CRVpro Maintenance/Operation Guidance

Introduction:

Depending on the application, rotary vane pumps may be exposed to chemical contaminants. These contaminants may chemically attack the pump oil, vanes, seals, oil case, pump module, and other components in the vacuum pump. For this reason, Welch advocates several best practices with any rotary vane Vacuum Pump:

1. Check oil level periodically (every day, every week, biweekly, monthly) and keep at MAX level; it depends on application.
2. Open GB for 5-10 min or longer after each process or once a day to purge vapors from inside of pumping module and oil. This procedure should also improve vacuum pressure.
3. Run pump with GB open if pumping on heavy load of water based solvents to prevent condensation inside of pumping module (see Condensable Vapors below index 1.)
4. Change oil frequently (monthly, bi-monthly, quarterly, etc.); frequency depends on application. To determine the frequency of the oil change, you can compare the color of the oil with the fresh oil through the oil window or drain a little bit oil out.
   If the color of the oil turns to Black, Brown oil smells pungent that means you should flush the vacuum pump and fill up with fresh oil.
5. Forced flush pump when change oil to clean inside of pumping module (see description below index 2).
6. Use inlet trap: refrigeration trap, liquid nitrogen trap, etc. to condense vapors before they enter the pump. (The trap select suggestion and maintenance method please see below Index 3).

Index 1: Condensable Vapors

To prevent condensation of vapors in the pumps:

1) Run with the gas ballast open if the vapor load is much less than 1% of the total gas load.
2) Run with the gas ballast open and change oil frequently if the vapor load is about 1% of the total gas load.
3) Use a cold trap if the vapor load is between 1% and 10%.
4) For conditions where the vapor load is greater than 10% of the total gas load, a cold trap and an oil inlet filtration system with chemical filter is recommended. However, under these circumstances, pre-drying the samples in a standard convection oven should be considered

Index 2: Forced Oil Flushing

When you drain oil through the drain valve, you are not removing the oil and contaminants that are inside the pumping mechanism. You are removing oil only from the oil case. Welch recommends that a forced oil flush of CRVpro pumps be performed at the regular maintenance oil change.

If the oil is heavily contaminated, the vacuum pump must be flushed, e.g.:

- Heavy clouding by condensates
- Suspended particles such as dust, fibres, abraded particles
- Dark coloration of the oil

The flushing liquid should be the type of oil which is currently being used.

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Oil Flushing Follow this Procedure:

1) **Check the Oil Level**
   If the oil level is well above the full mark, this may indicate either the pump has been overfilled with oil, or has ingested a liquid or a large amount of vapor (water or organic solvents). Go to Step 2.
   If the oil level is even with the full mark and you do NOT suspect corrosive gases or particulates (henceforth called contaminants) ingested have damaged the mechanism, before going to Step 2, run the pump for 15 minutes to allow the pump oil to warm up.
2) **Drain the Oil**
   Turn off the motor for the vacuum pump. Drain the oil into a clear plastic container. Look for contaminants settling to the bottom of container. Depending upon the amount of contaminants, you may need to repeat the following Steps 3 through 4 several times until the oil drains out clear.
3) **Add Pump Oil**
   Remove the hose barb intake fitting and O-ring. Flush the pump by adding approximately 150 ml of vacuum pump oil through the intake (IN) port while the pump is turned on for 15-20 seconds. While adding the pump oil, block the exhaust (OUT) port with the palm of your hand. Look for contaminated oil or other materials coming out of the drain. Turn off the pump.
4) **Repeat Step 3**
   Repeat adding pump oil until only clean oil comes out of the drain.
5) **Fill the Pump**
   Add the amount of Premium oil to the “Full” mark.
6) **Run the Pump**
   Reassemble the hose barb intake fitting and O-ring to the pump inlet. Plug the intake (IN) port with a rubber stopper. Turn the pump on and run it for 10 minutes. Close the gas ballast.
7) **Check the Vacuum Reading**
   Connect a thermocouple or Pirani vacuum gauge to the pump’s intake. If the pump is running nearly as well as when new, the total pressure reading of the gauge will be 0.010 mbar.

Index 3: Cold Trap Maintenance Procedure

Cold Trap maintenance is significant for pump usage especially for harsh Chemical application.

1) Monitor and replenish cryogens in the cold trap. Never start a pump downstream of a trap that doesn’t have an adequate cryogen level.
2) Clean the trap after each daily usage.
   a. Let it warm up in the fume hood, use cleaning solution to remove solvent and dry trap.
   b. Should better prepare a spare trap to replace dirty trap, and exchange for cleaning.
3) Should better install a Valve between the cold trap and pump, and close the valve after each day’s usage. To isolate the system and pump during not use.

Cold traps use a variety of cryogens, the most common of which are listed below. You should choose the right cold trap for different Chemical.

