Lifting Inserts	**Published Date: 17/07/2009**

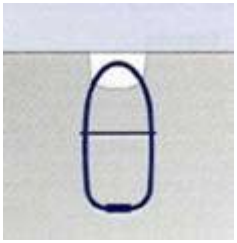
The vast majority of precast elements are lifted using proprietary lifting inserts. The range of types and sizes is enormous. This section does not cover every type available but describes the main types.

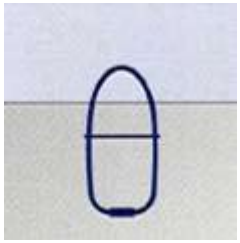
Polypropylene rope loops:

These are simple inserts made from polypropylene rope with the free ends swaged together to form a closed loop. In deep units, no reinforcement is specified, but in shallow sections they are normally secured by tying around reinforcing bar as shown. Relatively large edge distances are required. Marketed by several companies, the load capacity ranges between 150kg and 1200kg, and thus they are suitable mostly for small elements. The capacity is denoted by a plastic tag around the rope. Before use, the concrete around the loop should be checked for sharp edges/arrises that could damage the rope. After use, the protruding part may be cut off.

Wire rope loops:

When heavier elements have to be lifted, the wire rope is the next option. They are similar in appearance to the polypropylene loops but are made from steel wire rope. They range in capacity from 800 kg up to 99 tonnes. The smaller sizes are easily handled, but the largest sizes have rope 56mm in diameter and weigh some 68 kg each. The concrete in the vicinity of the loop must be reinforced, and guidance is given in suppliers' literature.





Loops may be installed exposed from the surface, or recessed as shown. For exposed loops, a standard crane hook is suitable. For recessed loops, suppliers can provide a special hook. The internal radius of the crane hook must be at least as great as the rope loop diameter.

Pin anchors:

Pin anchors are suitable for large precast elements and are commonly used in products such as slabs and pipes. The capacities range from 1.3 t to 45 t, with even greater capacities available for special cases. The length of the larger sizes can be as much as 1200mm. Reinforcement is required around the insert.

They are always recessed as shown, and require the use of a compatible lifting head. The purpose made recesses are formed with a rubber former that holds the insert in position during casting.

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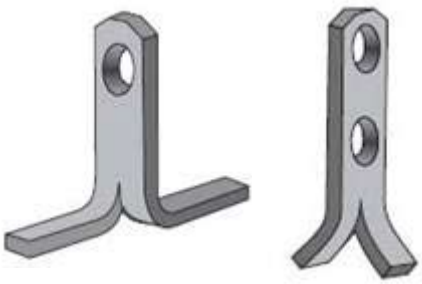
Rapid Lift:



Rapid Lift is a range of lifting inserts especially made for precast concrete. The load range is from 0.7t up to 26t, and there are several types, including simple spread anchor, erection anchor, flat foot anchor, and double-ended anchor. It is a well established system and allows quick attachment and release using a compatible ring clutch. The insert is held in place by a rubber former that creates a half-round recess. This recess accepts the ring clutch, which engages into a hole in the insert. The main advantage of this method is speed. It is also possible to release the clutch remotely by attaching Bowden cables.

This type of system has been available for many years, and during that time it has been copied extensively by other manufacturers. Due, in part, to the simplicity of the insert, they can be made with unsophisticated equipment. It is important therefore to ensure that inserts and ring clutches are manufactured to an appropriate standard of quality, with the relevant test certification being available. Ring clutches and inserts from different manufacturers should not be used with each other.

Threaded inserts:

Threaded systems are probably the most widely used method of lifting. The system consists of a cast-in insert having a female thread like a socket. This is used with a lifting attachment having a male thread.
It is possible to obtain systems that use a normal ISO metric thread. However, the vast majority of systems use a special thread called 'Rd' (short for round). This is a slightly different thread profile to a metric 'M' thread. The result is that, whilst an M thread can be screwed into an Rd socket, it is not possible to screw an Rd thread into an M socket. The purpose of this is to prevent a lifting head or loop being screwed into a fixing socket on a precast element and imposing heavier loads than expected. In addition, the fixing socket may be in a location that would not accept the higher load.

The simplest type of threaded insert is a barrel insert. This is intended for simple vertical lifting and is not normally used for turning units. The load range is from 5 kN (Rd12) up to 125 kN (Rd52). These capacities are for axial lifting. The capacity in shear is 50% of the axial capacity. The sockets have a hole near the base, through which a reinforcing bar is inserted. Manufacturers give guidance on the size and shape of bar.

Where units are shallow, such as a slab, a shorter version of socket may be used. This type is called a 'plate' or flat steel anchor. It has a plate welded to the base, which compensates for the loss of depth of the cone of resistance by increasing the width. The load range is as the barrel socket. However, the shear capacity is the same as the tensile capacity. The reinforcement required sits on top of the plate and manufacturers give guidance.

