

ZJB 型单级真空净油机

使用说明书

*INSTRUCTION MANUAL FOR  
MODEL ZJB SINGLE-STAGE VACUUM OIL  
PURIFIER*

自贡川滤设备制造有限公司

ZIGONG CHUANLU EQUIPMENT MANUFACTURE CO., LTD.

# 前 言

我厂系机械工业部分离机械设备定点生产厂，已有三十余年研制制造油液净化设备的丰富经验。通过近十几年的多期技术改造和不断研制开发新产品，现已发展为生产油水分离净化机、透平油过滤机、真空净油机、板框压力式滤油机、齿轮油泵等七个品种，十五个系列，一百三十多个规格的产品。

我厂工艺先进，加工设备和检测仪器精良，长期服务于能源、电力、铁道、石油、化工、冶金、航空和舰载加油等系统及广大用户，被指定为国内大中型重点工程项目油处理设备配套生产厂。产品畅销全国各地，远销巴基斯坦、孟加拉、印尼、泰国、缅甸、伊朗、越南、叙利亚、独联体、科威特等二十多个国家和地区，在国内外市场上享有较高的声誉。

## 一、用 途

ZJB 型单级真空净油机主要用于 330kV 及以下输变电设备用绝缘油的净化处理，它能高效地排除油中的水份，气体和杂质微料，提高油的耐电压强度和油品质量，保证电器设备的安全运行。因此，可供变压器、互感器、电缆、电力电容、高压开关和绝缘导管等电器制造厂、发电厂、供电局、铁路变电工区、送变电施工部门进行绝缘油净化处理和对高压电器设备进行真空注油和热油循环干燥。

## 二、主要技术参数

参数 型号	公称流量 (L/h)	极限真空 (Pa)	工作真空 (Pa)	工作油温 (°C)	加热功率 (kW)	总功率 (kW)	口径 (mm)		噪音 (dB)	电源
							进口	出口		
ZJB2KY ZJB2BY	2000	≤ 90	≤ 666	40-70	3 × 6	19.85	25	25	≤ 78	380V50Hz
ZJB 3KY ZJB 3KF ZJB 3BY	3000	≤ 90	≤ 666	40-70	4 × 6	27.3	32	32	≤ 80	
ZJB-4KY	≥ 4500	≤ 90	≤ 666	40-70	4 × 8	36.4	50	50	≤ 80	
ZJB 6KY ZJB 6KF ZJB 6BY	6000	≤ 90	≤ 666	40-70	4 × 12	53.29	40	40	≤ 82	
ZJB 9KF ZJB9BF	9000	≤ 90	≤ 666	40-70	6 × 12	80.59	40	40	≤ 83	
ZJB 12KF ZJB 12BF	12000	≤ 90	≤ 666	40-70	6 × 16	105.59	50	50	≤ 85	

