bigHead®

Core range

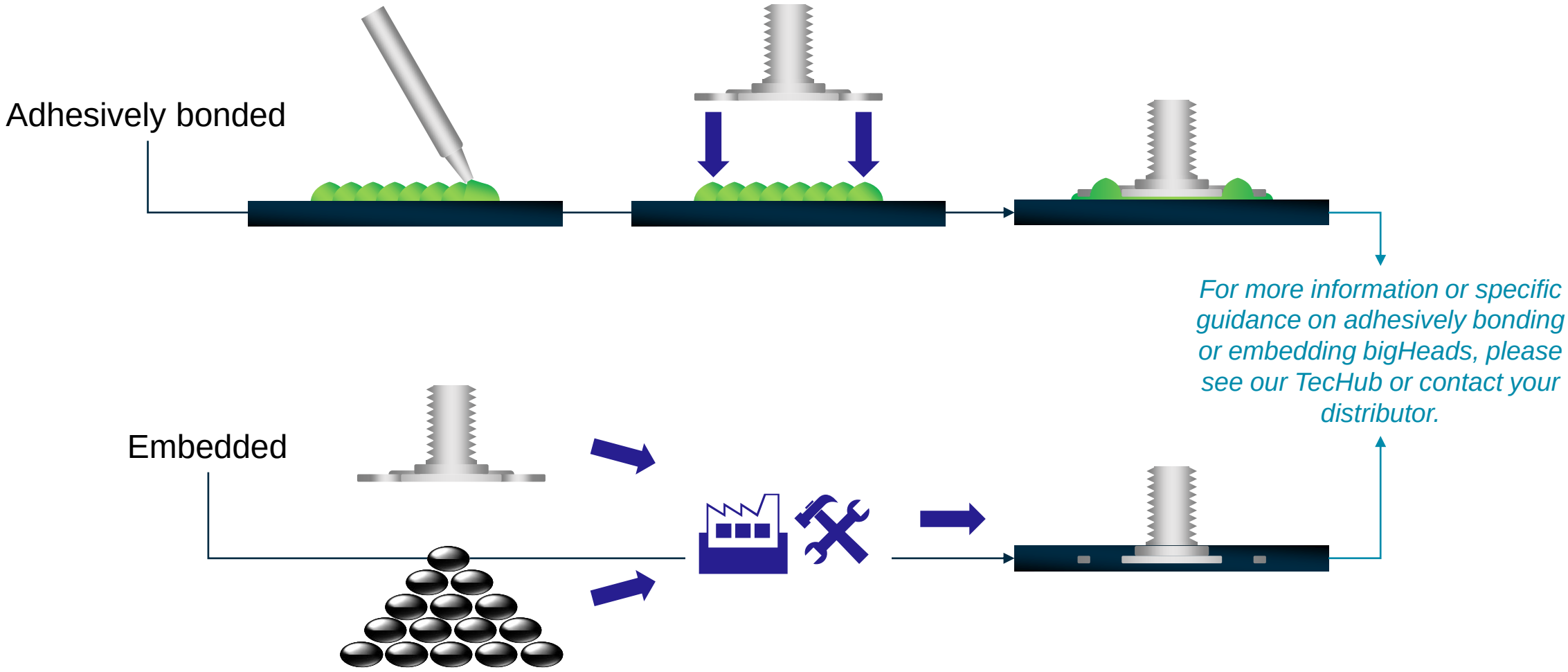
Fastening and assembly guidance

Fastening and assembly guidance

What is in this guidance document?

Typical installations of bigHeads

Adhesively bonded or embedded

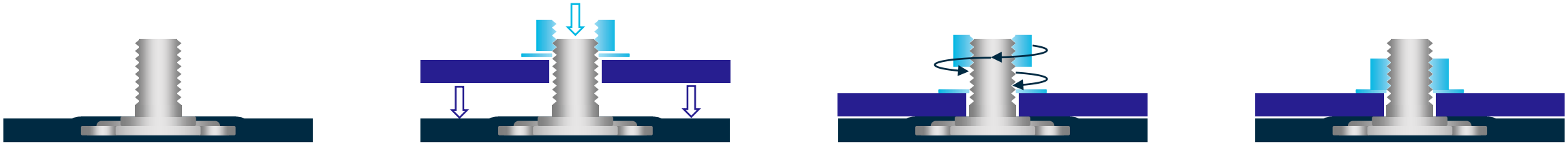


For more information or specific guidance on adhesively bonding or embedding bigHeads, please see our TecHub or contact your distributor.

Fastening with bigHeads

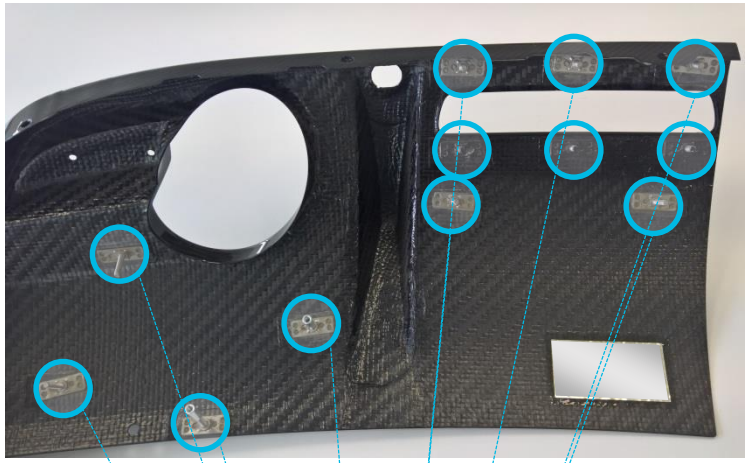
Typical assembly fastening techniques

Adhesively bonded collar fixing bigHead on component → Adjoining component fitted over bigHead collar, retained by screw and washer → Screw tightened into bigHead collar to secure assembly → Completed assembly



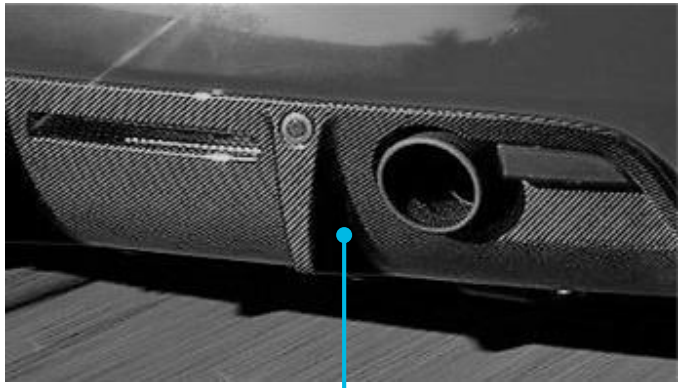
Embedded stud fixing bigHead within component → Adjoining component fitted over bigHead stud, retained by nut and washer → Nut tightened onto bigHead stud to secure assembly → Completed assembly

bigHead application/ usage example – adhesively bonded

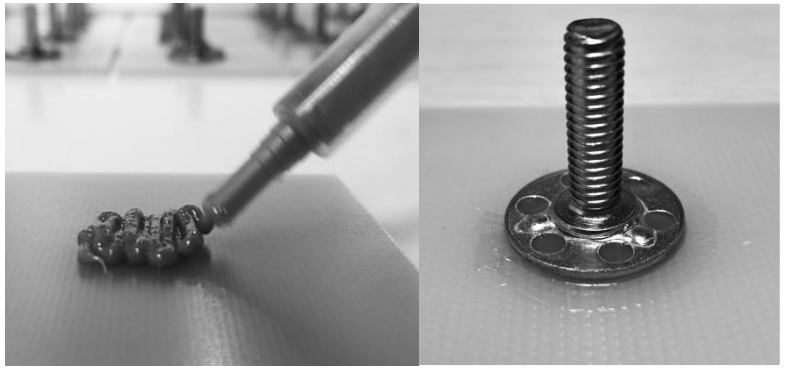


bigHeads used for creating fastening/ attachment points on composite component:

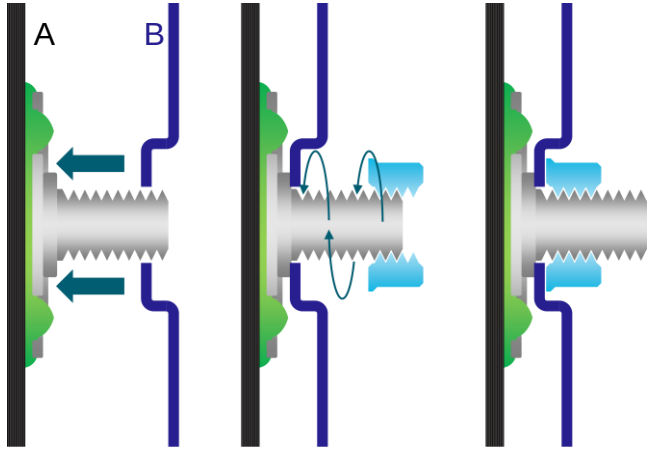
Design requirement: create metallic threaded fixing/ attachment points on a carbon fibre reinforced polymer composite material, without creating through-holes, and without visibility of fastening locations from unfastened side



Vehicle images courtesy of NetCarShow.com

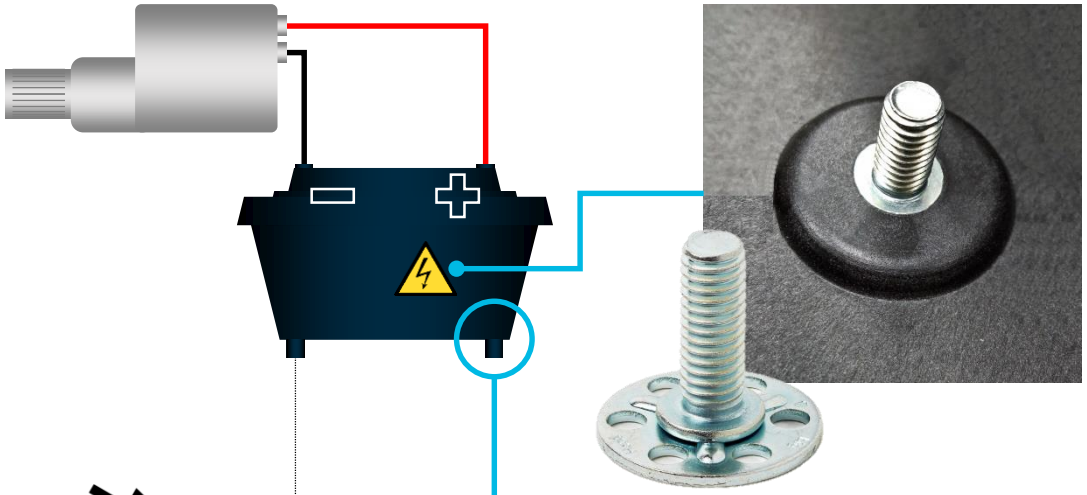


Integration concept: bigHeads adhesively bonded onto component after completion of composite laminating and curing (post-process integration)

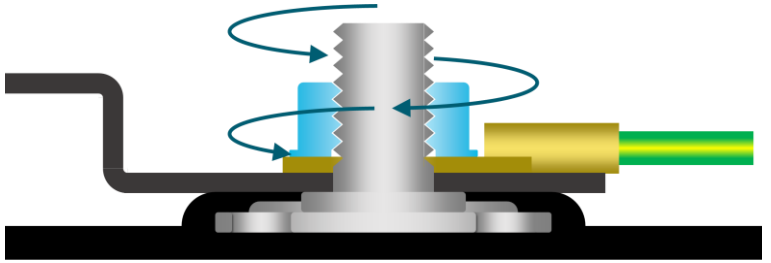


Assembly concept: Attachment between component A & B made by passing bigHead fixing through hole and securing with nut/ washer

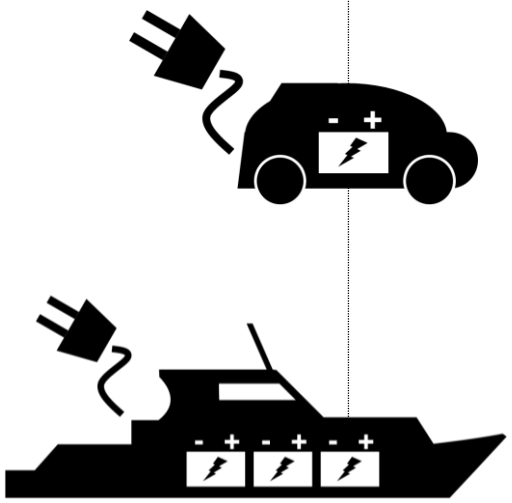
bigHead application/ usage example – embedded

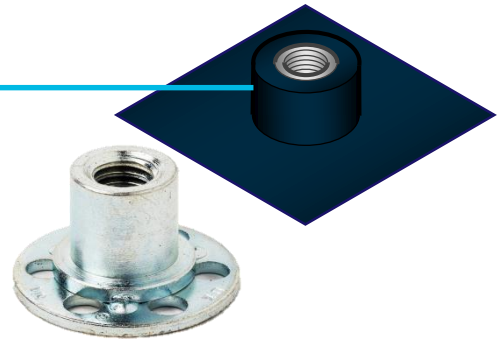


Design requirement:
provision of threaded stud connection points for mounting/ securing electrical components within the battery box – without through-hole or secondary installation operation

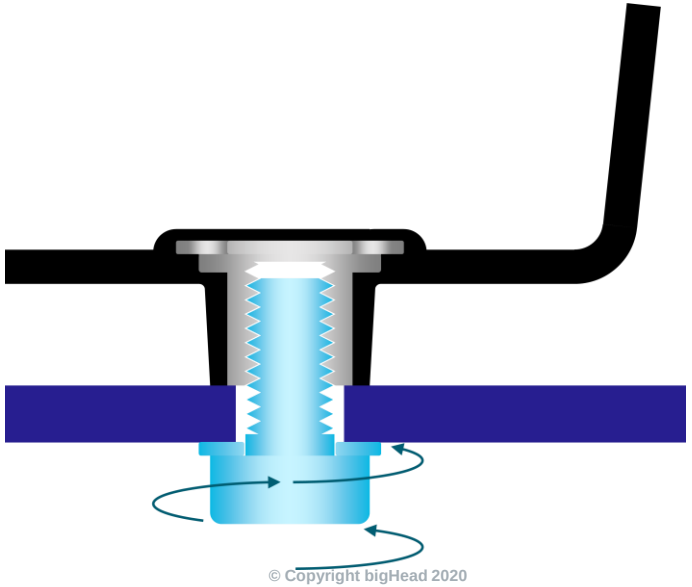


bigHeads embedded into battery box components by co-processing with injection moulded polymer/ fibre reinforced polymer



