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| Standard Operating Procedure for:**Use and maintenance of vacuum pumps** | PPE required: |
| **Introduction**This SOP covers the setup, basic use, and maintenance of rotary vane vacuum pumps. These pumps can be used for many applications. However, check with appropriate documentation before using a pump for a new application.If flammable materials are to be pumped A SEPARATE RISK ASSESSMENT IS REQUIRED. This risk assessment and SOP do not cover use of gas ballast. Gas ballast is used when pumping condensable vapours in high concentrations.Ensure appropriate **PPE** is worn during maintenance **including laboratory coat, safety glasses and nitrile gloves.** |
| **Before use**These are general points to consider before operation of a vacuum pump. The list is not comprehensive and every situation should be assessed on its own merits.1. Make sure pump has an up to date PAT certificate
2. Check that the pump oil-level is between the MAX and MIN marks on the bezel of the oil-level sight-glass; if it is not, DO NOT USE.
3. Ensure that vessel to be evacuated is appropriately set up. **If unsure ALWAYS ASK.** Never set up a new vacuum system (especial glass) on your own unless experienced.
4. Ideally use a suitable inlet-valve to isolate the pump from your vacuum system, important:
	* 1. if you need to allow the pump to warm up before you pump condensable vapours,
		2. if you need to maintain vacuum when the pump is switched off.
5. Avoid high levels of heat input to the pump from the process gases.
6. Ensure that any heating of the pump body will not affect any other equipment or cause a danger to others.
7. Make sure that the exhaust pipeline is either vented to a safe location or filtered. Also ensure that it cannot become blocked. **Check expiry date on filter, if it has expired DO NOT USE.**
8. Make sure pump is on a firm, level platform and it is located so that the oil-level sight-glass is visible.

**Maintenance schedule**

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| **Operation** | **Frequency** | **Operation** | **Frequency** |
| Check oil level | At least monthly | Clean the motor fan-cover and enclosure\* | Yearly |
| Replace Oil | 3000 hours or yearly | Clean and overhaul the pump (test motor)\* | 15000 hours |
| Inspect and clean the inlet or outlet filter | Yearly | Fit new blades\* | 30000 hours |

\*not covered in this SOP**Replace oil**Oil should be change minimum once a year unless pump is used heavily or for very dirty work.1. Allow the pump to cool to a safe temperature before you start maintenance work.
2. Ensure that the pump is decontaminated before maintenance and that you take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred – this may include an additional risk assessment.
3. Operate the pump for approximately ten minutes to warm the oil, then switch off the pump. (This lowers the viscosity of the oil and allows the oil to be drained from the pump more easily).
4. Isolate the pump from your electrical supply and disconnect it from your vacuum system.
5. Remove the oil filler-plug (1).
6. Place a suitable block under the pump-motor to tilt the pump and place a suitable container under the oil drain-plug (gravity drain). **CAUTION-HEAVY.**
7. Remove the oil drain-plug and allow the oil to drain into the container. Oil should be disposed of through chemical waste disposal route.
8. If oil is very dirty (water can be seen as “threads” in oil container.
	* 1. Refit the oil drain-plug and pour clean oil into the pump (up to MIN level).
		2. Reconnect the pump to the electrical supply and operate the pump for about 5 to 10 minutes.
		3. Disconnect the pump from the electrical supply, remove the oil drain-plug and allow the oil to drain out of the pump.
		4. Repeat this step until the oil reservoir is clean
9. Refit the oil drain-plug pour clean oil into the filler hole until the oil-level reaches the halfway level on the bezel of the oil sight-glass (12). This is normally sufficient for laboratory use. Heavier use may require filling to MAX.
10. Allow a few minutes for the oil to drain into the pump. If necessary, add more oil.
11. Refit the oil filler-plug.
12. Place gloved hand over inlet (4) and startup vacuum pump (see above).
13. Check that the oil-level in the sight-glass drops slightly (by 3 to 5 mm) after start-up. This shows that the pump has primed with oil.
14. If the pump fails to prime, operate the pump with the inlet open to atmosphere for approximately 30 seconds. Then isolate the inlet and check that the oil-level drops by 3 to 5 mm.
15. If the pump is working reconnect to the vacuum system.

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|  | Outlet nozzleOil filler-plugGas-ballast controlInlet-port (adaptor flange)Centering-ring and ‘O’ ring (supplied)Inlet-On/Off switchMotor terminal boxCable-glandOverload reset buttonBaseplateOil drain-plug (gravity drain)Oil sight-glassPump identification label |

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| **Inspect and clean inlet-filter**1. Unscrew the inlet adaptor (1) and remove the 'O' ring (2), circlip (3) and inlet-filter (4).
2. Wash the filter in a suitable cleaning solution. Allow the filter to dry.
3. Refit the inlet-filter (4), circlip (3), 'O' ring (2) and inlet adaptor (1).
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 | **Hazard symbols:**See individual users risk assessment |
| **Significant hazards:*** High temperatures
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| **Hazard phrases (H):**See individual users risk assessment |
| **Can it be done out of hours?**Vacuum pumps can be operated out of hours but **maintenance should not be performed out of hours.** |
| **This SOP is not relevant in the following circumstances:**1. SOP does not cover specific experimental risk these must be covered by user’s assessments.
2. Pumping of flammable materials or vapours or use of gas ballast.
3. Any other situation where the procedure may result in harm to yourself or others.
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