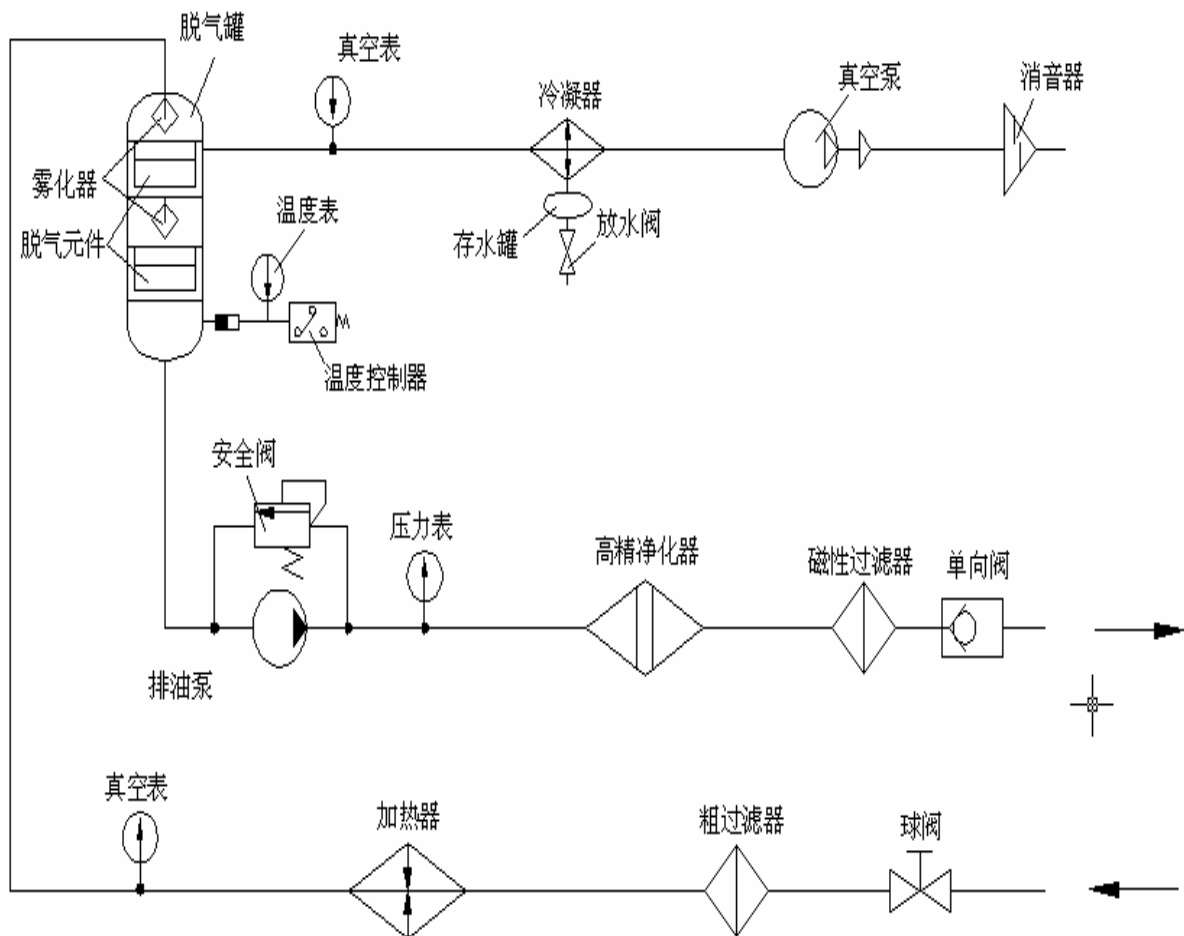
注：①型号最后两个字母的意义为：K 表示敞开型，B 表示封闭型；Y 表示移动式；F 表示放置式，T 表示拖车式。如：ZJB 6KY 表示敞开型移动式。

②总功率中，包括真空泵采用水冷时水泵功率（90W），若采用风冷和自来水冷却时，则无水泵，但水冷式真空泵可根据用户要求配备水泵和备用水箱。

### 三、结构与工作原理

ZJB 型系列真空净油机主要由真空脱气罐、排油泵、精滤器、粗滤器、真空泵、冷凝器、高精过滤器、电加热器及各种阀组成。

其原理为：待净化的油液在外界大气压的作用下经入口进入粗过滤器、大颗粒杂质被滤除；含有微粒杂质的油液经加热器加热后进入真空脱气罐，在极低的真空压力和脱气元件的作用下，油中的气体溃破油膜而析出，水份迅速蒸发，然后被真空系统排出；最后，油液被排油泵输送入高精过滤器除去微粒杂质，完成全部净化过程。



## 四、主要技术性能指标

待净化油指标: 含水 $\leq 50\text{ppm}$ , 含气 $\leq 12\%$ , 耐压值 $\geq 30\text{kV}$ , 经本机数次净化处理后, 可达下列指标:

1. 残余水份 $\leq 7\text{ppm}$
2. 残余气体 $\leq 0.3\%$
3. 过滤精度 $\leq 5\mu\text{m}$
4. 击穿电压 $\geq 65\text{Kv}$
5. 净化清洁度: NAS1638 6 级

