CFA Guidance Note:

Throughbolts (torque controlled expansion anchor)

1. INTRODUCTION

All anchors must be selected, designed and installed correctly. When this does not happen, the consequences can be serious in terms of damage to structures and human injury or even death.
To achieve safe anchorages, best practice should be followed at all times.
BS8539:2012 "*Code of Practice for the selection and installation of post-installed anchors in concrete and masonry*"[1] sets out to achieve this best practice through identifying the roles and responsibilities for all stakeholders in the process.
Complying fully with the Code and using only ETA approved anchors will provide a safe installation.

CONTENTS

SUMMARY

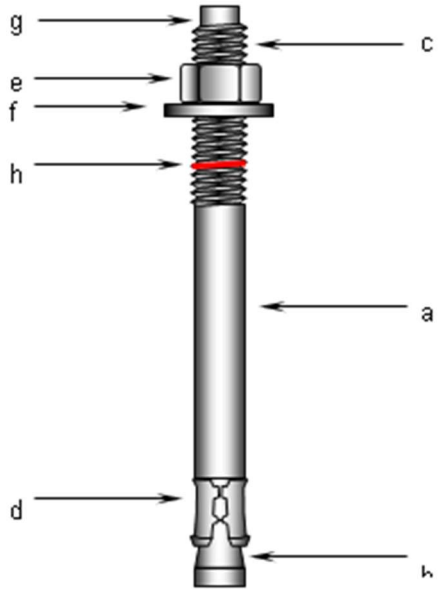
- Torque controlled expansion
- Follow up expansion
- Through fixed so no marking out
- Suitable for concrete only
- Hole diameter as bolt diameter
- M6 – M30
- Medium duty applications
- Carbon steel (Zinc plated and HDG), and stainless steel versions (A2, A4 and HCR 1.4529) see[1].
- Many with European Technical Assessments (ETA), some for cracked concrete – some for non-cracked concrete only.
- Some twin expander versions
- Some have indicator of correct setting depth
- Not generally removable without risking damage to substrate
- Some versions available with removable body

2 ANCHOR INTRODUCTION

One of the most popular types of expansion anchor, Throughbolts are chosen for their through fixing capability, ease of setting, reliability and wide range of sizes and finishes. Throughbolts are now the most commonly approved anchor type under the ETA system[2].

3 ANCHOR DESCRIPTION

The anchor comprises a body (a) with an expansion taper (b) at one end and threaded section (c) at the other. The tapered section carries an expansion clip (d) which, by virtue of carefully formed deformations, resists pullout from the substrate. A nut and washer (e & f) are assembled on the threaded portion to hold down the fixture. A plain nib (g) protects the threaded end from damage during setting. Some versions carry a depth mark (h) to indicate correct installation.



Some versions are available with two expansion sections one above the other.

3.1 OPERATING PRINCIPLE

Throughbolts epitomise the"Torque controlled" operating principle, with the load resistance achieved through Friction. Turning the nut causes the expansion taper to be pulled through the expansion clip forcing it against the sides of the hole. Tightening to the manufacturer's recommended tightening torque induces a tensile preload and equivalent clamping force through the fixture that is larger than the recommended tensile load. Further movement, caused by additional loading, will cause further expansion. This safety feature is often referred to as "Follow-up expansion".

4 TYPICAL APPLICATIONS

Applications most suited for throughbolts include all those where the fixture is in place at the time of installation and the hole can be drilled through it. These include; racking, structural bracketry, hand rails, curtain walling, balustrades, façade restraint systems, bracketry for the support of services, fixing down machinery and many more.

5 SELECTION

5.1 BASE MATERIAL SUITABILITY

Throughbolts are intended for use in concrete. Some manufacturers allow use in hard natural stone in which case their recommendations on positioning within the stone units, and other dimensional limitations, must be followed. They should not be used in brickwork or blockwork.

5.2 ANCHOR POSITIONING

Manufacturers' recommendations for close edge distances and spacing between anchors must be followed. Many manufacturers publish tables of edge distances and centre spacing with corresponding reduction factors which make the calculation of reduced allowable loads due to these factors a straightforward process. This is most appropriate for standard non safety critical applications.

5.3 EUROPEAN TECHNICAL ASSESSMENTS AND SELECTION SOFTWARE

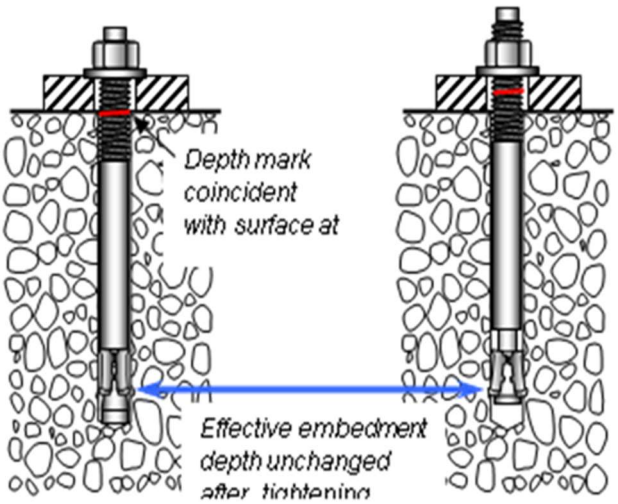
Throughbolts have gained the largest number of European Technical Assessments[2] (ETAs) for mechanical anchors so there is a wide choice available in both carbon steel and stainless steel for use in both cracked and non-cracked concrete. They are covered by EAD 330232-00-0601 Mechanical fasteners for use in concrete [3]. Anchor selection for safety critical uses is a straightforward process if manufacturer's software is available.

