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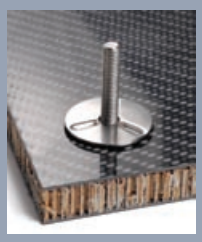
bigHead®
BONDING FASTENERS

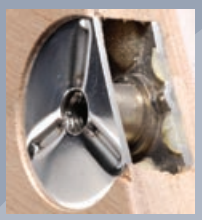
A new range of Composite Panel and Structure fastenings

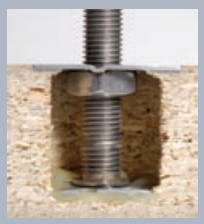


twindisk®
by BigHead

tapara
VEHICLE TECHNOLOGIES







The TwinDisk Composite Panels Fastening System

The use of composite panels and structures in the Aero, Auto, Marine, Construction and other core industries and applications is growing rapidly. These new materials, utilising carbon fibre, GRP, glassfibre, thermoplastic and alloy outer skins, consist of a core material – in honeycomb, block, foam or solid – bonded to outer skins of a different material.

BigHead has supplied its unique thin-head fasteners to industry, worldwide, for 40 years. A fast-growing Technology Partnership with **Caparo Vehicle Products** (see Page 7) has now provided the composites knowhow to perfect an entirely new, high-performance fastener for composite materials. The stainless steel TwinDisk, with its simple, strong design and unique BigHead weld technology, provides a rapid and efficient fastening point anywhere in a structure. Our own **BigBond** adhesives complete the system; for maximum strength, the 2-part **FS Acrylic** version is recommended for all types of composite materials.

How it works

The Twindisk has two heads, or disks, joined by an internally-threaded collar or a threaded stud. A hole is drilled into the panel; adhesive applied; and the Twindisk pushed into the cavity. The bottom disk is glued to the bottom skin; the top disk to the top skin (rebate cut or surface-mount). Tensile, shear and lateral loads are efficiently transferred to both skins; male versions are supplied with adjustable top heads, fitting depths from 5mm to 100+mm. Threads are M4 to M16 (male or female), and males have up to 50mm extra length. Head diameters are 20mm, 30mm and 40mm; other sizes can be supplied. 316 stainless steel ensures high strength and corrosion resistance.

For further technical/purchasing information, you'll find contact details on the back cover.

twindisk
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Asymmetric disks with female thread

Composite panels and structures vary widely in their constituent materials. Here, we show the TwinDisk method, and its mechanical principles. We've used wood, chipboard, alloy and carbon fibre for our test pieces; on this page, the composite material is a simple wooden panel, with a blockboard core and 3mm plywood skins on either surface. Bottom R.H. shows carbon fibre with a honeycomb core.

Spreading the dynamic load

The first picture shows the main hole cut through the top skin, down to the inner face of the bottom skin. The top surface then has an extra cut to fit the larger top disk - in this case, 40mm in diameter and 2.2mm deep. The 30mm bottom disk requires a 32mm fitting hole, to allow the bottom 'slug' of glue to flow through and around the disk's piercings for maximum adhesion.

Bonding to the top skin

BigBond is applied to the 5mm wide rebated surface - see picture 3. The top disk of every TwinDisk has three indents, each protruding 1mm from the disk's surface - the optimum thickness of the 2-part BigBond FS Acrylic adhesive. The indents ensure precise film thickness, low wastage and maximum adhesion. The TwinDisk is then firmly pushed into place. We recommend that any surplus glue is wiped off immediately - initial cure starts within a minute.

Flush fit - or surface glue?

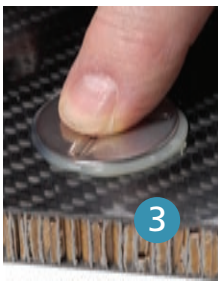
All TwinDisks are of 1.2mm thick stainless steel. If flush fit is required, a rebate of 2.2mm provides the 1mm glue depth. If skin thickness is less than this, the top disk is glued to the top skin leaving a 2.2mm high protruding disk. This method s less efficient, however, at distributing lateral shear stresses.

