Introduction of Proficiency Testing Programs for Ex Test Laboratories within the IECEx System

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Convenor of the ExTAG WG 10 „Proficiency Testing“
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Melbourne, AU

Motivation

PTB

- To provide evidence of competence for --
- Laboratory customers (manufacturers)
- Regulators
- End users
- To prevent conflicts under ExTLs
- To avoid distortion of competition under manufacturers --
- To foster fair play!!!

Our policy

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- compliance with requirements of ISO/IEC 17043
- full transparency of the programs
- no misuse of the results
- stimulate communication of laboratory staff to strengthen common understanding
- developing new methods of testing to improve their value
- experience exchange with IEC/TC 31 MTs experts about value and feasibility of the tests

Extract from a presentation of Daniel Tholen, A2LA

ISO/IEC 17043
Conformity assessment – General requirements for proficiency testing

6th Eurachem Workshop
7 October, 2008

Daniel Tholen, M.S.
A2LA, APLAC, ILAC

Scope of the ISO/IEC 17043

ISO/IEC 17043 Scope

This International Standard specifies general requirements for the competence of providers of proficiency testing schemes and for the development and operation of proficiency testing schemes. These requirements are intended to be general for all types of proficiency testing schemes, and they can be used as a basis for specific technical requirements for particular fields of application.

Definitions – What is provided?

- **proficiency testing scheme** - proficiency testing designed and operated in one or more rounds for a specified area of testing, measurement, calibration or inspection

- **proficiency test item** - sample, product, artefact, reference material, piece of equipment, measurement standard, data set or other information used for proficiency testing

Definitions of the ISO/IEC 17043

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Definitions – Who's involved?

- **proficiency testing provider** – organization which takes responsibility for all tasks in the development and operation of a proficiency testing scheme
- **participant** – laboratory, organization or individual, that receives proficiency test items and submits results for review by the proficiency testing provider

  NOTE In some cases the participant may be an inspection body

PTB tries to behave as the provider –
NOT excluding other laboratories to join the provider group

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Definitions – who else?

- **coordinator -** one or more individuals with responsibility for organizing and managing all of the activities involved in the operation of a proficiency testing scheme
- **customer -** organization or individual for which a proficiency testing scheme is provided through a contractual arrangement
- **subcontractor** – organization or individual engaged by the proficiency testing provider to perform activities specified in this International Standard and that affects the quality of a proficiency testing scheme

Definitions – from VIM, with Notes

- **metrological traceability** - property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty (+8 Notes)

- **measurement uncertainty** - non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used (+4 Notes)

Changes – Choice of method

- **4.5.2** Where participants are permitted to use a method of their choice, the proficiency testing provider shall have a policy and follow a documented procedure regarding comparison of results obtained by different test or measurement methods.

  The proficiency testing provider shall be aware of which different test or measurement methods for any measurand are technically equivalent, and take steps to assess participants' results using these methods accordingly.

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Traceability and Uncertainty

- **4.4.1.3** The proficiency testing provider shall document a plan before commencement of the proficiency testing scheme that shall address the following information and, where appropriate, reasons for its selection or exclusion:

  q) the origin, *metrological traceability* and *measurement uncertainty* of any assigned values;

- **4.4.5.1** The proficiency testing provider shall document the procedure for determining the assigned values for the measurands or characteristics in a particular proficiency testing scheme. This procedure shall take into account the *metrological traceability and measurement uncertainty* required to demonstrate that the proficiency testing scheme is fit for its purpose.

Types of programs

Annex A: Types of proficiency testing

- Revised from introductory language in ISO/IEC Guide 43-1
- Provides further explanation of NOTES in the definition of PT
  - Sequential schemes
  - Simultaneous schemes
    - EQA
    - Split level
    - Split sample
    - Partial process
    - Blind

First programs/“schemes“ to be drafted

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- #1: Flameproof
- #2: Intrinsic Safety
- #3: Increased Safety – motors

to be scheduled for 2010, second quarter

Concept Flameproof enclosures

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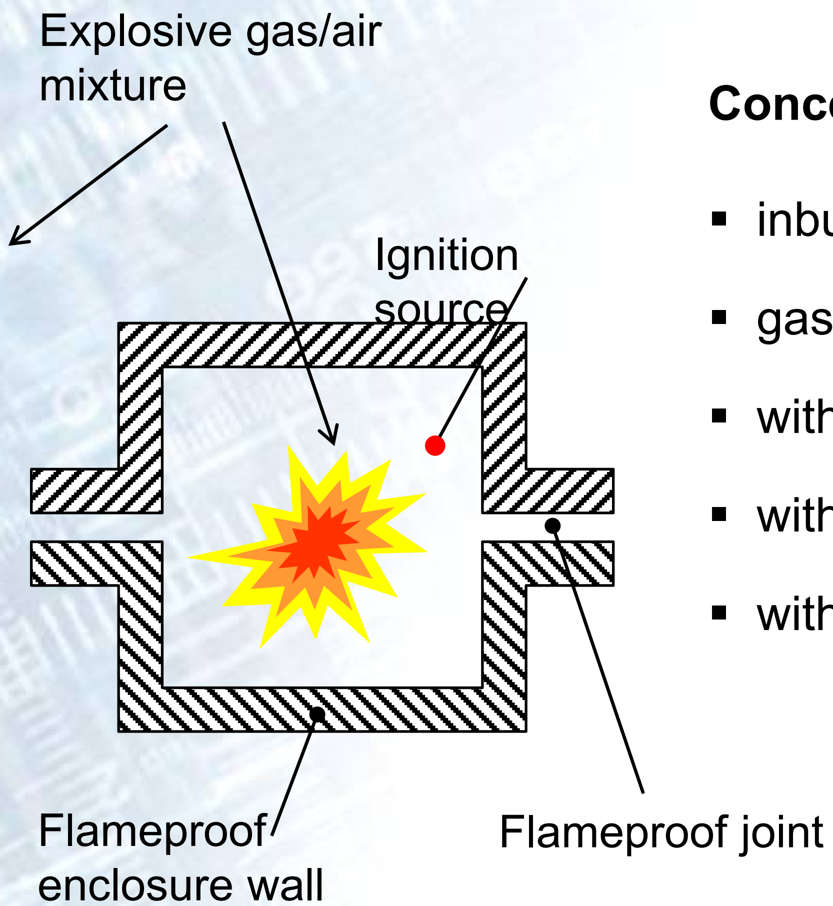
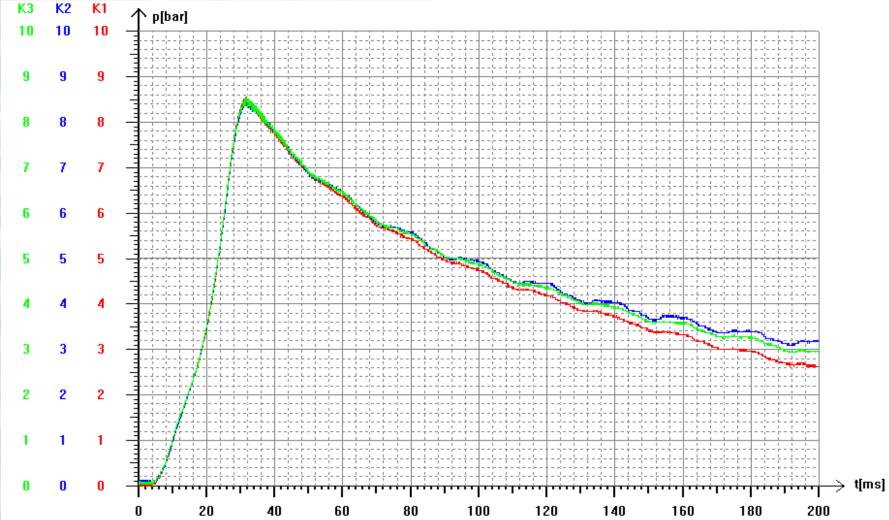


