Quick Guide: Refilling the LN2 Dewar

Step	Action PAGE 1
   	**WARNING: Risk of suffocation. Risk of injury due to low temperatures of liquids & metal parts. Contact with skin may cause cold burns. Contact with eyes may cause blindness.** **Therefore:** • **The lab must be equipped with oxygen monitors.** • **The ventilation rate during the refill process must be increased and should be > 10 hr^{-1} fresh air.** • **Windows and doors should be opened before starting the refill.** • **The refill procedure of the LN2 dewar has to be performed by personnel who have been trained to handle liquid nitrogen.** • **During the entire refill process wear protective gloves, goggles, apron & personal oxygen monitor.** • **The transport vessel for withdrawal of liquid nitrogen must be equipped with safety pressure release valve, be non-ferromagnetic and must be placed outside the 0,5mT (5 G) line.** • **The LN2 dewar can be placed on a scale (optional) to indicate the LN2 level in the dewar. The scale must be positioned outside the 0.5mT (5 G) line of a shielded magnet. (100L LN2 weighs 80kg).** **Be aware: When the LN2 dewar has been empty for longer than 2 weeks, the evaporation rate during the initial filling of the dewar will be higher than during normal use and refill.**
1	Open windows & doors and switch the room ventilation to 100% fresh air supply with a rate of >10 hr^{-1}. Bring the LN2 transport vessel into the lab. Then press <Refill> on the Prodigy Unit display (Fig.1).
i	During the entire refill process the status ***"Ready to Refill"*** will be displayed on the Prodigy unit.
2	Unscrew the black dummy plugs from GAS OUT port and from LN2 IN port by turning them counter-clockwise (Fig.2).
3	Connect the silicone overflow hose with a length of approx. 0.5 m to the GAS OUT (red) port. Turn the overflow hose such that the loose end points downwards, leading N2 to the floor (Fig.3).
4	Purge the PTFE transfer hose from the LN2 transport vessel (Fig.3 & 4) with N2 to remove moisture. Then connect it to the LN2 IN (blue) port, using the short silicone hose. (Fig.3)
	Do not remove the transfer hose during the refill process. **Excessive release of cold gas!**
NOTICE	Make sure that the transfer hose is not creased or kinked; otherwise problems may occur during the filling process. Normally, the transfer hose may shake vigorously due to the 2-phase flow with varying gas- und liquid percentage.

Figure 1. Press <Refill> on the Prodigy unit and wait until the message on the display changes from «Prepare Refill» to «Ready to Refill».

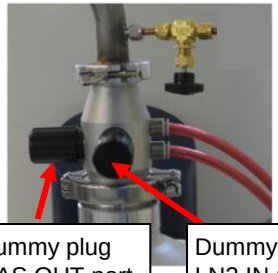

Figure 2. Unscrew the black dummy plugs by turning them counter-clock-wise.

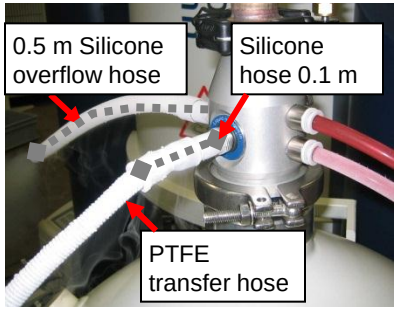

Figure 3. Connect the transfer hose and the overflow hose to the ports using the silicone hoses.

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Step	Action PAGE 2
5	Procedure for a typical LN2 transport vessel (Fig. 4 and 5): • Close the gas release valve (8) • Open the LN2 extraction valve (7) • + Slowly open the pressure generation valve (2) until a pressure of 200 - 250 mbar is generated and the liquid nitrogen flow starts. • Then close the pressure generation valve (2) again. The pressure can be decreased by partially opening and closing the gas release valve (8) or increased by opening and closing the pressure generation valve (2). • If the flow of liquid nitrogen has stopped (before finished) re-open the pressure generation valve according to step +. • **Do not exceed** a filling pressure of **350 mbar**.
6	Supervise the entire filling procedure so that you can immediately intervene should the pressure in the transport vessel exceed 350 mbar or when the LN2 dewar refilling is completed. A complete refill of an empty LN2 dewar takes approximately 20 min. (Further filling will cause LN2 spilling out of overflow hose).
	NOTICE Do not spill LN2 or cold gas over the vacuum safety valve of the LN2 dewar to avoid damage of the sealing or unnecessary activation of the safety valve.
7	Stop the dewar refill immediately, when LN2 overflows or the scale indicates a weight difference of ~80 kg: • Close the LN2 extraction valve (7) on the transport vessel. • Close the pressure generation valve (2) on the transport vessel. • Carefully open the gas release valve (8) on the transport vessel.
8	Wait for approximately 10 min until the transfer hose and the overflow hose have warmed up.
9	Remove the PTFE transfer hose, silicone hose and the overflow hose from the ports and remove the transport vessel. **Wear Gloves**!
10	Screw on the black dummy plugs hand tight by turning them clockwise. First screw on the LN2 IN port and then the GAS OUT port (marked with red ring). **Do not use any tools!**
11	Press the cool down-button on the Prodigy Unit and wait until the cool down process is completed, which is indicated by a continuously lit blue light indicating the COLD state on the Prodigy Unit.
12	After 1h, close windows & doors and switch the room ventilation to 100% fresh air supply with a rate of >3 hr^{-1}

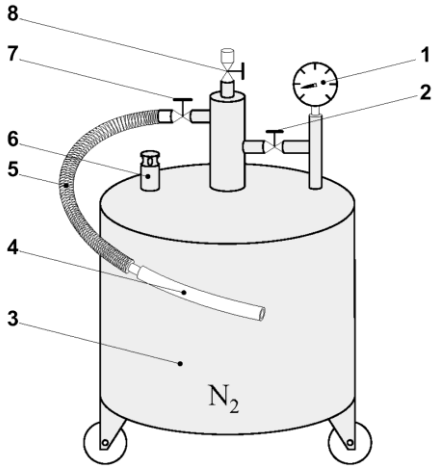

Figure 4. Typical LN2 transport vessel with pressure gauge (1), pressure generation valve (2), transport vessel (3), Teflon transfer hose or surrogated PFA hose (4), transfer hose with meshed metal sleeving (5), pressure relief valve (6), liquid nitrogen extraction valve (7) and gas release valve (8).

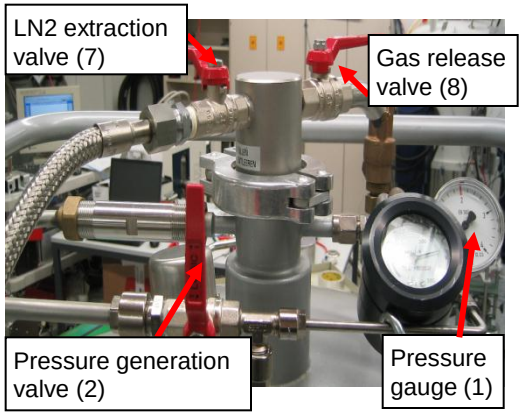

Figure 5. An example of a transport vessel. Consult the technical manual of your transport vessel for information about the actual vessel configuration.