Experts in air filtration for the protection
of laboratory personnel since 1968

White paper

Weighing in a filtered fume hood?

Ohaus balance & Erlab ductless filtering fume hood

Summary

The purpose of this paper is to show that accurate weighing results can be attained when choosing the proper combination of a balance within the appropriate ductless filtering fume hood. Weighing requires accuracy, especially when the readability of a balance reaches 0,01mg or more. In many applications the samples being weighed might be harmful or dangerous for the operator to inhale and the use of a filtered fume hood is required for the protection of the laboratory personnel. When using a hood, air flow, drafts, and vibrations can adversely affect the weighing performance of a balance and eventually cause errors to the measurement.

Dr. Cedric Herry
Director of Research & Development
Erlab

Szymon Holubowicz
Senior Market Manager Laboratory
OHAUS GmbH

Equipment

Ductless Filtering Fume Hood

For protection of the operator an Erlab Captair Smart 391 Ductless Filtering Fume Hood is selected because it is specifically designed to protect users against inhalation of chemicals while also accommodating the specific requirements needed for the use of a balance. This hood complies with international safety standards, such as AFNOR NFX 15:211. To comply with this standard, face velocities of the unit must be maintained between 0.4 and 0.6 m/s which requires a total airflow equal to around 220 m3/h. Despite this airflow, the unit is designed to minimize the turbulence that occurs in the enclosure and absorb the vibration that is generated by the fan. The hood was also equipped with a Trespa TopLabPlus work surface to minimize conduction of vibration to the balance.

Balance

Choosing a quality balance with applicable features will ensure a high accuracy of weighing. The Ohaus Explorer Semi-Micro balance is a modular model that easily fits within the filtered fume hood. To keep the vibration to a minimum, the balance includes a set of four infrared sensors to engage the automatic doors, an ionizer, and a grid pan. The display can be separated from the base of the balance to a distance of 1.5m with a standard cable. The automatic doors as well as the ionizer, tare and a number of other commands can be actioned with the use of four infrared sensors. This way there is no need for the operator to touch the balance during the weighing procedure which both adds to the protection of the operator as well as minimizes disturbances influencing the balance's performance. The grid pan helps the balance to stabilize up to 1s faster.

The model used for validation was the Explorer EX225D/AD equipped with an accessory grid pan. Balance's readability is 0,01mg up to 120g capacity and 0,1mg from 120g to the full capacity of 220g.

Validation Procedure

Testing

All tests were performed twice, with and without the air flow turned on and in both cases the results obtained were within the limits of PN-EN 45501 for Non-Automatic Weighing Instruments.

The validation process has been performed by an independent party, Pesage Creuen Michel. A set of calibrated weights were used. The class of calibrated weight was E2. All weights were certified on the 18th of June 2015, by SPF Economie (certificate number: E6/SMD-ENS/2015/011055.). The set of calibrated weights was comprised of the following: 1 mg, 2 mg, 2*mg, 5 mg, 20 mg, 20*mg, 50 mg, 100 mg, 200 mg, 200*mg, 500 mg, 1 g, 2 g, 2*g, 5 g, 10 g, 20 g, 20* g, 50 g, 100 g, 200 g. All calibrated weights comply to 71/317/CEE (26th of June 1971) and to 74/1478/CEE (4th of March 1974).