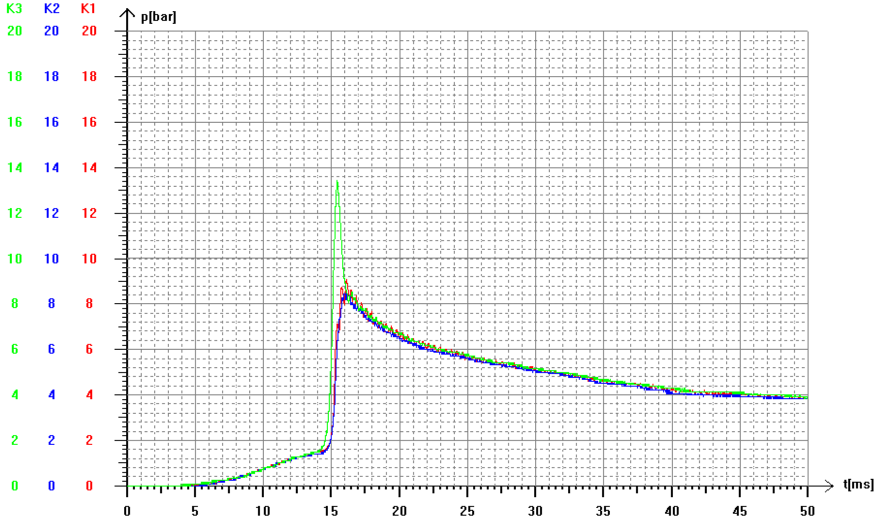
Concept of IEC 60079-1:

- inbuild components are potential ignition soruces
- gas explosion inside expected
- without damage of the enclosure
- without flame propagation from inside to outside
- without ignition by heat transfer inside to outside

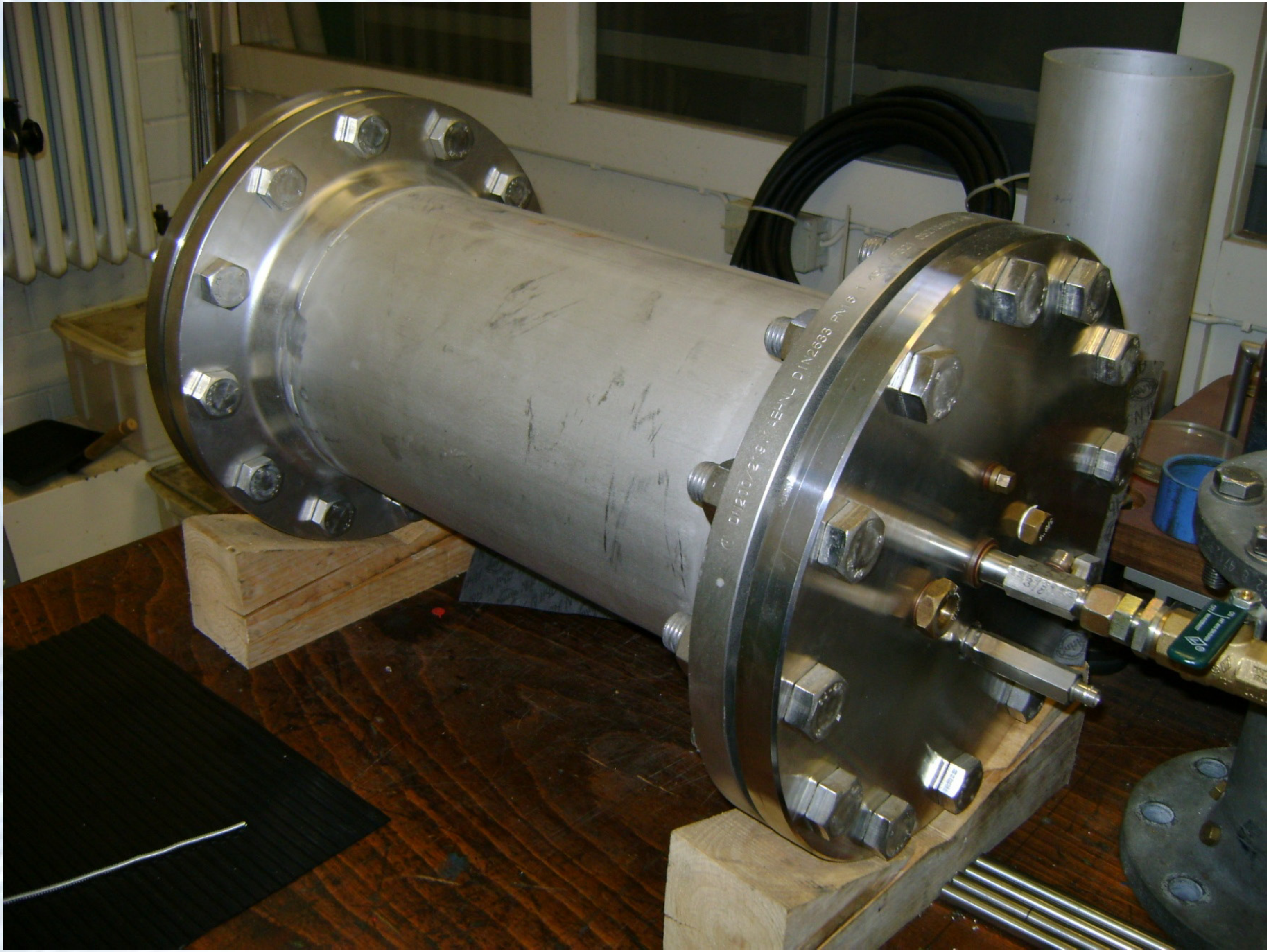
Program IECEx-PTP #1 „Flameproof"

- Measurand 1: Explosion pressure in 3 speeds
- To check proper response from the pressure measurement system





