

# **Legal Metrology Systems in general and especially in Germany**

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# What belongs to Legal Metrological Control (LMC)



*Definition of “**legal metrological control**” (see VIML, Item 2.1):*

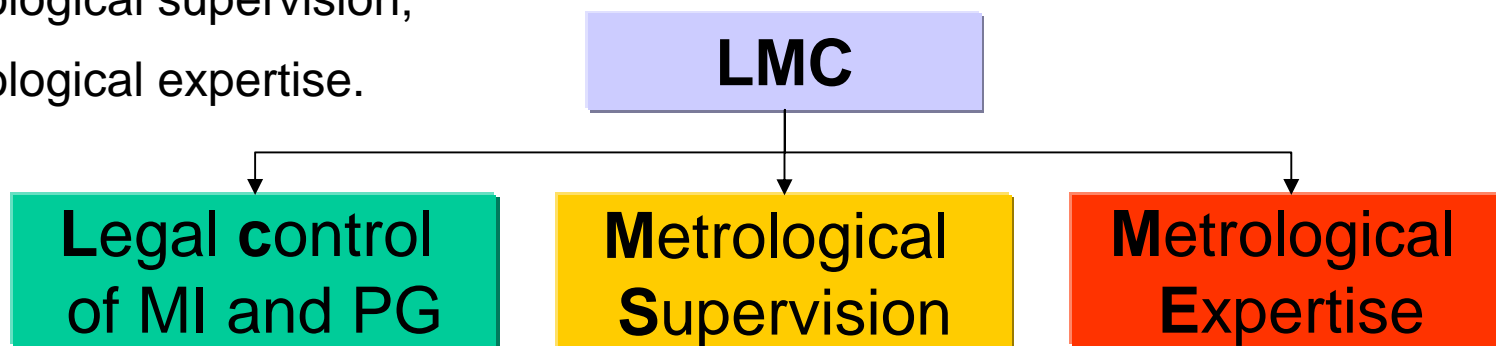
= the whole of legal metrology activities which contribute to metrological assurance

Legal metrological control, according to its definition includes three main elements:

legal control of measuring instruments and of prepackages;

metrological supervision;

metrological expertise.



Any effective system of assurance of metrological control is based on a combination (Framework ) of all three elements, as appropriate to the local jurisdiction; the third element completes the system by enabling it to resolve disputes. (see OIML D16)



**A lot of terms must be clarified**

**Definition: “legal control of measuring instruments”**

= generic term used to globally designate legal operations to which measuring instruments may be subjected, e.g. type approval, verification, etc.

(see VIML Item 2.2)

**Definition: „prepackage“**

= combination of a product and the packing material in which it is prepacked

(see OIML R 87)

