The European Group of Organisations
for Fire testing, Inspection and Certification

2010

ANNUAL REPORT AND NEWSLETTER

Ruth Boughey, retiring EGOLF Secretary General,
surrounded by members outside the MPA NRW offices in Dortmund, Germany, October 2010.

FINANCIAL REPORT

	2010 €	2009 €
INCOME		
Membership subscriptions	116,200	111,000
Courses, workshops & conferences	7,800	22,900
Other income	1,392	214
Total income	125,392	134,114
EXPENDITURE		
Secretary General	72,952	61,071
Executive expenses	9,199	9,088
GNB FSG Secretariat	10,518	8,938
Round robins and courses	30,200	22,600
Other expenses	9,843	5,552
Total expenditure	132,712	107,249

A VIEW FROM THE PRESIDENT

Vision and objectives

Preamble

Firstly, I would like to personally thank Ruth BOUGHEY, EGOLF's former Secretary General, who retired at the end of October 2010. She has been the face of EGOLF for over 6 years, and has brought constant optimism and dynamism to us all. I know that she remains available to offer advice and hope that she enjoys her retirement as much as she enjoyed her work.

I also want to welcome Christine ROSZYKIEWICZ, who had the difficult task of taking over from Ruth. With Christine, I am today fully secure in the knowledge that EGOLF is in good hands. I wish her all possible success in the management of the organization, with active support from the Technical Committee Chairmen, the Executive Committee, and all the volunteers amongst our members.

Where have we come from?

EGOLF was founded in 1988 with two main objectives: the first was to promote collaboration between the official fire testing laboratories, the second was to become the main representative body for third party organizations involved at a European level in the fire safety testing, inspection and certification activities.

Where are we now?

Since then, EGOLF has contributed widely to both improving the level of personal fire safety and to minimizing the losses and damage caused by fire in the environment.

EGOLF also provides a forum for discussing problems related to fire tests, and promotes research and development of fire testing activities.

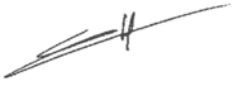
EGOLF has become a valuable quality label in the market, and, as a consequence, needs to ensure that all members implement best practice. To this end, we provide the tools which allow us to make continuously higher demands on the quality of our members and to promote consistently excellent performance. With more than sixty members in 24 countries, this challenge becomes ever greater.

Where are we going?

EGOLF strongly believes that quality is a must. We rely on accreditation (ISO EN 17025, 17020 and 45011) as a guarantee of the minimum level of competence in practice. However, as CE marking demonstrates, compliance with basic mandatory requirements is enhanced by voluntary certification. EGOLF has therefore developed its own vision of what is "best" practice, and is introducing a system whereby our members will have to be accredited not only to ISO standards, but also in respect of EGOLF standards (i.e. standards verified by an EGOLF audit). By implementing these rules, we will be able to detect and, if possible, prevent inappropriate practice.

Vision

I personally believe that the higher the target, the quicker our members will strive to reach the top of the fire testing, inspection and certification profession. My wish is that most, if not all members, through our support, seminars and training courses, will be able to demonstrate compliance with our shared views of best practice. This is how our organization will continue to be recognized by our customers as offering the best quality mark.



Pascal Coget
EGOLF President

EGOLF MEETING AT MPA NRW IN DORTMUND, OCTOBER 2010

AUTHORS

Christine Roszykiewicz (EGOLF) and Hendrik Rademacher (MPA NRW)

Plenary meeting

Dr Hans-Rudolf Wilde, Head of Radiation Protection, Calibration and Quality Management at MPA NRW, welcomed members to Dortmund and briefly described the work of the lab. The President of EGOLF, Pascal Coget (Efectis France) introduced a key topic at the meeting of Plenary concerning the outline plan for a new EGOLF Quality Scheme, ***"Steps to Excellence"***. The Scheme is intended to assist members to strive for excellence within the framework laid down in EGOLF's Statutes and Internal Rules. A lively discussion ensued and the conclusions will now feed into a detailed plan which we will be hearing more about in 2011 as it begins to play a pivotal role in the activities of TC4 – Accreditation, Certification and Inspection.

Ulf Wickström (SP) presented information about an innovative, new EGOLF course on fire science, which is featured in this Annual Report (see pages 16 and 17). This was followed by an interesting presentation from Petra Adamietz of TU Munich about the current state of development of a harmonised European test method for determining the smouldering behaviour of products.