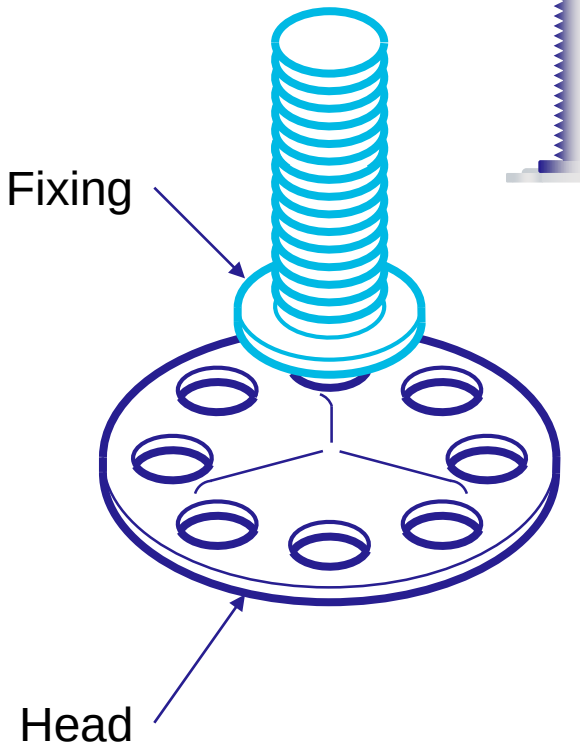


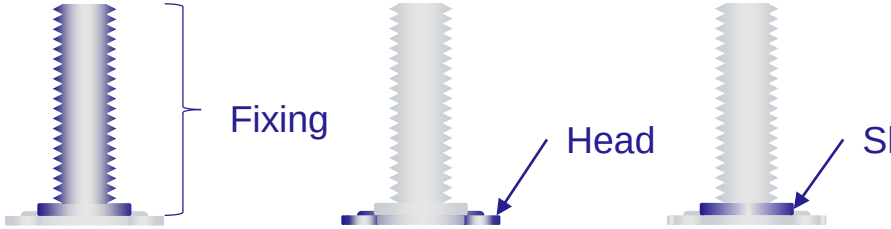
Design requirement:
provision of threaded sockets for use as attachment points for mounting/ securing the battery box in place – without through-hole or secondary installation operation

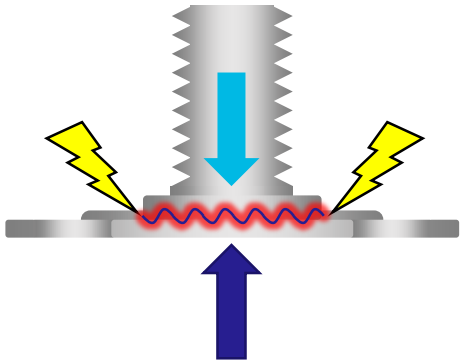


bigHead product design

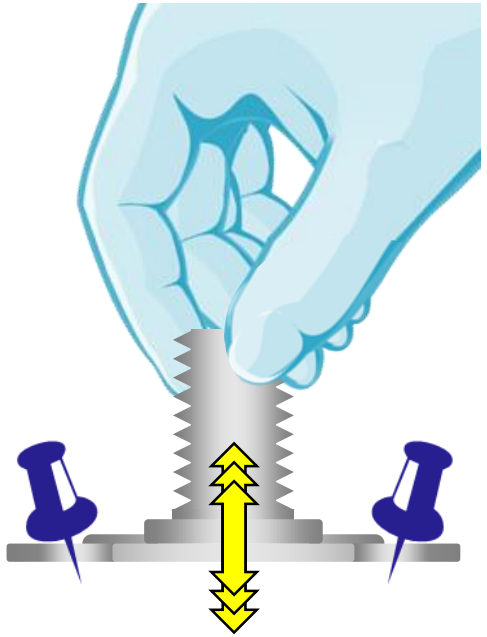
Familiarisation with principal elements







To make a bigHead, the fixings are welded to the Head…



…this creates the joint between fixings and Heads.

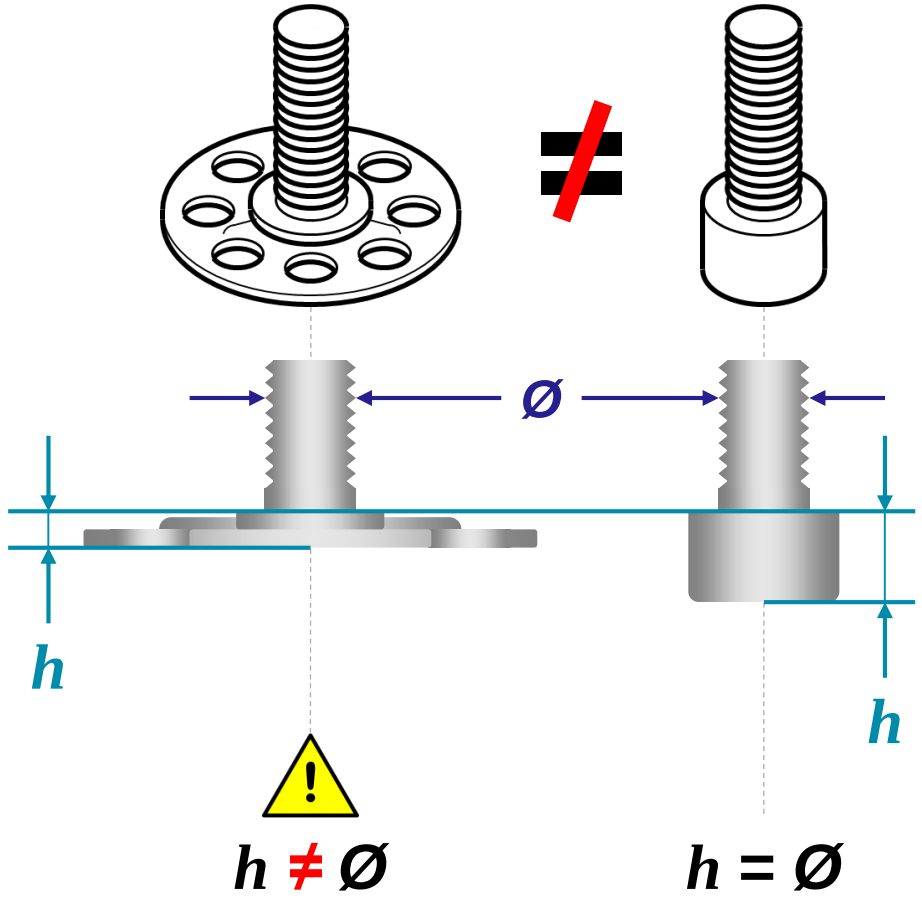
bigHead design principle

Understanding design intent and limitations

A bigHead is a speciality fastening product, typically used to provide attachment/ fixing/ fastening points within or onto a material or component. It is a very recognisable product; a fixing element attached to a relatively thin Head component that is typically larger in overall size than the fixing element.

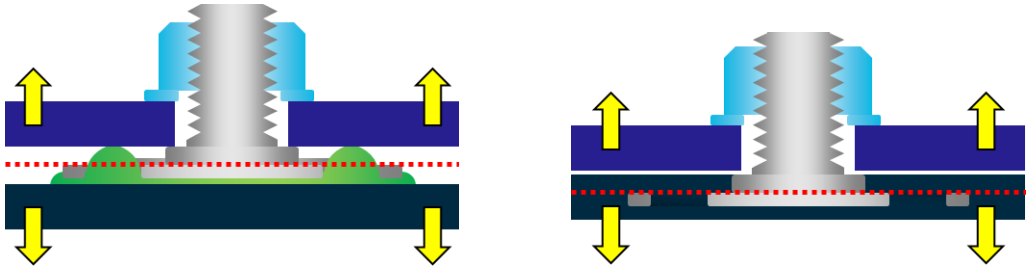
The bigHead itself provides the optimum balance of design flexibility, mechanical loading capability, additional weight and physical size. To achieve this, the size and thickness of the Head and shoulder parts of a bigHead are not directly proportional to the fixing thread size.

For this reason, a bigHead may behave differently under mechanical loading, and have different loading limitations to other fastener types or technologies with the same fixing/ thread size.