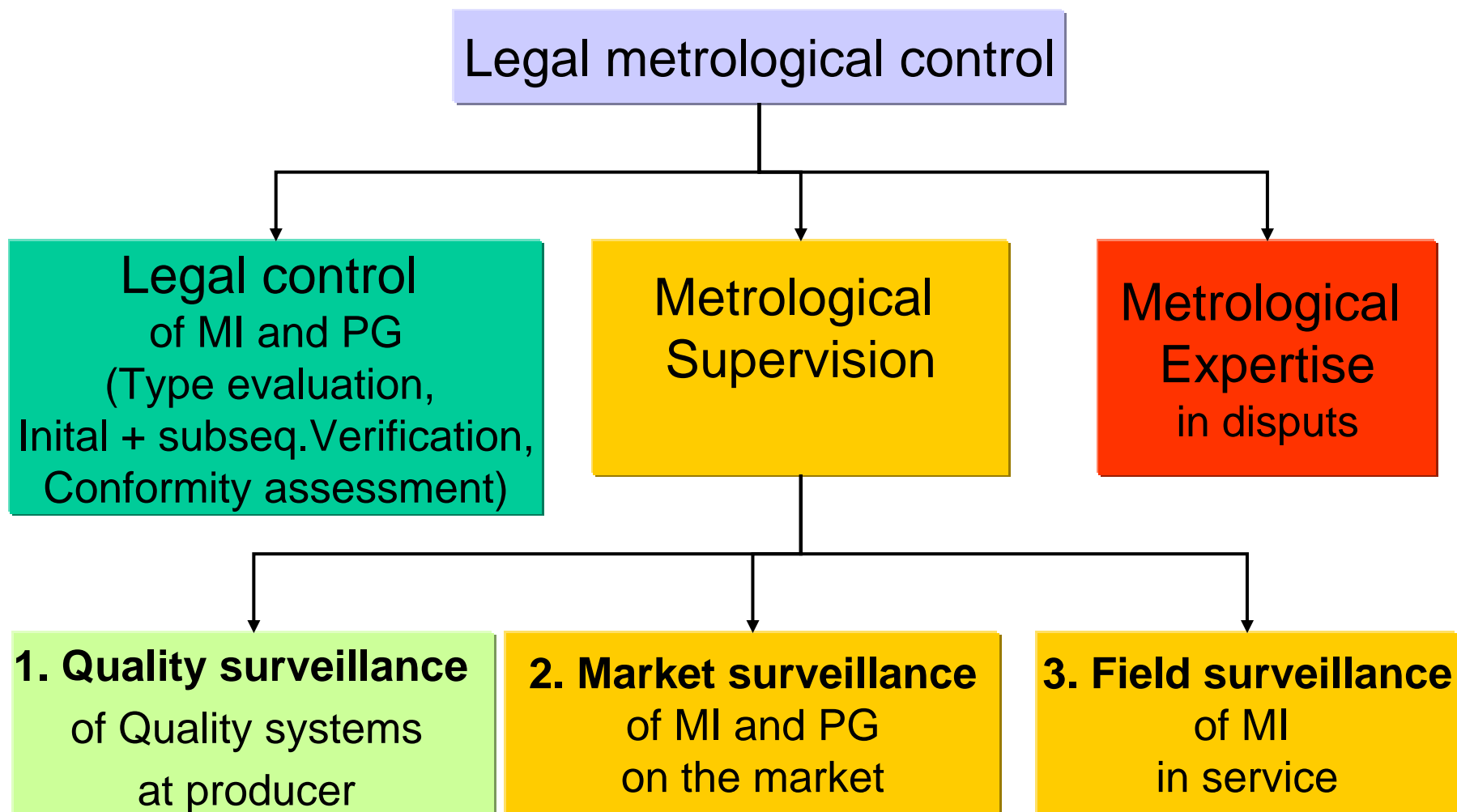
**Definition: „metrological supervision“**

control exercised in respect of the manufacture, import, installation, use, maintenance and repair of measuring instruments, performed in order to check that they are used correctly as

regards the observance of metrology laws and regulations

(see VIML Item 2.3)

*Note: Metrological supervision includes checking the correctness of the quantities indicated on and contained in prepackages.*



Legend: MI Measuring instruments  
PG Prepackaged goods

(see OIML D9)

*Definition: “ **Market surveillance**”*

Form of metrological supervision aimed at a measuring instrument and prepackage which is placed on the market and/or put into service for the first time, to ensure that all the elements of the conformity assessment system work properly and result in general compliance of the products with the provisions of the applicable regulations across a country or free trade Area.

(see OIML D9, Item 2.26)

# Quality Surveillance at the Manufacturer – one Form of Metrological Supervision



- The QMS assessed in this way is subsequently subject to regular quality surveillance as one form of metrological supervision (see OIML D 9 ).
- As to initial verification, this system is applicable to a majority of measuring instruments with the exception of those which, for various reasons, have to be verified in-situ (e.g. instruments of which the measuring performance can be typically dependent on the location of use, for instance the height above sea level, e.g. non-automatic weighing instruments of class I, II, sometimes III and exhaust gas analyzers - OIML R 99 , weighbridges, some automatic weighing instruments, etc.).
- In this case an independent, competent, third-party body should be available to perform the initial verification (assessment of conformity with the approved type) if this is not done by the manufacturer himself (to be decided by the user).
- This system, based on the direct involvement of manufacturers, can be made more robust by making **manufacturers liable by law for any damage** to public interests caused by their products that can be legally traced back to them.