At the end of the meeting members had to say good bye to Ruth Boughey, who was retiring from her post as Secretary General. Very warm appreciation was expressed for Ruth, who was described as the heart of EGOLF during the past six years. The President then extended a special welcome to the Secretary General Designate, Christine Roszykiewicz, who would be replacing Ruth as of 1st November 2010.

EGOLF Appointments

Executive Committee - Andrzej Borowy of ITB, Poland, was re-appointed to serve a further term of three years.

Chair TC2 Fire resistance - Anders Drustrup of DBI, Denmark, was re-appointed to serve a further term of three years

Chair TC4 Accreditation, certification and inspection - Gert van den Berg of Efectis Netherlands was appointed to replace Céline Borgonie (ex-wfrgent) for an initial period of three years.

EGOLF Secretary General

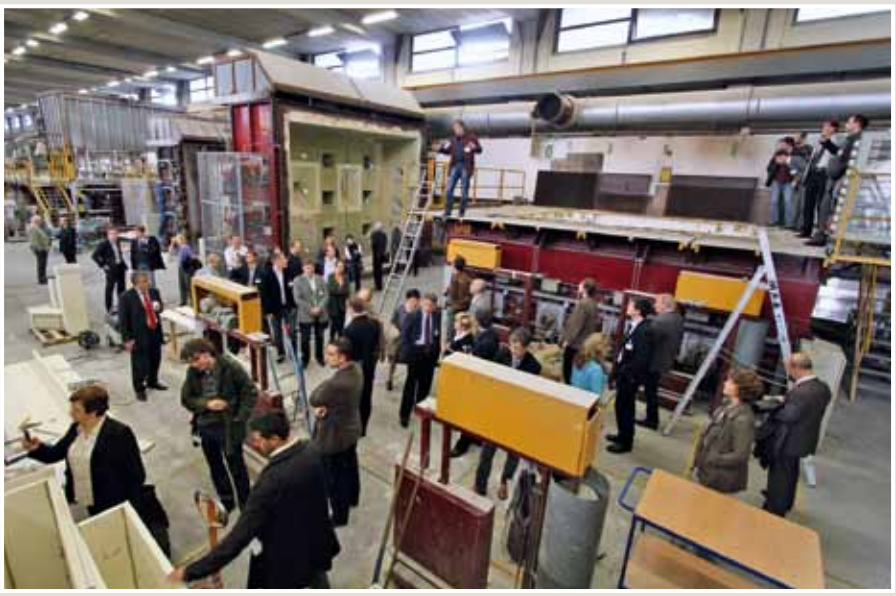
On 1st September 2010, EGOLF was pleased to announce that **Christine Roszykiewicz** would be working alongside Ruth Boughey, prior to taking up her appointment as Secretary General after Ruth's retirement at the end of October.

For the past 22 years Christine had been managing EU projects on behalf of the steel design and construction industry. Most of these projects concerned the provision of multi-lingual technical support, publications and online information systems to engineers and architects, in order to assist them in the transition from national codes to design to the Eurocodes. In all this time, she enjoyed working alongside colleagues in a large number of European countries and is both delighted and honoured to be following in Ruth's footsteps and to provide support to EGOLF's international membership. Her induction into the fire testing, inspection and certification community commenced in earnest during the EGOLF meetings in Dortmund.

Technical Committee meetings

TC1 (Reaction to fire) chaired by Hendrik Rademacher (MPA NRW)
A presentation was given on the final report of the round robin for test method **EN ISO 1716** 'Determination of the heat of combustion'. A detailed article is also featured on pages 8 - 11 of this Annual Report. Two further round robins (**EN ISO 118**2 'Non-combustibility test' and **EN ISO 11925-2** 'Ignitibility of building products subjected to direct impingement of flame – single flame source test') are ongoing and reports will be published in 2011. A third is planned in 2012 on **EN ISO 9239** 'Floor coverings – determination of the burning behaviour using a radiant heat source'.

A new item on the agenda was introduced which will give host laboratories the opportunity to demonstrate their competence in finding new solutions to the testing of products. On this occasion, a staff member from MPA NRW gave a presentation on the testing of cartridge filters using test method **EN ISO 11925-2**. Other important issues concerned discussions on help desk items. These included questions and problems which laboratories encounter during their daily work when resolving how to test the reaction to fire behaviour of products, or how to interpret the relevant standards. Solutions identified during these discussions have resulted in a number of new harmonised procedures and recommendations, all of which are available to members via the EGOLF website.



