

Stamped and Sealed

Reliable and secure measuring instruments with official approval

by Hermann Hartmann

Officially approved measuring systems as a basis for invoicing

Every drop counts! This realization comes to all of us eventually - usually

when we are filling up with petrol or studying our heating oil or gas bills. But even then, no-one normally throws doubt on the accuracy of the amounts determined or the figures shown, as the state takes responsibility for ensuring that directives are complied with and that measurements are demonstrably correct.

In many areas of public life, various measurements such as length, volume, mass etc. play an essential role, since they are the basis upon which business partners agree on a buying or selling price. From a historical point of view, therefore, it has always been among the privileges of those in power at any given time to control the way weights and measures are applied in public use. Decades ago already, the introduction of the SI unit system based on the physical MKS (meter, kilogram, second) parameters led to worldwide harmonization in the technical field. Previously, regional or historical differ-



Figure 2: Calibration keg as a reference standard. Photos & tables: GEA Diessel

ences had led to the emergence of a variety of systems of unit; and despite international conventions, such units of measurement as the gallon or the mile remain in use in some countries even today.

A similar situation prevails with regard to official regulations, which continue to be handled very differently in individual countries all over the world. Although organizations such as the OIML ("International Organization of Legal Metrology" in Paris) have existed for many years and their recommendations

have been implemented to a certain degree, the peculiarities of each individual state in the fields of weights and measures and of customs and excise regulations continue to lead to wide divergences. Even within the EU, the measurement systems associated with approval and calibration procedures are still subjected to a whole number of regulations specific to the individual Member State concerned.

Domestic type approval

With effect from 30.10.2006, the "M.I.D" ("Measuring Instruments Directive", 2004/22/EC on the type approval of measuring instruments) provides for the harmonization of regulations and procedures, so that in future a single "language of approval" will be spoken at least within the current 25 Member States. The official metering of "liquids except water" will in future be governed by MI-005.

The aim of legally monitored metrology is to protect the consumer from being unjustly disadvantaged as a result of the deliberate or unintentional manipulation of measurement results; for confidence in the reliable determination of measurements is utterly basic to fair trading.

The law lays down what is required of measuring systems, and provides for individual instruments to be tested by an independent body in what is known as the type approval procedure (a preventive procedure covering initial calibration, sealing, stamping etc.). The profile of these requirements depends on the type and construction of the meter. For example, it may be laid down that there must be some way of verifying the functionality of a chain of electronic amplifiers, or there may be a defined method of dealing with errors if tolerances are exceeded, or of monitoring the accuracy of the program memory.

In Germany, this type approval procedure is generally the responsibility of the Physikalisch-Technische Bundesanstalt (PTB) in Brunswick. In the Netherlands,



Figure 1: Excerpt from a PTB type approval certificate



Figure 3: Officially approved IZMSE flow meter as a volume pulse generator

the responsible body is the Nederlands Meetinstituut (NMI) (Figure 1).

The type approval procedure also lays down conditions for the process of calibration (e.g. calibration only with an official pre-test certificate, determination of the reference standard etc.) in accordance with the applicable calibration regulations. This so-called repressive procedure lays down the requirements for recalibration and for monitoring the market, including provisions for sanctions against the operator (Figure 2). Initial calibration and recalibration of measuring instruments or systems are carried out on the basis of approval by the regional weights and measures offices. Calibration will typically take place once a year. The Approval Ordinance as now in force after revision to take account of the M.I.D does not have any direct impact on the operators of legal metrology systems.

Measuring instruments and procedures in the field of liquid foodstuffs

Already in the early post-war years, our company made a name for itself specializing in officially calibrated metering devices and procedures in the field of liquid foodstuffs. Type approval certificates for both individual measuring instruments and complete measuring systems have existed since

the 1950s. Metering applications that are subject to the Weights and Measures Act are constantly being further developed from the practical and rational points of view, in order to simplify or automate the operator's work without interfering with the aim of protecting the consumer. The introduction of official calibration into the volumetric filling of barrels, for example, gave breweries a useful alternative to the repeated and time-consuming calibration of each individual barrel.

The electromagnetic flow meter of Type IZMSE is one of a list of officially approved instruments that have a long tradition. The maximum measurement tolerances achieved by this volumetric meter easily comply with the limits for calibration errors, which for this application are set at 0.3% of the measured value. The reproducible results are of course much better than this (Figure 3).

In complete measuring systems, the flow meter is often used as a simple pulse generator operating by volume, but other variants of this type of volumetric meter are also permitted:

- Operation as a multichannel volumetric pulse generator
- Operation with an officially approved main counter
- Operation with redundant signal transmission to a subsidiary counter



Figure 4: IZMTE metering system with integrated main counter (including official pre-test certificate for calibration)

- Operation with bus communication to a central operating station (e.g. of the ZEVODAT-F type)
- Operation with switching outputs for the separate and independent control of filling processes
- Operation with an officially approved printing unit (e.g. via a bus printer of the DI-Print type)
- Operation with data transfer to a central data capture unit (e.g. of the ZEVODAT-M type) (Figure 4)

Although the use of officially approved measuring instruments is a basic prerequisite for any measuring system



Figure 5: Measuring unit for tanker vehicles with main counter and printer



Figure 6: Post-mix filling plant

on which invoicing is based, additional measures must also be taken to guarantee precise and verifiable metering as required by the Weights and Measures Act. An essential criterion, for example, is that when volume is to be determined, there must be a reliable way of avoiding air in the measuring sections.