Cut through the top skin, removing core material. For flush fitting, rebate the top skin. Top disks are 10mm larger than the bottom; the rebate provides a gluing surface for the top disk

Apply BigBond Acrylic adhesive 4-5mm deep into the 'well'. The hole should allow a 1-2mm depth of glue below the bottom disk - surplus glue is forced through holes and locks disk in place

Glue is applied generously to the rebated surface. Rebate is 2.2mm deep; disk is 1.2mm thick, and a 1mm standoff (created by 3 indents in the disk) ensures the correct 1mm depth of the adhesive layer required.

Press the TwinDisk firmly into position. Any surplus adhesive round the top disk should be removed immediately - initial set is 5 minutes.

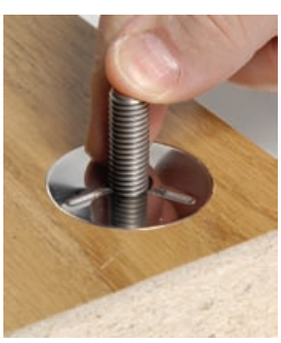


The main cut for this 40/30 version TwinDisk is 32mm wide, for installation clearance and free flowing of the BigBond adhesive within the well. The rebate cut, again, is 2.2mm deep to ensure a firm fixing platform for the rim of the top disk.

When applying adhesive into the rebated second cut, use generous amounts. Any excess glue will adhere to the inside of the clearance hole, giving extra support to the top disk mounting.

*The picture shows the TwinDisk ready for insertion. The top disk has been screwed down to the exact height required for flush fitting, **before** final installation.*

The completed installation. When ordering, ensure that the remaining height of thread is sufficient for the fastening requirement - once the BigBond has cured, it's permanent!



Asymmetric disks with male thread

On this page our test piece is 43mm thick heavy-duty chipboard with solid wood facings. We have used a fairly heavy thread on this example - an M8 stainless; we can supply up to M16 if required. Stud height can also be varied.

Variable-height, heavy duty fastenings

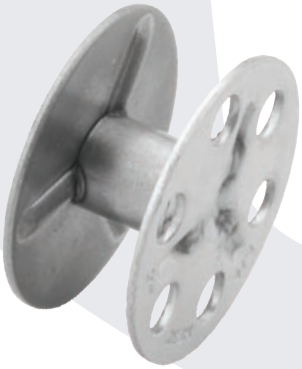
The TwinDisk principle works very well in its male version. Given that the choice of main stud is sufficient to cope with the lateral and tensile forces likely to be encountered, the rotating top disk allows a wide range of material thicknesses to be catered for. The standard BigHead range includes bottom disks of up to 70mm in diameter - suitable support for M16 threads.

Lateral/shear forces - top skin support

In the example shown, the solid wood top skin is 5mm thick and is well able to accept a 2.2mm rebate cut, ensuring the maximum resistance to lateral stresses. In this method it is vital that a 'dry run' is done, to measure and fix the positioning of the top disk after drilling both holes; after glue is applied to the top skin, the top disk cannot then be spun down completely without disturbing the top layer of glue.

Retro-fit ability - a tailored fastening

The heavy-duty male TwinDisk is already proving popular in retro-fitting cabins and decks in the marine world, and for seating in municipal transport projects. The quick, simple method of drilling a hole down to the inner surface of the bottom skin; adding adhesive; winding the top disk down; and gluing into position, saves significant amounts of time and labour, as well as ensuring very high service performance.



Parallel disks with male or female thread

For some applications, parallel disk sizes are used. These can be installed using the 'plug' method, where the top skin is undercut after making the main cut down to the bottom skin. The resultant T-shaped chamber is then filled with adhesive and the TwinDisk pushed in - when set, the fastener is locked in. This version is also used where lateral loadings do not require the extra gluing of the top disk - instead, it is supported laterally by the panel's top skin.