EGOLF members visiting the lab at MPA NRW, Dortmund, during meetings in October 2010.

TC2 (Fire resistance) chaired by Anders Drustrup (DBI, Denmark)

The main focus of the TC2 meeting revolved around the large number of help desk items submitted by members and also draft recommendations prepared as a result of solutions arrived at during the previous meeting in April 2010. A few examples of topics under consideration included contradictions between European standards for direct application (EN 1364-1 Annex A) and indirect application (EN 15254-4), glazed constructions in doors as well as side panels in doors (EN 1634-1), a draft method for testing air transfer grills (ETAG 026-4:2008), and clarification of when to use the cotton pad (EN 1363-1:1999). A number of problems and interpretation of the different standards were resolved, resulting in agreement on harmonised testing procedures and further recommendations for the benefit of EGOLF members.

The committee was also informed about four new EGOLF courses which would be held in the New Year:

- **Heat transfer for fire laboratory experts**
  SP, Sweden on 12-13 January 2011 and 09-10 February 2011
- **Harmonisation course: EN 1634-1 Fire resistance tests for door, shutter and openable window assemblies**
  DBI, Denmark on 01-02 February 2011.
- **Harmonisation course: EN 1366-3 - Penetration Seals and EN 15882-3 – Extended application,**
  SP, Sweden, 19-20 April 2011
- **Workshop on Steel Protection**
  DBI, Denmark, on 31 May 2011

TC4 (Accreditation, Certification and Inspection) chaired by Céline Borgonie (wfrgent)

During the meeting of TC4, members were informed about some recent and very fruitful discussions held with EA (European Accreditation). Another topic concerned the format for reporting the results of Round Robins. On behalf of the members, the incoming chairman of TC4, Gert van den Berg (Efectis NL), expressed appreciation to Céline Borgonie who was chairing her last meeting of TC4, prior to leaving her post at wfrgent.

Large scale façade test for determining the reaction to fire behaviour of external thermal insulation composite systems with rendering (ETIC).

Visit to fire laboratory and gala dinner

After an intense day of meetings and technical discussions, members enjoyed a relaxing coach drive through the lovely North Rhine-Westphalia countryside to the MPA NRW fire test laboratory at Erwitte, which is about 65 km east of Dortmund. Here they were introduced to fire resistance and reaction to fire testing equipment and treated to a large scale façade test for determining the reaction to fire behaviour of external thermal insulation composite systems with rendering (ETIC). After an initial and unexpected technical problem, which was dealt with speedily and competently by MPA NRW's technical staff, the test successfully demonstrated the current German method for testing façades.
The visit was followed by a Gala Dinner at the beautiful Erwitte Schloss Hotel, in honour of Ruth Boughey. The French President, Pascal Coget, took this opportunity to practise his German as he raised a toast to Ruth and to the hosts at MPA NRW.

EGOLF members at the ready with their cameras during large scale façade test (ETIC).

ROUND ROBIN REPORT ON THE HEAT OF COMBUSTION TEST METHOD IN EN ISO 1716:2002

AUTHORS

Bernd Restorff (MPA BAU HANNOVER) and Sven Kühnen (MPA NRW)

1. Introduction

During the EGOLF meetings in Boras, Sweden, in April 2007 and in Prague, Czech Republic, in October 2007, EGOLF TC1 decided that a round robin exercise should be performed among its members. It was decided that the round robin should be carried out on the determination of the heat of combustion test method, described in the European standard EN ISO 1716: 2002.

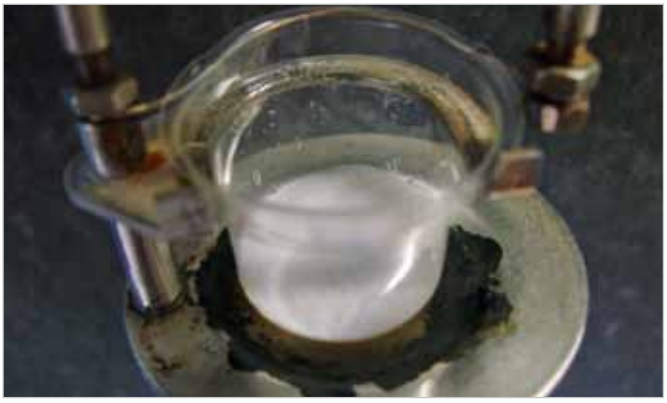
The aims of the round robin exercise were as follows:

- to ensure that EGOLF laboratories were able to perform the EN ISO 1716 test in a proper way
- to obtain information about reproducibility and repeatability
- to identify variations in equipment, procedures and tools

The round robin exercise was organised by EGOLF members MPA BAU HANNOVER and MPA NRW. Assistance was given by the following steering group members:

- Gary Blume – MPA Braunschweig
- Sergio Lopez – AFITI (2008)

35 laboratories participated in the round robin.



