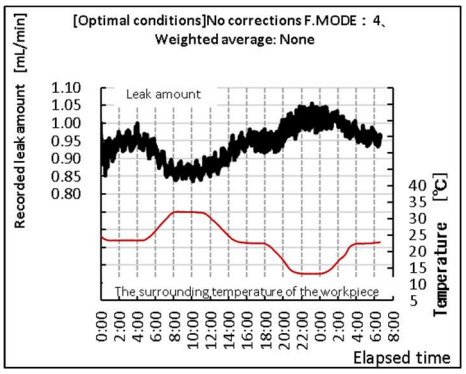
FUKUDA

Reduction in misjudgments due to time-dependent and aging-related changes

By updating the master data according to environmental changes, it becomes possible to approach measurements under optimal conditions. However, if environmental changes fluctuate significantly, updating the master data with each fluctuation is inconvenient and unrealistic. By combining appropriate updates to the master data with weighted average corrections, it becomes possible to achieve more accurate measurements under optimal conditions.

The relationship between differential pressure changes and corrections due to environmental (temperature) changes

A cylindrical tank (50 mL) was connected to the work side of the leak tester (model: FL-611) via piping (O.D. 1/4 inch, high pressure 1 m), and placed in a constant temperature chamber with the master side valve closed. The ambient temperature of the tester was varied between 10 to 30° C as an external disturbance, and the differential pressure change was recorded as a leak amount. The actual measurement results after applying various corrections are shown.



【F.MODE: 4, Weighted average: None,】

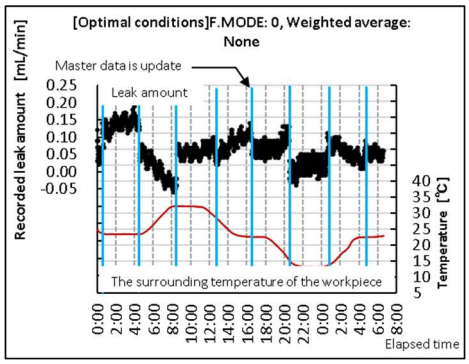
・As a result, when no corrections were applied, the following occurred.

・The leak amount display results fluctuate significantly up and down. This is because the change in the surrounding temperature of the workpiece acted as an external disturbance, causing the differential pressure change (≈ leak amount display) to vary.

Result

Measurement Range	Average value	σ n-1
0.83～1.09	0.94	0.058

＊Master data update ≒ Mastering and fitting measurement.



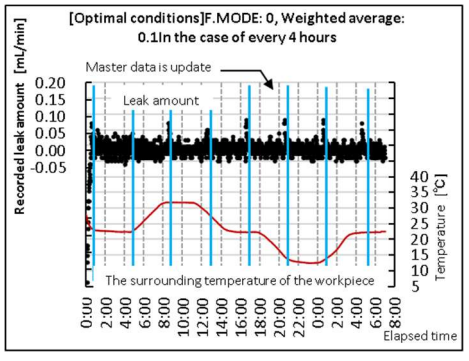
【F.MODE: 0, Weighted average: None, In the case of every 4 hours】

・When the master data is updated at a certain point in time, the 'zero point' shifts based on the differential pressure change situation influenced by the temperature at that moment, which is considered an external disturbance. However, the measurement values will change with subsequent temperature variations.

・Compared to the case with no corrections applied, the average value shifted by 0.88 mL/min towards the '0' side. By applying mastering (F.MODE: 0, Weighted average: None), the display value becomes closer to '0'. However, the variability (σ n-1) remains large. This is because the correction is not following the external disturbance influences.

Result

Measurement Range	Average value	σ n-1
-0.06～0.19	0.06	0.045



【F.MODE: 0, Weighted average: Weight 0.1, In the case of every 4 hours】

In cases where external disturbances are changing, as in the experiment, using F.MODE: 0 and no weighted average often results in the correction not following the disturbance effects, as mentioned earlier. Therefore, to follow the disturbance effects, corrections were made using F.MODE: 0 and a weighted average with weight 0.1. As a result, the average value became closer to '0' and the variability (σ n-1) decreased, as shown below.

Result

Measurement Range	Average value	σ n-1
-0.04～0.09	0.00	0.02

・The reason for the significant variation in the differential pressure value when no correction is applied is clearly due to the change in ambient temperature, which is the disturbance in this experiment. However, in reality, there may be other factors, such as issues with the seal condition or workpiece assembly. In such cases, applying a weighted average correction could delay the detection of anomalies. (The weighted average correction targets a value arbitrarily decided for correction.)

・As such, please be cautious, as applying corrections incorrectly in situations where 1) the condition is inappropriate or 2) the weighted average value is incorrect, can lead to misinterpretation of the actual condition."