(see OIML D16-2011, Item 6.1.1.2)

**Definition: “in-service surveillance” (alternatively “field surveillance”)**  
= a form of metrological supervision aimed at establishing that a measuring instrument in use in the field complies with the statutory requirements

*Note 1: “Field surveillance” should not only cover the instrument itself but also the user, to evaluate the proper use of the instrument.*

*Note 2: on the relation between market surveillance and field surveillance:  
Both types of surveillance can in principle overlap but where a conformity assessment of a measuring instrument indicates that the findings can be directly related to the responsibilities of manufacturers or their representatives, the matter **should be dealt with by market surveillance**.*

(see OIML D16, Item 2.25)

The **framework systems** of metrological control (typical **combinations of control elements**) to be used in application to the various existing situations in the present-day legal metrology are as follows:

- Measuring instruments **at the market stage**;
- Measuring instruments **in service**;
- Metrological control of prepackages;
- Complementary activities of metrological control.

(see OIML D16-2011, Item6)



# Prototyp of a restrictive System of LMC



A highly restrictive legal metrology control system typically includes, by law and regulation, all of the following:

- type evaluation and type approval of measuring instruments;
- installation requirements;
- initial verification both at the factory and at point of use;
- environmental requirements.

All the operations are performed by legal metrology officials for a fee.

(see OIML D16-2011, Item 6.1.1.1)

# Prototyp of a balaced System of LMC



A **balanced system** can be based on:

type evaluation and type approval carried out by competent bodies (accredited or peer reviewed - generally called conformity assessment bodies) with a maximum mutual recognition of either type approval certificates or corresponding test reports (e.g. OIML MAA, EU global approach);

initial verification by the manufacturer (in the factory) based on an assessment of his quality management system by a competent body (an accredited certification body for quality management systems having expertise in the given field). In this specialized assessment concentrated on conformance of any individual measuring instrument to the approved type the existence of an over-arching certified quality management system (QMS, based on the ISO 9000 family of standards) is taken into account.

(see OIML D16-2011, Item 6.1.1.2)

=> **Increasing Market surveillance** on MI, which intended to placing on the market  
**This is the current system of LMC in Germany**

# Prototyp of a highly liberal System of LMC



A highly liberal system can be developed from the balanced system by extending the assessed QMS to cover the design stage of those measuring instruments (the R&D operations of the manufacturer). The relevant competent body, having assessed this more complex QMS, would subsequently assess technical documentation of any new type (design) of the measuring instrument (resulting eventually in the issuance of a design certificate).

In this system no third-party testing is required. It can be assumed that the majority of tests will be carried out by the actual manufacturer. Instead, there is third-party assessment of the technical documentation.

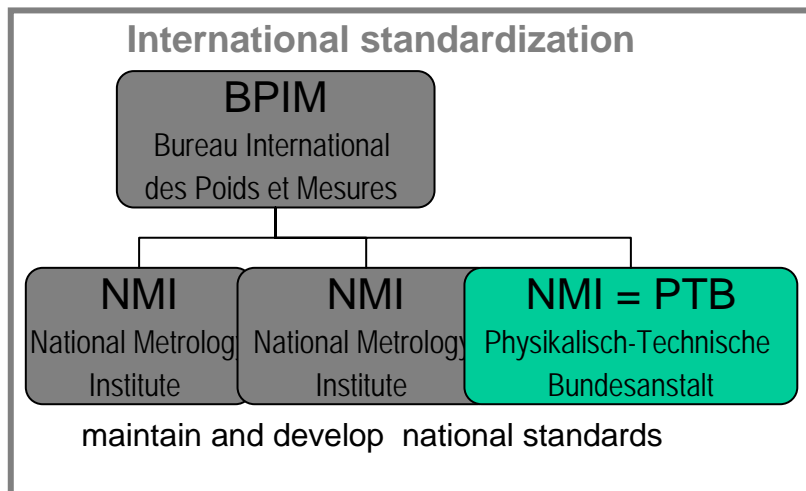
(see OIML D16-2011, Item 6.1.1.3)

## Scientific & Research



*International Measurement Confederation*

## Metrology Institutions



## Legal Metrology Organizations



harmonization ...