Loading scenarios for bigHeads

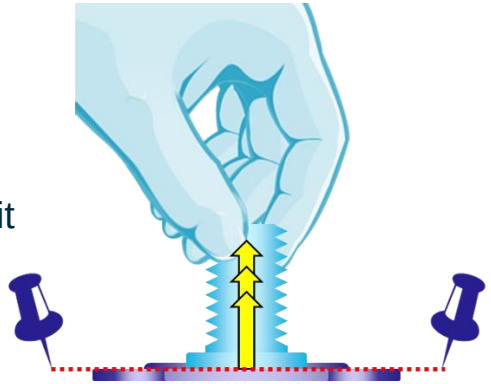
Application loading and assembly loading

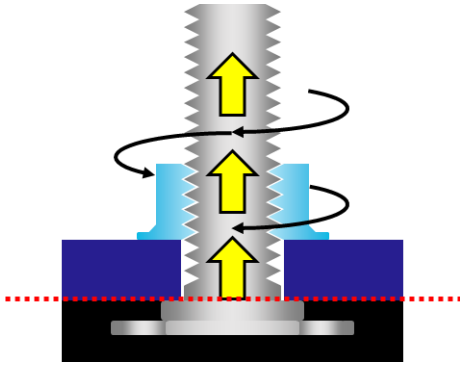


Weld loading: typically occurs during **application loading/ normal usage**

The fastened components/ materials move apart in opposite directions. This creates a tensile force between the fixing and the Head, across the welded joint of the bigHead. On request, bigHead can provide maximum recommended WLL values for bigHead products in this loading condition.

WLL
Weld Loading Limit

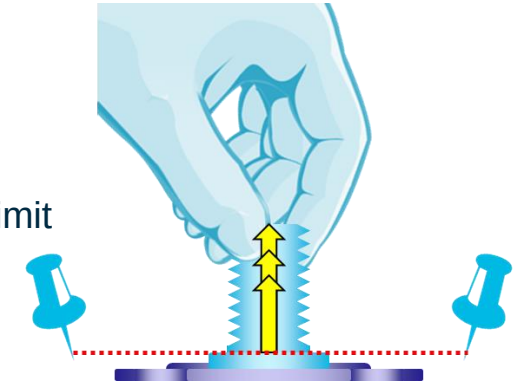




Fixing loading: typically occurs during **assembly**

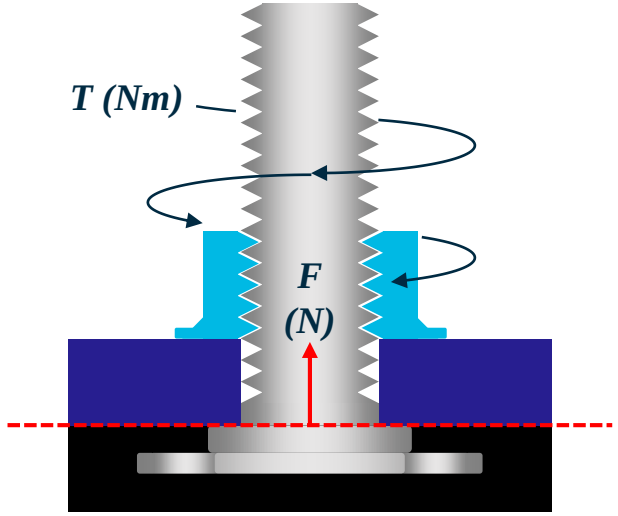
Tightening of the nut onto the bigHead creates a compressive force between the fastened component and the bigHead shoulder, and a resultant tensile force within the bigHead fixing. On request, bigHead can provide maximum recommended FLL values for bigHead products in this loading condition.

FLL
Fixing Loading Limit



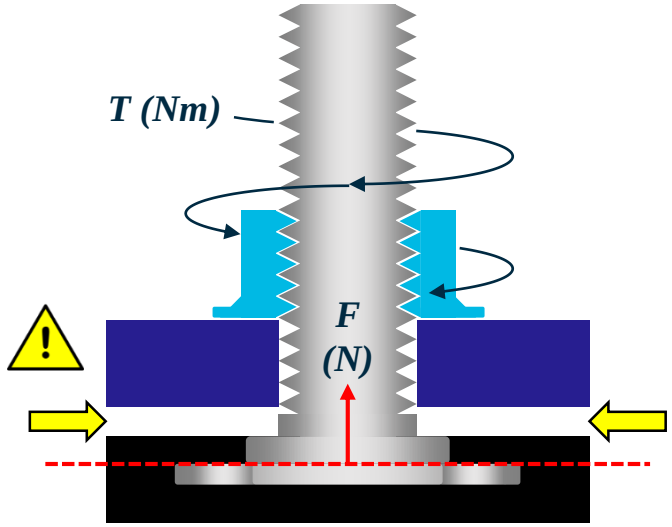
Assembly condition awareness

Correct and incorrect assembly conditions for bigHeads

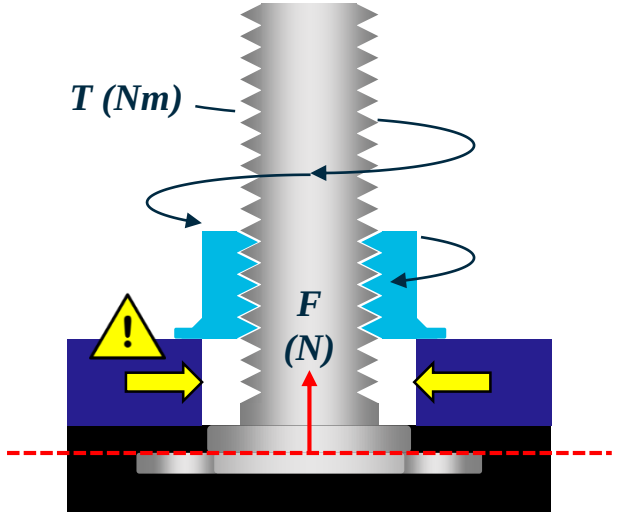


Correct condition:
adjoining component meets shoulder and clearance hole is smaller than bigHead shoulder diameter

Tightening the nut with torque T (Nm) creates a tensile force (F) that clamps the adjoining part against the fixing shoulder



Incorrect condition:
gap between component with bigHead and adjoining component

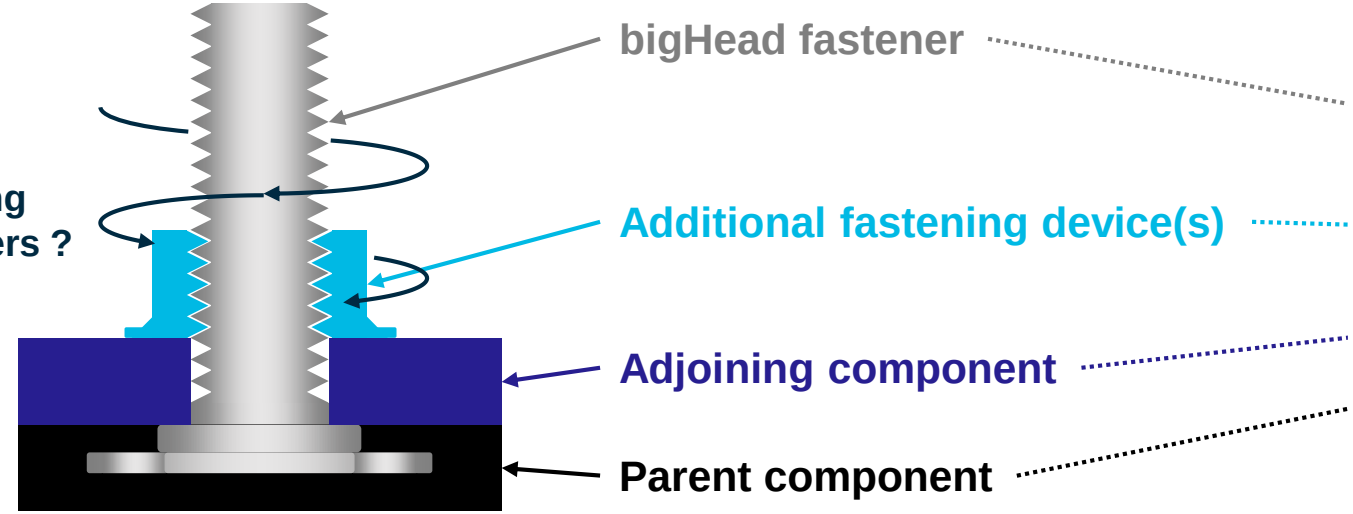


Incorrect condition:
clearance hole is greater than 80~90% of bigHead shoulder diameter

If you would like assistance or support with avoiding these incorrect conditions in your assembly or assembly design, please contact bigHead or your distributor.

