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EUROPEAN STANDARDIZATION OF MASONRY PRODUCTS WITHIN CEN/TC 125

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ABSTRACT

Since the „Construction Products Directive" was issued in 1988 the European Standards Institute, CEN, has been assigned to implement standards which will allow construction products to be traded freely whithin the whole European market.
There have been unexpected difficulties especially in the field of masonry products due to the historically deep-rooted differences in masonry construction designs and the wide variety of masonry products in Europe. The aim is to set product standards which have been "adjusted" to the construction regulations of all member countries. The harmonization of the requirements will finally be confirmed with a "CE mark".
"Technical Committees", TCs, have been working on the standardization. CEN has instructed CEN/TC 125 to deal with masonry products. A first generation of so-called "ordinary standards", which have not been harmonized yet, has already been presented and the most important test standards have now also been completed.
However, the technical contents of the presented product standards should be seen as compromises which do not always contain all the rules set for producers and customers in every member state.
Also there are still some difficulties in applying the standards to the new European basis of design regulated by "Eurocode 6" for masonry structures. The communication provides an overview of the TC 125 product standards and their practicability using masonry units standards as an example.

Key words: *Masonry, masonry unit standard, CEN TC/125, harmonized standard, ordinary standard, CPD, mandate for masonry, CE-mark.*

2. INTRODUCTION

– Construction Products Directive (CPD)

By 1988 the European Commission had already passed the Construction Products Directive, intended to remove existing barriers to trade for construction products within the European Economic Area of the then 18 Member States. A construction product is any product produced for incorporation in a permanent manner in construction works; in addition to classic products such as, for example, masonry units and masonry mortars, also included are prefabricated buildings, units and prefabricated containers etc.

The essential requirements of construction products as defined in the CPD are laid down in the "interpretative documents", which apply to the following characteristics:

– Mechanical resistance and stability

– Safety in case of fire

– Hygiene health and the environment

– Safety in use

– Protection against noise

– Energy economy and heat retention

Since it was recognised that the technical rules and provisions for construction could not be presumed to be equivalent in all Member States, it became clear that the instrument of *harmonization* would be called for. This meant that the laws, regulations and administrative provisions of the Member States would need to be brought into line with one another where they present an obstruction to the free movement of goods and services within the Single European Market. In order for this to be put into practice, the CPD sets out a way to achieve common, "harmonized" technical specifications. The main instrument for this has so far been to draw up *harmonized European standards*. This does not rule out the additional possibility of meeting the requirements of the CPD by means of *European technical approvals* and/or existing *national standards* which able to be adopted by the Member States.

The objective of the CPD is not, then, to bring more detailed national provisions in the area of construction law into line with one another at a European level. Rather the CPD expressly confirms the individual responsibility of the Member States for safety in construction and for establishing their own more detailed building rules and regulations. This also applies to the concept of the "Eurocodes", i.e. the common European standards for stability in construction, which accor-

ding to the view of the Commission so far are not primarily to fulfil the requirements of the CPD, but rather place emphasis on the production of "construction works" and are not significant for "construction products". Work on the "Eurocodes" in fact began at around the same time as the CPD was developed. From the point of view of their particular approach, they can look back on a longer history than the product standards.

This contribution to the topic is hereafter exclusively concerned with how *harmonized standards* for masonry units are formulated.

3. IMPLEMENTATION OF THE CONSTRUCTION PRODUCTS DIRECTIVE AT NATIONAL LEVEL

As already mentioned, the CPD in principle accepts differing national levels of safety and protection. It therefore allows the Member States to continue determining their respective regulations in respect of use of construction products provided these are in harmony with the requirements set out in the harmonized technical specifications.

This makes the commission's wish that the area of use of construction products also be regulated in a uniform manner considerably more difficult to realise. In particular, this is due to the fact that the regulatory authorities in the Member States differ greatly from one another and adapting all "historical" customs to create a uniform whole would here mean far-reaching intervention in national practices in the construction area.