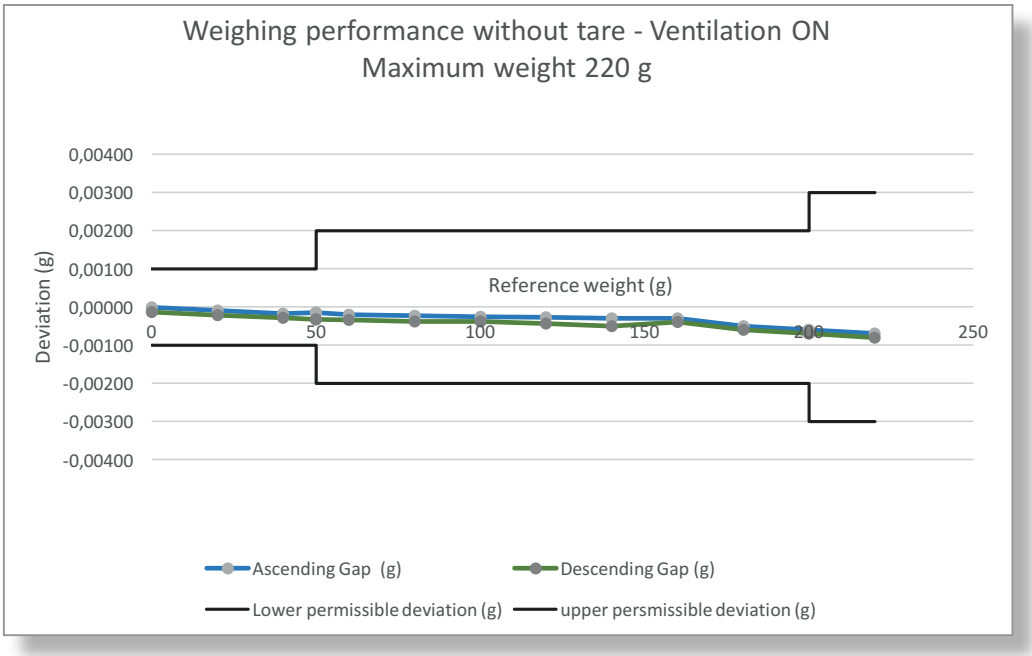
The following tests have been performed:

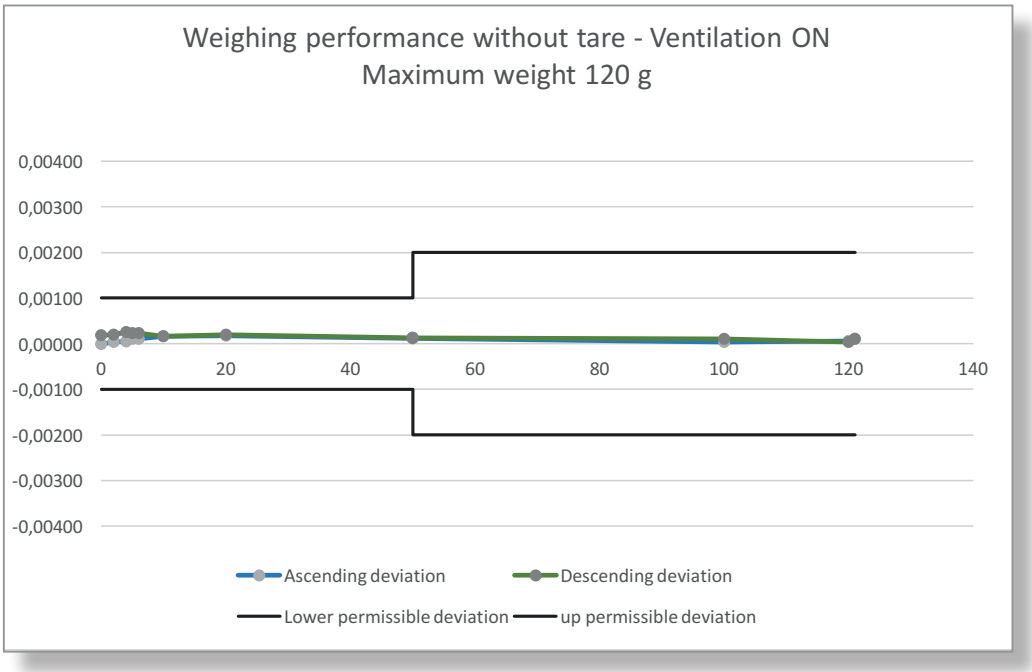
- Performance test without tare
- Eccentricity
- Repeatability

Test results

Weighing performance without tare

Two test procedures have been performed, up to maximum 120g and 220g capacity separately. Both of these were done with and without the air flow turned on.
Without air flow within the normal parameters of balance usage as compared to usage of a balance in a filtered fume hood. This ensures that the comparison is of equal stature.
For each procedure a selection of test weights was placed on the pan in ascending and descending order.
In both cases, for each maximum capacity, the results obtained were within the limits of maximum permissible errors as described in the norm.





