念，把客户的需求作为我们研发的起点，怀着对高极限真空度、低噪音和高可靠性的执着追求，推出适合全球不同区域客户需求的高可靠性VRD系列真空泵。

全新 VRD 系列真空泵的设计是一项系统工程。开始时，我们的团队研究产品的定位，发放了1200多份市场调查问卷，通过与全球30多个国家和地区的客户的沟通和交流，分析了国内外产品的优点和不足，结合终端使用客户的要求，得出以高极限真空、低噪音、和高可靠性为定位点。从构思到筛选到最后定案，我们对几十个不同的方案进行了研究讨论，期间有来自ABB公司，Valeo公司以及Shell公司的电机专家、品质管理专家、制造专家，润滑油制造专家以及真空技术专家和现代工业设计团队一起执行这个项目，最终完成产品的开发。

为确保 VRD 系列的制造品质达到设计品质，我们引进日本OKUMA最先进的立式加工中心，德国WENZEL三坐标测量仪器，建立了恒温、恒湿的装配车间，引进精益生产管理方式，确保从加工、测量、装配的各个环节精确无误。

VRD系列真空泵采用整体式泵体结构，强制油泵润滑和油压控制系统，并采用Shell为VALUE飞越定制的高品质真空泵油确保泵腔具有极高的精度及良好的消滑性能；同时选用进口的油封和氟橡胶的密封圈，保证了各种工况下的可靠密封性和更长的使用寿命；日本NSK轴承及瑞士SANDVIK材料的排气阀片均能保证100亿次的运行寿命，这一切保证VRD系列的高极限真空度，低噪音和高可靠运行。

## Table of Contents

## 目录

## Table of Contents

## 目录

◇ Forward	◇ 前言
I Use information.....1	I 使用须知.....1
II Safety indication.....2	II 安全标志.....2
III Attentions.....2	III 注意事项.....2
IV Reception and storage.....4	IV 真空泵的接收和保管.....4
IV-1 Reception.....4	IV-1 真空泵的接收.....4
IV-2 Operating and storage environment.....4	IV-2 真空泵的运转、保管.....4
1. Description.....5	1 产品概况.....5
1.1 Application.....5	1.1 用途及使用范围.....5
1.2 Function.....5	1.2 结构原理.....5
1.3 Technical specification.....7	1.3 泵技术参数.....8
1.4 Dimension.....9	1.4 外形尺寸.....9
2. Installation.....9	2 安装.....9
2.1 Transportation.....9	2.1 搬运.....9
2.2 Installation site.....10	2.2 泵安装场地.....10
2.3 Installation.....10	2.3 泵的安装.....10
2.4 Adding oil.....10	2.4 加油.....10
2.5 Working temperature.....11	2.5 泵的工作环境温度.....11
2.6 Low temperature start up.....11	2.6 泵的低温启动.....11
3. Electrical Connections.....12	3 接线.....12
3.1 Pump with single phase AC motor.....12	3.1 带单相电机的泵.....12
3.2 Pump with three phase AC motor.....13	3.2 带三相电机的泵.....13
4. Vacuum system connection.....14	4 真空系统连接.....14
4.1 Requests for vacuum system connection.....14	4.1 真空系统连接要求.....14
5. Operation.....15	5 运转.....15
5.1 Before operation.....15	5.1 运转前.....15
5.2 Operation.....15	5.2 运转.....15
5.3 Switching off.....16	5.3 停止运转.....16
6. Maintenance.....17	6 维护.....17
6.1 Oil checking.....17	6.1 检查泵油.....17
6.2 Oil change.....18	6.2 换油.....18
6.3 Oil change procedure.....19	6.3 换油的方法.....19
6.4 Cleaning the dirty.....19	6.4 清洁进气口过滤网.....19
6.5 Routine checking.....20	6.5 常规检查项目.....20
6.6 Trouble shooting.....21	6.6 常见故障及排除.....22