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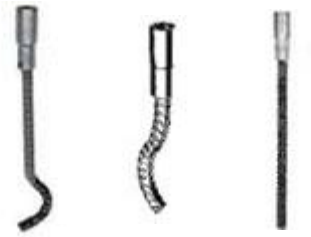
Rapid Lift:



For turning flat precast units, a longer version of insert is used. These consist effectively of a barrel socket swaged onto a length of reinforcing bar. The bar is normally (but not always) bent near the end. The shape of the bends varies between manufacturers. The purpose of the bar and the associated reinforcement is to spread the effect of the transverse loads imposed during turning. The load range is from 5 kN (Rd12) up to 200 kN (Rd60), with the shear capacity being half of the tensile. The reinforcement configuration is more complex than for simple inserts and manufacturers' literature should be consulted. In addition, the full capacity can only be taken with adequate thickness of concrete, which can be over 200mm. As well as being used for turning panels, these are also used in large panels for vertical lifting. In this case the length may become a factor since the longest inserts are some 1200mm long.

Threaded inserts are used either with a lifting loop, or a lifting head. The lifting loop is made from wire rope, with the two ends swaged into a threaded length with the thread type and size matching the cast-in insert. For lifting at directions greater than 45o from straight, it is recommended to use a distribution basin to prevent 'tight' bending at the top of the insert. Lifting loops are relatively cheap, but need to be carefully maintained with regular inspection to detect any damage to the strands of the loop.

A more robust alternative is to use a swivel eye (swivel head). This is a steel insert that allows the full capacity of the insert to be used in all directions. Once screwed in, the steel loop can rotate freely through 360o. There is a pressure plate that distributes the local pressures to the concrete. Although robust, these must also be regularly inspected for wear and damage. Both lifting loops and swivel heads are normally subject to insurance requirements that they are covered by individual test certificates, and kept on a register of lifting equipment. Cast-in inserts on the other hand are subject to batch testing by the manufacturers. It is essential that inserts are obtained only from suppliers that have the quality systems to provide this testing and certification.

High efficiency inserts:

Recent developments in precast use have included the manufacture of 'pods'. These are often used in prisons and hotels as a way of prefabricating rooms. The flat panels are assembled at the precast factory and the complete fabrication is delivered to site. From the lifting viewpoint, the disadvantage is that the weight of concrete to be lifted is disproportionate to the thickness of the individual pieces of concrete. To address this, new types of inserts have been developed. These give considerably greater capacity for a given thickness of concrete. For example a single insert in a 150mm thick wall has a capacity of 110kN. The largest Rd insert that can be used to full capacity in 150mm concrete is an Rd30 long wave anchor, having a capacity of only 40kN. These high efficiency inserts have a different thread profile to both metric and Rd and thus they are not compatible with eitherl. The lifting heads must have the same thread also.

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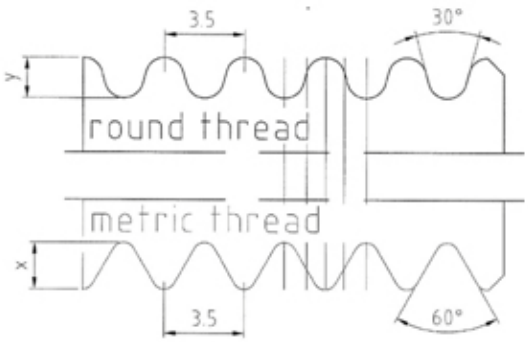
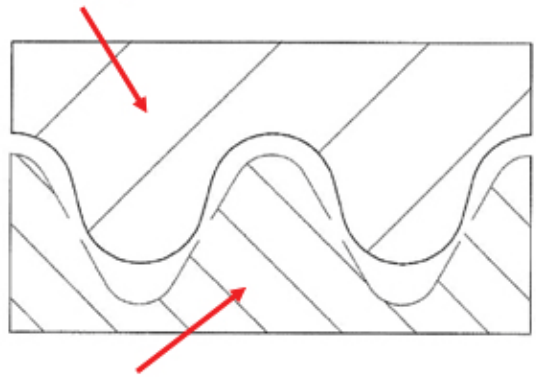
Comparison between Rd lifting threads and M metric threads:



The more rounded Rd thread, whilst having the same pitch, has a different angle of slope to the threads when compared to a metric (M) thread.

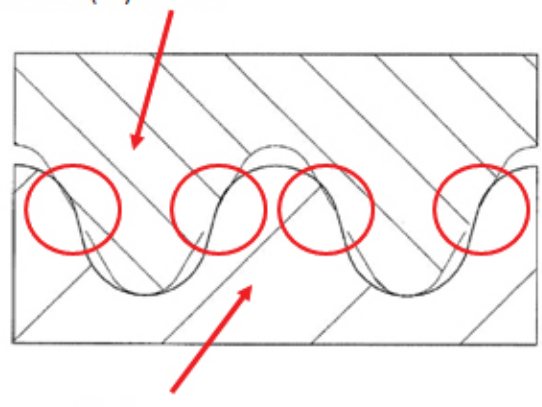
Round (Rd) threaded socket



Metric (M) bolt

A metric (M) thread will screw into a round (Rd_) socket. However, the fit is not the same face-to-face tolerance as a metric/metric fit, and should not be used for critical connections.

Metric (M) socket



Round (Rd) insert

A round (Rd) insert will not screw into a metric socket. The different slopes on the thread cause 'jamming'.

This is an important safety feature on site.