

**Operating manual
Re-installing vacuum
level in VI lines**

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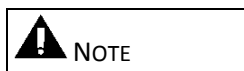
Operating Manual Re-installing vacuum level in VI lines

I. STRUCTURE OF THE MANUAL / CLARIFICATION

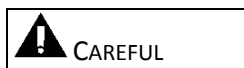
The various aspects of this manual are clearly listed here. Points of attention are marked throughout the entire manual in the following way (the interpretation is also given):



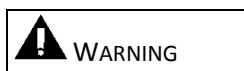
Offers suggestions/advice to the operator in order to perform certain tasks more easily.



Points out possible problems to the operator.



Indicates damage to the system or directly linked equipment when the operator does not carefully adhere to the procedures.



Warns the operator of possible injuries if the procedures are not adhered to properly.



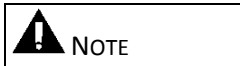
The life of the operator is directly threatened.

**Demaco Holland bv considers the operator to be:
the one who operates the machine or equipment supplied by Demaco Holland bv.**



The operator is responsible for the safety of any assisting employee. The operator must ensure, before starting the machine or application, that no dangerous situation can occur for the assisting employee.

II. SAFETY AND HEALTH CONCERNS



This user manual must be read by the operator as soon as possible in order for him to become familiar with the operation of this equipment.

From the point of view of injuries to the operator, specific attention is given to the dangers that can occur when using liquid nitrogen. On Demaco Holland bv equipment, where the operator may come into contact with liquid nitrogen, you can find the label as shown below. It warns the operator of the presence of coldness and it is indicated that safety glasses and gloves with wrist protection should be worn.



figure 1; *Safety label on Demaco Holland bv products*

This user manual should at least be available for consultation at the head of the department. We recommend that a copy be made of this manual inserted in plastic folders, or bound, and put on view at location with the control cabinet.

We also recommend to carefully read the Demaco safety instruction "Safety guidelines for working with cold media". Extensive information is provided in this manual about working with cryogenic media. A copy of the "safety instruction" is shipped with this delivery. Should you require more copies of this instruction in order to create a safe working environment for your operator(s), additional copies can be requested from Demaco Holland bv. Contact our sales department.

Operating Manual Re-installing vacuum level in VI lines

1 INTRODUCTION

This instruction is meant for vacuum insulated pipes which are under the suspicion of having a bad vacuum level.

By reinstalling a proper vacuum level heat inleak will again be minimised.

2 REQUIRED TOOLS

- A vacuum pump configuration capable of reaching a vacuum level of 1×10^{-3} mbar.
- Pump out tool for Demaco pump valve.
- Heating element or burner (paint stripper).
- Vacuum grease.

3 EVACUATING INSTRUCTIONS

3.1 Preparation.

- Drain the inner pipe from any liquid gasses.
- Wait until the inner pipe has reached near ambient temperatures.
- Loosen all connections to the part you want to pump out.
- To accelerate the process of pumping, it is advisable to heat up the inside of the pipe as well as the outside, by using a heater or a paint stripper. A temperature of minimal 60 °C is advised, maximum temperature 120 °C.
- Make sure all ends of the pipe are heated. This process will take at least 6 hours. Make sure that the O-rings of the Johnston couplings don't get too hot (120 °C max.).
- When it is not possible to disconnect the pipe maybe it is possible to disconnect a nearby pipe which can be heated along with the target pipe.

3.2 Reinstalling vacuum.

- Remove the plastic cap from the pump valve.
- Remove the securing pin from the pump valve housing.
- Remove the vacuum grease from the vacuum plug with a paper cloth.
- Make sure that the pump valve is very clean. Dust or dirt that gets between the sealing surfaces will create a leak. This may permanently damage the vacuum. Also make sure that the pump-out tool is clean.
- Place the pump out tool over the pump valve. Make sure that it is properly in place.
- Push the knob of the pump out tool downwards until you feel that it has reached the plug of the valve.
- Turn the knob clockwise while pressing gently until you feel that you have reached the end of the thread. Do not tighten the spindle in the plug.
- Connect the vacuum pump set to the pump out tool using a flexible line.
- Start the vacuum pump according the suppliers instructions.
- When a vacuum level of 1×10^{-3} has been reached you can open the pump out tool by lifting the knob slowly without turning it. Be careful, when the vacuum is pumped at too fast, the insulation layers may be damaged.
- When reaching the top position you can secure this position by twisting the knob a quarter of a turn.

