CETA® Newsletter

Dear readers,

Here is our newsletter no. 16, issued on the occasion of the MOTEK 2010 fair trade. In it, you will find a short report of our attendance to the CONTROL CHINA 2010 exhibition in Shanghai, which took place for the first time in China. Our practical tip will deal with the meaning of the capability index C_g and its influence on the measuring time. At our exhibition stand (hall 5, stand 5013), we will present some practical applications. We are looking forward to meeting you there.

Wishing you a pleasant reading,

Günter Groß
Managing Director

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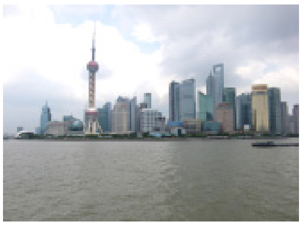
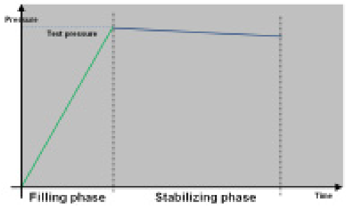
CETA exhibitor at the CONTROL CHINA 2010 in Shanghai

The CONTROL CHINA 2010 trade fair, organized by the trade fair company Schall, took place for the first time in China, from August 18th to 20th, 2010 in Shanghai. Several hundred CETA test devices are already in use in China, and our CETA field service has various times been called for to perform maintenance and calibration work in China. Exhibiting at the trade fair was the logical consequence. Since quality control for products manufactured in China is gaining more and more importance, it was no surprise that CETA met with keen interest at the trade fair. In addition to numerous discussions with prospective and regular customers, we also had the opportunity to visit customers on site. This is a clear indication that quality control is taken quite seriously.

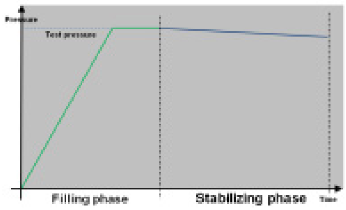


New additional function for the device CETATEST 815: „smooth filling“

Leak-testing sometimes requires a slow increase of the filling pressure, for example to simulate a pressure curve, prestress an elastic test part, or to avoid exceeding the pressure load of a membrane as prescribed by the membrane manufacturer. For this purpose, we created the additional function „smooth filling“, available for the CETATEST 815 series. This special filling function can be combined with the test modes pressure decay, pressure rise and closed component. With this function, filling speed (e.g. 100 mbar/s) and filling pressure (final value) can be specified. When the filling pressure has been reached, it is possible to a) either immediately go ahead with the stabilizing phase, or b) go on filling with filling pressure till filling time is over and final pressure is obtained. The pressure-time curves are schematized below.



a) Filling phase ends upon reaching the test pressure. Stabilizing phase follows immediately.



b) After reaching test pressure, pressure is refilled and held till end of filling phase.

Simplification of RS-232 interface programming - CETA1015.DLL for device series x10 and x15

Leak and flow testing often require logging of the measured values, parameter settings and control modes of the test device. These requirements significantly exceed the possibilities of a PLC. The RS-232 interface or Profibus are available as an alternative. However, those are usually more complicated to program, meaning a longer time investment. This prompted CETA to develop a DLL (Dynamic Link Library). The function library CETA1015.DLL allows a much easier transfer of test values, parameters, etc. Compared to programming with the RS-232-telegrams, there is a gain of time of at least factor 5. Besides, the use of the DLL functions is much less fault-prone. The control of the successful telegram exchange is done by a CRC check, which is implemented in the functions. The DLL can be integrated in all established programming languages as well as in LabView. A 60-page documentation in English contains the description of the functions (such as prototype stipulation, input and output values) and programming examples. This DLL option is available for the x10 series (from firmware 5.14b on) and for the whole x15 series. With it, the test devices can be integrated in the company network and data structures.

CETA practical tip: The influence of the capability index C_g on the measuring time

The typical process of leak-testing consists of the filling, stabilizing, testing and venting phases. In practice, the question often arises about the duration of the whole testing time. Unfortunately, there is no general answer to this question because of the influence of numerous factors (e.g. test part and its properties, adaption, external influences). It is at least possible to give a rough estimate of the testing time when the measuring equipment capability by means of the capability index C_g is required. The capability index C_g allows an objective estimation of whether the testing process is characterized by process-sure repeat accuracy – i.e. whether good parts and marginal reject parts can be clearly differentiated and assessed. In practice, $C_g > 1{,}33$ or $C_g > 1{,}67$ are often required. The C_g value is defined as follows (please also refer to CETA newsletters no. 5 and 13):

$$C_g = \frac{0{,}2 \cdot T}{6 \cdot s} \quad (1)$$

The tolerance T is the difference of the average test results between a master tight part and a marginal test part (simulated by a master tight part and connected test leak with flow rate corresponding to the leak rate limit). The standard deviation s is calculated from the distribution of the test results with marginal rejects. In this case, the tolerance corresponds to the pressure decay during the test phase, e.g. T = Δp (2). Using the leak rate formula (please refer to CETA newsletter no. 1), we can calculate the pressure decay depending on the leak rate Q_L and the volume of the test part:

$$\Delta p = \frac{Q_L}{V_{Testpart}} \bullet \frac{100.000\ Pa}{60\ s/\min} \bullet t_{Test} \quad (3).$$

By inserting (3) in (1) and allowing for (2), we obtain the following estimation of the test time against leak rate, volume, standard tolerance and C_g:

$$t_{Test} = f(V_{Testpart}, Q_L, C_g, s) = \frac{V_{Testpart} \cdot C_g \cdot s}{Q_L} \bullet \frac{9}{500} \bullet \frac{\mathrm{s}}{\mathrm{Pa} \cdot \mathrm{min}}$$

The test time (in sec) is directly proportional to the test part volume (in ml), the C_g value (nondimensional), the standard deviation (in Pa) and inversely proportional to the leak rate (in ml/min). Using the units indicated in brackets will bring about a result of the test time in seconds. The larger the test part volume, C_g value and standard deviation and the smaller the leak rate, the longer the necessary test time.

Example: A volume of 150 ml (sum of the volumes of test part, device measuring circuit, pneumatic measuring line and adaption) is to be leak-tested at a permissible leak rate of 2 ml/min and a pressure of 3 bar. $C_g > 1{,}67$ is required to establish test equipment capability. A standard deviation of 0,5 Pa to 1,5 Pa can be expected for typical good test series. Therefore, the necessary test time can be estimated at 1,3 s to 3,4 s. The standard deviation represents a critical determining factor. For procedures to reduce the standard deviation, please refer to CETA newsletter no. 13.

In this connection and for the sake of completeness, it is necessary to mention that these considerations are only valid in case of ideal test conditions, i.e. pressure decay due to a leak and time are linearly dependent during the test phase. In practice, due to the prescribed production cycle time, these conditions are not always given. Still, the above-mentioned interrelation has proved valuable for an estimation.