Assembly tightening considerations

Factors that affect tightening torque and tightening parameters



Optimum tightening parameters for an assembly always depend on the combination of materials properties and thread friction coefficients within the assembly. Tightening parameters should always be determined and validated by appropriate testing.

Tightening parameters depend on the whole assembly

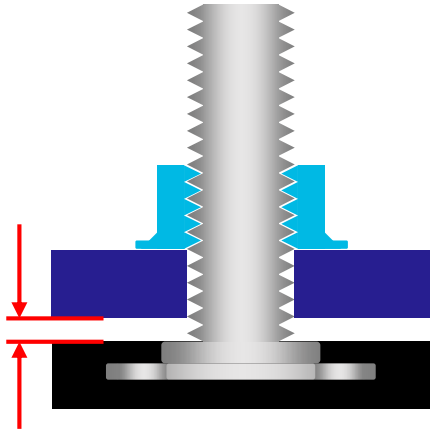
To determine the ideal tightening torque or tightening parameters for a given application, we must always consider the fastener assembly, or “system” that the bigHead will form a part of.

This includes the fastened components and their materials composition, and the combination of fastener products used to make the assembly.

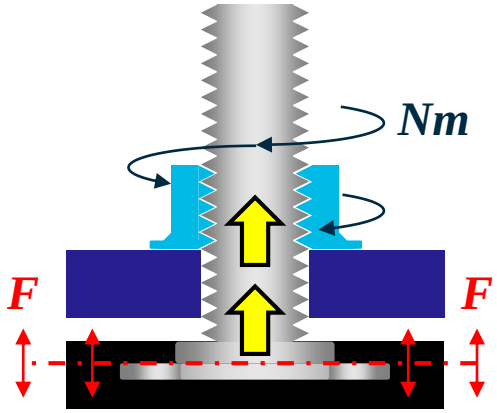
Please always contact bigHead or your distributor for further information or advice about tightening parameters and assembly/ applications testing.

Why are assembly gaps incorrect?

Example for embedded bigHead with stud fixing

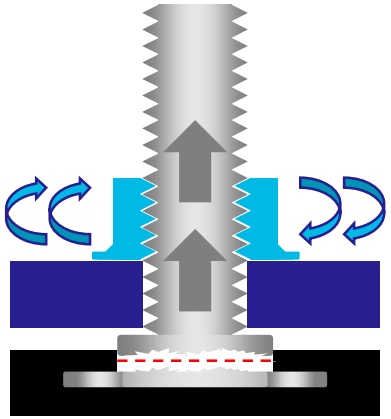


Gaps between components and adjoining components:



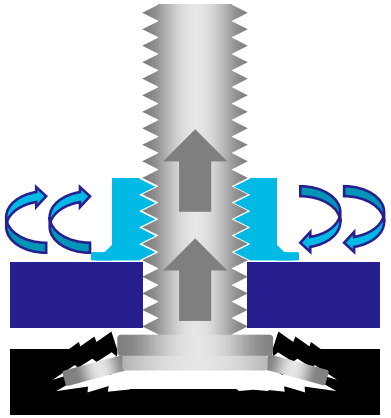
*…tensile forces (**F**) occurring during tightening operations (**Nm**) can cause upwards movement (⇧) of the fixing into the gap space:*

bigHead overload



*Tensile forces (**F**), and resultant movement of the bigHead relative to the parent component during nut tightening can cause overloading and subsequent failure of the bigHead*

Material failure

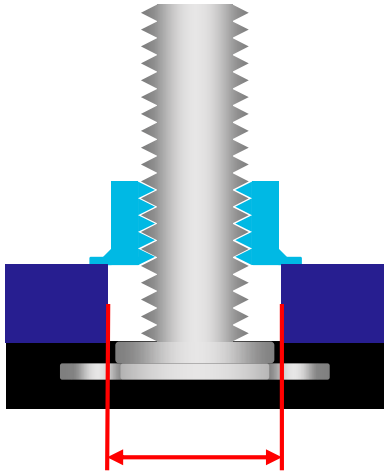


*Tensile forces (**F**), and resultant movement of the bigHead relative to the parent component during nut tightening can cause overloading of the component material around the bigHead*

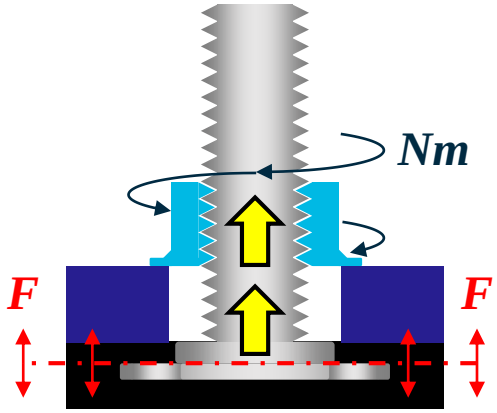
Incorrect assembly designs or assembly parameters can cause overloading or failure of the bigHead.
Please contact bigHead or your distributor for further information or advice about assembly testing.

Why are large clearance holes incorrect?

Example for embedded bigHead with stud fixing

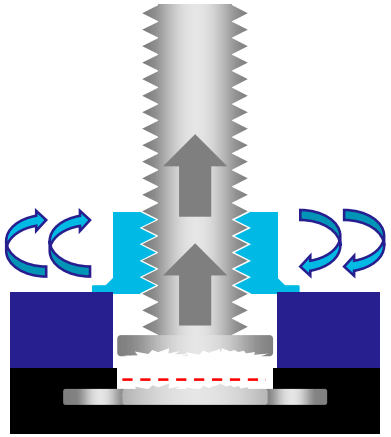


Clearance hole larger than bigHead shoulder:



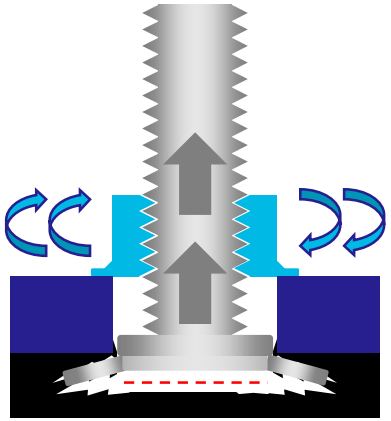
*…tensile forces (**F**) occurring during tightening operations (**Nm**) can cause upwards movement (⇧) of the fixing into the clearance space:*

bigHead overload



*Tensile forces (**F**), and resultant movement of the bigHead relative to the parent component during nut tightening can cause overloading and subsequent failure of the bigHead*

Material failure

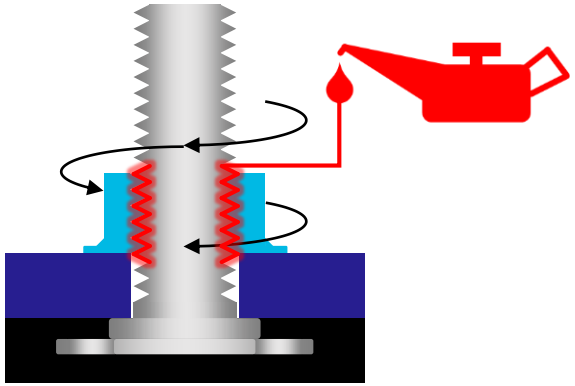


*Tensile forces (**F**), and resultant movement of the bigHead relative to the parent component during nut tightening can cause overloading of the component material around the bigHead*

Incorrect assembly designs or assembly parameters can cause overloading or failure of the bigHead.
Please contact bigHead or your distributor for further information or advice about assembly testing.

Other factors that affect assembly operations

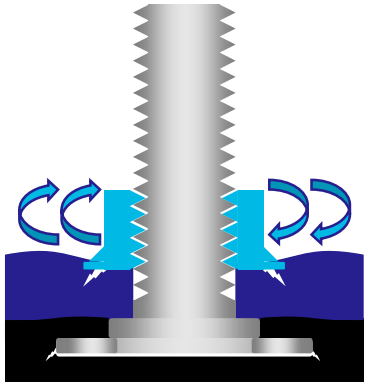
Key considerations when designing assemblies or specifying assembly parameters



Thread friction coefficients and presence of lubricants

Thread friction coefficients of different materials and/ or presence of lubricants within the assembly will affect the transfer of radial forces (applied torque) into axial forces (resultant forces).