Reference weight (g)	upper permissible deviation (g)	Ascending Gap (g)	Descending Gap (g)	Lower permissible deviation (g)
0,001	0,001	-0,00001	-0,00014	-0,001
20	0,001	-0,00009	-0,00022	-0,001
40	0,001	-0,00018	-0,00029	-0,001
50	0,001	-0,00015	-0,00032	-0,001
50	0,002	-0,00015	-0,00032	-0,002
60	0,002	-0,00020	-0,00034	-0,002
80	0,002	-0,00023	-0,00038	-0,002
100	0,002	-0,00025	-0,00038	-0,002
120	0,002	-0,00027	-0,00044	-0,002
140	0,002	-0,00030	-0,0005	-0,002
160	0,002	-0,00030	-0,0004	-0,002
180	0,002	-0,00050	-0,0006	-0,002
200	0,002	-0,00060	-0,0007	-0,002
200	0,003	-0,00060	-0,0007	-0,003
220	0,003	-0,00070	-0,0008	-0,003

Table 1: Recorded deviation between measured values and reference weight with fan of the fume hood turned on. Balance range up to 220 g.

Reference weight (g)	upper permissible deviation (g)	Ascending Gap (g)	Descending Gap (g)	Lower permissible deviation (g)
0,001	0,001	-0,00001	0,00019	-0,001
2	0,001	0,00003	0,0002	-0,001
4	0,001	0,00005	0,00025	-0,001
5	0,001	0,00010	0,00023	-0,001
6	0,001	0,00010	0,00023	-0,001
10	0,001	0,00016	0,00016	-0,001
20	0,001	0,00017	0,0002	-0,001
50	0,001	0,00012	0,00013	-0,001
50	0,002	0,00012	0,00013	-0,002
100	0,002	0,00004	0,00011	-0,002
120	0,002	0,00006	0.00003	-0,002
121	0,002	0,00010	0,0001	-0,002

Table 2: Recorded deviation between measured values and reference weight with fan of the fume hood turned on. Balance range up to 120 g.

Eccentricity

Since the balance is a dual range instrument, two test procedures have been executed. For the 0,01mg readability range a 40g test weight has been used and for the upper range with 0,1mg readability a 70g and 75g test weight load has been used. Tests were performed both with and without the air flow turned on. Obtained results met the criteria described in the norm.

Figure 1: location of eccentricity measuring points

Figure 1: location of eccentricity measuring points

Location	Reference weight (g)	Measured value (g)	Maximum permissible deviation (g)	Deviation (g)
1	75.000	75.0000	0.002	0.0000
2	75.000	75.0006	0.002	0.00006
3	75.000	75.0004	0.002	0.00004
4	75.000	74.9999	0.002	-0.0001
1	70.000	69.99980	0.002	-0.00020
2	70.000	69.99978	0.002	-0.00022
3	70.000	69.99979	0.002	-0.00021
4	70.000	69.99976	0.002	-0.00024

Table 3: Results of eccentricity test with 70 g and 75 g test weight. Fan of the fume hood turned on. Balance range up to 220 g.

Location	Reference weight (g)	Measured value (g)	Maximum permissible deviation (g)	Deviation (g)
1	40.000	40.0001	0.001	0.0000
2	40.000	40.0002	0.001	0.00006
3	40.000	40.0003	0.001	0.00004
4	40.000	39.9999	0.001	-0.0001

Table 4: Results of eccentricity test with 40 g weight. Fan of the fume hood turned on. Balance range up to 120 g.

Repeatability

Similar to the previous test procedures, repeatability tests have been performed separately for the 120g and 220g weighing ranges. For the 0,01mg readability range two test weights have been used, namely 60g and 120g. The remaining range with 0,1mg readability has been tested with 100g and 200g test weights respectively.