**SI-System  
of units**

traceability

## Players / Parties for

### Legal Tasks

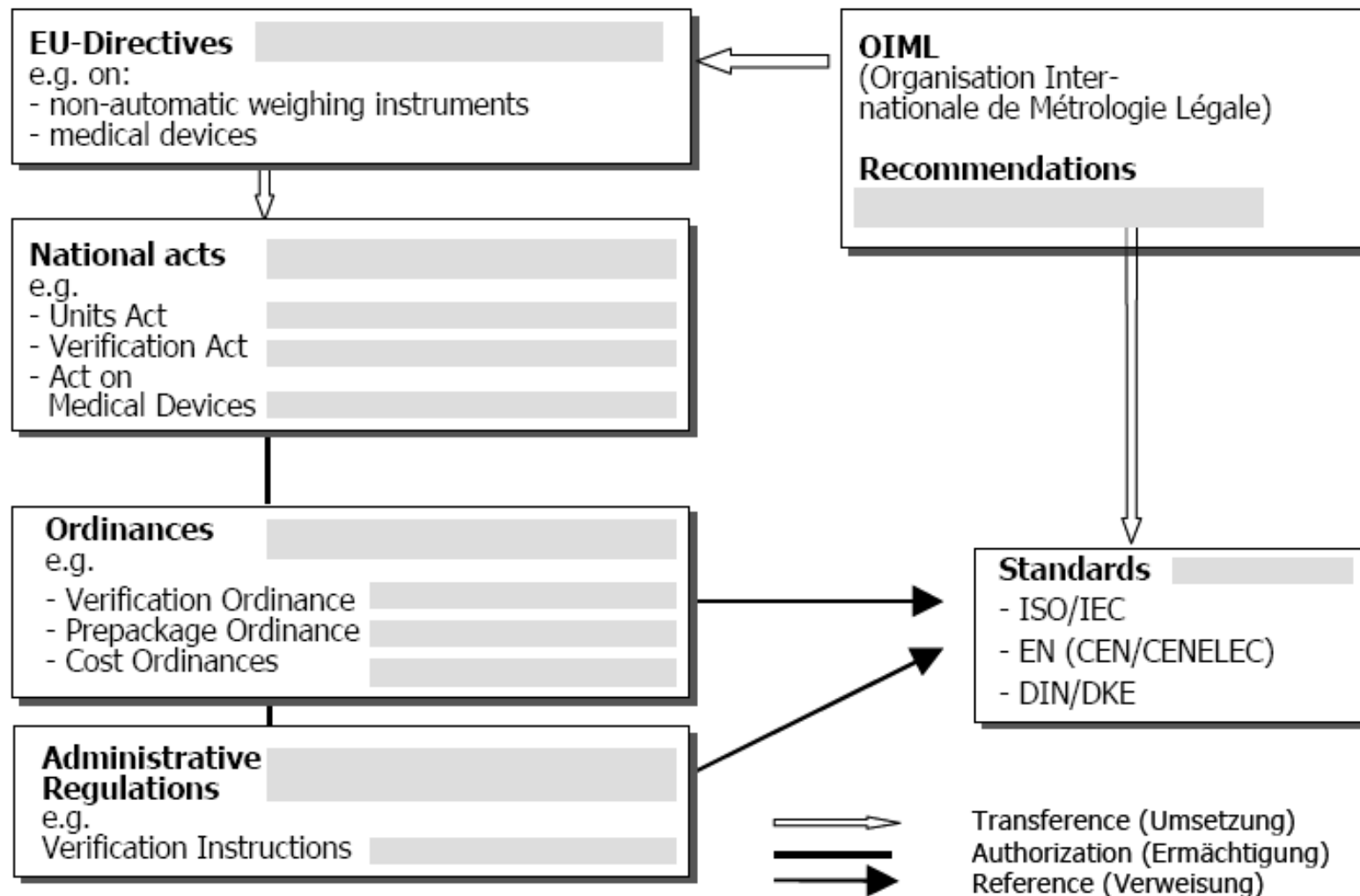
Legal Metrology Control  
Approval, Supervision,  
Verification

### Economy driven Tasks

Accreditation, Calibration,  
Conformity evaluation

**Correct units and measurements in trade, health and industry**

# Legal bases in Legal Metrology



(see DAM- En.Material on Law and Administration 2004)

# Elements and Parties of Measurement Infrastructure



- International System of units of physical quantities (SI),
- NMI's that maintain and develop the national standards of measurement,
- calibration laboratories that maintain the traceability path and
- laboratory accreditation organizations,
- type / pattern approval testing laboratories,
- measurement legislation and
- authorities for enforcement of these measurement regulations,
- scientific and technical committees that develop international measurement standards and recommendations and
- training of metrologists and measurement engineers and technicians.

