Average static evaporation rate

Average static evaporation rate for Dewar vessels and Cryo container

What is an average static evaporation rate?

In order to compare the insulation performance of Dewar vessels and cryo containers and their operability and quality a simple reproducible measuring method should be used. It is the static measurement of the evaporation rate of liquid nitrogen (LN2) or dry ice (CO2). Static means here a measured value where the filling capacity, the handling or application of container is not affecting the result. The in such way determined evaporation rates are comprehensible without any problems for each user at his place.

The evaporation rates of LN2 or CO2 for Dewar vessels made of glass, indicated by KGW-ISOTHERM , refer to a warranty period of 2 years (related to the vacuum), in accordance with DIN 12492 (inclusive a tolerances of 15 % of mentioned value). For cylindrical Dewar vessels type 00 to S 22, flat-bottomed vessels type FB and type DSS and GSS all evaporation rates were measured with a loosely lied-on plug. Standard lid was used for type 26 to 29 and 21 to 24 AL. For type 30/4 to 35 the standard lid and an additional insulating disk was used.

How is the average static evaporation rate measured?

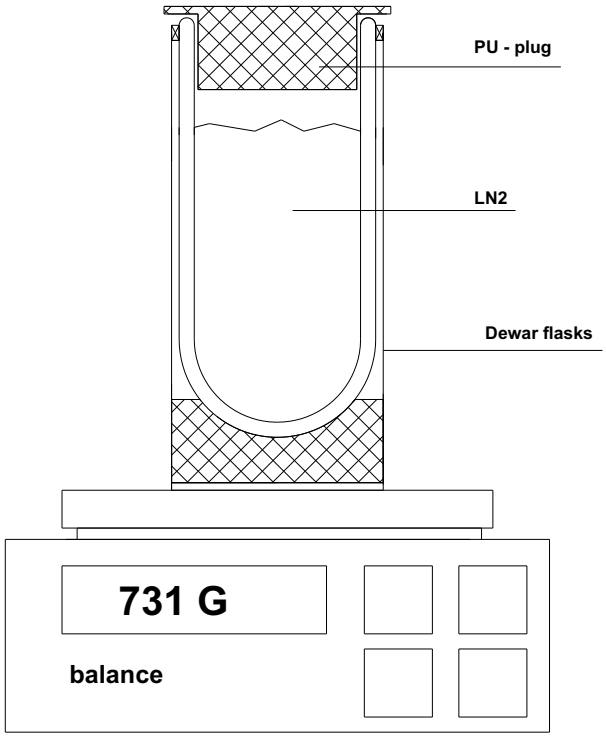
The Dewar vessel is completely filled with a coolant (LN2 or CO2). The evaporation rate is determined at room temperature without moving or opening the vessel. This can take place via continuous weighing of the Dewar vessel or via volume measurement of the exhaust gas. KGW-ISOTHERM was choosing the continuous weighing of Dewar vessel so that every user can reconstruct and examine the insulating performance of his Dewar vessel locally at any time.

Therefore only a balance is needed that can seize the weight values manually or electronically.

The expiration is as follows:

The empty Dewar vessel with plug or lid is placed at the balance. Subsequently, the balance is set through pressing the Tara key to 0 gram, while the container stands on the balance. If now the Dewar vessel is filled with LN2 or CO2 the balance is only measuring the weight of coolant. After the container was completely filled, please wait about 30 minutes to start the test.
This time is needed by the coolant to cool down the vessel so that a thermal equilibrium can be built up inside of the vessel. After approx 30 minutes the test can start.

KGW test assembly for LN2 evaporation rate



At the KGW-Isotherm method (continuous weighing of Dewar vessel), the coolant decrease in weight is now measured every hour and the value is noted. If the balance indicates 0 gram or only a small amount of coolant is measured (remnant value) at the end of test, the measurement is stopped. Two values were examined now: weight data and time data.

This data are processed as follows:

Subtract the remnant value (if any) from the starting coolant weight. Now you have the total value. This total value must be divided by the number of measured hours. The result is the static evaporation rate of coolant in gram per hour.

For example: type 9 C = 731 gram of LN2 as starting value
Measuring period: 60 hours
Remnant value: 2 gram

Result: 731 gram minus 2 gram = 729 gram as total value (731 g 2 g = 729 g).
This total value of 729 gram is divided through 60 hours = approx 12 gram per hour as average static evaporation rate (729 g / 60 h = 12 g/h); or 12 gram multiplied by 24 hours = 288 gram per day (12 g x 24 h = 288 h/day).

LN2 conversion from gram to litres:

1 litre LN2 weighs approx 800 gram
1 gram LN2 means approx 0,00125 litres
288 gram multiplied by 0,00125 is approx 0,36 litres per day (288 g x 0,00125 = 0,36 l)

Diagram of a Dewar vessel type 9 C, initial value 731 gram of LN2, measuring period of 60 hours, remnant value of 2 gram; measured on a balance