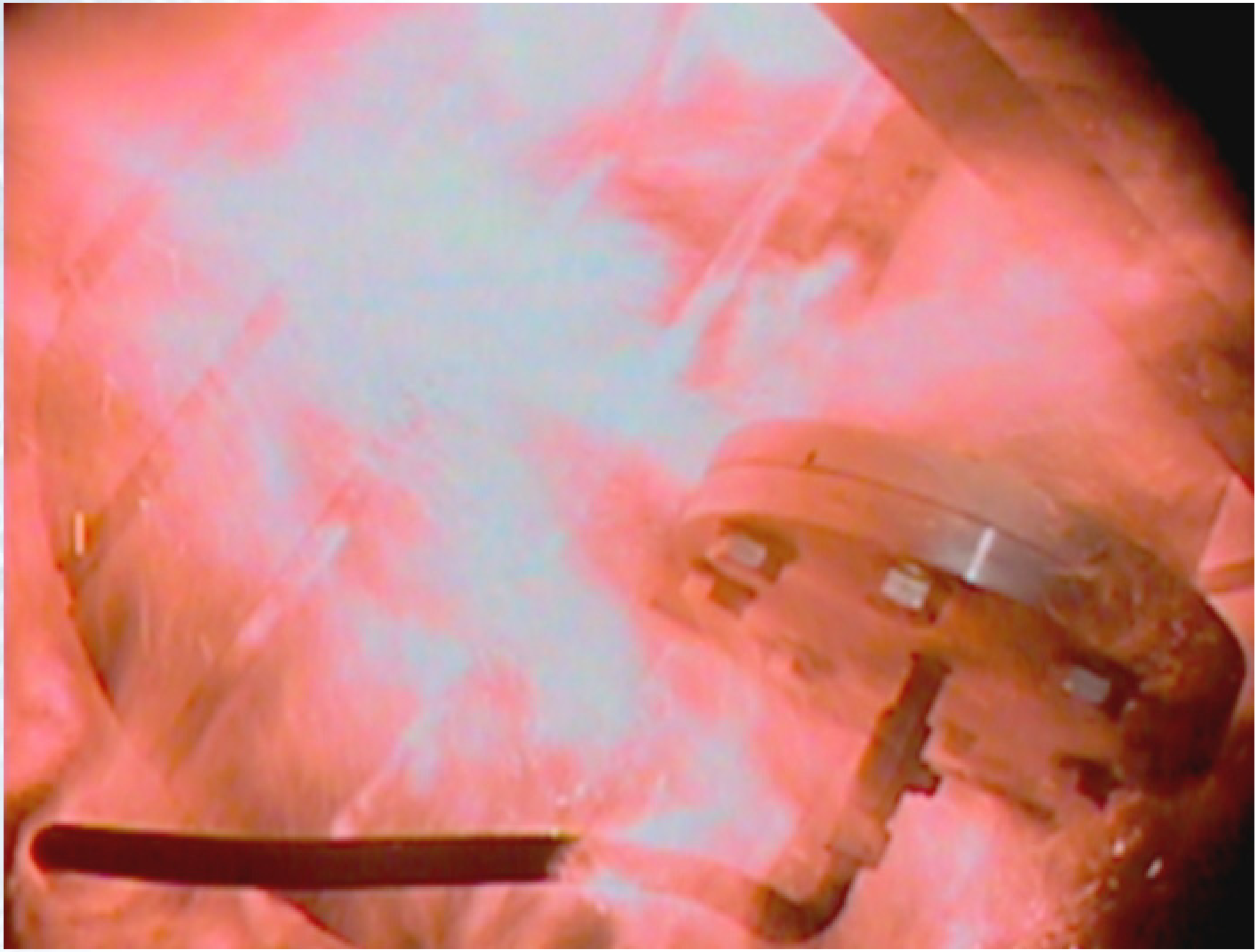
Enclosure model



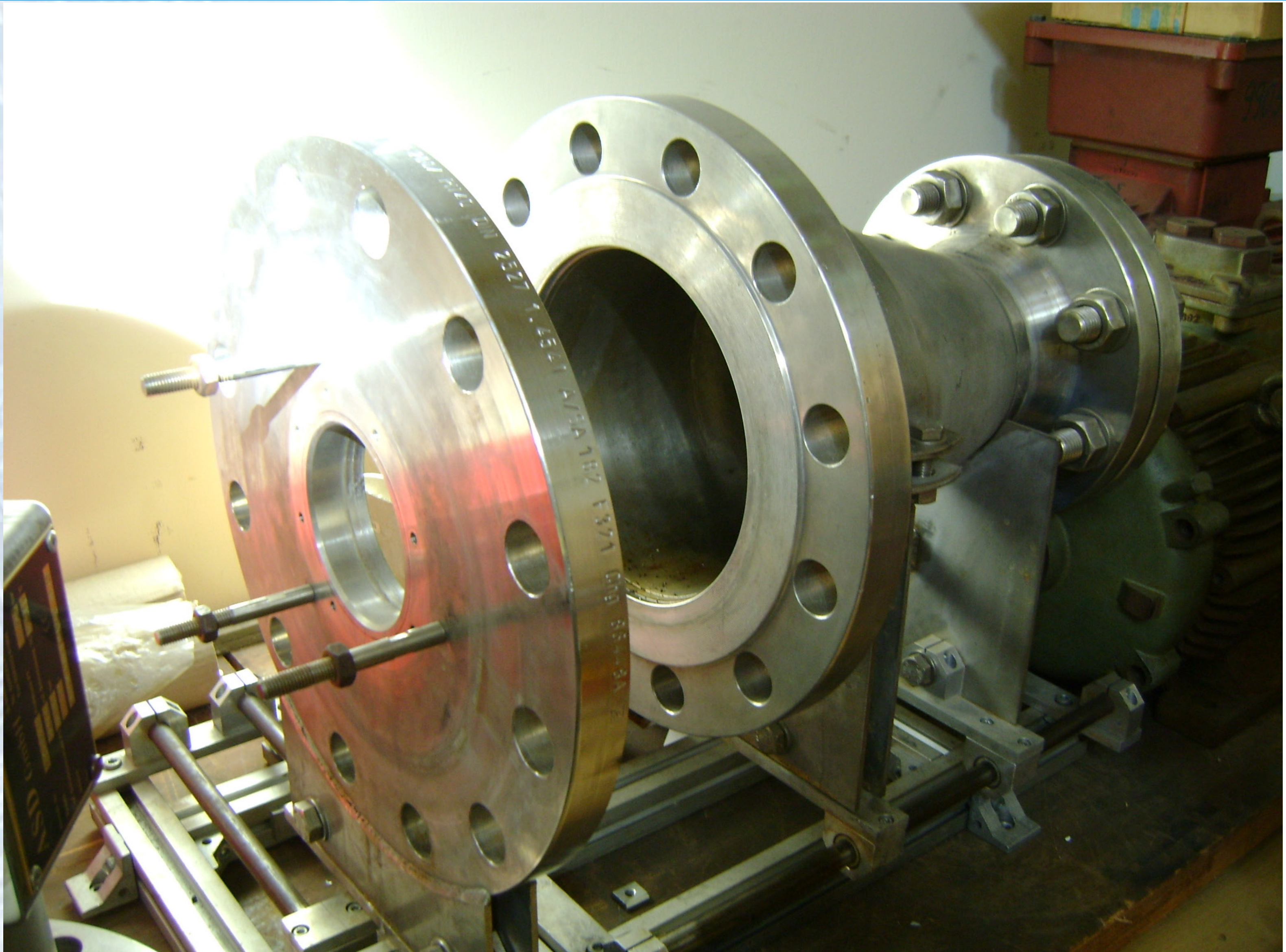
- **Measurand 2: Flame propagation**

- **To check proper response from the propagation test set up**

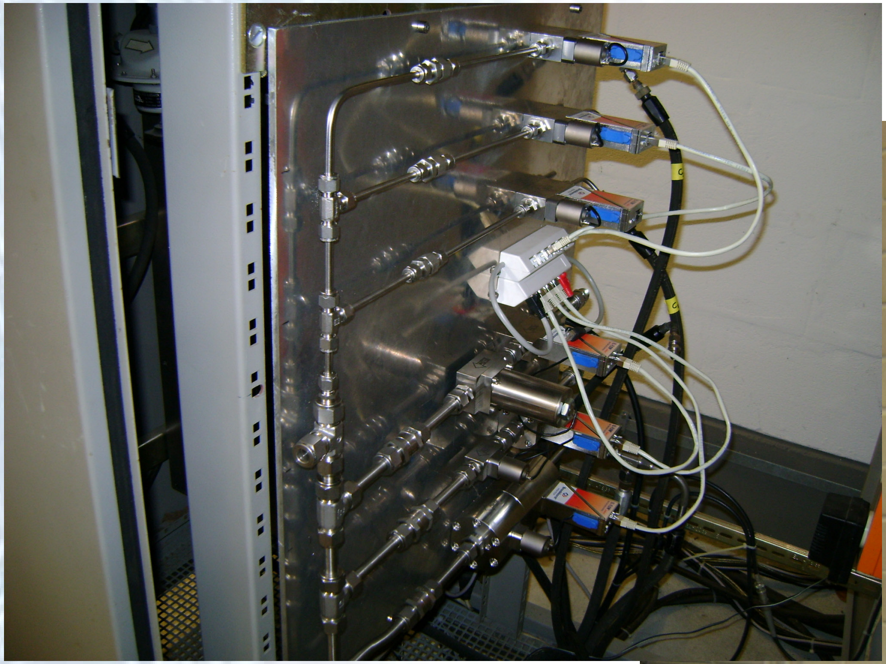
Flame propagation recorded by high speed camera