5.4 CHANGING SPECIFICATIONS

Although throughbolts appear to be a simple product a great deal of development work will have gone into the design and manufacturing process to ensure these anchors function correctly in the varied applications they are used in, especially those with ETAs.
They may even look very similar but performance can vary and specifications should not be changed from one type to another unless the same design considerations have been taken into account for the proposed alternative. Comparisons of basic performance data, e.g. safe working loads, or proof tests on site will not confirm the appropriate safety margin or that edge/spacing criteria are met.

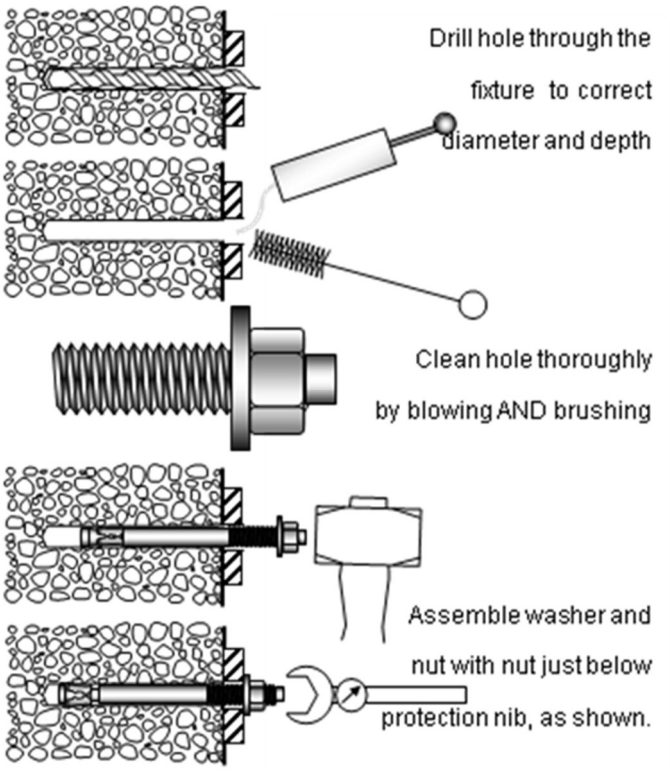
5.5 EMBEDMENT DEPTHS

Some manufacturers quote alternative embedment depths for each length of anchor. Recommended loads will be reduced with reduced embedment depths and fixture thicknesses increased. Manufacturers usually mark the different embedment depths on the body of the anchor although these will not usually be visible when installed through the fixture. If visible the relevant mark should be coincident with the surface of the concrete after the anchor is tapped into the hole. Although the body will be pulled through the fixture on tightening the effective embedment depth will not change as the expander will not move in the concrete. It is important that the specifier makes it clear on all specifications and drawings which embedment depth is intended.



6 INSTALLATION

A typical installation procedure is outlined below. The manufacturer's instructions must always be followed.



Hole depths are often quoted for the maximum fixture thickness. In this case if thinner fixtures are used the hole depth must be increased pro rata. Unlike some anchor types throughbolts do not rest on the bottom of the hole so holes may be much deeper than the minimum required.

Hole diameters in the concrete are the same as the nominal bolt diameter but the tip of the drill bit used to drill into the concrete will be slightly larger (to allow for wear) and will not pass through a hole of that diameter in steel bracketry – clearance holes must be at least 1mm larger but not so large as to allow the fixture to pull over the nut.

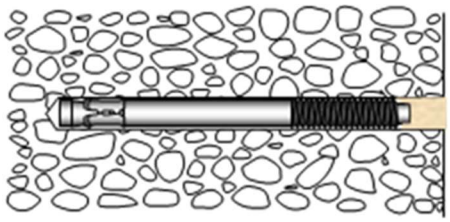
For safety critical applications a torque wrench should always be used to ensure the correct tightening torque is achieved.

6.1 MAINTENANCE

Maintenance schedules should avoid the occasional retightening of nuts unless carefully carried out with a torque wrench otherwise the bolt will eventually be withdrawn from the concrete.

6.2 REMOVAL

Traditional throughbolts are not easily removed. If it is known before installation that they may no longer be required at some stage in the future it is a simple matter of drilling the hole about 10mm deeper than the overall
length of the anchor. Once the anchor is finished with the nut and washer can be removed along with the fixture and the anchor knocked to the base of the hole which should then be filled with a suitable grout.



Technique for hiding throughbolts after use.

Versions are available whose body may be unscrewed from the expansion section to allow removal of the projecting thread once the anchor is finished with. The reduced cross sectional area of this threaded portion necessitates a reduction in load capacity with this type as it may not have the same capacity as the same size of other types.

References

[1] CFA Guidance Note: *Fixings and corrosion*. Downloadable free from www.fixingscfa.co.uk.

[2] CEO Guidance Note: *European Technical Assessments for anchors used in construction.* Go to www.fixingscfa.co.uk.

[3] EAD330232-00-0601 *Mechanical fasteners for use in concrete*. EOTA. Downloadable from www.eota.be.