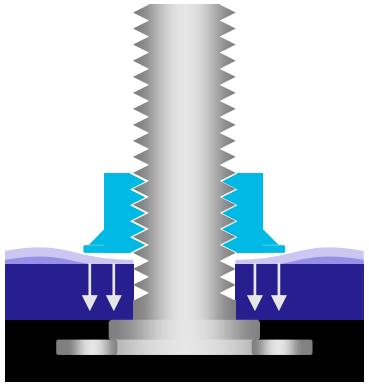
Variations in the amount of force transfer may affect the applicability/ suitability of assembly parameters, e.g. tightening torque value, so it is important to always clarify thread friction coefficient values and determine whether lubricants are present within the assembly.



Compression of the assembly materials

Tightening operations on bigHead assemblies may create high levels of compressive clamp force on the assembly materials, with subsequent damage to or failure of the materials.

Applications testing is typically required to determine clamp-load behaviour, and appropriate tightening parameters/ profiles for a given material and assembly configuration.



Creep relaxation within the assembly

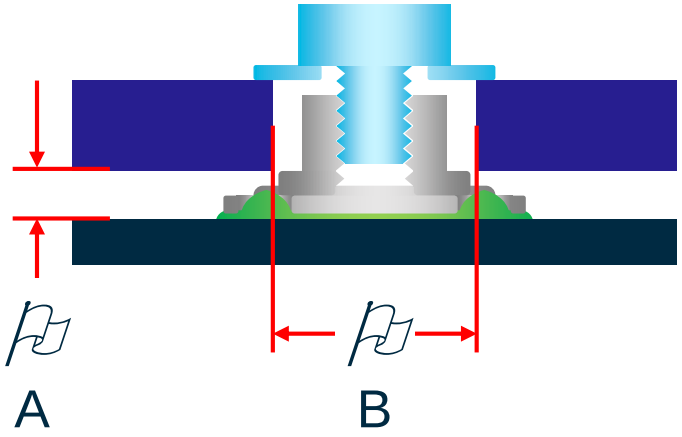
Creep relaxation is a critical consideration if the materials within the assembly are susceptible to creep or viscoelastic behaviour under compressive loading (e.g. thermoplastic polymers or polymer matrix composites).

Especially if the adjoining component material is susceptible to creep-relaxation, it is imperative to undertake appropriate testing to determine or qualify long-term assembly integrity expectations.

Please contact bigHead or your distributor for further information or advice about assembly or applications testing.

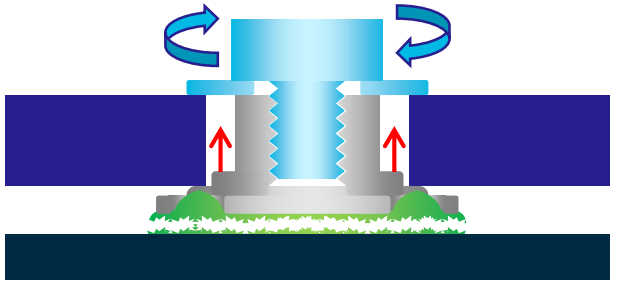
Assembly case study – adhesively bonded

Example of bigHead adhesively bonded to component



A Assembly gap between component and adjoining components

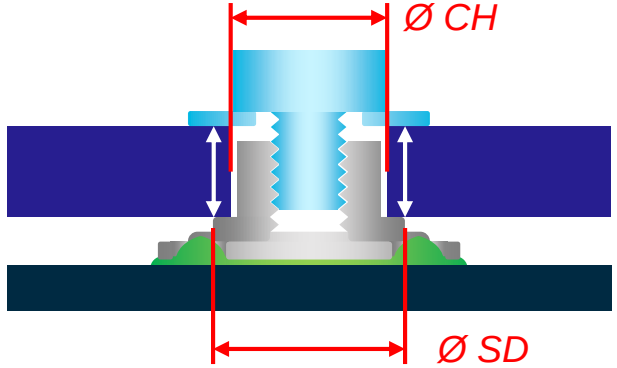
B Clearance hole in adjoining component is larger than shoulder



Possibility of bigHead detachment during tightening:

Resultant axial forces during screw tightening may cause upwards movement (↑) of the bigHead collar into the clearance hole – which may overload the adhesive joint in tension…

Always check the bigHead shoulder diameter before specifying clearance hole sizes.



Ø CH = 80~90% Ø SD

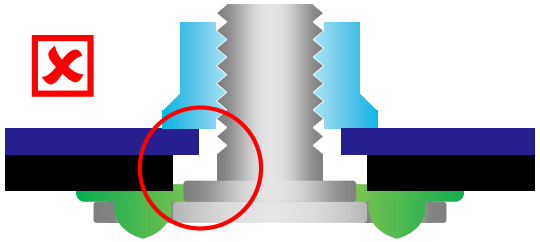
Resolution possible by reducing clearance hole size:

Ideally, clearance hole (CH) diameter is between 80% and 90% of shoulder diameter (SD)

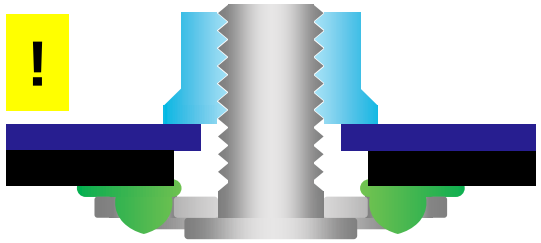
If the adjoining material is clamped against the bigHead shoulder, the correct assembly condition is achieved, even with the gap between the parts.

Assembly case study – adhesively bonded

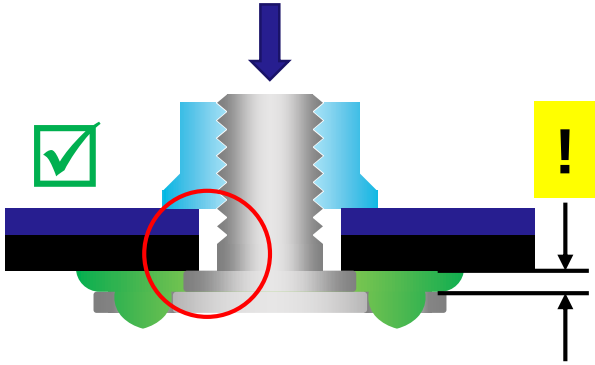
Example of bigHead adhesively bonded through component



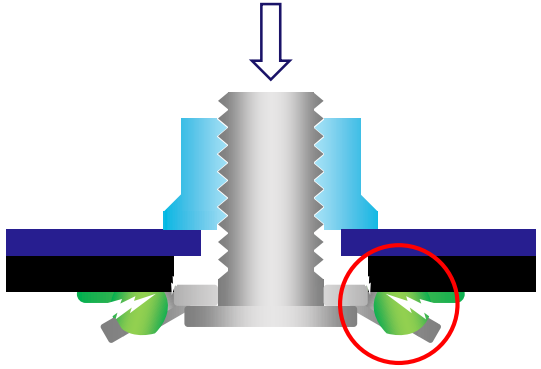
Proposed configuration with Core range product:
Incorrect condition: clearance hole is larger than shoulder diameter