	Reference weight (g)	Measured value (g)	Maximum permissible deviation (g)	Deviation (g)
1	100.000	100.00004	0.002	0.00004
2	100.000	100.00001	0.002	0.00001
3	100.000	100.00009	0.002	0.00009
4	100.000	100.00004	0.002	0.00004
5	100.000	100.00015	0.002	0.00015

Table 5: Results of repeatability test with 100 g test weight. Fan of the fume hood turned on. Balance range up to 220 g.

	Reference weight (g)	Measured value (g)	Maximum permissible deviation (g)	Deviation (g)
1	200.000	200.00020	0.002	0.00020
2	200.000	200.00030	0.002	0.00030
3	200.000	200.00020	0.002	0.00020
4	200.000	200.00030	0.002	0.00030
5	200.000	200.00030	0.002	0.00030

Table 6: Results of repeatability test with 200 g test weight. Fan of the fume hood turned on. Balance range up to 220 g.

	Reference weight (g)	Measured value (g)	Maximum permissible deviation (g)	Deviation (g)
1	60.000	60.00006	0.002	0.00006
2	60.000	60.00000	0.002	0.00000
3	60.000	60.00002	0.002	0.00002
4	60.000	60.00004	0.002	0.00004
5	60.000	60.00003	0.002	0.00003

Table 7: Results of repeatability test with 60 g test weight. Fan of the fume hood turned on. Balance range up to 120 g.

	Reference weight (g)	Measured value (g)	Maximum permissible deviation (g)	Deviation (g)
1	120.000	120.00001	0.002	0.00001
2	120.000	120.00004	0.002	0.00004
3	120.000	120.00005	0.002	0.00005
4	120.000	120.00007	0.002	0.00007
5	120.000	120.00005	0.002	0.00005

Table 8: Results of repeatability test with 120 g test weight. Fan of the fume hood turned on. Balance range up to 120 g.

Conclusion

Test results show that the balance's performance when placed under a filtered fume hood during normal operation does not change drastically, allowing the balance to perform within the limits stated in the EN-PN 45501 for Non-Automatic Weighing Instruments. Vibrations and air-flow disturbances caused by the Captair Smart 391 Ductless Filtering Fume Hood have no negative effect on EX225D/AD performance. The combination of the Ohaus balance and Erlab hood allows for both safe and accurate measurements.

Erlab's state of the art Research & Development Laboratory relying exclusively on filtration

Erlab above

About Erlab

We provide safety, we protect your health

Erlab invented the ductless fume hood in 1968. With more than 50 years of experience in the field of chemical filtration and protection of laboratory personnel; we know the formula for safety. With Erlab, you will never have to wonder or worry if our products are safe. We build each one of the following 7 ingredients into our products, and without all of them, your health and safety will be compromised.

1 Erlab R&D Laboratory

The engineers and chemists in our state-of-the-art R&D laboratory understand molecular filtration. We are committed to designing products that are safe and of the highest quality, strive to improve our products, and continuously develop new products that provide greater protection in the laboratory.

2 Strict Safety Standards

We hold ourselves to the highest standard and adhere to the strict AFNOR NF X 15-211: 2009 filtration safety standard as recognized by ANSI Z9.5-2012.

3 A Published Chemical Listing

It all begins here. Without this listing, we are not compliant with AFNOR NFX 15-211. Our in-house laboratory tests and independent testing verifies the retention capacity of over 700 chemicals for our filters.

4 Independent Testing

Erlab filters have been independently tested multiple times at various concentrations guaranteeing that our safety solutions all adhere to the strict performance criteria of the AFNOR NF X 15-211:2009 standard assuring that the emissions concentration at the filter exhaust will always be lower than 1% of the TLV.

5 Application Questionnaire

Our laboratory specialists will recommend the appropriate filtration fume hood, type of filter, and personalized advice.

6 Certificate of Validation for the chemicals used in the hood

A certified PhD chemist issues a Certificate of Validation with a list of the chemicals approved for use in the hood.

7 Our Safety Program

We back up our products 100%. This program includes your specialized chemical evaluation, validation of your hood upon installation, and your filtration safety specialist that ensures your hood is operating to its full potential.

LABRepCo
An Employee-Owned Company

erlab

www.labrepco.com