Material 1 (copolyamide) before the test.

Material 1 (copolyamide) after the test.

2. Material tested

The first sample for the round robin exercise was a copolyamide in powder form. This material was selected because it is homogeneous and no special preparation of the samples is necessary. Furthermore, the product has a PCS-value ≥ 30 MJ/kg, and therefore no combustion aid is necessary for the tests.

The second material was a mineral wool with a nominal density of 15 kg/m³. The PCS-value should be between 1,5 MJ/kg and 2,0 MJ/kg. The third material was a black glass tissue with a nominal area weight of 60 g/m². The PCS-value should be between 3,0 MJ/kg and 4,0 MJ/kg.

Material 2 (mineral wool) before the test.

Material 2 (mineral wool) after the test.

3. Test procedure

The following instructions on the test procedure were given to the participants before the test:

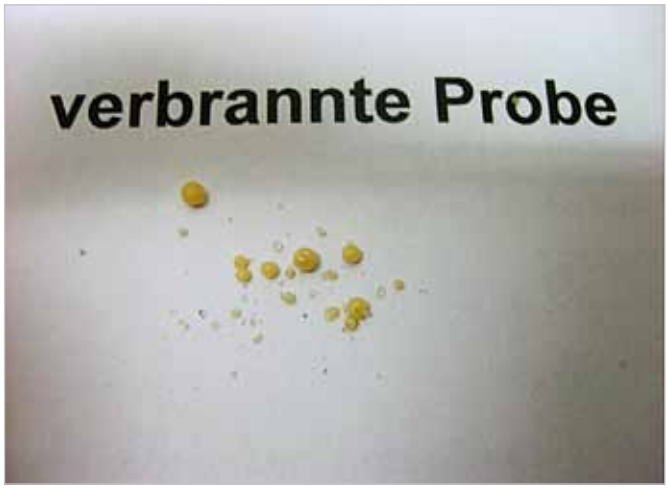
The round robin exercise with Material 1 is divided in two parts (Procedure 1 and Procedure 2).
Make only three determinations of the PCS value according EN ISO 1716, even if the criteria in table 1 of this standard are not fulfilled.

Procedure 1 (individual procedure of your lab):
- Take one digital photo of the specimen before the test, which characterizes for all three single PCS value determinations.
- Perform the test according to EN ISO 1716 as you would usually do in your laboratory.
- Take three digital photos (one of each single PCS value determination) of the specimens after the test.

Procedure 2 (for all labs the same procedure):
- Take 0.5 g of Material 1
- Do not mill the material more.
- Do not use any auxiliary combustion aid.
- Make three determinations of PCS value according to EN ISO 1716.
- Take three digital photos (one of each single PCS value determination) of the specimens after the test.

For the tests of Material 2 and 3 the labs should use Procedure 1.

Material 3 (glass tissue) before the test.



Material 3 (glass tissue) after the test.

4. Statistical analysis

The data were analysed according to ISO 5725-2:1994/Cor 1:2002 "Accuracy (trueness and precision) of measurement methods and results – Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method.

5. Discussion

5.1 General

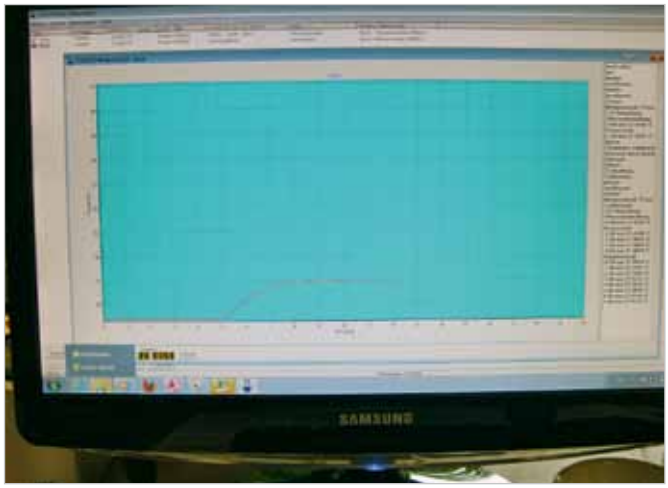
All in all 35 labs participated in this round robin exercise, but the number of labs changed dependant on the different material used. In the first round 32 labs carried out the tests with Material 1 Procedure 1 and 2. After this 34 labs determined the gross heat of

combustion of Material 2 and Material 3 in a second round. An EGOLF training course in testing according to EN ISO 1716 was attended by 27 of the 35 labs listed on the EGOLF website.