This is equivalent to the first four levels of the national measurement system

# National Metrology Infrastructure in Germany before MID



## International standardization

**BPIM**

Bureau International  
des Poids et Mesures

**NMI**

National Metrology  
Institute

**NMI**

National Metrology  
Institute

**NMI = PTB**

Physikalisch-Technische  
Bundesanstalt

maintain and develop  
national standards

## Legal Tasks

**Government**

Federal Ministry  
for Economy

**State**

Ministry  
for Economy

**State**

Ministry  
for Economy

**State**

Ministry  
for Economy

**Enforcement  
Authorities**

**responsibility**

**Verification  
Offices**

Metrological supervision  
of MI & PG

**Initial** and subsequent  
Verification of MI  
control of prepackages

**State Approved  
Test Laboratories**

Verification of utility meters

**Manufacturer  
of MI**

Production of  
MI for legal use

**Supplier  
of MI**

Put into market

## Economy driven Tasks

**Accreditation  
Body = DAkkS**

**Calibration  
Laboratories**

Traceability of standards  
for industrial use

Explanation: MI- Measuring Instrument

QMS - Quality Management System in Production





## Directives

- 86/378/EEC Safety of toys
- 89/106/EEC Construction products
- 89/686/EEC Personal protective equipment
- 90/385/EEC Active implantable medical devices
- 92/42/EEC Hot-water boilers
- 93/15/EEC Explosives for civil uses
- 93/42/EEC Medical devices
- 94/9/EC Equipment and protective systems intended for use in explosive atmospheres
- 94/25/EC Recreational craft
- 95/16/EC Lifts
- 96/98/EC Marine Equipment
- 97/23/EC Pressure equipment
- 98/79/EC In vitro diagnostic medical devices
- 99/5/EC Radio and telecommunications terminal equipment
- 99/36/EC Transportable pressure equipment
- 2000/9/EC Cableway installations designed to carry persons
- 2000/14/EC Directive on the emission in the environment of noise and vibration
- 2004/22/EC Measuring Instruments Directive
- 2004/108/EC Electromagnetic compatibility

EU

Directives  
Guidelines

National Acts  
and Ordinances

Technical Rules / Normative  
Documents

Measuring Instrument Directive  
(MID)



# The Background for Conformity Assessment



## Reasons:

- recent changes in the global economy , aimed at supporting free trade
  - development of measuring instruments
- ⇒ metrological legislation over measuring instruments  
often has to be split into two parts
- 1) being put on the market (the market stage) and
  - 2) measuring instruments in use (the in-service stage).

This enables legal metrology to be adapted to the requirements of free trade agreements and at the same time can provide scope for a direct and more extensive involvement of manufacturers not limited to carrying out the tests only in their metrological control as appropriate.

To reflect these changes, this type of legal control over measuring instruments is therefore generally called ***conformity assessment activities***.