## 五、安装与调试

### (一)、安装

- A、本机带有吊环, 起吊时注意检查是否损坏。
- B、由于本机采用移动或固定放置式, 用户不需要另行设计安装基础, 只需将本机移动或放置在油罐附近的平地面上即可。对于固定放置式机型需用木垫水平。
- C、油池液面不能低于本机入口 500mm。
- D、电源进线的选用必须能够承受在本机全开状态时的最大电流。

### (二)、调试

- 1、关闭本机所有阀门, 接上进出油管, 保证油池到本机进出口油路畅通;
- 2、接好三相四线电源。本机设有安全接地标志, 要特别注意接好零线;
- 3、启动真空泵, 检查旋向是否正确;
- 4、启动排油泵, 注意电机旋向是否正确;

5、调试检查各功能装置时，应注意不要长时间空载。特别是在检查排油泵与加热功能的联锁情况时，只能在一瞬间完成。

## 六、操作与使用说明

### (一)、开机

1、启动真空泵，注意真空度的上升情况；

2、当真空度达到（真空压力表所示）-0.08MPa 时，打开入口阀；

3、当油进入真空脱气罐下透视孔 3/4 时，即可启动排油泵；

4、油液循环正常后，即可启动自控加热器。注意启动加热器前应先将温度调节在 45—65℃的自控范围内，以 65℃为最佳状态。然后根据处理油量的多少和周围环境温度的高低决定是否开启 1<sup>#</sup>和 2<sup>#</sup>辅助加热器。

### (二)、使用说明

#### 1、使用范围

A、本机作业时的环境温度应在-30—40℃范围内。

B、在温度较低的环境中使用，必须先将真空泵油加热到 15℃左右才能启动。

C、待净化的油液不能太脏（即油中水份、杂质颗粒太多），否则，必须先用其它过滤设备（如我厂生产的板框压力式滤油机）充分滤除，以免影响净油机的脱气效率或堵塞过滤元件。

D、使用场地的海拔高度的高低会直接影响本机的真空。

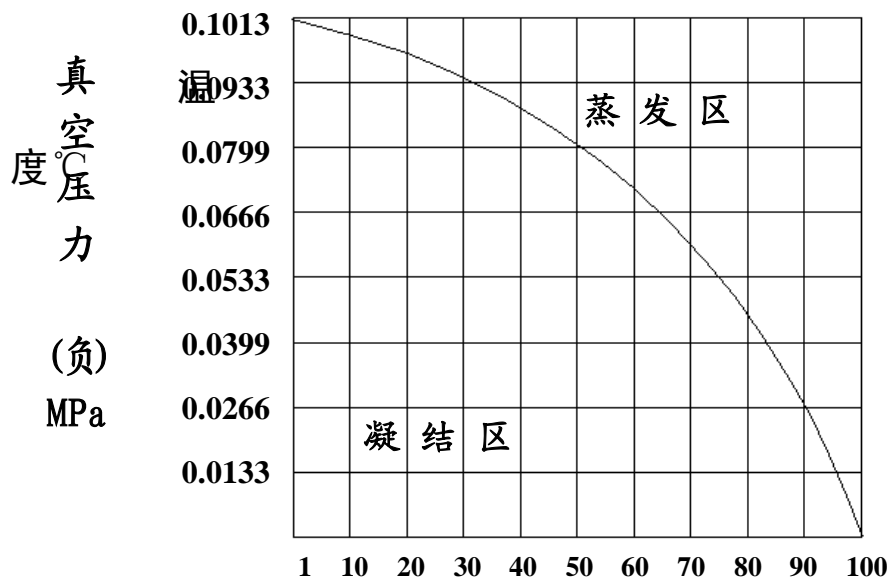
海拔高度与真空度换算表

真 空 度		海拔高度 (m)
(-MPa)	(mmHg)	
0.1013	760	0
0.0990	742.7	200
0.0968	726.2	400
0.0957	717.9	500
0.0902	676.7	1000
0.0846	634.7	1500
0.07908	593.3	2000

2、水的汽化温度与油温、真空度的关系对照表及饱和曲线图：

真空度(毫米水银柱)	水的汽化温度	油 温
-750	10℃	≥ 20℃
-742	20℃	≥ 30℃
-727	30℃	≥ 40℃
-714	35℃	≥ 45℃