5.2 Equipment of the labs

The 35 participating labs used different types of calorimeter, produced by different manufacturers. The working methods were adiabatic, isoperibolic or isothermal.
Due to the test results of this round robin exercise, there was no significant influence of the equipment of the labs. Also the used combustion aids like benzoic acid, paraffin oil, PE-bag etc. did not lead to different test results.

Calorimetric bomb being placed before the test.



Temperature rise in an adiabatic calorimeter.

5.3 Outliers and stragglers

The number of outliers and strugglers due to the between-laboratory consistency is less than the number due to the within-laboratory consistency. Reasons for the outliers and stragglers of the test results of some labs could not be found in the test reports of the labs. Also the photos taken of the test materials before and after the tests show no significant deviations from the given test procedure.

5.4 Results dependent on attendance at an EGOLF training course

The result of this round robin exercise is based on satisfactory handling of the test procedure. Training for this is given in special courses organised by EGOLF and it is certainly beneficial for the person who carries out the test to have attended the relevant EGOLF training course. As a very minimum, information from the course should be made available to these persons. It is also important that EGOLF gives members the opportunity to offer their lab. personnel repeat training courses at frequent intervals.

5.5 Results compared to values in Annex B of EN ISO 1716

All statistical values from the EGOLF round robin exercise are clearly less than the maximum values of the Standard EN ISO 1716 Annex B Table B.2. This shows that the labs can carry out this reaction to fire test in a very proper way.

5.6 Results compared to classification criteria in EN 13501-1

Material 1 (copolyamide) is used as a part (thickness ≤ 1 mm) of an external non-substantial component of non-homogeneous products (e. g. glueing glass tissues on mineral wool boards). No lab met the requirement of Class A1 (PCS ≤ 2,0 MJ/kg) according to EN 13501-1 Table 1 footnote b. Using footnote c of EN 13501-1 Table 1, all labs met the requirement of Class A1 (PCS ≤ 2,0 MJ/m²), if the area weight is limited dependant on the other parts of the external non-substantial components.

Material 2 (mineral wool) is used as a homogeneous product or a substantial component of a non-homogeneous product. Out of 29 labs in the statistical analysis:

- 25 labs met the requirement of Class A1 (PCS ≤ 2,0 MJ/kg),
- 3 labs only met the requirement of Class A2 (PCS ≤ 3,0 MJ/kg) and
- 1 lab met neither Class A1 nor Class A2.

Material 3 (glass tissue) is used as a part (thickness ≤ 1 mm) of an external non-substantial component of non-homogeneous products. No lab met the requirement of Class A1 (PCS ≤ 2,0 MJ/kg) according to EN 13501-1 Table 1 footnote b. However, using footnote c of EN 13501-1 Table 1, all labs met the requirement of Class A1 (PCS ≤ 2,0 MJ/m²), if the nominal area weight of 60 g/m² of the glass tissue is taken into consideration.

6 Conclusions

The analysis of the tests results of this round robin exercise shows that:

- most of the participating labs are able to perform the EN ISO 1716 test in a very proper way.
- the repeatability and reproducibility of standard deviations for the PCS values are lower than the values reported in the standard EN ISO 1716 Annex B Table B.2.
- there is no significant influence caused by the equipment, test procedure or tools of the labs.

FROM THE DIRECTIVE TO THE CONSTRUCTION PRODUCT REGULATION: THE PATH TO JULY 2013

Yannick Le Tallec
Chair of the Fire Sector Group (SH02)
of GNB-CPD

The Construction Product Directive (CPD) 89/106/EEC was published in December 1988 and has been amended by Council Directive 93/68/EEC of 22 July 1993 and Regulation (EC) No 1882/2003 of the European Parliament and Council of 29th September 2003. Since its publication, the CPD has been transcribed into national law and applied in different European countries and applied. However the CPD is in some points ambiguous (conformity to the standard, fitness for use etc.) and its complexity has sometimes made difficult to apply.