# Implementation of New Approach in Germany



## Recent Aspects after Implementation of Measuring Instruments Directive

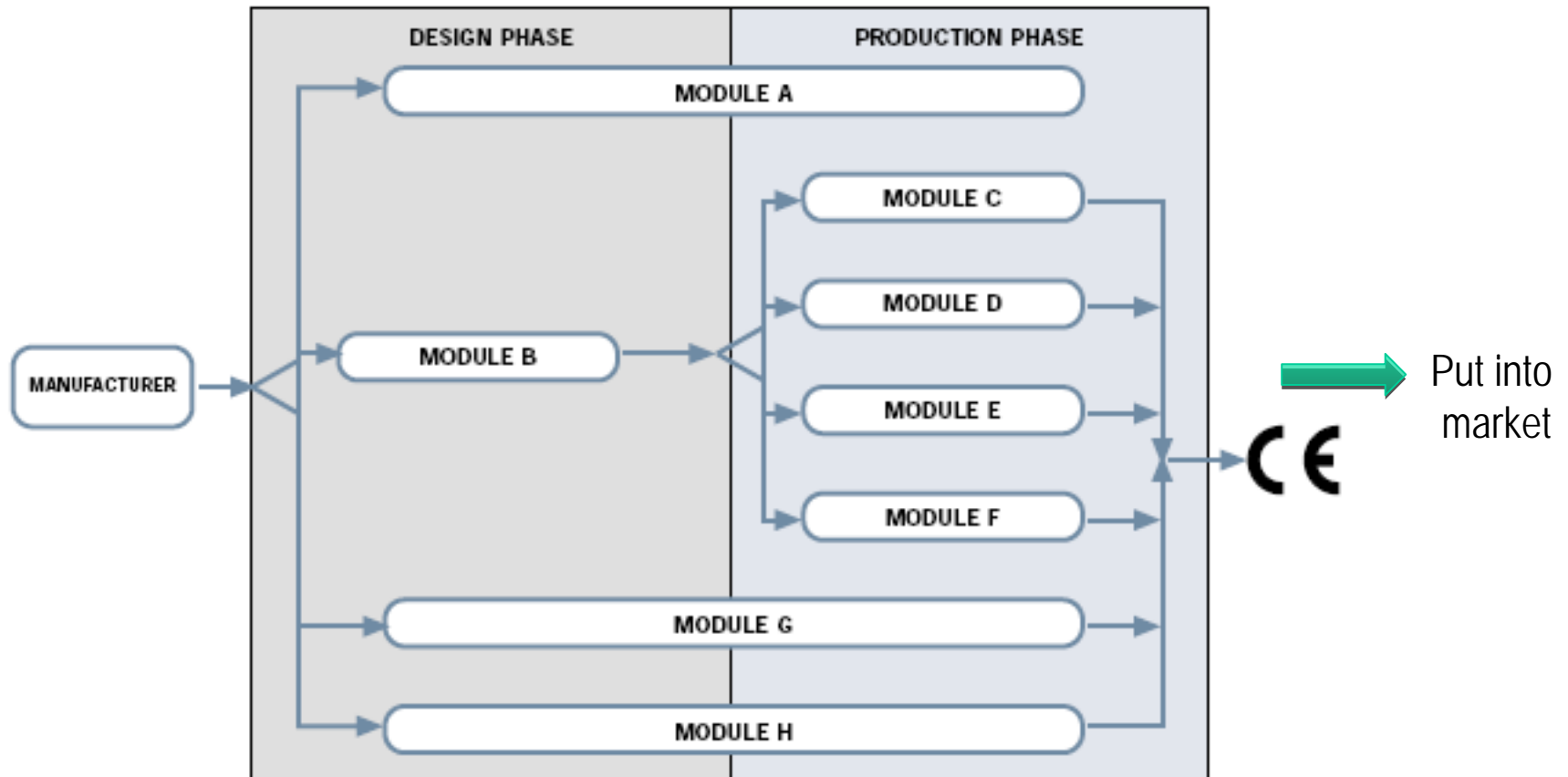
- the current verification act and ordinance has implemented the MID
- general requirements and conformity assessment modules will be identical for all meters under legal control (as in MID)
- besides MID national regulated measurements will exist
- PTB is notified body for Modules B, D and H1
- Enforcement Authorities are notified body for Modules A, F for Measures and several for Modul D
- MID conformity assessment are much more complex than current approvals (additional tests)
- **notified bodies** besides PTB and Enforcement Authorities was established

# Conformity Assessment

## a necessary Element of New Approach

Reference: “Guide to the Implementation of Directives Based on New Approach and Global Approach “(BlueGuide)

**Table 5/2 • Simplified flow chart of conformity assessment procedures •**



# National Metrology Infrastructure in Germany after Implementation of MID

## International standardization

**BPIM**

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des Poids et Mesures

**NMI**

National Metrology  
Institute

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**NMI = PTB**

Physikalisch-Technische  
Bundesanstalt

maintain and develop  
national standards

## Legal Tasks

**Government**

Federal Ministry  
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Minis  
for Eco