Cryogen	Temperature	Typical Chemicals trapped
Ice Water Slurry	0°C	Heavy organic compounds
Refrigerated Coil	–20°C to –40°C	Water Vapor
Dry Ice/Acetone or Dry Ice/Ethanol	–78°C	Acetonitrile, Dichloromethane, Ethyl acetate, Acetic acid, Acetic anhydride, (DMSO), DMF, Methylbenzene, Tetrahydrofuran
Liquid Nitrogen	–196°C	NH3

Notes: For other information that you need, please spend time check the manual.

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CRVpro 旋片泵维护/操作指导

简介：

在某些应用环境下，旋片泵可能会接触易腐蚀性化学介质。 这些介质可能会侵蚀泵体内的油、旋片、密封件、油箱、泵体定转子……零件。针对于以上情况，WELCH 总结了以下关于旋片泵使用和维护的方法：

1. 定期检查油位（每天、每周、每两周、每月，检查频率取决于不同的应用环境和使用状态），将油位保持在最高限位；
2. 为了净化泵体内和油里的残留介质，每次使用结束后打开气镇并运行泵 5-10 分钟，该操作同样可以提高泵的真空度；
3. 当抽易冷凝的气体介质时可以开气镇运行，目的是阻止介质在泵内冷凝（请参考索引 1）；
4. 按照一定的周期更换油（每月、每两月、每个季度…）换油的频率由不同的应用环境决定。用户可以通过油镜窗观察已用油的颜色或者泄出少许油和新油对比，如果油的颜色偏暗或者气味刺鼻则需要对该泵腔体进行清洗和换油；
5. 旋片泵腔体的清洗（请参考索引 2）；
6. 当抽取腐蚀性或者易冷凝气体时进气口需要安装连接冷阱来冷凝介质气体，防止化学介质进入泵体造成腐蚀。（冷阱的选择和维护请参考索引 3）；

索引 1： 对于易冷凝气体泵的使用规范

为了阻止介质气体在泵内冷凝请参考以下操作：

1) 如果该易冷凝介质占所抽气体＜1%，请开气镇运行设备；
2) 如果该易冷凝介质占所抽气体=1%，请开气镇运行设备并增加换油频率；
3) 如果该易冷凝介质占所抽气体＞1%且＜10%，请在进气口之前加装冷阱；
4) 如果该易冷凝介质占所抽气体＞10%，请在进气口之前加装冷阱和化学过滤器。（该情况最佳的处理方法是提前对该气体做干燥处理来降低易冷凝气体的占有比例，然后再使用旋片泵处理。）

索引 2： 旋片泵腔体清洗

泄油本身并不会完全清除泵腔体内的残留污染介质，所以 WELCH 建议定期换油的同时清洗泵腔体。

以下情况如油被严重污染，必须清洗腔体，例如：

- 油质污浊并含有固态冷凝物质；
- 油里含有悬浮物，如灰尘、纤维、颗粒；
- 油色变暗；

腔体清洗液应该是 CRVpro 的专用油。

腔体清洗程序：

1) 检查油位

如果油位超过最高油位，这证明该泵加油过量或者油里混入了过多的溶剂（水或者有机溶剂），该情况请直接计入步骤 2；

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如果油位在最大值而且客户觉得侵入的气体或介质并没有腐蚀泵体，在进入步骤 2 前请开机 15 分钟提高油温，以利于污染物泄出；

2) **泄油**
关机，将油泄入干净的塑料容器。观察容器底部沉淀的污染物，根据不同的污染程度请重复 3、4 步直到泄出干净的油；

3) **加油清洗**
使用开口钳拆除进气口卡箍、O 型圈、接头（方便在进气口加油）。开机 15-20 秒，同时向进气口加油 150ml，出气口堵住。观察出油口流出的液体，最后关机；

4) **重复第 3 步**
重复上一步直到只有干净的油从出油口流出；

5) **添加油**
添加油到最高限位；

6) **开机**
安装 O 型圈和接头，用橡胶垫堵住进气口，关气镇开机 10 分钟；

7) **测量真空度**
将真空表接到进气口，如果该泵比较新则真空度可以达到 0.010mbar；

索引 3： 冷阱维护程序

冷阱的维护对于泵的使用，尤其是在抽取化学腐蚀性介质的应用下非常必要：

1) 及时补充冷阱冷媒，不要在冷媒不充足时开机；
2) 每次使用完后请及时处理冷阱里冷凝的溶剂；
   a. 使用通风柜加热冷凝管并清理残留溶剂和干燥冷凝管；
   b. 可以准备一个备用冷凝管轮流交替使用；
3) 在冷阱和泵之间安装阀门，并在每天使用后关闭阀门来隔绝泵和系统；

以下列出了最常用的冷阱冷媒，客户最好根据不同的介质选择对应的冷阱媒介。

冷阱媒介	冷阱温度	客户典型介质
冰水	0°C	重有机化合物……
制冷管	–20°C to –40°C	水蒸汽……
干冰/乙醇	–78°C	乙腈、二氯甲烷、乙酸乙酯、 醋酸、 醋酸酐、二甲基亚砜、二甲基甲酰胺、甲苯、四氢呋喃……
液氮	–196°C	氨气……

注：如需了解其他信息请查看随泵说明书。

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