Adhesive/Resin Plug method

The first picture shows the main cut through the plywood surface skin of the blockboard test piece, down to the inner skin surface. The normal 1mm clearance is recommended around the circumference of the bottom disk, to allow the adhesive to flow through and around the disk and central column to form a complete, permanent anchorage.

The initial cut is made through the top skin, removing all core material down to the internal surface of the bottom skin. A working clearance of 1-2mm ensures that the adhesive can flow through and round the bottom disk.

Flush fit gluing considerations

All TwinDisks are manufactured to a precise overall height, allowing a glue thickness under the bottom disk of 1mm; height is calculated to leave the top head flush with the top surface. The clearance of the main hole can be reduced to 1mm overall; this gives lateral support to the top head. Note the depth of glue in picture 2.

This picture illustrates the use of standard BigBond adhesive, as the test piece is wooden blockboard. A generous quantity is applied into the well which, when cured, creates an extremely strong and permanent adhesive 'pot'.

Optional polished finish

All TwinDisks are made in 316 marine grade stainless steel. Some customers require polished heads; we're happy to quote the extra cost.

Core-fill heat cure method

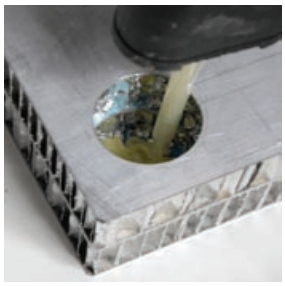
For composite materials such as carbon-fibre, panels are normally cured in an autoclave. This requires the use of a syntactic film such as **Synspand® EA 9890** or **9899.2DF.** This is wrapped around the TwinDisk core in the normal way; during cure the film expands, locking into the core material and locating the TwinDisk firmly and permanently in position.

The TwinDisk is installed by pushing firmly down into the adhesive well. Depth of insertion can be controlled with care, to give either a flush or slightly recessed head fit as required.

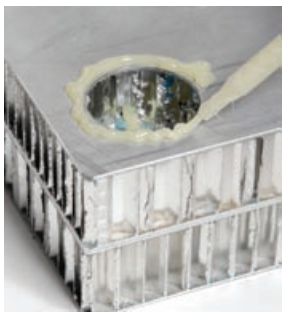
Variations on a theme

The TwinDisk principle - parallel heads, glued to the top and bottom skins of a panel or floor to form a 'box girder' mounting for a fastening - is highly adaptable. Within the classic BigHead range, for example, are the constituents for tailoring a TwinDisk to virtually any depth and strength of material. If cosmetic looks are not important, the TwinDisk's unpierced top head can be replaced by a traditional, pierced, BigHead disk; these are made in diameters of up to 70mm.

The main hole is cut down to the level of the bottom skin, and all debris removed. The well thus formed is filled with a generous application of BigBond adhesive; the surplus is forced through the holes and completely covers both disk surfaces.



For mountings where a larger top disk is used, adhesive is applied round the hole's rim as shown. It is possible to use parallel disks in this situation; the method is clearly illlustrated on Page 5.



The TwinDisk is now ready to install. Press down firmly into the hole, seating the top head on its glue cushion. Apply enough pressure to eject surplus glue, and for the top disk's indents to contact the panel's skin.

Any surplus glue should be wiped away without delay - if you wait for longer than 30-40 seconds it will already be starting to cure! Initial cure (giving up to 60% of maximum strength) is reached after 40 minutes; 100% strength takes at least 3-4 days.

Deep-section panels/flooring

Our picture sequence shows a 55mm-deep section of alloy flooring - used typically in marine and transport decks and floors. The basic procedure remains unchanged; a 30mm hole (in this case) cuts the honeycomb core away, down to the bottom skin. Ideally, the width/height aspect ratio should be around 1:1; for maximum lateral stability in this sample, we recommend a bottom disk of 50mm diameter and a top disk of 60mm/70mm.