7. Supplied Equipment.....23	7 供货设备.....23
7.1 Standard equipment.....23	7.1 标准设备.....23
7.2 Accessories.....23	7.2 附件.....23
8. Warranty.....23	8 保修条款.....23
9. Spare parts.....24	9 泵易损件.....24
9.1 Explode drawing.....24	9.1 泵分解图.....24
9.2 Spare parts list.....25	9.2 易损件一览表.....26

## Forward | Use information

- Thanks for trusting and using our products, we will try our best to supply you with good products and service.
- Please check the product received is same as you ordered and also the accessories, operating manual are attached. Please check the product if there is any damage during transportation.
- Contact with local distributor if the above problem is found.
- Please read the operating manual carefully before operating and use the pump according to the product operating procedures.
- We reserve the right to modify the design and specified data including operating manual without notice.
- Add vacuum oil before starting up for the first time.

### ⚠ Warning

In order to prolong the usage of the vacuum pump, please read the operating manual carefully before installation, operation, repair and maintenance, which can help you to fully understand the safety, specification as well as operating procedure of the vacuum pump.

## || Safety indication

Only operate VRD vacuum pump in a proper way according to operating manual can ensure the safety and efficient operation of the pump. In order to enable you to fully understand the operating manual and the content of warning, we list following safety indications.

### ⚠ Warning

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

## 前言

### | 使用须知

- 尊敬的用户,感谢您对 VALUE 飞越 的信任与支持,欢迎您使用本公司的VRD系列高可靠性真空泵产品(以下简称泵),我们将竭诚为您提供优质的服务。
- 请您仔细检查收到的产品是否和订购产品一致,备附件、使用说明书等是否齐全,运输过程中是否有损坏。
- 如果发现上述情形请及时与本公司营业部或当地经销商联系。
- 在使用本产品前,请您务必仔细阅读此说明书,按产品操作规程进行操作。
- 产品(包括说明书)以后若有任何改动,请恕不另行通知。
- 新机使用前请务必按要求加注真空泵油。

### ⚠ 警告

为确保该产品长期稳定运行,在您安装、运转、检修或保养以前,请您仔细阅读此说明书,以便充分理解有关安全方面的问题及该泵的技术参数和操作方法等相关的注意事项。

## || 安全标志

只有按照本说明书正确使用,才能保证泵的安全和有效运行。为了使您能够充分理解此使用说明书及该产品上的警告标志,我们列出了各项安全标志及警告的内容。

### ⚠ 警告

表示如果使用出现错误,会造成人员伤亡,危险性较大。

### ⚠ Attention

Indicates procedures must be strictly observed to prevent damage or destruction of the pump.



This warning label indicates the possibility of electrical shock. Disconnect the pump from the power supply in the process of electrical connection, repair and maintenance. Make sure the proper cover of junction box before running.



This warning label indicates when opening the pump, do not touch the pump, until it has cooled.

### ⚠ 注意

表示如果使用出现错误,可能会造成设备损伤,使设备无法正常运转或性能下降。



本警告标贴表示可能有触电的危险,在接线、维修保养时,请先将电源切断,再进行操作。运转时请将接线盒的盖子盖住。



本警告标贴表示泵运转时及运转停止后,而整个泵的温度还很高时,请不要触摸。

### || Attention

### ⚠ Attention

Before the connection, please check the power supply is the same with the required power supply.

### || 注意事项

### ⚠ 注意

使用的电源必须与产品所标识的电源相一致。

### ⚠ Warning

Electrical connection work must only be carried out by a skilled electrician in accordance with the electrical equipment technical standard and connection regulation.

### ⚠ 警告

电源连接必须由具有电工上岗证的人员按电力设备技术标准和布线规定正确操作。

### ⚠ Warning

Do not place obstacles which will influence the ventilation around the motor in order to avoid scald or fire.