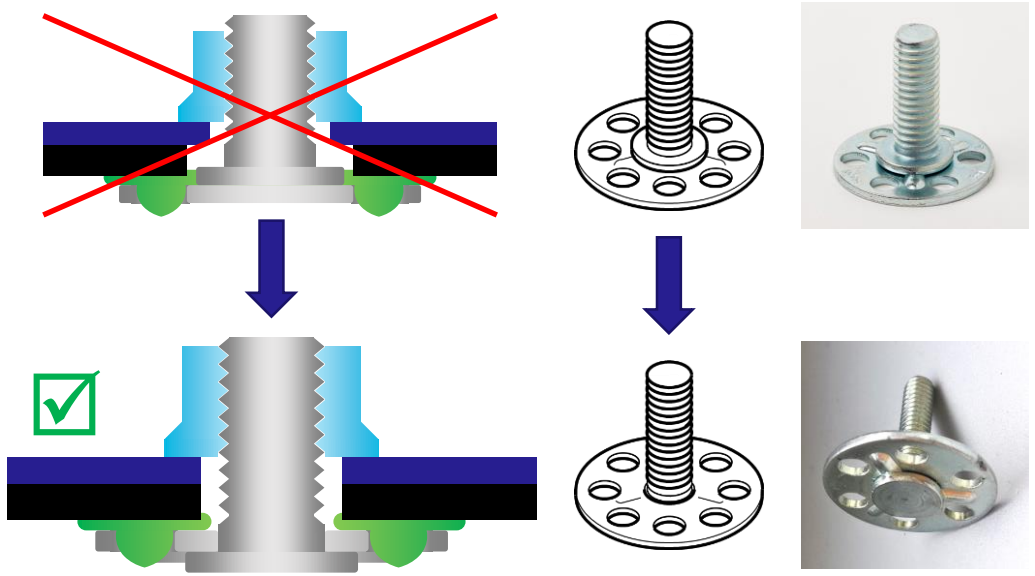
bigHead product alternative:
Reverse weld product configuration
bigHead product can withstand greater resultant force during tightening.



Correct condition achievable by reducing clearance hole size:
This will require an increase in the adhesive bondline thickness, which may be unacceptable/ undesirable.



Possible issue:
Crowning of bigHead through hole during tightening operation
This can only be checked by application/ assembly test



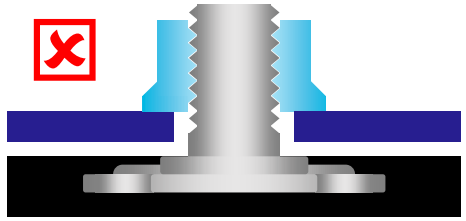
Recommendation for through-material bonding applications:

- **Minimum: Ensure clearance hole in lowermost component is smaller than bigHead shoulder diameter**
- **Optimum: Consider using reverse weld bigHead product configuration**

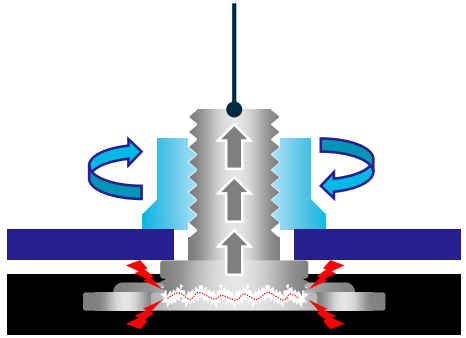
Please always contact bigHead or your distributor to discuss assembly designs: we are always happy to work together to find the optimum fastening solution for different assembly designs.

Assembly case study – embedded

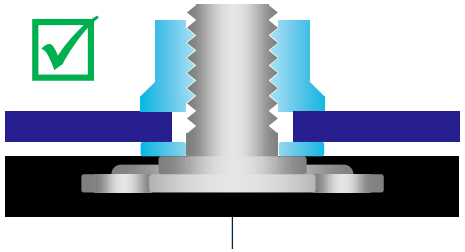
Example of embedded bigHead assembly with gaps between components



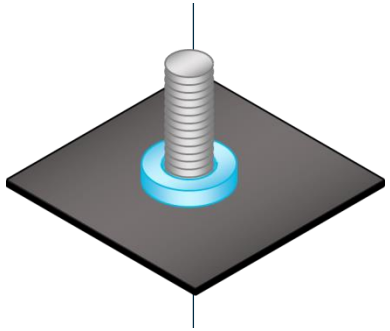
Proposed configuration with Core range product:
Incorrect condition: gap between parent & adjoining components within assembly



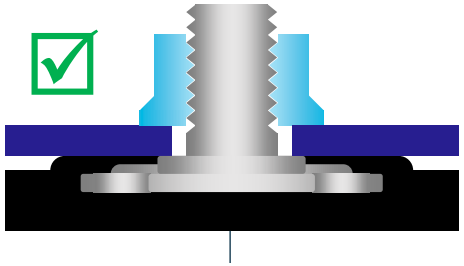
Potential failure:
Overload of bigHead, or failure of embedment material during tightening operation



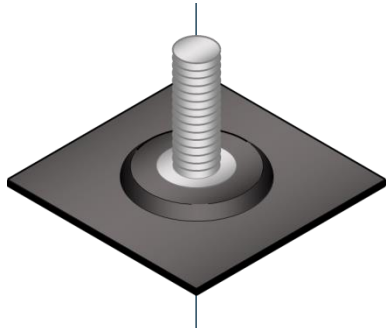
Possible solutions:
Additional washer between components



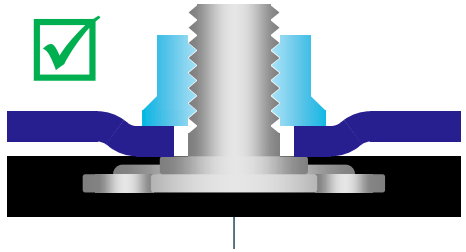
- ✓ No redesign of assembly components required
- ✗ Increases part count, cost & weight
- ✗ Increases assembly time & complexity



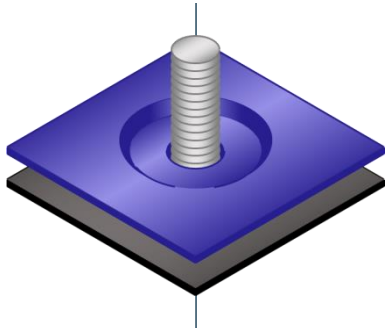
Raised pocket of material around bigHead



- ✓ No additional part count
- ✓ Minimal weight addition
- ✓ No increase to assembly time or complexity
- ✗ Requires parent component redesign



Contour feature in adjoining component



- ✓ No additional part count
- ✓ No weight addition
- ✓ No increase to assembly time
- ✗ Requires adjoining component redesign

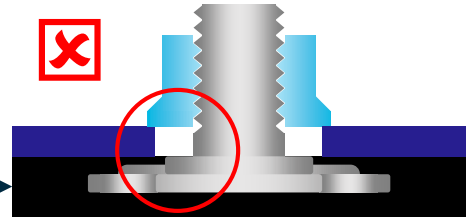
Assembly case study – embedded

Example of embedded bigHead assembly with oversize clearance hole

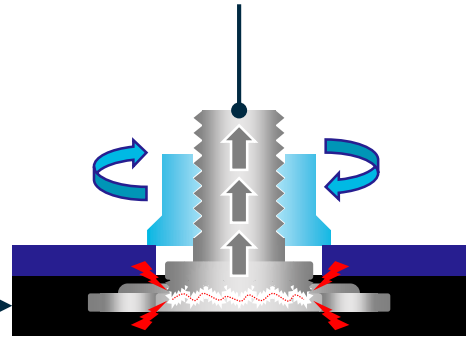
This is <u>one of the most common assembly design mistakes</u> and cause of overloading with bigHead products:

If the adjoining component has a clearance hole larger than the bigHead shoulder, and suitable assembly parameters are not determined by assembly/ applications testing, there is significant risk and high likelihood that assembly tightening operations will cause overload and subsequent failure of the bigHead.

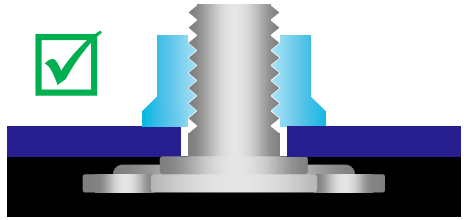
bigHead will not accept responsibility for any failures or losses arising from overloading or misuse of bigHead products.