For this purpose, our company manufactures air eliminators and special gas bubble detectors which, in association with appropriate system control units, are able to ensure compliance with the regulations for the approval of a measuring system. The company possesses, for example, official approval (e.g. from the Weights and Measures or Customs and Excise authorities) for the following measuring systems:

- Milk reception systems, stationary or vehicle-mounted
- Volume determination for beer or beer wort
- Filling of beer kegs
- Filling of casks with post-mix beverages
- Discharge of beer into bulk vessels
- Beer discharge systems on vehicles
- Beer discharge for serving at major events (large-scale catering)
- Determination of alcohol during the dealcoholisation of beer or wine
- Reception systems for alcohol

	TOTAL	OK	OVER	UNDER
up1	76	76	0	0
up2	315	315	0	0
up3	48	48	0	0
up4	496	496	0	0
up5	1	1	0	0
up6	0	0	0	0
up7	0	0	0	0
up8	0	0	0	0

Figure 7: Documentation of filling statistics in the computer

- Reception or discharge systems for liquid sugar

In addition, the company has further approvals for measuring systems outside the field of food production (e.g. for urea, liquid fertilizers etc.). The approval of measuring systems thus often relates not only to the process, but also to the type of liquid to be metered.

Due to the dissolved CO₂ content, for example, the official metering of beer requires different parameters with regard to the equipment of the plant and the reference standard from those required for the metering of milk (which is influenced by frothing). If a metering procedure that is already in use is to be used for a different liquid, an extension or supplement to the approval will generally be required (Figure 5).

Example: officially approved cask filling for concentrate beverages

Where soft drinks are dispensed in largish catering operations, special dispensers are often used which mix carbonated water with the beverage concentrate (the so-called post-mix) to a finished drink only as it is dispensed into the glass. The manufacturers supply this valuable concentrate in 9 or 18 liter containers. Their customers will therefore naturally insist not only on precise metering when these containers

are filled, but also that they should be filled precisely to the intended volume level.

Reliable and officially approved filling results can only be achieved by a combination of mechanical parts (two-stage filling valve, air eliminator, product feed etc.), all finely coordinated and the necessary metering and filling technology with the IZM-MEV (automatic switch-off control) device (Figures 6 & 7).

For documentation purposes, the individual fillings and the overall filling statistics, including any incorrectly filled containers (whether the quantity was too much or too little) can be transferred to a PC. In this way, important quality parameters of the production process are continuously recorded, more or less on the side. The same measurement technology is by the way widely used in breweries for the filling of beer kegs.

Example: official determination of the alcohol level during dealcoholization

The quantities of alcohol extracted during the process of producing non-alcoholic beer or wine must be precisely recorded for Customs and Excise purposes. This is a highly sensitive issue, involving as it does a sum of some €13 of alcohol duty that the state charges on every liter. Here too, of course, the first requirement is a highly accurate measuring system. Owing to the limited conductivity of the liquid, an officially approved mass metering device or a mechanical rotary piston meter must be used for this application.

As a recording unit, the officially approved ZEVODAT control unit is used.

Within the control system, the measurement values for volume, density and temperature are combined to calculate the amount of pure alcohol in liters (Figures 8 & 9).

In order to secure the measurement process against all possible forms of tampering, in this application the complete measuring section is sealed inside a kind of stainless steel cage. It



Figure 8: Completely sealed measuring section for alcohol

is then only possible to gain access to it under the supervision of a Weights and Measures official.

Officially approved reception units are far more widely used for the transfer of alcohol in the spirituous liquor industry, for example, or in the manufacture of cosmetics.

Summary

Legal metrology rests on the basis of an accurate measuring instrument, a reliable and tamper-proof metering procedure and official approval by a state

authority for the application concerned. Our company is a specialist in officially approved measuring instruments and supplies complete metering systems all over the world that are approved under the regulations of the particular country concerned.

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Improved Dirt Removal With New Bottle Washers

Bottle washers rank among the most cost-intensive pieces of equipment in a line, which is why their availability, their resistance to malfunctions and their efficiency are vital considerations. In order to improve the efficacy of the dirt removal function, a leading German company has developed a new pre-soak concept.

Given a typical line size of 60,000 bottles an hour, about 1 g of dirt is brought in per bottle (excluding labels). That's 60 kg an hour, which with a weekly constant running time of 150 hours adds up to 9 tons. Before starting development work, the company asked itself the

fundamental question: what's the best way to cope with such a conglomeration of sand, beverage residues, crowns, cigarette ends, glass fragments and bits of dress. Mechanical systems, such as sieving-conveyor removal systems or rotating cullet scrapers, are susceptible to malfunctions. And because of where they are installed, they are concomitantly difficult to clean and maintain.

Hydraulic solution

For this reason, the solution adopted was a hydraulic one: a propeller pump with a recirculation rating of about 500 m³/h ensures a flow across the machine. The recirculated flow is taken from the filtered side of a small label removal unit, pumped through a pipe extending over the width of the machine, and fed back into the machine again. This flow energy is sufficient to convey all the dirt and dress residues through the pre-soak channel into the sieve case.



The flow channel in the bottom pre-soak segment. The high turbulence of the flow gives the dirt involved no opportunity to collect. Photo: Kronen AG

In the specially shaped lower section of the sieve case, the heavier parts, like glass or sand, settle to the bottom under gravitational force. The lighter substances, like label paper, are carried along on the surface and taken out of the machine on the sieving conveyor removal unit. The glass fragment collecting tank is connected to a removal lock with a vertical pipe. The valves are controlled and the lock emptied in dependence on the amount of glass fragments collected. With this new pre-soak concept the cleaning performance capabilities of its bottle washers has significantly improved.

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Figure 9: ZEVODAT operating and display unit