### ⚠ 警告

请不要在电机周围放置有碍通风的障碍物,以避免异常升温而造成烫伤或火灾等。

### ⚠ Warning

The products must be grounded and the motor circuit must be equipped with a suitable rated motor protection switch before starting up.

### ⚠ 警告

启动泵前，必须保证电机有效接地，并连接适当额定值的电机保护开关。

### ⚠ Attention

The pump must be operated at ambient temperatures between 5-40°C.

### ⚠ 注意

泵的使用环境温度应为5-40°C。

### ⚠ Warning

The exhaust line must be unblocked before operating. Make sure that the gas flow from the exhaust port is not blocked or restricted in any way.

### ⚠ 警告

泵在运行前，排气口必须保持畅通，不得以任何方式堵塞或限制排气口气流。

### ⚠ Attention

Check the oil level before running. Do not operate the pump without oil or short of oil. Otherwise it will result in the pump failure.

### ⚠ 注意

泵在运转前应检查油位，不要在泵没有加油或缺油的情况下使用，否则会造成泵的失效。

### ⚠ Warning

When opening the pump, do not touch the pump, until it has cooled.

### ⚠ 警告

泵在长时间运转过程中或者刚刚停止运转、而泵温度还很高时，请不要触摸电机和泵，以免烫伤。

### ⚠ Warning

VRD series vacuum pumps shall not suitable for pumping of toxic, corrosive, flammable and explosive gas.

### ⚠ 警告

泵严禁抽除有毒、腐蚀性及易燃易爆气体。

### ⚠ Warning

VRD series pumps are strictly prohibited to operate in the explosion hazard and flammable area in case of explosion or fire.

### ⚠ 警告

泵严禁在有爆炸危险及易燃物品的场所使用，以避免引起爆炸或火灾。

### ⚠ Attention

If the medium pumped contains a small amount of dust, condensable gases, some corresponding accessory should at all events be installed. Otherwise, it will cause pump failure or deduction of performance.

### ⚠ 注意

抽除含少量粉尘、可凝性气体时需安装相适应的附件，否则会造成泵的失效或性能急剧下降。

### ⚠ Warning

Disconnect the power supply during the repair and maintenance, in order to prevent electrical hazard.

### ⚠ 警告

检查、修理泵时，必须切断电源再进行操作。这样可以避免触电或者泵突然启动而造成人员伤亡。

## IV Reception and storage

### IV-1 Reception

Please do following inspections when you received the product:

- Whether the product is same as you ordered.
- Whether the accessories (including the first time use vacuum oil, accessories) are same as contract.
- Whether there are any damages during transportation.

If any questions, please contact with your local distributor or our sales department.

## IV 真空泵的接收和保管

### IV-1 真空泵的接收

在您收到产品并打开包装后，应对以下几项内容进行检查：

- 是否与您所订购的产品一致。
- 附件（包括可以加一次的泵油、选购件）是否按合同配备。
- 运输过程中是否造成破损。

如果有问题，请您与当地经销商或我公司营业部取得联系。

### IV-2 Operating and storage environment

In order to achieve stable, reliable operation, following requirements should be satisfied during storage and operation:

- Working ambient temperature/humidity: 5-40°C, Below 85%RH
- Storage and Operating altitude < 1000m
- Storage and operating environment:
  - 1) No corrosive, flammable and explosive gases.
  - 2) The pump must be stored in a room with good ventilation.
  - 3) Avoid direct sunlight.
  - 4) Far away from heat source.
  - 5) No dust
  - 6) No frost

### IV-2 真空泵的运转、保管环境

为使泵稳定、可靠运行，在保管、运转时必须满足以下条件：

- 运转时的温度和湿度：5—40°C，85%湿度以下
- 保管和运转：海拔高度 < 1000m
- 保管和运转时的周围环境：
  - 1) 没有腐蚀性和易燃易爆的气体
  - 2) 必须放置在室内，且通风良好
  - 3) 避免日光直射
  - 4) 远离热源体
  - 5) 无灰尘
  - 6) 无霜

### ! Attentions

Do not invert the pump or subject the pump to any impact. Otherwise, the pump may be damaged.