### 饱和曲线图



- 3、变压器油遵照变压器制造厂的注油操作规程来处理。
- 4、热油循环按照净油规程和方法进行。

## 七、油性能测试

- 1、本机正常运行工作，且油液循环数次后，即可取样化验。
- 2、取样时应保持油温 45—65℃，真空度应<666Pa，取样应按操作规程进行。
- 3、化验油样的性能指标应符合本说明书中第四条 —— 技术性指标的规定。

## 八、停 机

当油处理完毕或中途需要停止运行时：

- 1、关闭进油阀；



- 2、当真空脱气罐内排油完毕，断开排油泵电源；
- 3、关闭真空泵；
- 4、打开冷凝器阀，放掉里面油水混和液，注意放后要关闭阀门；
- 5、断开总电源。

## 九、操作注意事项

- 1、真空泵工作时，应注意泵油标显示的油液情况，油液应在油标线上，真空泵油水份较多时，要及时更换。
- 2、运行中冷凝器内存液较多时，要及时放掉。
- 3、经常注意压力表值，当压力 $>0.5\text{MPa}$ 时，应清洗过滤器或更换过滤元件。
- 4、粗滤器、真空脱气罐顶部的滤网应经常拆下清洗，保持清洁，以免堵塞，造成进油不足或压力过高。
- 5、注意真空脱气罐内油位的平衡，可通过液位阀作调节。
- 6、运行中随时注意泵及相应电机的运行噪音和温度是否正常，如异常应立即排除。泵及电机允许温升不得大于 $40^{\circ}\text{C}$ （即最高温度不得大于 $80^{\circ}\text{C}$ ）。
- 7、冬季停机后，应放尽冷却水，以免冻裂真空泵。
- 8、本机停置不用时，应将真空泵油放尽，注入新油，同时打开各阀门，将存油放尽，系统保持一定的真空度。

## 十、维护保养及故障排除

### (一)、维护保养

- 1、设备每运行 50 小时应检查：
  - a、电器控制系统是否安全、可靠；
  - b、恒温控制是否灵敏、可靠、准确；
  - c、泵轴封是否损坏、泄漏；
  - d、运行系统有无堵塞现象，泵及相应电机运行噪音及温升有无异常；
  - e、各管路系统及密封处有无漏气、漏油现象；
  - f、工作压力是否正常。
- 2、电机每运转 3000 小时，应补加 ZL-2 或 ZL-3 锂基润滑脂。
- 3、应随时注意补加真空泵油。
- 4、如果停机一月以上，本机应放在干燥的地方，关闭电气柜门和所有阀门，盖好机身。

### (二)、故障排除方法

序号	故 障	生 产 原 因	排 除 方 法
A	真 空 度 达 不 到 额 定 数 值	1.真空泵没有工作 ； 2.真空表指示不正确； 3.管路系统或其它密封不良生产漏气； 4.真空泵油太脏或不足。	1.重复启动； 2.校准或更换； 3.检修； 4.更换新油或加油至油标线上。
B	接 上 电 源 后 机 组 不 启 动	接线不正确或不牢固	检查电源相序是否正确，接线是否牢固
C	排油量少	1.系统有堵塞物或进油管口径不对；	1.排除，更换；

		2.排油压力过大，滤渣太多； 3.滤网或滤芯堵塞； 4.油泵轴封损坏； 5.进油管过长或吸程过高或进空气。	2.排除； 3.清洗，更换； 4.更换； 5.调理。
D	油泵有异常响声	1.泵或电机紧固松动； 2.内部零件损坏； 3.进油量不足。	1.紧固； 2.更换； 3.调整。
E	真空泵有异常响声	1.泵或电机紧固件松动； 2.零件损坏； 3.真空泵油太少。	1.紧固； 2.更换； 3.补加真空泵油。
F	加热器开启后油温不升高或升高极少	1.联锁； 2.加热器损坏，线路断接； 3.恒温器定值不对。	1.重复启动； 2.换加热器或检查电路； 3.重新调整。
G	取样化验达不到性能指标	1.待净化油水分、气体、杂质太多； 2.过滤元件损坏； 3.取样方法不正确； 4.真空度太低； 5.管道及罐内太脏； 6.脱气罐内泡沫太多。	1.作前极处理； 2.更换过滤元件； 3.按正确取样方法； 4.按 A 处理； 5.用干净油循环冲洗； 6.调整。