In Germany, for instance, the regulations on area of use are determined by very different legal authorities, partly by the Federal states but partly also at national level.

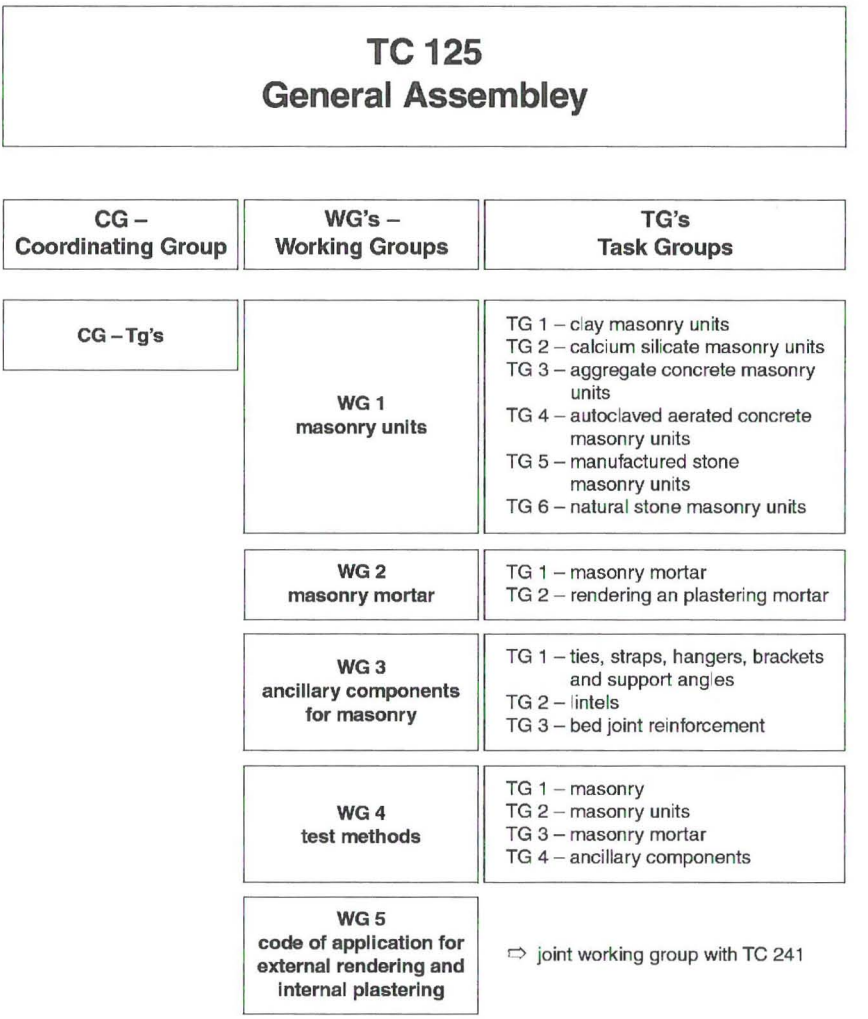
As yet there is still no simple way of resolving this problem presented by the *harmonized product standards*. It is expected that the construction products will first of all be divided into specific use classes using national "bridge documents". These classes classify and govern the construction-specific technical characteristics required in Germany which do not form part of the harmonized product standards.

4. TASKS ASSIGNED TO CEN

The European standards body CEN, based in Brussels, was charged with the task of formulating the standards for construction products. The national standards authorities for the Member States work in co-operation with CEN.

CEN founded the Technical Committee TC 125 to address the area of masonry construction.

Figure 1. "Structure of TC 125".