For alloy or composite skins

The TwinDisk principle can be utilised regardless of panel material, with aluminium and other alloys posing no structural adhesion problems. The potential for bi-metallic galvanic corrosion with 316 stainless steel is minimal, and a generous adhesive film thickness effectively prevents any contact between the two different metals.

Up to M16 studs for Heavy Duty use

With a bottom disk diameter potentially as large as 60mm (or even larger if required, to special order), it is also perfectly feasible to use thread sizes of up to M16 for maximum lateral stress resistance. These can be in either male or femal threadform, with male versions supplied in any length from 20mm up to 150mm.

TwinDisk:

Designed and built by BigHead.

Forty years ago, the first-ever BigHead was manufactured. Aimed primarily at the plastics moulding industry, the brilliantly effective idea of a thin, large-diameter head pierced by holes allowing molten plastic to flow through and around it, soon ensured its adoption by other industries. BigHeads are now designed in to countless products manufactured in steel, plastics, composites, wood, concrete, brick - indeed, virtually every common material.

Central to BigHead's success is its unique welding technology, perfected after long and patient research during the early years. This ensures that a BigHead weld is always the strongest part of the finished fastener.

The company has recently introduced a number of new versions - TwinDisk was developed as a result of requests from long-established customers, particularly in the Marine industry, adopting composite panels and structures in their new ranges. Extensive research led to a developing technology partnership with the **Caparo Vehicle Group**, whose Basingstoke-based Vehicle Technologies division (CVT) has been closely involved in the development of the TwinDisk concept.

Acknowledgements:

In putting this brochure together, we have received constant encouragement and help from a number of companies and individuals. **David Skertchly** and his team at **Caparo Vehicle Technologies (CVT)** have helped us harness our welding technology to the TwinDisk system, and given us invaluable technical advice and support. Several manufacturers of composite materials and panels and their staff have also been more than generous with their time and expertise (as well as some of their products); these include John Nixon and the team at **Advanced Composites Limited; Technical Resin Bonders Limited; Lola Composites Limited**; and **EPM Technology Limited.**

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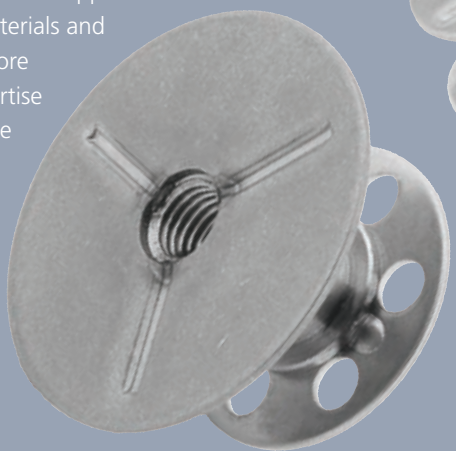
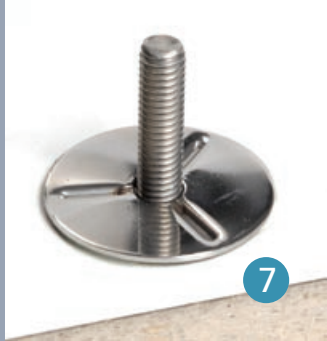
OUR TECHNOLOGY PARTNER

Caparo Vehicle Technologies (CVT) designs, sources and manufactures prototype and low to medium volume composite parts, assemblies and vehicle Body-in-White, within the UK. Its own manufacturing staff works closely with customers' and in-house engineering teams to design and prepare for high-quality and cost-effective composite-based production, regardless of complexity or production volume.

*CVT's stunning **Caparo T1** composite two-seater*

The Basingstoke composites facility includes full laminating, trim and autoclave capability





TwinDisk:

The advanced fastening solution for all types of composite panel and structure requirements

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