Model for flame propagation tests at shafts

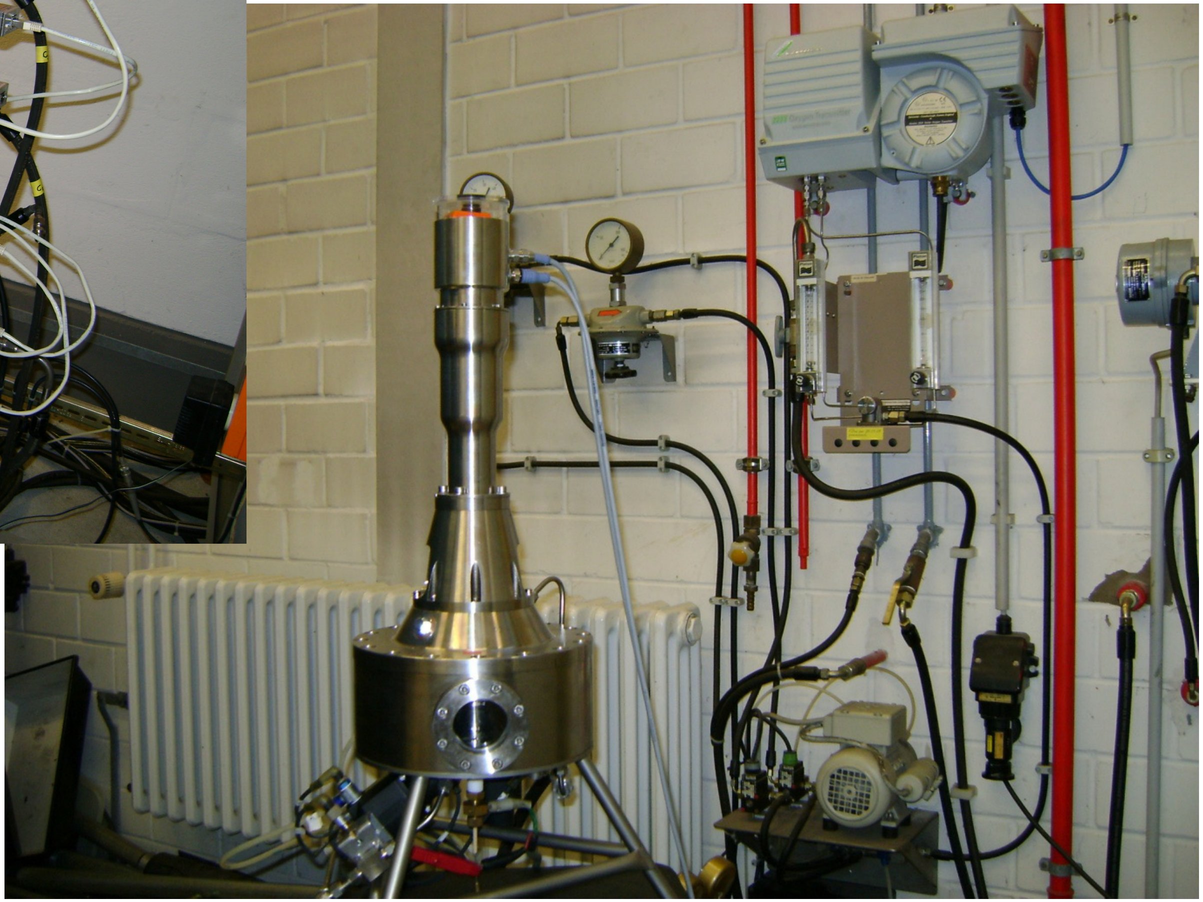


Gas mixture properties to measure

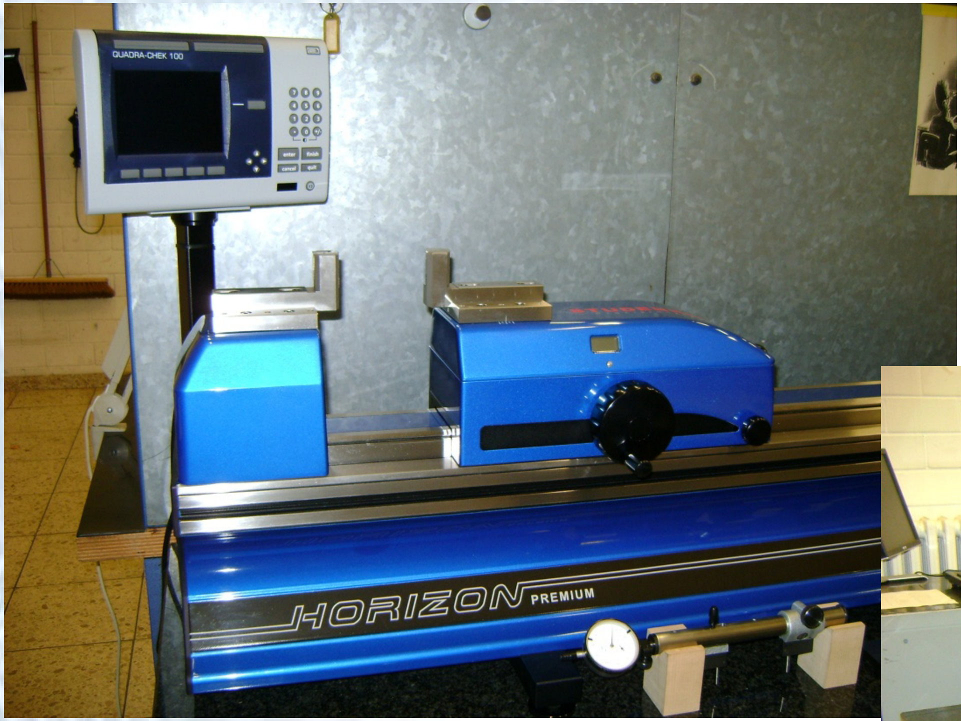


Flowmeter

MESG, Oxygen analyser

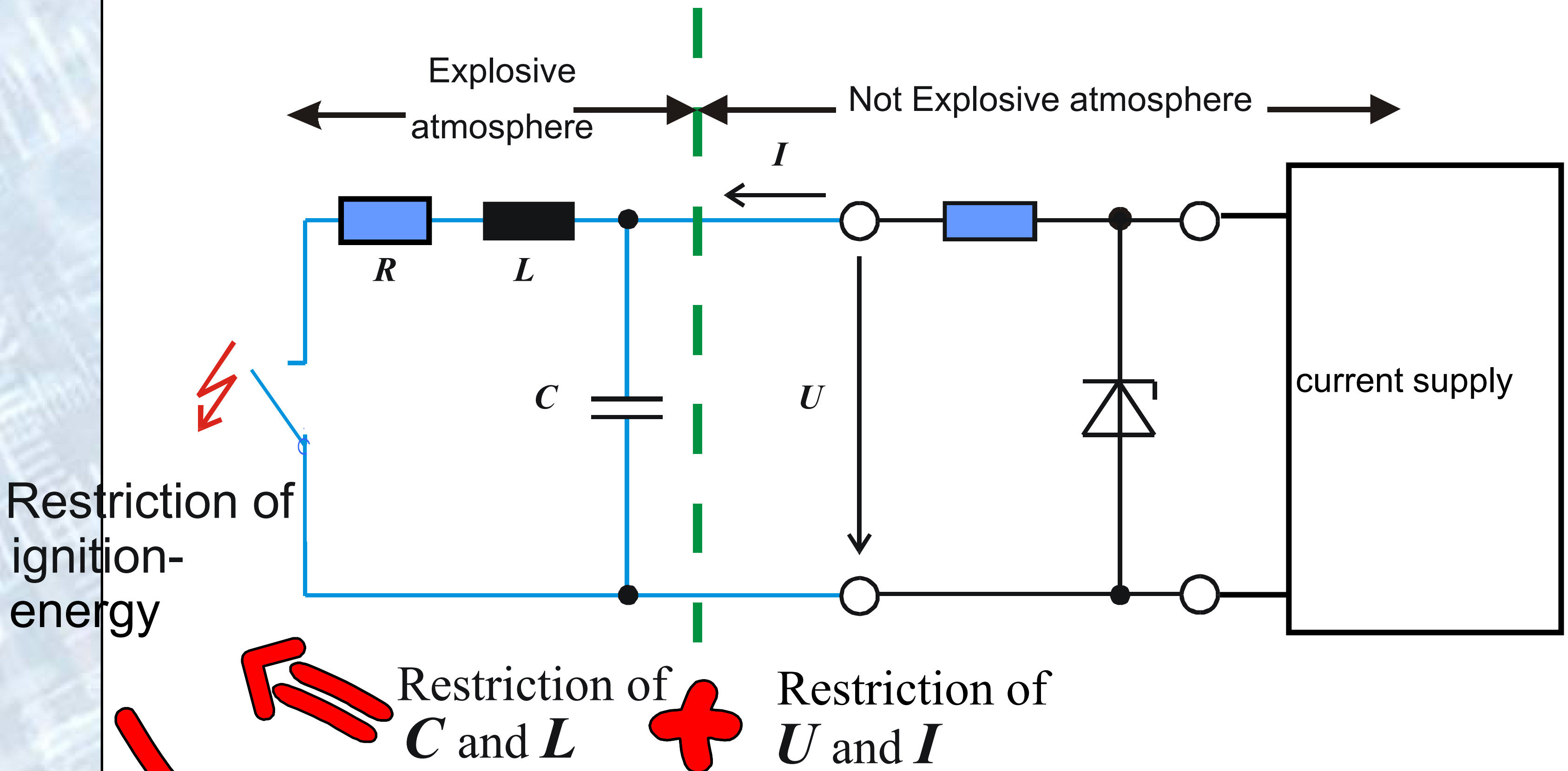


Size of the flamepath to measure



Program IECEx-PTP #2: Intrinsic safety

- type of protection based on the restriction of electrical energy within apparatus and of interconnecting wiring