In 2008, the Commission began revision of the CPD. The first draft was established in May 2008. The final step of the revision is the publication of the Construction Product Regulation N°305/2011 (CPR) on 4th April 2011, with the CPR entering into force 20 days after its publication. On 1st July 2013, the CPR will be fully applicable.

Why the revision?

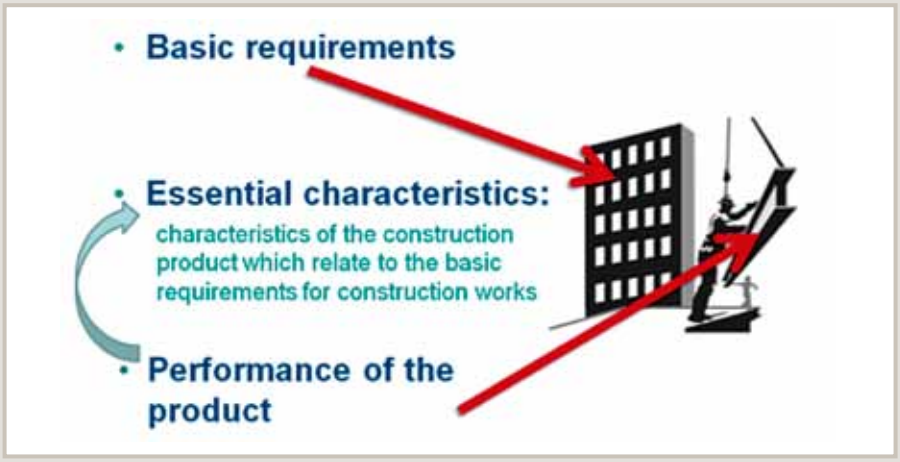
The aim of the revision was to address some perceived problems in the text of the CPD and the way in which it has been implemented rather than to undertake a complete revision of the CE marking process that has already been established in the member states. It was also necessary to revise the CPD in the wider context of the revision of the ''New approach directives", whose objectives were to clarify the procedure, increase the credibility of CE marking and to improve market surveillance.

The revision process follows the New Legislative Framework (NLF). The NLF consists of three legal instruments:

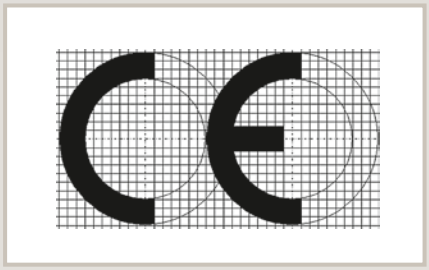
- Regulation n° 764/2008: laying down procedures relating to the application of certain national technical rules to products lawfully marketed in another Member State;
- Regulation n° 765/2008: setting out the requirements for accreditation and market surveillance relating to the marketing of products;
- Decision n° 768/2008: Common framework for the marketing of product.

Specificity of Construction products under the New Approach

The CE marking process and declaration of performance provide information about the product end use.
Performances are assessed by compliance with a standard (assuming that the product meets the requirements). However, in the case of construction products, it indicates that the declared performances conform to the requirements. This difference is related to the fact that the construction products are intermediate products whose end use cannot be predicted unlike other products covered by a new approach Directive (e.g. toys, machinery etc.) which are designed and sold for a single purpose.



Evolution: what are the differences?



The aim of the revision was to address some problems identified with application of the CPD, with the aim of clarifying the text, simplifying the process and improving the credibility of CE marking of Construction Products. Another issue was the fact that CE marking is not uniformly applicable in all Member States.

The first main and fundamental modification is the Regulation itself:

- A Directive means that the member states will have to implement it in their national legislation: the CPD was implemented in member states with different regulatory frameworks and CE marking was not mandatory in 5 member state countries
- A Regulation is directly applicable in the Member States (MSs): CE marking is therefore mandatory in all MSs.

The cornerstone of the ''new system" is the Declaration of Performance (DoP) and the product shall conform to the characteristics declared in the DoP. When a manufacture establishes a DoP, the product shall be CE marked for the performances declared.
The other differences are listed below. The first set of differences is related to terminology. However the modifications are not trivial and are particularly important when implementing the system.