The TC 125 first convened in 1988. Great Britain chairs the TC 125. TC 125 now essentially comprises the product areas masonry units, masonry mortars and ancillary components for masonry. Working groups for each of these respectively were set up. To compare structural characteristics, it is essential to establish common test criteria for individual features. An additional working group was set up for this purpose. Since in the area of masonry mortars there was overlap with standards from CEN/TC 241 "Gypsum and gypsum based products", a method of bringing the respective standards into line with one another had to be found. This was achieved in the WG 5 "Code of application for external rendering and internal plastering" of the joint working group with CEN/TC 241. The work was moreover directed by a co-ordination group with no power of decision.

5. MANDATING

An essential criterion for a *harmonized European product standard* and for granting of the CE marking is that the standard has been drafted on the basis of a task of the Commission, a so-called *mandate*. The fact that these mandates for the product standards were only submitted by the Commission at a very late point created extraordinary difficulties for the technical experts in the TCs.

Harmonized standards always comprise a "harmonized" or "mandatory", part, i.e. a part which meets the specifications of a mandate of the European Commission, and a "voluntary" part. Only the harmonized – mandatory – part of the standard gives rise to obligations in the area of construction law for the Member States.

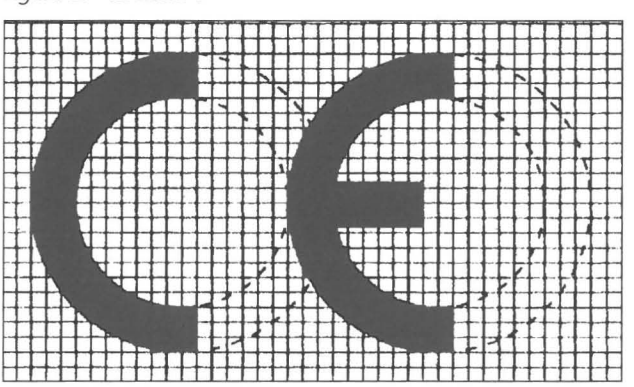
5.1. Content of the mandate

All EC Member States were active to a greater or lesser extent in formulating the mandate. The mandate was drafted by the Standing Committee of the Commission and the Preparatory Group assigned to it. In any case, the formulation of the mandate had less to do with technical expression than with its intention of enabling products to rapidly be traded within the meaning of the CPD. This explains why, even at the stage of classifying product families and determining minimum requirements, decisions were made which were difficult to reconcile with usual standards practice for construction products in the individual Member State countries.

This meant that it came as a great surprise that beyond the so-called Euroclasses for the reaction of construction materials to fire and the fire resistance classes for components, no classes or levels for other product performance features were given.

In a compromise, the option was later added of putting "voluntary" classes of minimum requirements in the non-harmonized part (informative part) of a standard.

Figure 2. "CE-mark".



The principle of the mandate is that of demanding all the characteristics for a product family officially required in one EC Member State.

As yet it is still unclear why, for instance, masonry units are divided into 2 different groups which differ from each other by the system of their attestation of conformity (System 2+ and System 4). Depending on the intended use, this results in two quality levels of masonry units. It remains questionable, in any case, if a manufacturer will be in the position to safely foresee the later use of the masonry unit he has manufactured and to adapt the attestation of conformity for the product to this.

5.2. Requirements of masonry units

For masonry units, the following characteristics are mandated and therefore mentioned in the *harmonized part* of the standard:

- Compressive strength
- Dimensional stability
- Bond strength
- Active soluble salts content
- Dangerous substances, radioactivity
- Durability of all characteristics and frost resistance

In addition, further characteristics such as reaction to fire, water absorption, thermal resistance and direct airborne sound insulation are mentioned in the mandate. They relate to the component fabricated from the masonry units (... in end use conditions). The TC 125's opinions on the mandate therefore indicate that these characteristics are governed in other standards, e.g. in the "fire protection" part of Eurocode 6 and the European Standards for Heat insulation and Protection against noise. All other characteristics desired of masonry units, be they desired by the market or the user, are voluntary and can, upon agreement of the experts in the WG 1 working groups for the masonry units product family, be regulated in an informative annex.