### ! 注意

请不要将泵倒置，也不要让泵体受到冲击，否则会使泵体遭受破坏。

## 1 Description

VRD series vacuum pump is a high speed, motor direct drive, oil-sealed rotary vane vacuum pump. The pump adopts integrated cylinder structure, inner oil pump design, automatic anti-suckback valve design, oil pressure control system and adjustable gas ballast valve design.

The pumps are designed with rational structure, safety and reliability. It has high flow rate, high ultimate pressure and low noise level. The pumps are free of oil leakage and easy for maintenance. It is a highly reliable vacuum pump proved by global customers.

### 1.1 Purposes and scope

The VRD series vacuum pump is the basic equipment in vacuum application field, especially in researching, teaching, medical field, vacuum coating .

The VRD series vacuum pump can be used as the main pump for the low/medium vacuum system; also this kind of pump could be used as the backing pump for roots pump, diffusion pump, molecular pump and other ultra-high vacuum system.

### 1.2 Structure and principle

The VRD series is double-stage direct coupled rotary-vane vacuum pump; the advantages of this pump are high reliability, low noise and high ultimate vacuum. This pump had a whole body structure, forced lubrication and hydraulic control system. At the same time, a different permeability designed gas valves made the pump maintain a high reliability in different using environment.

## 1 产品概况

VRD系列真空泵是属于高速直联（电机直接驱动）双级旋片油封（油密封）式变容真空泵。其泵体采用整体式结构设计，内置齿轮油泵设计，压力油控制的防回流阀设计，油泵压力控制系统，油液循环过滤系统，低噪音NSK轴承及完善的气镇密封结构设计，不同渗气量的气镇阀设计，流畅的外观设计。

该泵结构设计合理，安全可靠，抽速大，极限真空度高，低噪声，不喷油，不漏油，维修方便，造型美观大方，是全球客户验证的高可靠性真空泵。

### 1.1 用途及使用范围

VRD系列真空泵是真空应用领域中最基本的真空获得设备，特别适用于需要获得高极限真空低噪音环境的科研、教学、实验室、分析仪器、医疗器械、真空镀膜等不同真空应用领域。

VRD系列真空泵可作为中、低真空系统的主抽泵，也可以作为罗茨泵、扩散泵、分子泵等中高真空、超高真空系统的前级泵。

### 1.2 结构原理

VRD系列真空泵为双级直联旋片式真空泵，产品以高可靠性、低噪音和高极限真空度为设计定位，通过采用世界最先进的整体式泵体结构设计，强制油泵润滑油压控制系统，同时具有不同渗气的气镇阀设计使得产品在不同使用环境中保持高可靠性。

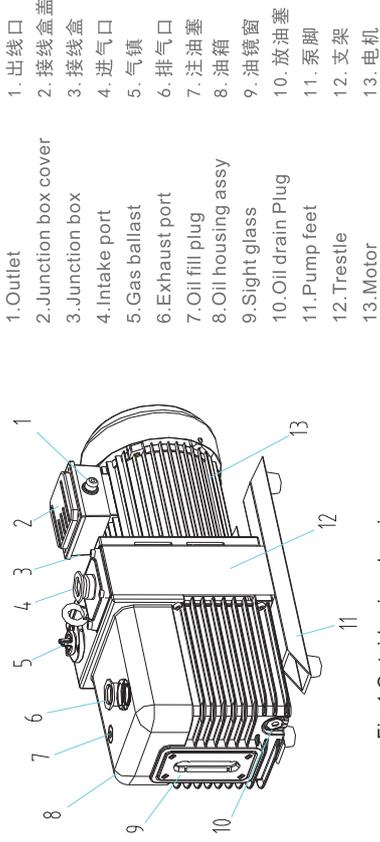


Fig.1 Outside view drawing  
图1 外观图

Refer to Fig. 2 for functional diagram: The rotor, mounted eccentrically in the pump cylinder, has two vanes which divide the pump chamber into two different changeable compartments. When the pump rotor which was driven by the motor clockwise rotated, chamber 1 will suck air from small to big, and chamber 2 will complete the transmission of air, then chamber 3 will compress and exhaust air from big to small, and complete a work cycle from suction- compress-exhaust finally, achieve the vacuum of the system.