**State**

Minis  
for Eco

**State**

Ministry  
for Economy

**Enforcement  
Authorities**

Metrol. supervision  
Market surveillance  
of MI & PG

**Verification  
Offices**

Verification of MI  
control of prepackages

**State Approved  
Test Laboratories**

Verification of utility meters

**Notified Bodies**

Conformity Assessment  
of MI or QMS

**Manufacturer  
of MI**

Production of  
MI for legal use

**Supplier  
of MI**

Put into market

responsibility

## Economy driven Tasks

**Accreditation  
Body = DAkkS**

**Calibration  
Laboratories**

Traceability of standards  
for industrial use

Explanation: MI- Measuring Instrument

QMS - Quality Management System in Production

# Notified Bodies and Conformity Assessment



- The primary task of a notified body is to provide services
- for conformity assessment on the conditions set out in the
- directives. This is a service to the manufacturers in an area
- of public interest.
- Notified bodies are free to offer their conformity assessment
- services, within their scope of notification, to any economic
- operator established either inside or outside the Community.
- They may carry out these activities also on the territory of
- other Member States or of third countries.
- Manufacturers are free to choose any notified body that has
- been designated to carry out the conformity assessment procedure
- in question according to the applicable directive.

(See Blue Guide)

- System of legal metrology has a long tradition in Germany more then 100 years
- a lot of different meters are verified or under legal control
  - balances
  - utility meters, like gas and electricity meters ,
  - fuel dispensers
  - measuring container for beer / wine (for instance glasses in restaurants)
- Germany is a federal state of states
- Responsibilities are divided
  - verification and market surveillance are tasks of federal states
  - federal government is responsible for unity of legal metrology
  - European Measurement Instrument Directive (MID) was implemented in Verification act in 2006 and became active in October 2006
  - after that: initial verification was replaced by EU-conformity declaration

Aim of the German Verification act:

- protection of consumers
  - safeguarding of a fair trade
  - safeguarding of correct measurements in health protection, environment protection etc.
  - improvement of trust in official measurements  
(for instance traffic measurements)
- 
- verification duty (which meters have to be verified)
  - permission to issue ordinances in respect of verification
  - responsibilities (state governments , duties of PTB)
  - Penalties

divided in general part and appendices

**general part** (main content in respect to utility meters) :

- duties during
  - placing on the market
  - using
  - having meters ready for use
- exception from verification
- values used in legal metrology
- reverification period
- approval (general requirements, kinds of approvals, procedures, tasks of PTB)
- verification (procedures, seals, MPE, reverification, investigations of MPE in service)
- general requirements on meters for approval and verification
- state approved test laboratories (acceptance, management, duties)



## Approval for verification (until MID)

- different kinds:
  - national approval, European approval, general approval
- approved meter type has to fulfil general requirements and the „state of the art in respect to the verification ordinance”
- national approvals only by PTB

## Verification

- conducted by local verification offices (balances, fuel dispensers)
- utility meters by state approved test laboratories under supervision of the verification authorities of the states
- verification authorities work currently cost neutral (expenses are equal to income)

## Parts of verified meters

- metering sensor
- display
- computer and/or auxiliary equipment
- **auxiliary equipment is treated as verified meters**

results of verified meters must be clearly distinctive from results of not verified meters or functions

## **Procedure of Verification:**

- inspection concerning the correct construction of a meter  
(Is the instrument identical to the approved type?)
- metrological test  
(MPE's have to be fulfilled, adjustment may happen during verification procedure)
- Sealing
- Verification may be carried out in different steps (example: test of a conversion device is carried out in a state approved test laboratory of a manufacturer, sealing happens after the installation)
- requirements on test facilities are approved by general assembly of all involved parties in verification
- verification fee is fixed in cost ordinance

- [1] John Birch A.M.: *Benefit of Legal Metrology for the Economy and Society. A study for the International Committee of Legal Metrology*
- [2] OIML V1:2000 *International Vocabulary of Terms in Legal Metrology (VIML)*.
- [3] OIML D16:2011 *Principles of assurance of metrological control*
- [4] OIML D 9:2004 *Metrological supervision*.
- [5] Blue Guide *Guide to the Implementation of Directives Based on New Approach and Global Approach*  
[http://ec.europa.eu/enterprise/policies/single-market-goods/documents/blue-guide/index\\_en.htm](http://ec.europa.eu/enterprise/policies/single-market-goods/documents/blue-guide/index_en.htm)