Proposed configuration with Core range product:
Incorrect condition: clearance hole in adjoining component is larger than bigHead shoulder

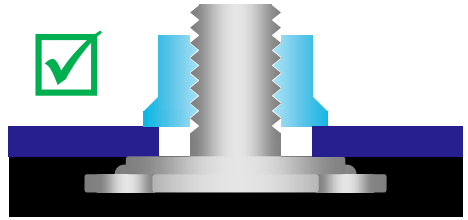


Potential failure:
Overload of bigHead, or failure of embedment material during tightening operation



Possible solutions
Correct condition by assembly design: clearance hole smaller than shoulder diameter

Clearance hole sizes
We are happy to provide recommendations on clearance hole sizes – please contact bigHead or your distributor.



Correct condition achieved by requesting specialist bigHead design: enlarged shoulder diameter permits use of larger clearance hole

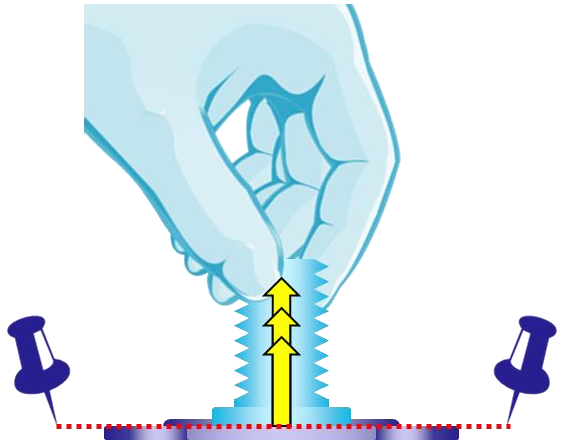
Enlarged shoulders
Please ask about our Engineered to order service if you require a bigHead with this feature

Please do not hesitate to contact bigHead or your distributor to discuss assembly designs and applications testing: it is always much easier to resolve potential issues at the design and prototyping stage than trying to resolve overload induced failures on the production line.

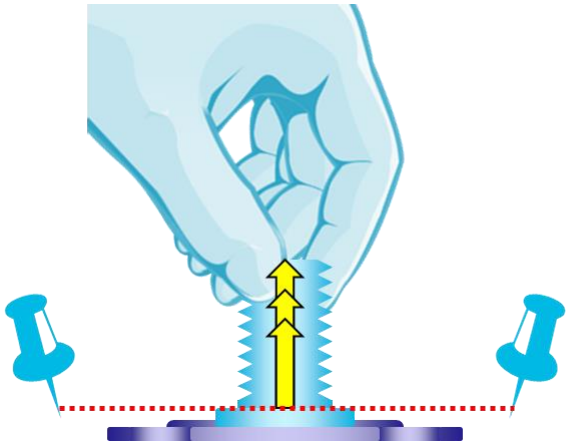
Supporting data for assembly discussions/ decisions

Information we can provide on request for Core range products – please contact us

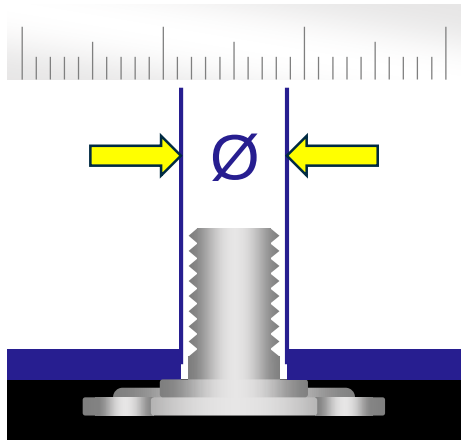
Recommended maximum weld load limits (WLL)



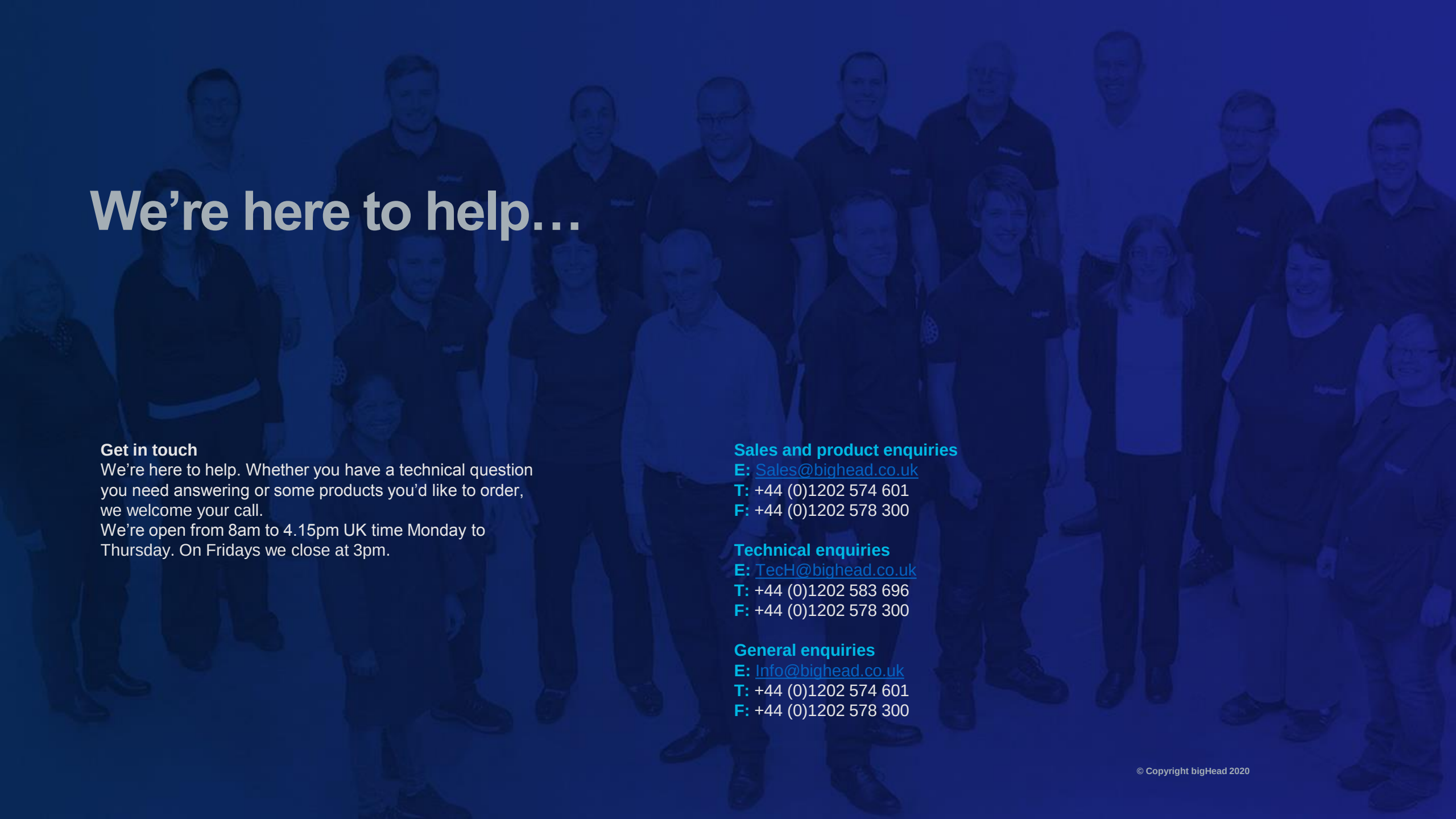
Recommended maximum fixing load limits (FLL)



Recommended maximum clearance hole sizes



Please contact bigHead or your distributor if you would like to discuss a specific assembly topic in more detail, or if you would like further information or advice on applications/ assembly testing.



We’re here to help…

Get in touch
We’re here to help. Whether you have a technical question you need answering or some products you’d like to order, we welcome your call.
We’re open from 8am to 4.15pm UK time Monday to Thursday. On Fridays we close at 3pm.

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