No ignition within explosive atmosphere

Spark test apparatus

- The spark test apparatus is arranged to produce *make-sparks* and *break-sparks* in the prescribed explosive test mixture (see IEC 60079-11 Annex B).

International standardized
Spark test apparatus

Spark test apparatus

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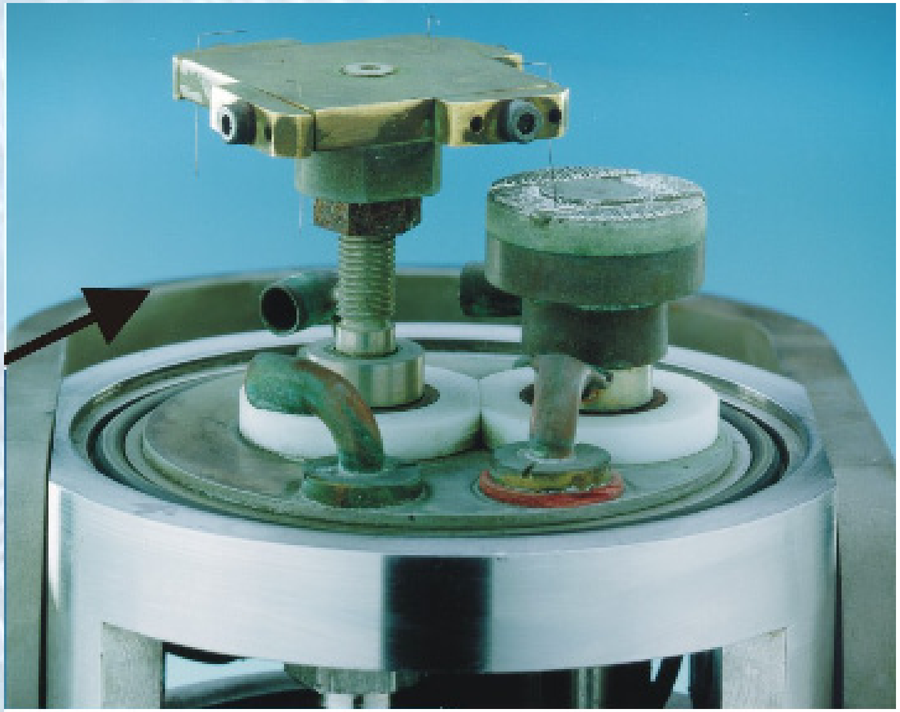
-Description of the contact arrangement