# INTRODUCTION

With experiences of manufacturing oil/liquid purification equipments of 30 years or so and being direct under The Ministry of machine-building of China, our plant mainly produces oil/water separation purifier, turbine oil filter, vacuum oil purifier, frame press type filter and gear oil pump, including 7 varieties, 15 series and more than 30 specifications.

Our plant owns up-to-date technology and excellent equipments and measuring apparatus. And it is among the key manufacturers which fabricate products for important projects at home. Our products find their wide use in energy, power, railway, petroleum, chemistry, metallurgical, aviation and military industries. Our products have ready markets at home and be exported to Pakistan, Bangladesh, Indonesia, Thailand, Burma, Iran, Viet Nam, Syrian, former Soviet Union and Kuwait etc., winning high reputation.

## 1.APPLICATION

Model ZJB single-stage vacuum oil purifier is mainly used for oil treatment of transmission and transformation equipments below 330kV, effectively removing water, gas and particles contained in oil and improving withstand voltage and quality of oil. In doing so, safe running of electric apparatus are ensured. Namely, it is suitable for insulation oil treatment for transformer, mutual inductor, cable, power capacitor high voltage switch and insulation conduit manufacturers, power plant, power supply and transmission / transformation department and for vacuum oil injection and circulation / drying of thermal oil in high voltage electric apparatus.

## 2. PRINCIPAL TECHNICAL DATA

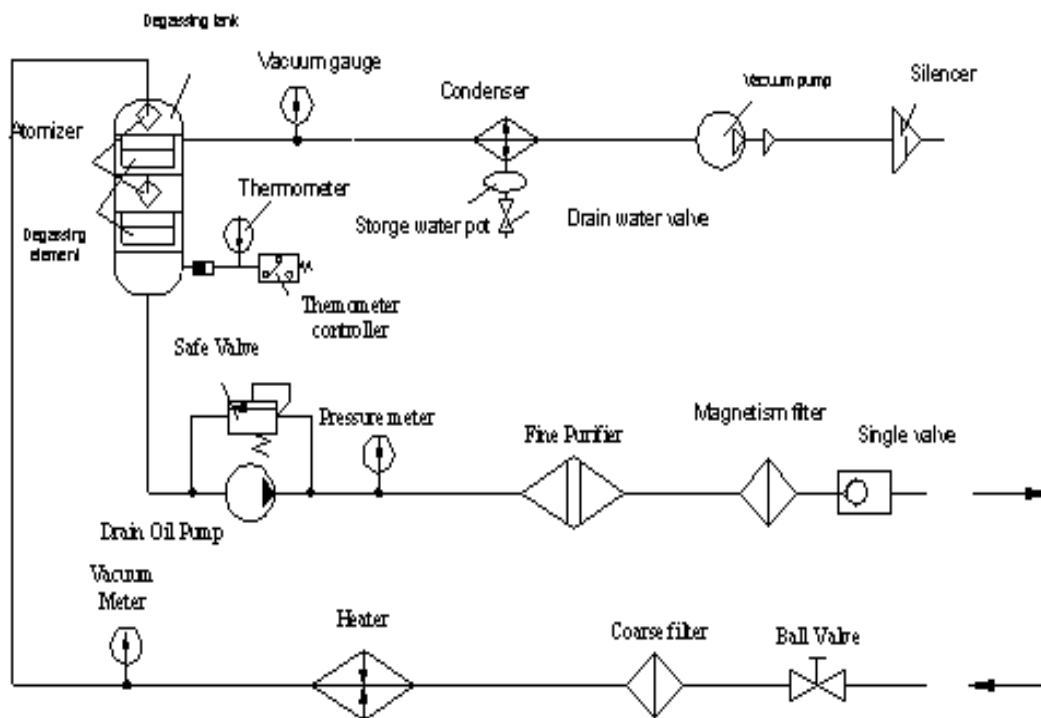
DATA MODEL	Nominal Flow (L/h)	Vacuum Limit (Pa)	Working Vacuum (Pa)	Working Temp. ( °C )	Heating Power (kW)	Total Power (kW)	Diameter( mm)		Noise (dB)	Power Supply
							Inlet	Outlet		
ZJB2KY ZJB2BY	2000	≤ 90	≤ 666	40-70	3 × 6	19.85	25	25	≤ 80	380V50Hz
ZJB3KY ZJB3KF ZJB3BY	3000	≤ 90	≤ 666	40-70	4 × 6	27.3	32	32	≤ 80	
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ZJB 12KF ZJB 12BF	12000	≤ 90	≤ 666	40-70	6 × 16	105.59	50	50	≤ 85	

