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English Version

Design and Use of Inserts for Lifting and Handling of Precast Concrete - Elements

Conception et utilisation d'inserts pour le levage et la
manutention du béton préfabriqué - Éléments

Bemessung und Verwendung von Transportankern für
Betonfertigteile

This Technical Report was approved by CEN on 2 March 2008. It has been drawn up by the Technical Committee CEN/TC 229.

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Foreword

This document (CEN/TR 15728:2008) has been prepared by Technical Committee CEN/TC 229 "Precast concrete products", the secretariat of which is held by AFNOR.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

To ensure the performance of the precast concrete products, lifting and handling should be taken into account in the design of the product.

Inserts are used for lifting and handling of precast elements. They should meet an appropriate degree of reliability. They should sustain all actions and influences likely to occur during execution and use.

This Technical Report deals with all lifting inserts cast into precast concrete elements i.e. lifting parts developed and produced at the precasting plant as well as lifting inserts as part of a system supplied by a manufacturer of lifting systems. The intent of this document is to give information to precast product designers.

The failure of inserts for lifting and handling could cause risk to human life and/or lead to considerable economic consequences. Therefore inserts for lifting and handling should be selected and installed properly by skilled personnel.

This Technical Report based on current practices gives recommendations for correct choice and design of lifting inserts according to the lifting capacity of their part embedded in the concrete. It is based on EN 1992-1-1 (Eurocode 2) and on published supplier's data.

In the Technical Report numerical values for partial safety factors are recommended as basic values that provide an acceptable level of reliability. They have been selected assuming that an appropriate level of workmanship and of quality management (Factory Production Control) applies. They may be applied in the absence of national regulations.

1 Scope

1.1 Scope / General

This Technical Report provides recommendations for the choice and use of cast-in steel lifting inserts, hereafter called 'inserts' for the handling of precast concrete elements. They are intended for use only during transient situations for lifting and handling, and not for the service life of the structure. The choice of insert is made according to the lifting capacity of their part embedded in the concrete, or may be limited by the capacity of the insert itself and the corresponding key declared by the insert manufacturer. The report covers commonly used applications (walls/beams/columns and solid slabs and pipes) and the range of these applications is further limited to prevent other types of failure than concrete breakout failure (cone failure), failure of supplementary reinforcement or failure in the steel insert. A basic supposition is that the concrete is demonstrably uncracked during all lifting situations.

The limitation in scope is used to obtain simple design models. Further information may be found in [1].

The recommended safety levels are intended for short-term-handling and transient situations.

This Technical Report applies only to precast concrete elements made of normal weight concrete and manufactured in a factory environment and under a factory production control (FPC) system (in accordance with EN 13369:2004, clause 6.3) covering the insert embedment.

This Technical Report does not cover :

- The design of the insert itself (for inserts manufactured by insert suppliers).
- The lifting key that hooks on to the embedded lifting insert as a component between the insert and the lifting machinery (crane, excavator...), nor its compliance with the embedded insert. These components, when brought to the market separately, are covered by the Machinery Directive (98/37/EC).
- Lifting inserts for permanent and repeated use.

This report is not an interpretation of the Machinery Directive.

1.2 Types of inserts for lifting and handling

This Technical Report applies to the embedment of lifting inserts made by the precaster for his own use as well as lifting inserts forming part of lifting systems brought to the market by a lifting system supplier, see tables 8.3 and 8.6. Devices made by the precaster may consist of smooth bars, prestressing strands and steel wire ropes. The system devices may be e.g. internal threaded inserts, flat steel inserts and headed inserts.

Lifting loops of ribbed bars are not covered, nor wire ropes of less than 6 mm.

1.3 Minimum dimensions

This Technical Report applies in general to inserts with a minimum nominal diameter of 6 mm or the corresponding cross section. In general, the minimum anchorage depth should be $\ell_a = 40$ mm.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1990:2002, *Eurocode — Basis of structural design*.

EN 1992-1-1:2004, *Eurocode 2: Design of concrete structures – Part 1-1 : General rules and rules for buildings*.

EN 10025-2:2004, *Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels*.

EN 10138-3, *Prestressing steels — Part 3 : Strand* ¹⁾.

EN 12385-4:2002, *Steel wire ropes — Safety — Part 4 : Stranded ropes for general lifting applications*.

EN 13369:2004, *Common rules for precast concrete products*.

EN 13414-1:2003, *Steel wire rope slings — Safety — Part 1 : Slings for general lifting service*.

CEN/TR 14862:2004, *Precast concrete products — Full-scale testing requirements in standards on precast concrete products*.

3 Definitions and symbols

For the purposes of this document, the following terms, definitions and symbols apply.

3.1 Definitions

3.1.1

concrete breakout failure

concrete cone separated from the base material by loading the insert

3.1.2

concrete breakout resistance

the resistance corresponding to a concrete cone surrounding the insert or group of inserts separating from the member

3.1.3

edge distance

the distance from the edge of the concrete surface to the centre of the nearest insert

¹⁾ Presently under preparation