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- When using a turbo molecular pump be sure to shut down this pump before opening the pump valve to avoid damage to this pump.
- You can start your turbo molecular pump after reaching save vacuum levels again.
- After reaching a vacuum level of 1×10^{-3} mbar keep the pumps running for another hour, or until the vacuum level is considered acceptable.
- To close the pump valve, now slowly press the spindle into the pump-out tool. Be sure that the plug is completely inserted in the pump valve.
- Relieve the vacuum on the pump side of the pump-out tool.
- Carefully turn the spindle counter clockwise to disconnect the spindle from the plug. Push the spindle a little, to be sure that the plug stays in place. When the spindle is completely removed from the plug, a little click can be heard or felt every time the end of the threads pass each other. This indicates that the spindle is properly disconnected.
- Switch off the vacuum pump in the way prescribed by the manufacturer.
- Disconnect the pump-out tool.
- Push the securing pin back in the pump valve housing.
- Place the plastic cap back on the pump valve.
- Reconnect all the pipes making sure no O-rings get damaged.

3.3 Measuring the vacuum level.

The vacuum level can not be measured with the pump connected to the vacuum. Therefore a small adjustment of the above setup is required if the vacuum level is to be measured correctly. The following procedure can be used to correctly measure the vacuum level:

- Place an additional valve before the suction of the pump and a vacuum gauge between this valve and the pump out tool.
- Open this valve, leave the pump valve on the VI pipe closed. Pump until a vacuum of 1×10^{-4} mbar is reached.
- Close the additional valve and directly open the pump valve on the pipe.
- Note the vacuum level.

For small pipes, one should correct for the volume of the measuring system as follows:

- Note the pressure measured above as p_1 .
- Close the pump valve on the pipe, then open the additional valve on the pump. Pump until 1×10^{-4} mbar is reached again.
- Close the additional valve and directly open the pump valve on the pipe.
- Note the vacuum level as p_2 .
- The correct vacuum level can be calculated as $p = p_1 \cdot p_1 / p_2$.

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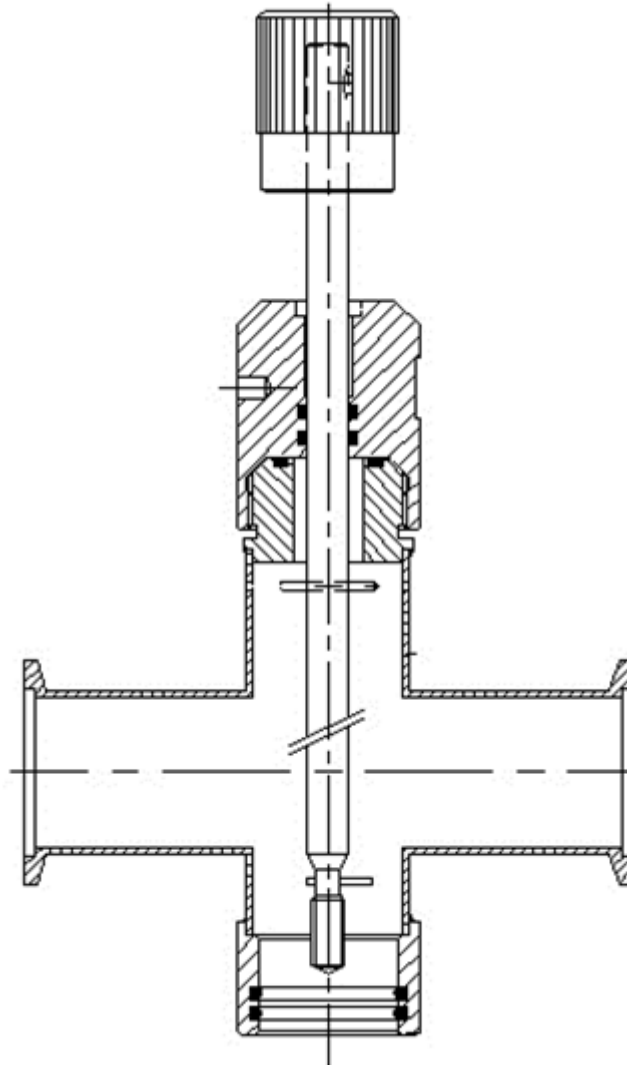


Figure 1. Pump out tool

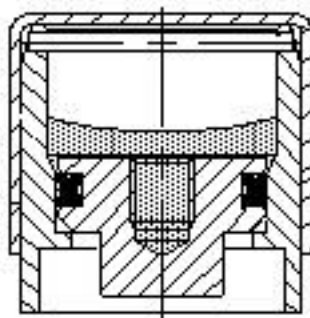


Figure 2. Pumpvalve