6. PRODUCT STANDARDS IN TC 125 WG 1, "MASONRY UNITS"

6.1. Non-harmonized and harmonized standards

CEN /TC 125 decided by a majority to first publish the product standards for masonry units, rendering, plastering, masonry mortar and ancillary components for

masonry in an initial stage as *non-harmonized European standards* –so called "ordinary standards"–, as long as these were accepted as EN in the formal vote. The first part of the stages shown in the table in Fig. 3 relates to the non-harmonized standards for masonry units.

Next, the missing regulations and those necessary to create a harmonized standard (essentially the conformity criteria in Annex ZA) were to be added as an amendment to the draft standards from the first stage. If there was a vote in favour of the "ordinary standards", then for the relevant standard only the amendment was to go through the further steps of standardization, CEN enquiry (CE), and formal vote (FV) –in order to avoid all the technical content of the draft standards already accepted being debated again within the framework of CEN.

Since Parts 1, 3 and 5 of the masonry unit standard series were not voted for by a majority in the final vote (FV failed), meaning that no uniform decision was reached for all masonry unit standards, TC 125 decided to push ahead with processing all the standards in WG 1 using completed drafts. Part 6 of the standard, natural stone masonry units, which has been left behind in the backlog, is to be picked up again at this point. Nevertheless, the "ordinary standards" EN 771-2 and EN 771-4, which have gained a positive vote, are to be sent for publication in accordance with the CEN regulations.

6.2. Provisions for masonry units

All masonry unit standards shall contain no compressive strength or relative density classes in the normative part. An informative Annex ZA in every product standard shall link the respective product standard to the Construction Products Directive (CPD) and the mandate of the European commission (e.g. to the essential requirements of the construction product according to the CPD, to the attestation of conformity process and to CE marking). In accordance with the mandate, the masonry units are divided as in EC 6 into "Category I" and "Category II" masonry units.

prEN 771-1

Provisions for masonry units - *Part 1: Clay masonry units*
The standard applies to clay masonry units for use in load-bearing and non load-bearing walls, as well as brick facing and rendered and plastered masonry units, including inner lining in superstructures and substructures and external chimney masonry.

It describes product characteristics relating to dimensional allowances, form, strength, bulk density, frost resistance, active soluble salt content, water absorption, heat retention properties and usual damp-related deformation along with the test procedures to be used. The characteristic values are to be stated by the

manufacturer. Nominal dimensions and standardized dimensions are not usually included.

prEN 771-2

Provisions for masonry units - *Part 2: Calcium silicate masonry units*

The standard applies to calcium silicate masonry units for use in load-bearing and non load-bearing masonry units in superstructures and substructures as well as in chimney masonry. The maximum perforation proportion of the calcium silicate masonry units is restricted to 60%. The standard also contains information about moulded and supplementary bricks. It does not apply to products manufactured using primarily schist as raw material, ground-level sheets and bricks for use in damp-proofing courses. It describes product characteristics in respect of strength, bulk density, dimensional accuracy and frost resistance, giving the test procedure to be used. The characteristic values are to be stated by the manufacturer. Compressive strength classes and bulk density classes are given in an informative Annex.

prEN 771-3

Provisions for masonry units – *Part 3: Aggregate concrete masonry units*

The standard applies to aggregate concrete masonry units for use in load-bearing and non load-bearing masonry units, along with brick facing and rendered and plastered masonry, in superstructures and substructures. It does not apply to ground-level sheets or masonry units used in the manufacture of damp-proofing courses. It describes product characteristics in respect of strength, bulk density, dimensional accuracy, form, heat retention properties, water absorption and damp-related deformation, giving the test procedure to be used. The characteristic values are to be stated by the manufacturer.