Contact arrangement

•*Parameter of a contact arrangement:*

-**Volume of an explosion chamber: 250cm^2**

-**Diameter of Tungsten wires: 0.2 mm**

-**Diameter of electrode holder: 50 mm**

-**The distance between cadmium disc and wire holder: 10 mm**

-**The free length of the wires: 11 mm**

-**Rotation speed of the holder: 80r/min**

-**A rotating cadmium contact disc with two slots**

Motivation

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- possible correction for the standardized procedure of practical tests of intrinsic safety circuits

- Identification of errors and their minimization

- Method of quality improvement to be established

- harmonization of procedural instruction

Objective

- Fluctuation range to be ascertained for ignition capability by practical tests with Spark test apparatus, also ignition probability to be determined for defined circuits

- test device to be provided for participants:
  - All defined circuits in a Black box
  - Tungsten wires
  - Test procedure

Program objectives

The defined circuits to be tested is connected to the contacts of the Spark test apparatus, where ignition takes place within a defined numer of operations of the contact system.

Ignition probability of test circuits about $2*10^{-3}$ is to be exactly determined by 20 times Measurements.

7 defined circuits:

a) resistive

b) resistive-inductive

c) resistive-capacitive

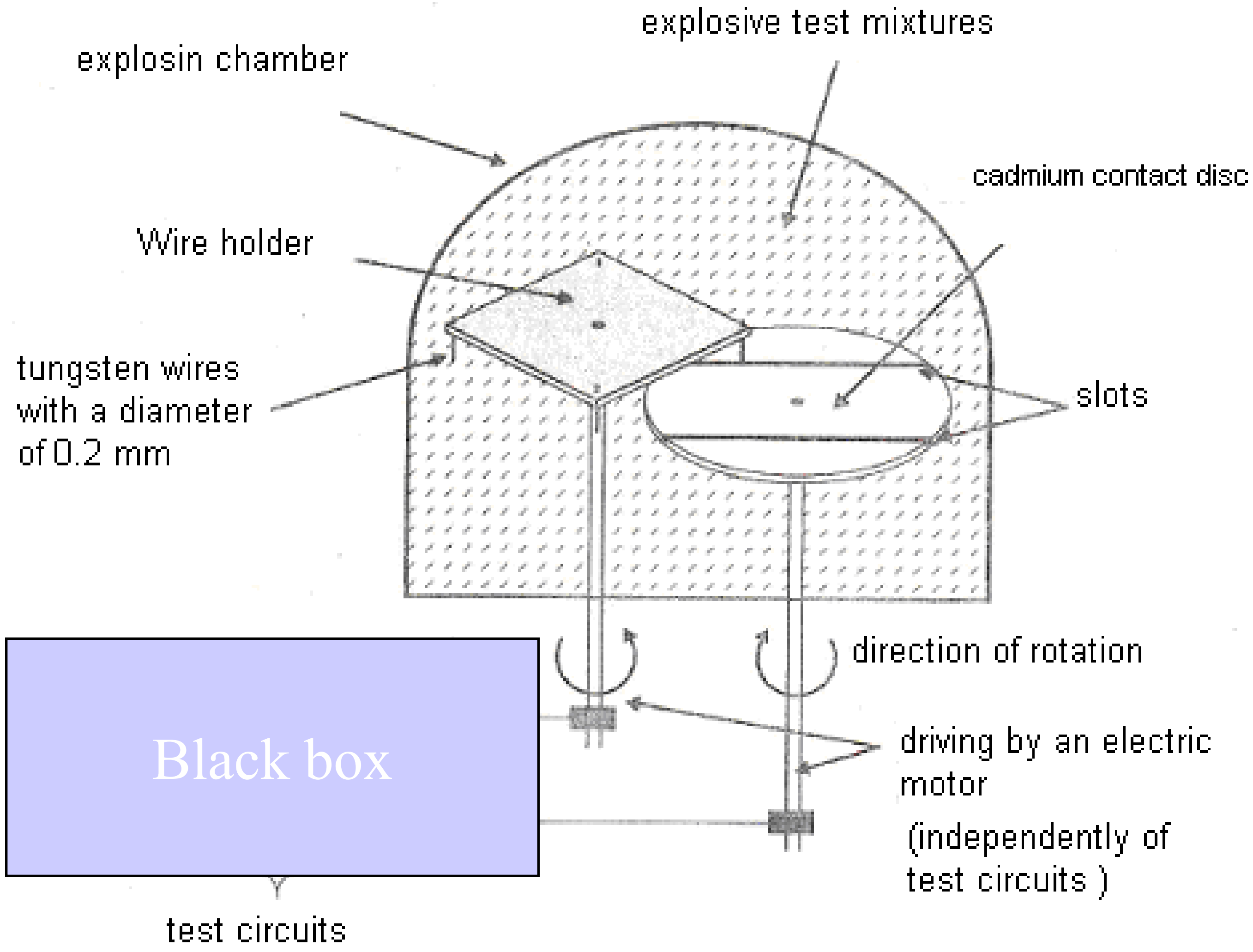
d) mixed resistive-inductive-capacitive (dimensioning A)

e) mixed resistive-inductive-capacitive (dimensioning B)

f) Electronic current limiting with rectangular characteristic

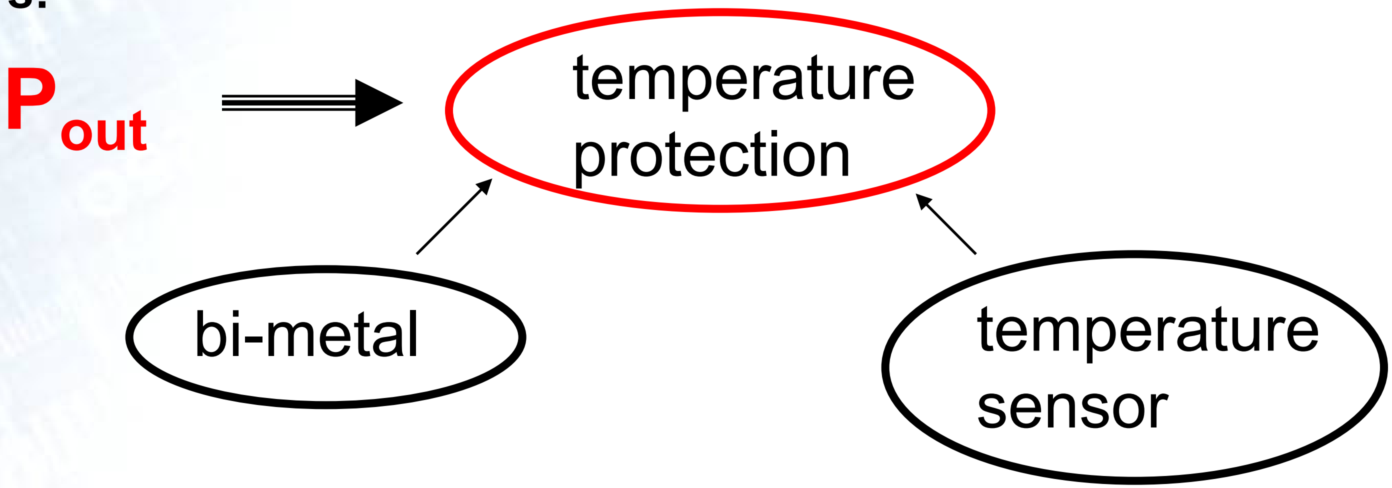
g) Electronic current limiting with rectangular characteristic and electronically limited spark duration