CPD		CPR
Essential requirements	*Becomes*	Basic requirements
Declaration of Conformity	*Becomes*	Declaration of Performance
System of attestation of conformity	*Becomes*	System of assessment and verification of constancy of performances

Basic requirements:

The CPD considered six essential requirements for construction work, the CPR introduces the same or slightly modified six basic requirements and adds a seventh requirement on sustainable use of natural resources. The first, the second and fifth basic requirements remain unchanged. For the third basic requirement, the reference to the REACH directive[1] is required by the CPR.
The table 1 shows the evolution of the requirements.

(1) Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency.

CPD	CPR*
1- Mechanical resistance and stability	1- Mechanical resistance and stability
2- Safety in case of fire	2- Safety in case of fire
3- Hygiene, health and the environment	3- Hygiene, health and the environment ***throughout the life cycle + safety of workers***
4- Safety in use	4- Safety and accessibility in use
5- Protection against noise	5- Protection against noise
6-Energy economy and heat retention	6-Energy economy and heat retention ***Energy efficiency of construction work during construction and dismantling***
	7-Sustainable use of natural resources

(*) Text in bold denotes extension of the requirements within the CPR.

Systems of assessment and verification of constancy of performance:

The system of attestation of conformity, specific to the CPD and now to the CPR, remains in principle unchanged. The systems are defined as the assessment and verification of constancy of performance. The main modification in the CPR is that system 2 no longer exists. The other systems will remain unmodified (systems 1+, 1, 2+, 3 and 4), meaning the process already established can stay unchanged.

Technical tools:

Evaluation of performance under the CPR is based on two types of harmonized technical specification: Harmonised standards (art. 17 of the CPR) and European Assessment Documents (EAD – art. 19 and 20 of the CPR). In the application of the CPR, the harmonized standards will remain basically the same (when the mandate is modified and accepted by the Commission, the characteristics related to the new basic requirements will be introduced).
The European Assessment Documents could be slightly different from the actual European Technical Approval Guidance (ETAG).

CPD	CPR
ETAG adopted => CE+ETA mandatory (in France – not the case everywhere)	ETA (new) voluntary decision of the manufacturer
CUAP (CDP art. 9.2) voluntary	If ETA (new) delivered then CE marking mandatory
ETA => fitness for use for all relevant characteristics	ETA (new) => List of essential characteristics relevant for the intended use (to be agreed between the manufacturer and TAB)
ETA => validity 5 years	ETA => no validity date

Note: The acronym ETA will remain but the meaning will change from "Approval" (DPC) to "Assessment" (CPR).

Simplified Procedures

A simplified procedure (chapter VI of the CPR) is included in the regulation; this procedure is based on appropriate Technical documentation. This procedure may replace the type testing or type calculation by an Appropriate Technical Documentation demonstrating product performance. Simplified procedures cover the procedures already used in the CPR: sharing, cascading, CWFT, CWT etc.
Simplified procedures can also be used in a specific way for micro-enterprises manufacturing a product covered by a harmonised standard, under systems of assessment and verification of constancy of performance 3 and 4.
When a product is covered by a system of assessment and verification of constancy of performance 1+ or 1, the Appropriate Technical Documentation shall be verified by a notified body.

Notifying authorities, Notified Bodies and Technical Assessment bodies (TABs)

The CPR does not involve major modifications for Notifying authorities (chapter VII of the CPR) and Notified Bodies. The reference to Regulation n° 765/2008 encourages the accreditation of notified bodies.
The criteria for Technical Assessment Bodies (chapter V of the CPR) are more clearly defined, with a list of product area and requirements for TABs. As a minimum, the Organisation for Technical Assessment will have to be reconsidered, since the tasks for TABs will be changed (e.g. approval becoming assessment and fitness for use for all relevant characteristics becoming performances of essential characteristics agreed for the intended use).

The countdown to July 2013

The CPR entered into force on the 24th April 2011 and the CE marking of products according to the CPR will become mandatory on 1st July 2013.
During the preparatory period, the implementation of articles 1and 2 (general provisions), 29 to 35 (Technical Assessment Bodies), 39 to 55 (Notifying Authorities and Notified Bodies), 64 (Standing Committee) and annex 4 will commence and the ‘’system” shall be ready for application of the remaining articles on the 1st July 2013.

EGOLF COURSE IN HEAT TRANSFER AT SP

AUTHOR

Ulf Wickström (SP)

SP has organised its first ever two plus two day course in basic heat transfer and temperature calculation theory. EGOLF sponsored the development of the course which, though theoretical, contains important parts which are demonstrated in the laboratory.