It does not contain nominal dimensions or standardized dimensions. Notes are also given on fire resistance, protection against noise, frost resistance and resistance to sulphates.

prEN 771-4

Provisions for masonry units – *Part 4: Autoclaved aerated concrete masonry units*

This standard applies to autoclaved aerated concrete masonry units for use in load-bearing and non load-bearing masonry units in superstructures and substructures as well as in chimney masonry. It describes the product characteristics in respect of strength, bulk density, dimensional accuracy, thermal conductivity,

damp-related deformation and gives information on frost resistance with reference to the relevant test procedure. The characteristic values are to be stated by the manufacturer.

The standard does not apply to ground-level sheets, lining of flues and masonry units intended for use in damp-proofing courses. Standardized dimensions for autoclaved aerated concrete masonry units are not given.

prEN 771-5

Provisions for masonry units - *Part 5: Manufactured stone masonry units*

The standard applies to manufactured stone masonry units for use in load-bearing and non load-bearing brick facing in superstructures and substructures. It does not apply to ground-level sheets, to masonry units for lining flues, to masonry units with adhesive, decorative layers or masonry units for use in damp-proofing courses.

Product characteristics are given in respect of strength, bulk density, dimensional accuracy, heat retaining properties, water absorption levels and damp-related deformation and the corresponding test procedure given. It also contains information on frost resistance. It does not contain nominal dimensions or standardized dimensions. The manufacturer must state the characteristic values.

prEN 771-6

Provisions for masonry units - *Part 6: Natural stone masonry units*

The standard applies to natural stone masonry units with a thickness > 80 mm for use in load-bearing and non load-bearing masonry. It describes product charac-

Figure 3. "Work status of the product standards for masonry units in CEN/TC 125 / WG 1".

Work status of european masonry unit standards within CEN/TC 125

Standard No.	draft standard issued	titel	actual work status	CEN status
ordinary standards				
771-1	Sep. 99	Clay masonry units	FV-failed	59
771-2	Sep. 99	Calcium silicate masonry units	FV-successful	59
771-3	Sep. 99	Aggregate concrete masonry units	FV-failed	59
771-4	Sep. 99	Autoclaved aerated concrete masonry units	FV-successful	59
771-5	Sep. 99	Manufactured stone masonry units	FV-failed	59
771-6	Nov. 99	Natural stone masonry units	FV-in progress	51
harmonized standards				
771-1	Feb. 00	Clay masonry units	CE-in progress	43
771-2	Feb. 00	Calcium silicate masonry units	CE-in progress	43
771-3	Feb. 00	Aggregate concrete masonry units	CE-in progress	43
771-4	Feb. 00	Autoclaved aerated concrete masonry units	CE-in progress	43
771-5	Feb. 00	Manufactured stone masonry units	CE-in progress	43
771-6	–	Natural stone masonry units	draft awaited by TC 125	31

teristics in respect of strength, petrography, density, porosity, dimensional accuracy, thermal conductivity, water absorption, frost resistance and crystallisation of salts with reference to the corresponding test procedures. Information is also given on fire and noise protection. The characteristic values are to be stated by the manufacturer.

7. WORK STATUS OF THE TEST STANDARDS

The development of standardization in respect of the test standards for masonry has been a much happier one. TC 125, along with the standard series EN 1052, puts forward both test standards for masonry and, with the standard series EN 772, EN 1015 and EN 846, test standards for masonry units, -mortars and the ancillary components for masonry. All important standards have been adopted by TC 125 and will soon be introduced by the national standards bodies. Only a few test procedures still require clarification, for instance the water retentiveness of fresh mortars, the durability of mortars and the freeze/thaw resistance of clay masonry units.