原理图如图2所示：泵转子偏心地安装在泵缸体内，通过两个始终紧贴缸壁的旋片把泵腔分成两个大小变化的腔体。当电机带动泵转子顺时针旋转，腔体1由小变大完成吸气，腔体2完成气体的传输，腔体3由大变小压缩排气，完成一个吸气-压缩-排气工作周期。当电机连续转动，泵体则实现不断吸气-压缩-排气，从而达到对容器抽气的目的。当排出的气体通过气道转入另一级（低真空级），由低真空级抽走，再经低真空级压缩后排至大气中，即组成了双级泵。这时总的压缩比由两级来负担，因而提高了极限真空度。

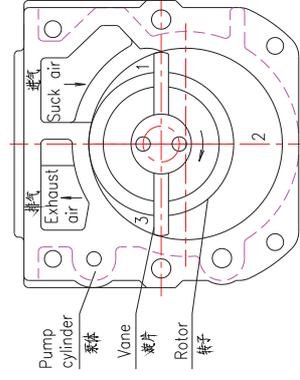


Fig.2 Functional diagram  
图2 工作原理图

### 1.3 Pump technical specification

#### 1.3.1 Technical Specification:

Model	VRD-4	VRD-8	VRD-16	VRD-24	VRD-30	VRD-48	VRD-65
Displacement speed m <sup>3</sup> /h(L/s)	50Hz 4(1.1)	8(2.2)	16(4.4)	24(6.6)	30(8.3)	48(13.3)	65(18)
	60Hz 4.8(1.3)	9.6(2.6)	19.2(5.2)	28.8(7.9)	36(9.9)	57.6(16)	78(21.6)
Ultimate partial pressure without gas ballast(Pa)	5×10 <sup>-2</sup>	5×10 <sup>-2</sup>	4×10 <sup>-2</sup>				
Ultimate total pressure without gas ballast(Pa)	5×10 <sup>-1</sup>	5×10 <sup>-1</sup>	4×10 <sup>-1</sup>				
Ultimate total pressure with gas ballast(Pa)	3	3	8×10 <sup>-1</sup>				
Power Supply	Single/3-ph	Single/3-ph	Single/3-ph	Single/3-ph	Single/3-ph	3-ph	3-ph
Power rating (KW)	0.4/0.37	0.4/0.37	0.75/0.55	1.1/0.75	1.1	1.5	2.2
Intake and exhaust DN (mm)	KF16/25	KF16/25	KF25	KF25/40	KF25/40	KF40	KF40
Oil Capacity (L)	0.6~1	0.6~1	0.9~1.5	1.3~2.0	1.3~2.0	3.3~4.5	3.3~4.5
	1440	1440	1440	1440	1440	1440	1440
Motor speed (rpm)	50Hz 1720	1720	1720	1720	1720	1720	1720
	60Hz	1720	1720	1720	1720	1720	1720
Ambient temperature	5~40℃	5~40℃	5~40℃	5~40℃	5~40℃	5~40℃	5~40℃
Noise level (dB)	≤56	≤56	≤58	≤58	≤58	≤62	≤62
Weight (kg)	19	21	30	35	43	62	65