- Notes: 1. K, designates open type, B, closed one. Y, indicates movable type, F, fixed type, T, denotes trailer type. For instance, ZJB 6KY denotes open/ movable type.
2. The said total power involves water pump power (90W) in case vacuum pump adopts water cooling. If air cooling and tap water cooling is chosen, water pump is not available. However, we may provide water pump and water tank according to clients' requirements.

### 3. STRUCTURE AND OPERATION PRINCIPLE

Model ZJB single-stage vacuum oil purifier mainly consists of vacuum degassing tank, oil drain pump, fine filter, coarse filter, vacuum pump, condensor, electric heater and valves. It operates in such a way that large size particles are removed when oil to be purified enters into coarse filter under the action of atomosphere and when oil containing fine particles (heated by heater) goes into vacuum degassing tank, gas contained in oil is separated out and water contained is evaporated rapidly under action of high vacuum and degassing element. The said separated gas and vapour is discharged by vacuum system. Finally the oil is delivered to fine filter by oil drain pump to remove fine particles.

#### Working Principle



## 4. MAIN TECHNICAL PROPERTY INDEX

Oil to be purified: water content  $\leq 50\text{ppm}$

Gas content  $\leq 12\%$

Withstand voltage  $\geq 30\text{kV}$

The following index of purified oil can be obtained after treating several times.

1. Residual water content  $\leq 7\text{ppm}$

2. Residual gas  $\leq 0.3\%$

3. Filtering precision  $\leq 5\mu\text{m}$

4. Breakdown voltage  $\geq 65\text{kV}$

5. Purified cleanness: NAS1638 class4

## 5. INSTALLATION AND COMMISSIONING

### 5.1. INSTALLATION

5.1.1. The machine is provided with lifting lugs. Check to see whether they are damaged.

5.1.2. Since the machine is of movable or fixed type, no foundation is needed. For fixed type, our clients are required to prepare wood to level it.

5.1.3. Oil level of oil pond should not be 500mm below the inlet.

5.1.4. Power wire chosen should meet the max. Current value specified for the machine.

### 5.2. COMMISSIONING

5.2.1. Close all valves of the machine. Connect inlet and outlet pipes to the machine. Make sure that pipes from oil pond to inlet and outlet are through.

5.2.2. Connect 3-phase 4-wire power supply. The machine is provided with grounding mark. Do connect earthing conductor.

- 5.2.3. Start vacuum pump, Check motor for correct running.
- 5.2.4. Start Drain oil pump, and check to see whether rotation is O.K.
- 5.2.5. When commissioning, long-time idle running should be avoided.

Especially for checking interlock between inlet oil pump and heater, the checking should be done instantaneously.

## 6. OPERATION

### 6.1. START

- 6.1.1. Start vacuum pump. Watch vacuum rise.
- 6.1.2. Open inlet valve when vacuum reaches  $-0.08\text{MPa}$  (see vacuum gauge).
- 6.1.3. Oil drain pump may be started when  $3/4$  of lower visual hole of vacuum degassing tank is filled with coming oil.
- 6.1.4. When oil circulation is normal, start automatic control heater. It should be noted that temperature should be set to  $45-65^{\circ}\text{C}$  ( $65^{\circ}\text{C}$  is best) before starting heater. Start of auxiliary heater 1 and 2 depends on oil quantity to be treated and ambient temperature.