EGOLF is dedicated to raising the quality of the services which its members offer to clients. EGOLF has therefore developed so called harmonization courses for several of the most frequently used European test methods. As a matter of fact each member must have at least one technician trained in the various test methods they work with. The new course now being offered is more general and theoretical. It aims at improving and harmonizing the understanding of temperature, heat and heat flux, and at giving the background theory relevant to fire safety engineering.

The first course was attended by 16 experts from nine European countries. Enthusiastic participants are shown in Figures 1 and 2. In a feedback questionnaire, they all expressed satisfaction with the course and indicated that they would recommend it to their colleagues.

Figure 1. Christophe Lemerle of CSTB and Baila Guisse of Efectis, both from France, observe a demonstration fire test.

Figure 2. 16 experts from 9 countries participated in the first course.

Content of the course

The course is adapted to the needs of EGOLF member fire experts, to provide deeper knowledge and awareness of reaction-to-fire phenomena such as ignition, as well as of phenomena relevant to the fire resistance of structures. All topics are listed in a comprehensive compendium. Special focus is given to measurement of temperature and heat flux.

In summary, the course covers the following topics:

- Introduction to concepts, terms and symbols
- Heat conduction
- Convection
- Radiation
- Mixed boundary conditions
- Measurements
- Practical temperature calculations in fire safety engineering
- Numerical methods and computer programs
- Demonstration/lab. exercise
- Fire development

The course mainly follows theories presented in standard text books but several theories and calculation methods given are especially suitable for fire engineering problems. One of the essential topics discussed is the difference between radiation temperature and gas temperature and how these can be measured and combined into the so called adiabatic surface temperature. In a demonstration test, four types of devices for measuring temperature - two plate thermometers (PTs) and two thermocouples (TCs) - were mounted in front of a radiant panel (see Figure 3). One of the PTs was bright and one blackened, and one thermocouple was very thin (0.12 mm) and one coarse (3 mm). The measured temperatures as a function of time are shown in Figure 4. Note that the PTs in this case reach considerably higher temperatures than the TCs. The lowest temperature is by the thin thermocouple. Why? And why are the PT measurements so useful as a basis for temperature estimates and calculations, both for fire resistance and reaction-to-fire tests? The answers to these questions and other issues were discussed in detail during the course.

SP is planning to hold the course again later this year.

Figure 3. Two TCs and a Gardon gauge heat flux meter mounted in front of a radiant panel. The measured temperatures are shown in Figure 4.

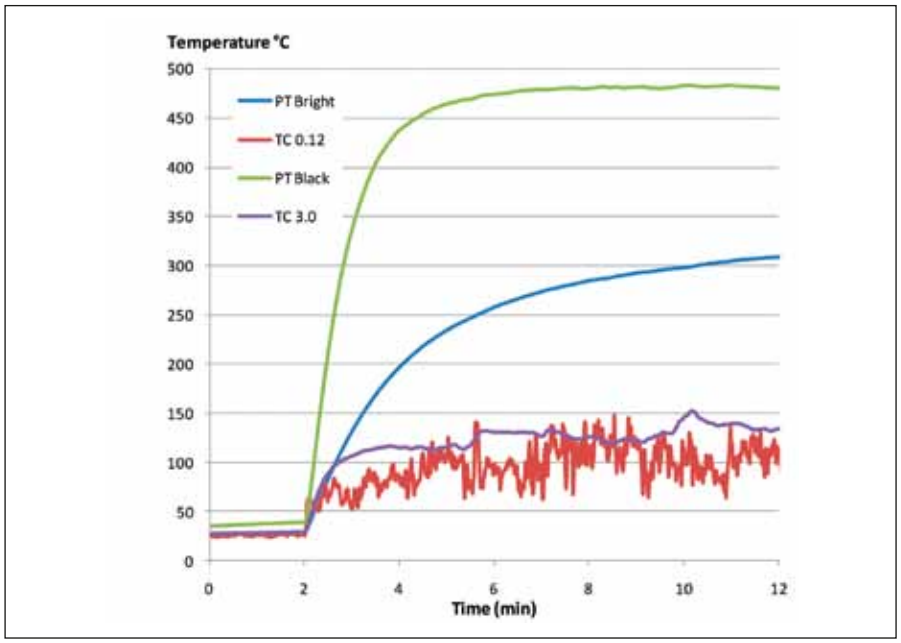


Figure 4. Temperature measured with the four thermocouples shown in Figure 3.

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