8. CORRELATION WITH EC 6, THE EUROPEAN DESIGN CODE FOR MASONRY

The standards for masonry products have been formulated with the task of the European Commission of CEN/ TC 125. They are aimed at meeting the requirements of the CPD. There were early parallel endeavours to harmonize the principles of the measurement regulations for building works in Europe. This is still being put into practice today with "Eurocodes" in CEN/TC 250. Unfortunately, it has not always been possible to effect close agreement between the TC's in the process. This has resulted in the fact that the interfaces in the content are at present not compatible in every respect. The following aspects are taken as examples in relation to the draft of the EC 6 in existence since 1996:

The "Eurocode 6" - EC 6 – for masonry, in its part for materials, divides masonry units into groups according to percentage size and orientation of holes in the units when laid. In the product standards, however, these grouping have so far not come up again.

For measuring the load-bearing capacity of masonry walls, the EC 6 starts with a characteristic compressive strength f_k, calculated using the "normalized" compressive strength of masonry units and mortars. The European Commissions mandate did not, however, regulate the specification of this normalized compressive strength of units and mortar. The existing drafts of the product standards therefore do not require the manufacturer to give the normalized compressive strength according to common criteria.

In order to establish the strength of masonry – in particular the shear strength – the EC 6 provides that masonry units with webs and shells are to reach a "com-

bined thickness". This means the sum of the material between or around holes (as a percentage of the gross area of the unit) – measured in the direction of the wall thickness. The product standards have so far not addressed this. There is still also no agreement on a suitable test for all common types of perforated masonry materials.

Along with, perhaps, a somewhat greater level of tolerance among the standards experts involved, clear specifications will be necessary in future from the Commission and CEN, in order to ensure that these European standards can be put into practice, a goal which is certainly desired by all parties.

9. PLANNED TIME SCALE FOR COMPLETION

CEN is currently under great pressure due to the infinitely lengthy process of formulating and implementing the European product standards. On the one hand, industry has lost its sense of euphoria about harmonization and is still only grudgingly prepared to invest more money and time for harmonization purposes. On the other hand, the Commission fears the failure of the whole project and the accompanying loss of credibility.

The upshot of all this has been that attempts are now being made to greatly reduce the time taken for steps in the standardization process, the lengths of which were usual up until now, e.g. not only the time scales for translation and ratification, but also the process of deciding on technical content. Of course, this can only be done with the consensus of all the Member States concerned.

The *drafts of harmonized masonry unit standards* are now (see above) at the stage of the CEN enquiry, which will be complete around the end of October 2000. CEN/TC 125/ WG 1 is obliged, to submit agreed-upon drafts by early 2001. These drafts must take into account all comments. The drafts will then go to a formal vote in the summer of 2001.

It is expected, then, that a first generation of harmonized product standards for masonry units will come into being in around September 2001. The participating nations are thereupon obliged to incorporate these standards into their national law and to withdraw from force any contravening national standards.

10. CONCLUSION

The European standards for masonry products are standardized by CEN in the technical committee 125, the CEN/TC 125. To this end the European Commission has a mandate which sets forth the scope of the standard, the performance features of the products and the criteria for attestation of conformity with the product standard. Standards which incorporate all the criteria of the mandate are called *harmonized product standards.* If a manufacturer can show the conformity of his

product with the harmonized standard, his products can be granted the CE -mark. This is the prerequisite for free trading of the product in the European Economic Area. The nations affected are obliged to incorporate the harmonized product standards into their national system of standards. At present there are draft standards for masonry products whose contents represent a compromise (the lowest common denominator) struck from all the traditional rules and regulations from the States involved. Since, for example, the great diversity of all masonry unit formats could not be accommodated, when incorporating into national building law regulations, more or less comprehensive amendments will first of all be necessary.

The application rules for construction products will remain as before within the jurisdiction of the individual Member States, as will safety regulations. It is nevertheless obvious that successful trading in construction products will only be possible if their applicability in construction practice is ensured.

For this reason endeavours are being made to also harmonize the European design codes. The present drafts are however not as yet entirely compatible with the product standards.

It is expected that a first generation of harmonized standards for masonry products will appear by 2001.

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