### 1.3 泵的技术参数

#### 1.3.1 技术参数如表1所示:

型号	VRD-4	VRD-8	VRD-16	VRD-24	VRD-30	VRD-48	VRD-65
抽速 m <sup>3</sup> /h(L/s)	50Hz 4(1.1)	8(2.2)	16(4.4)	24(6.6)	30(8.3)	48(13.3)	65(18)
	60Hz 4.8(1.3)	9.6(2.6)	19.2(5.2)	28.8(7.9)	36(9.9)	57.6(16)	78(21.6)
极限分压强-无气锁 (Pa)	5×10 <sup>-2</sup>	5×10 <sup>-2</sup>	4×10 <sup>-2</sup>				
极限总压强-无气锁 (Pa)	5×10 <sup>-1</sup>	5×10 <sup>-1</sup>	4×10 <sup>-1</sup>				
极限总压强-有气锁 (Pa)	3	3	8×10 <sup>-1</sup>				
电源	单/三相	单/三相	单/三相	单/三相	单/三相	三相	三相
电机功率(KW)	0.4/0.37	0.4/0.37	0.75/0.55	1.1/0.75	1.1	1.5	2.2
进排气接口 DN(mm)	KF16/25	KF16/25	KF25	KF25/40	KF25/40	KF40	KF40
用油量(L)	0.6~1	0.6~1	0.9~1.5	1.3~2.0	1.3~2.0	3.3~4.5	3.3~4.5
	1440	1440	1440	1440	1440	1440	1440
电机转速 (rpm)	50Hz 1720	1720	1720	1720	1720	1720	1720
	60Hz	1720	1720	1720	1720	1720	1720
工作环境温度	5~40℃	5~40℃	5~40℃	5~40℃	5~40℃	5~40℃	5~40℃
Noise level (dB)	≤56	≤56	≤58	≤58	≤58	≤62	≤62
重量(kg)	19	21	30	35	43	62	65

Chart 1 Technical specification

### 1.3.2 Pumping speed characteristic

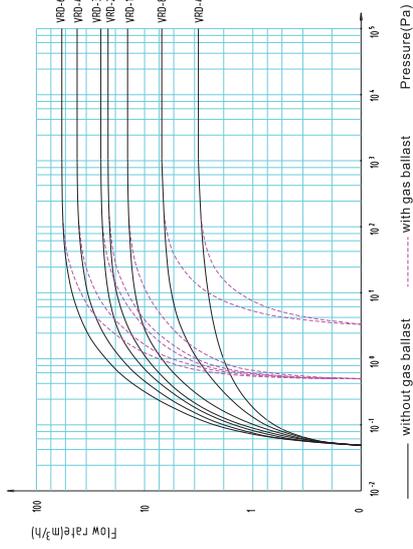


Fig.3 pumping speed characteristic

表1 技术参数

### 1.3.2 系抽气速率曲线如图4表所示:

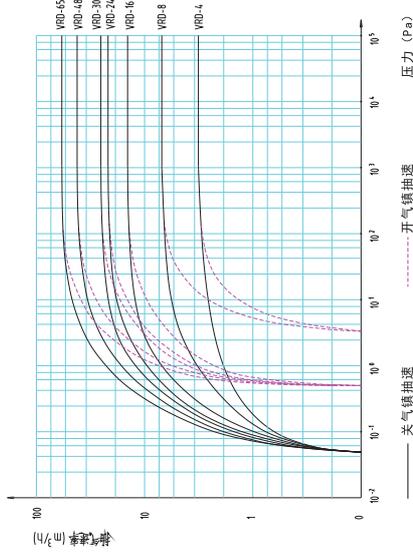
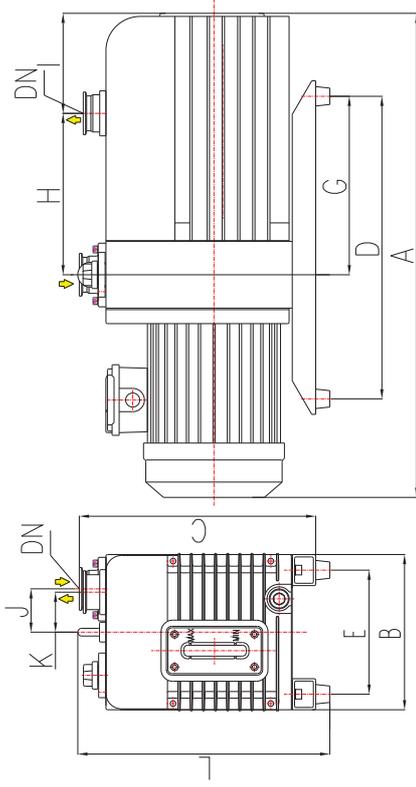


