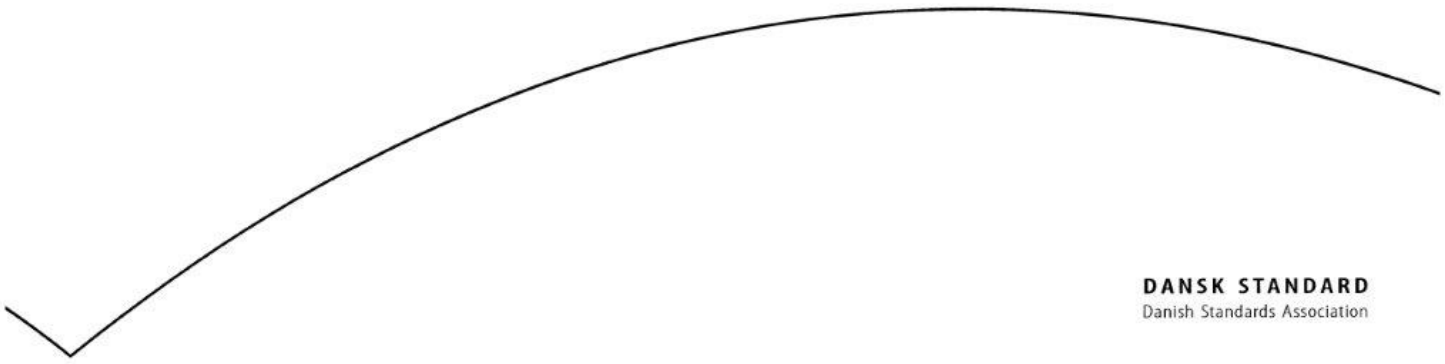
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2016-03-18

Dimensionering og brug af indstøbnings-dele til løft og håndtering af præfabrike-rede betonelementer

Design and use of inserts for lifting and handling of precast concrete elements



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TECHNICAL REPORT CEN/TR 15728

RAPPORT TECHNIQUE

TECHNISCHER BERICHT February 2016

ICS 91.100.30 Supersedes CEN/TR 15728:2008

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 Anwendung von Transportankern für Betonfertigteile - Elemente

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European foreword

This document (CEN/TR 15728:2016) has been prepared by Technical Committee CEN/TC 229 “Precast concrete products”, the secretariat of which is held by AFNOR.

This document supersedes CEN/TR 15728:2008.

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 lifting inserts cast into precast concrete elements. 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 according to the lifting and handling instructions.

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), EN 1993-1-1 (Eurocode 3), CEN/TS 1992-4-1 and on published supplier’s data.

Safety levels should be determined nationally. In the Technical Report numerical values for safety factors as used in different CEN member states are given for information and 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.

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.

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1 Scope

1.1 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). The range of these applications is further limited to prevent other types of failure than concrete breakout failure (cone failure), bond failure, failure of reinforcement or failure in the steel insert.

Due to lack of information this report does not cover double shell walls, floor plates and beams for beam-and-block floor systems.

The safety levels are given for information and 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 13369:2013, 6.3) covering the insert embedment.

This Technical Report does not cover:

— the design of the lifting inserts independently placed on the market;

— lifting inserts for permanent and repeated use.

This Technical Report is prepared based on the fact that the anchorage in the concrete of parts of the lifting assembly is governed by the Construction Products Regulation. Lifting accessories independently placed on the market are governed by the Machinery Directive.

1.2 Types of inserts for lifting and handling

This Technical Report applies to the embedment of lifting inserts. Devices made by the precaster may consist of smooth bars, prestressing strands, steel plates with anchorage or 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.

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 h_{ef} = 40 mm.

Wire ropes of diameter less than 6 mm are not covered.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

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

EN 1993-1-1:2005, *Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings*

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

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

EN 13369:2013, *Common rules for precast concrete products*

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

3 Terms and definitions and symbols

For the purposes of this document, the following terms and 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
resistance corresponding to a concrete cone surrounding the insert or group of inserts separating from the member

3.1.3
edge distance
distance from the edge of the concrete surface to the centre of the nearest insert

3.1.4
anchorage length
for cast-in headed insert bolts and splayed inserts is illustrated in Figure 1

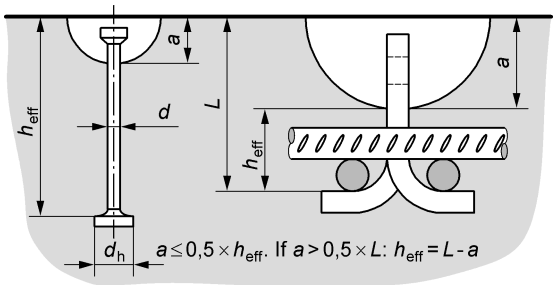


Figure 1 — Examples of anchorage length for different types of inserts

3.1.5
embedment depth
distance from the concrete surface to the farthest point of insert, measured perpendicular to the concrete surface