### 6.2. APPLICATION

#### 6.2.1. Scope

- A. Ambient temperature:  $-30-40^{\circ}\text{C}$ .
- B. In cool regions, before start, vacuum pump oil should be heated to  $15^{\circ}\text{C}$  or so.
- C. Oil to be treated should not be very dirty (having high water / impurity content). If so, other filter equipment (frame press filter) is needed to remove the most of impurities in order to avoid low efficiency of degassing and blocking of filter elements.
- D. Elevation of working site affects vacuum of the machine.

### Conversion Table Between Elevation and Vacuum

Vacuum	Elevation
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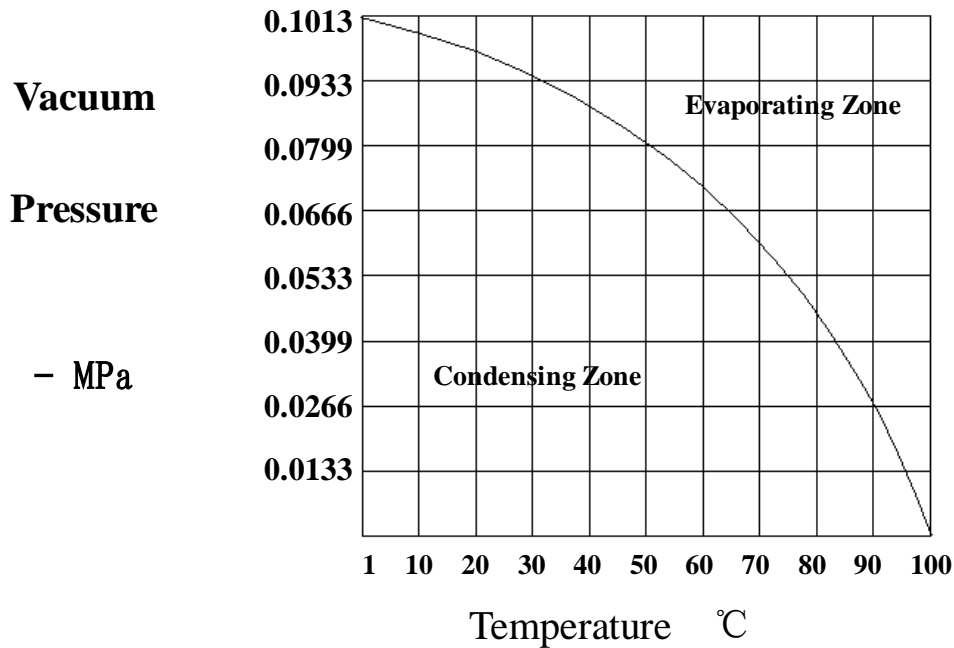
(-MPa)	(mmHg)	(m)
0.1013	760	0
0.0990	742.7	200
0.0968	726.2	400
0.0957	717.9	500
0.0902	676.7	1000
0.0846	634.7	1500
0.07908	593.3	2000

#### 6.2.2. Relationship Between Vapouring Temperature and Oil Temperature / Vacuum and Saturation Curve.

VACUUM (mm Hg)	VAPOURING TEMP	OIL TEMP
-750	10 °C	≥ 20 °C
-742	20 °C	≥ 30 °C
-727	30 °C	≥ 40 °C
-714	35 °C	≥ 45 °C

#### 6.2.3. For treating transformer oil, relevant procedures issued by the transformer manufacturer should be observed.

6.2.4. Hot oil circulation should be done according to oil purifying rules and process.



## 7. OIL PROPERTY TEST

7.1. After normal running of the machine and several oil circulations, sampling can be done.

7.2. When sampling, 45-65°C should be maintained and vacuum should be less than 666Pa. Sampling should be done according to specified procedures.

7.3. Chemical analysis result of the sample should be in conformity with that specified in article 4.

## 8. SHUTDOWN

When shutdown is needed, the following should be done.