图3 泵抽气速率图

## 1.4 Dimension 外形尺寸



The dimension for VRD series pump

TYPE	A	B	C	D	E	G	H	I	J	K	L	DN
VRD-4	460	144	207	240	120	126	154	45	45	34	230	KF16/25
VRD-8	460	144	207	240	120	126	154	45	45	34	230	KF16/25
VRD-16	520	188	272	320	148	160	165	69	59	38	295	KF25
VRD-24	560	188	272	320	148	160	185	82	59	47	295	KF25/40
VRD-30	560	188	272	320	148	160	185	82	59	47	295	KF25/40
VRD-48	730	234	358	396	190	200	223	157	69	55	390	KF40
VRD-65	730	234	358	396	190	200	223	157	69	55	390	KF40

Fig. 4 pump dimension 图4 外形尺寸图

## 2 Installation

### 2.1 Transportation

Any negligence will cause pump damage. Take care during transportation.

#### ! Warning

Pump must only be moved when stopped and supply switched off.

#### ! Warning

Check the pump for the presence of any oil leakage. Since there exists the danger that someone may slip on spilt oil.

### 2 安装

#### 2.1 搬运

搬运过程中任何一个小的疏忽都可能造成系的损伤，请小心搬运。

#### ! 警告

泵只有当停止运转，且断开电源后才可移动。

#### ! 警告

由于流出的油有使人滑倒的危险，请检查泵是否漏油。

#### ! Warning

When lifting the pump you must make use of the hook provided on the pump.

### 2.2 Installation site

When choosing the pump installation site, please consider the followings:

- Suitable for installing, maintenance and disassembly
- Good ventilation
- Convenient for electrical connecting

#### ! Warning

VRD series pumps are strictly prohibited to operate in the explosion hazard and flammable area in case of explosion or fire.

#### ! Warning

Do not place obstacles which will influence the ventilation around the motor in order to avoid scald and fire.

#### ! 警告

当吊起泵时必须使用泵上的吊环螺钉，使用前请确认吊环螺钉是否旋紧。

### 2.2 泵安装场地

泵安装场地选择应考虑：

- 方便安装、维护、拆卸等作业；
- 良好的通风条件；
- 方便接线。

#### ! 警告

泵严禁在有爆炸危险及易燃物品的场所使用，以避免引起爆炸或火灾。

#### ! 警告

请不要在电机周围放置有碍通风的障碍物，以免异常升温而造成烫伤或火灾等。

### 2.3 泵的安装

泵连接到真空系统时，可直接将泵脚(11/图1)水平放置于地面上，也可卸下橡胶胶脚(11/图1)用机脚螺栓连接。

#### ! 注意

如果将泵倾斜安装，可能会造成泵的振动、噪声加大，甚至损坏。请将泵水平安装在平稳、牢固的地方。

### 2.4 加油

拧开注油塞(7/图1)，按要求加注泵油，第一次加油时应加至油位上限MAX 80%处。

#### ! Attention

Oblique installation may result in pump's vibration, high noise or even damage. The pump should be set up on a flat and firm surface.

### 2.4 Adding oil

Open the oil fill plug (7/ Fig.1), add the oil according to the technical data. Add oil to recommended oil level for the first time.