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NER Testing Procedure for Vapor Shippers

Please be aware of your testing environment. Ensure tanks are shielded from heat sources, direct air movement, and excessive disturbances of the tank during NER testing which can increase liquid evaporation. Limit movement of the tank during testing.

1. Weigh empty unit with cork/cover but without any inventory accessories and record as Empty Weight, [kg].
Empty Weight must be taken before filling, while the inside of the Vapor Shipper is at room temperature. Keep canisters, racks, and other accessories out of the tank during the NER test.
2. Fill unit to bottom of neck tube. Details below for recommended filling procedures.
 - a. 2. Fill unit to bottom of neck tube.
 - b. a. If you are working with a warm vessel, it is MVE's recommendation to slowly add small amount of liquid to the bottom of unit and allow it to sit until the liquid nitrogen stops rapidly boiling to cool the unit. Position the vacuum port facing away from the operator or other personnel.
 - c. To obtain the optimized Hold time. You will need to refill the unit to bottom of the neck more than once until the liquid level is steady.
 - d. Follow established safety practices and procedures for transferring LN2.
 - e. Fill the vessel with a funnel or transfer line when possible. Transfer using LN2 hose with phase separator or pouring container using a funnel.
 - f. If you are filling your vessel from a pressurized source, make sure it is a low-pressure source (22 psi or below).
3. Replace cork/cover and allow unit to stand for minimal 24 hours.
4. Weigh unit and record as First Weight, [kg].
5. Allow filled unit to sit undisturbed for another 24 (+/-0.25) hours.
 - a. Consider the accuracy and resolution of your scale to determine if additional days are required between the first and second weights in order to obtain an accurate NER. Make sure to record number of hours between first and second weight.
6. Weigh second time and record as Second Weight, [kg].
7. Calculate evaporation rate by using Equation 2. The difference between the first weight and the second weight is the daily evaporation rate in kg. This figure roughly signifies the normal evaporation rate, or N.E.R, [Liter/Day]
- 8.



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$$\frac{(First\ Weight - Second\ Weight) \times 29.6919}{Number\ of\ Hours}$$

If there is major frost or condensation on outside of container during this time, it would indicate either a weak or no vacuum.

9. Pour out LN2 (procedure see 9a). Replace cork/cover and take weight as Charged Weight.
 - a. To completely dispense all liquid nitrogen, invert the unit until liquid nitrogen dripping has stopped, set the unit upright and view if any liquid nitrogen pools at the bottom of the unit. If liquid nitrogen starts to pool, invert the unit again. Repeat as necessary until all liquid nitrogen is removed from the unit, in accordance with ICAO Packaging Instruction 202.
10. Calculate Hold Time, [Days], by using Equation 3. Subtract the Empty Weight from the Charged Weight and divide by 0.8083; then divide by *NER*

$$Hold\ Time = \frac{(Charged\ Weight - Empty\ Weight) \div 0.8083}{NER}$$