Test circuits

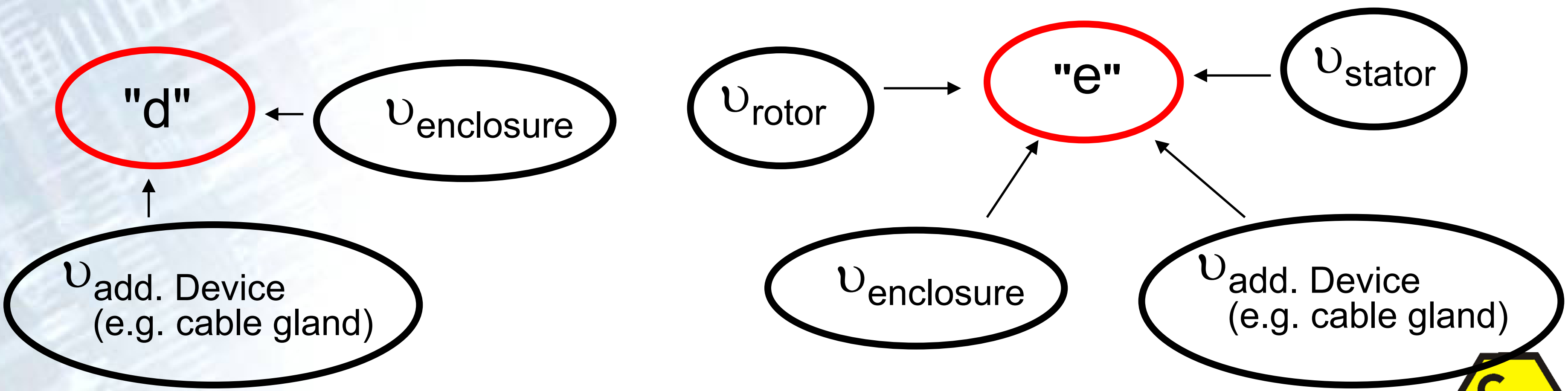


IECEx-PTP program #3: "Temperature class of Increased Safety Motors"

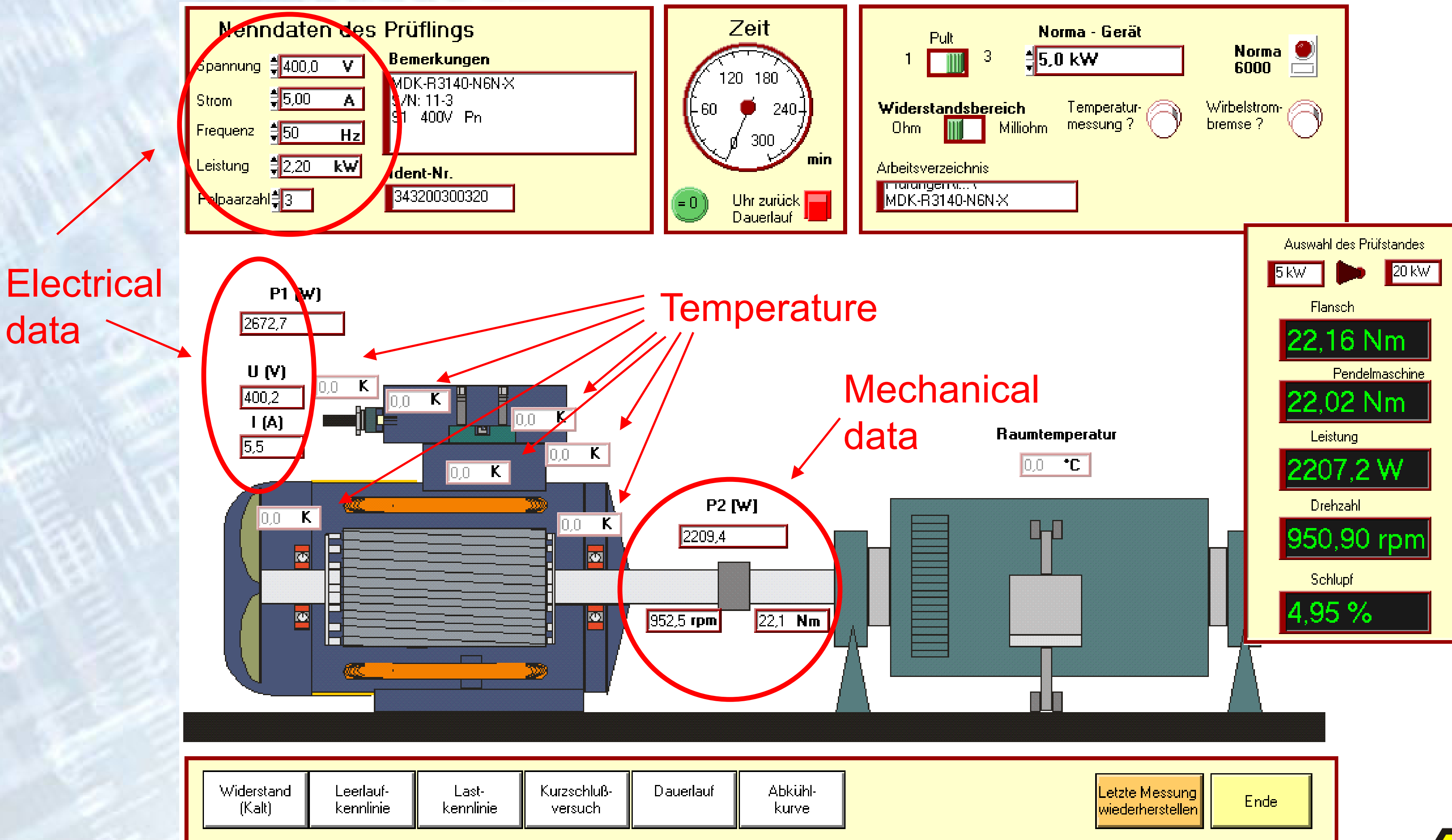
Relevant parameters:



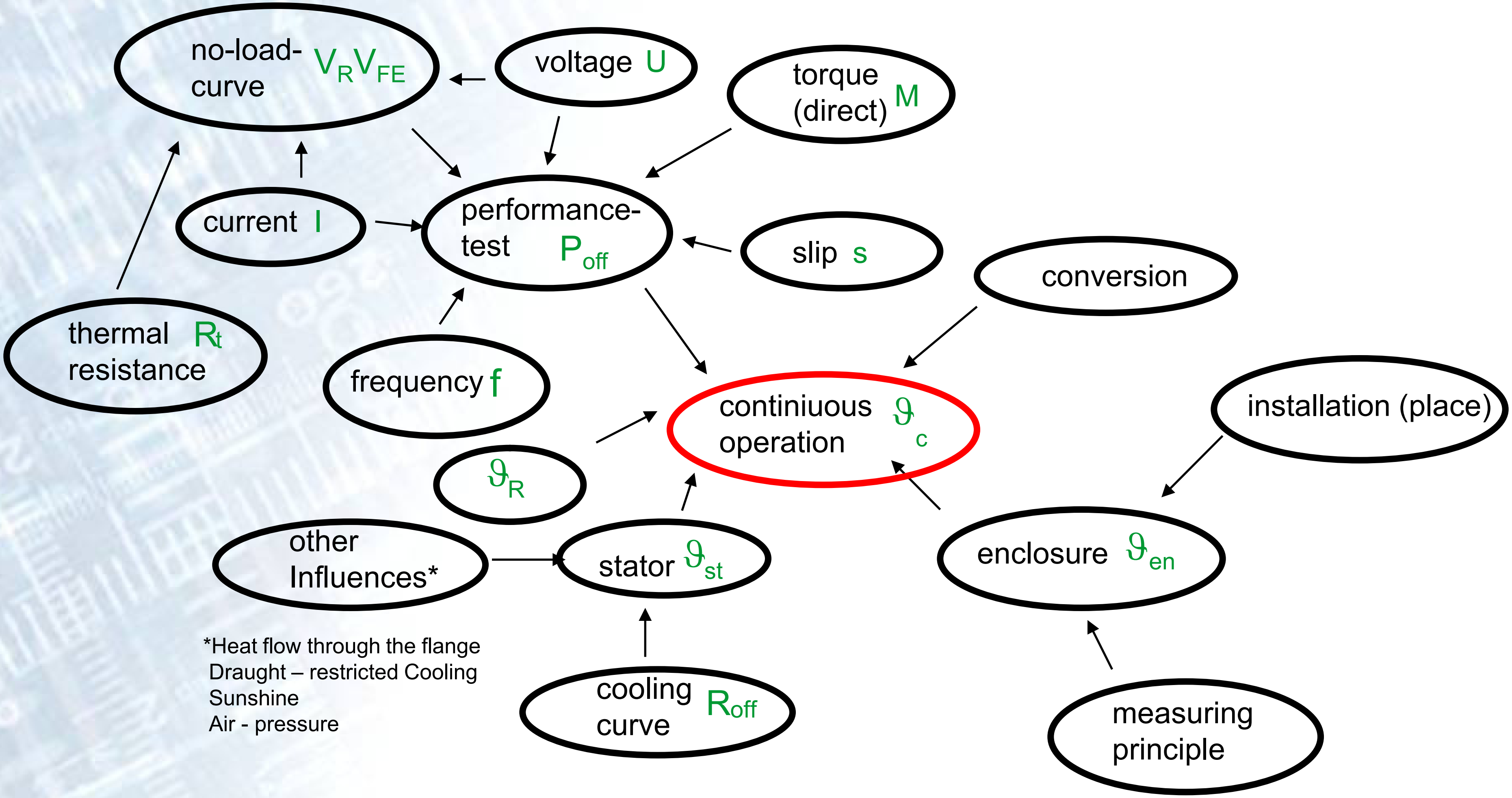
Type of protection:



Electrical Test of Motors, Equipment, etc.



Relevant parameters: type of protection "d"



Uncertainty of measurement: "t_E"

Identification of rated power:

$$P_{out} = P_{in} - (P_{Cu1} + P_{Fe} + P_{add}) - (P_{Zu} - (P_{Cu1} + P_{Fe} + P_{add}) * s) - P_{Fr}$$

U in % = ?, I in % = ?

f in % = ?, n in % = ?

M in % = ?, R in % = ?

cos φ in % =?

Conversion of rated power:

$$I_N = I_{mess} \cdot \frac{P_N}{P_{mess}} \cdot \frac{U_{mess}}{U_N}$$

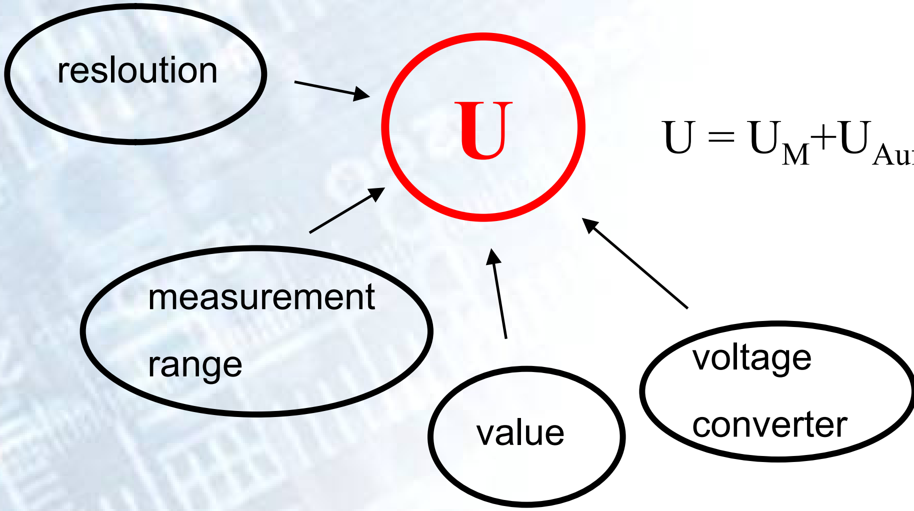
$$\Theta_{St\_N} = \Theta_{St\_mess} \cdot \frac{\frac{I_N}{I_{mess}} + \left(\frac{I_N}{I_{mess}}\right)^2}{2} \longrightarrow \text{stator } \vartheta_{st}$$

$$s_N = s_{mess} \cdot \frac{P_N}{P_{mess}} \cdot \left(\frac{U_{mess}}{U_N}\right)^2$$

$$\Theta_{L\_N} = \Theta_{L\_mess} \cdot \frac{\frac{s_N}{s_{mess}} + \left(\frac{s_N}{s_{mess}}\right)^2}{2} \longrightarrow \text{rotor } \vartheta_{ro}$$

Guide of uncertainty measurement (GUM)

For example: voltage U



$$U = U_M + U_{Aufl.} + U_{MB} + U_{MW} + (U_{Wandler}) \Longrightarrow \%$$

=> All factors of influence have to be analyzed and weight => Interlaboratory comparison

Proficiency testing project team

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Proficiency testing project team

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Competence:

1983 - today: Technology of Flameproof Testing