8.1. Turn off oil inlet valve.

8.2. When vacuum degassing tank empties oil, turn off oil drain pump mains.

8.3. Turn off vacuum .

8.4. Open condenser valve to let out mixture. Then, close the valve.

8.5. Turn off power supply.

## 9. PRECAUTION

- 9.1. When operation, keep an eye to oil level, oil level should be above oil mark. In case vacuum pump oil contains much water, oil change should be made.
- 9.2. During running, excessive water accumulated in condenser should be discharged.
- 9.3. Often watch gauge. When pressure is above 0.5MPa, rinsing filter or changing filter element is required.
- 9.4. Coarse filter and screen at the top of vacuum degassing tank should be dismantled for cleaning regularly. This can prevent blocking and insufficient oil supply or excessive pressure.
- 9.5. Oil level of vacuum degassing tank can be balanced by means of level valve.
- 9.6. During operation, pay attention to noise and temperature of pump and motor. Faults found should be removed at once. Permissible temperature rise of pump motor should be below 40 °C (Max. Temperature should be below 80°C).
- 9.7. If shutdown is made in winter, cooling water should be drained off in order to avoid vacuum pump damage caused by freezing.
- 9.8. When the machine is to be stored, drain oil from vacuum pump and new oil should be added into it. At the same time, open heater valve to let out oil to enable the system to have certain vacuum.

## 10. MAINTENANCE/SERVICE AND TROUBLESHOOTING

- 10.1.1. After 50 hours' running, the following should be done.
  - a. Check whether control system of electric apparatus is safe and reliable.
  - b. Check to see thermostat control is sensitive, reliable and accurate.
  - c. Check to see whether pump shaft seal is damaged or leaking.

d. Inspect running system for blocking and pumps and relevant motor for abnormal noise and temperature rise.

e. Inspect pipings and sealed joints for leakage.

f. Check to see whether operating pressure is O.K.

10.1.2. After running for 3000 hours, 2 or 3 lithium base grease should be added to the machine.

10.1.3. Add oil to vacuum pump in due time.

10.1.4. In case the machine need to be stored for more than one months, it should be placed in dry place. The electric cabinet door and all valves should be closed and the machine be covered with proper thing.

## 10.2. TROUBLESHOOTING

No.	Failure	Cause	Remedy
A	Rated vacuum can't be obtained	1. Vacuum pump does not work; 2. Incorrect vacuum gauge indication; 3. Gas leaking due to poor sealing of piping system or other joints; 4. Dirty vacuum pump oil or the oil is insufficient.	1. Interlock, start repeatly; 2. Correct or change; 3. Service; 4. Renew oil or supplement to oil mark.
B	The machine does not work after power is on.	Incorrect or loose wire connection.	Check phase of power supply and the wire connect-ion.

C	Low oil discharge.	1. The system is blocked or incorrect inlet/outlet pipe diameters; 2. Excessive oil discharge pressure or too much filter-ed matter; 3. Screen or filter cartridge blocked; 4. Shaft seal of oil pump is damaged; 5. Oil inlet pipe is too long or lift is too high or air enters.	1. Remove, change; 2. Remove; 3. Rines or change; 4. Change with new one; 5. Adjust.
D	Abnormal noise of oil pump	1. Fasteners of pump or motor are loose; 2. Internal parts are damaged; 3. Inlet oil is insufficient.	1. Fasten; 2.Change; 3. Regulate.
E	Abnormal noise of vacuum pump	1. Fasteners of pump or motor are loose; 2. Parts damaged; 3. Vacuum pump oil is insufficient.	1.Fasten; 2.Change; 3.Supplement oil.
F	No or less temperature rise after heater switch is turned on.	1. Interlock; 2. Heater is damaged, circuit is disconnected; 3.Thermostat valve is incorrect.	1. Start repeatedly; 2. Change or check circuit; 3. Regulate again.
G	Chemical analysis results of sample does not answer to specified ones.	1. Oil purified contains much water, gas and impurities; 2. Cartridge damaged; 3. Inocorrect sampling method; 4. Vacuum is too low; 5. Dirty pipes and tank; 6. Too much foam is degassing tank.	1. Pretreat; 2. Change; 3. Do with orrect one; 4. Handle according to A; 5. Rinse with clean oil; 6. Regulate.

