

Fasteners

Status Work in progress

Topics for discussion

- Are the instrument teams interested in a central procurement of remote handling bolts?
 - Centrally procured
 - Cost split between instrument
 - Reduced range of sizes and lengths that the instruments need to adjust to
- Materials in the fasteners

Section Intro

This procedure is designed to provide the preferred RH method for designing mechanical fasteners. However, should the design of a fastener assembly require features outside of this specification the ESS RH team must be consulted at the earliest possible stage. It is also essential that the ESS RH team be consulted throughout the design process to ensure all mechanical fasteners are fully RH compatible.

Error rendering macro 'toc' : null

Links

Male fasteners

Head styles, dimensions & tolerances

Hexagonal heads

Modified hexagonal head bolts (SS ISO-4014, 4016, 4017 or 4018) is the preferred style of bolt head for RH interfaces. [Where practicable, given other design constraints, this style of bolt head should be used.](#) A lead-in cone should be made to provide ease of engagement of the RH ring spanner (see Figure 1). In addition, an integral shoulder is preferable to maintain engagement of the spanner. This feature is especially useful for pop-up bolts.

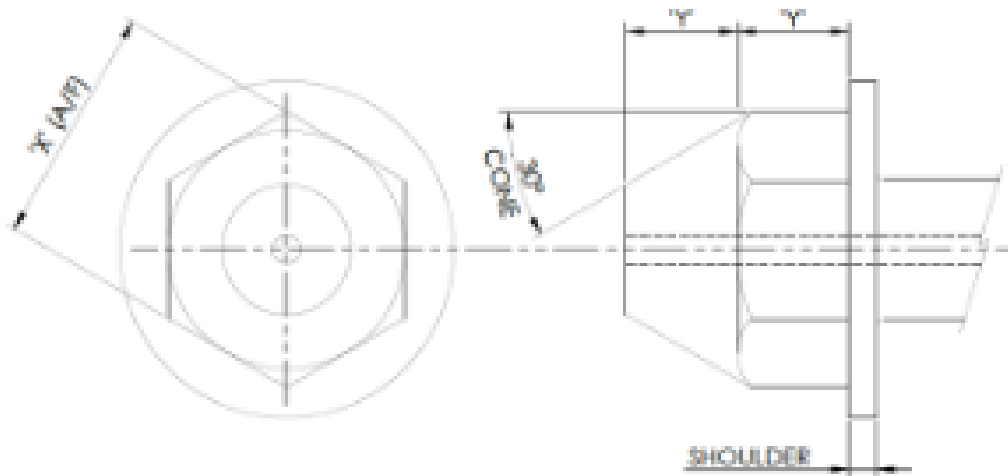


Figure 1 - Hex head modifications

No bolts should use a head size smaller than an M16. M8-M12 should use M16 head size in juncture with a colour mark to indicate size and avoid over-torque.

Table 1 - Lead-in cone head bolts

| Dimension | M8 | M10 | M12 | M16 | M20 |
|-----------|-------|-------|--------|-------|-------|
| Head size | M16 | M16 | M16 | M16 | M20 |
| Colour | Red | Blue | Yellow | White | Green |
| X (A/F) | 24.00 | 24.00 | 24.00 | 24.00 | 30.00 |
| | 23.67 | 23.67 | 23.67 | 23.67 | 29.67 |
| Y | 10.18 | 10.18 | 10.18 | 10.18 | 13.21 |

Hexagon socket heads

Standard ISO Metric plain socket heads to ISO 4762:2004 is the alternative style of bolt head.

Flat bottom hexagonal sockets are not acceptable as they do not allow misalignment of the ball-ended key to be accommodated.

Pilot holes

To assist recovery from failure all in-bunker bolts from M10 upwards shall have a 2mm diameter pilot hole drilled through the full length to enable them to be drilled out.

Thread Dimensions & Tolerances

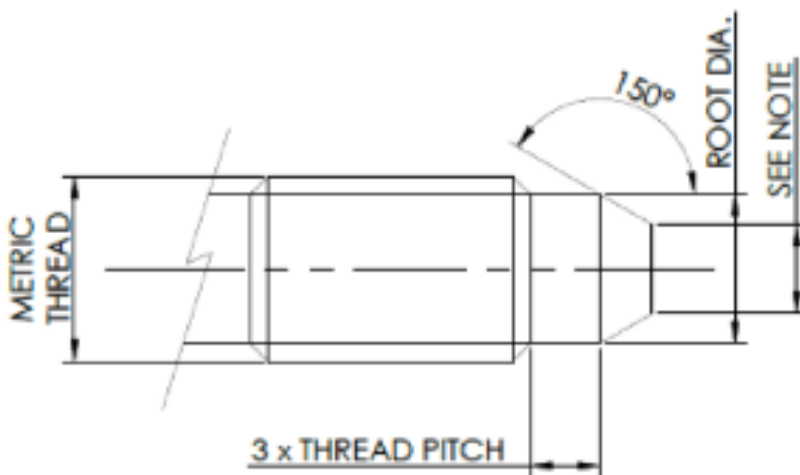
All threads shall conform to the ISO Metric Course thread form to ISO 965-1:2015. The standard thread size range shall be, M8, M10, M12, M16 & M20. For larger sizes, seek advice from the ESS RH team.

The minimum specified full thread length shall be 1 times the nominal bolt diameter. Either rolled or cut thread forms are acceptable as long as a good surface finish is provided.

Nose style

Where possible a standard bolt nose style should be used (Figure 2):

- Parallel nose diameter machined to root diameter of thread
- Length of nose is 3 times the thread pitch. This length can be reduced, where the bolt axis is maintained by its housing to prevent cross-threading, to a limit of 1.5 times the thread pitch if required.



Note: the nose should be small enough to be within capture range of the female thread

Figure 2 - Bolt nose

In some circumstances the nose of the bolt can be designed to remain proud of the component and act as a dowel in aligning the component being installed. The use of a protruding nose for this purpose is valid for all bolt designs – pop-up & non pop-up.

Captive fasteners

Pop-up fasteners

It is preferable that all mechanical fasteners be held clear of mating components faces during assembly. It is also preferable if fasteners are held in place once disengaged to prevent components being dropped and lost in the bunker area. The best method of achieving this is by using captive pop-up fasteners. Given here are examples of a range of methods that can be used to provide a captivated pop-up fastener. The desired spring load is from 5 to 15 N.

Having an exposed head (Figure 3, Figure 4 and Figure 5) is preferable, however, there are circumstances where the head needs to be protected or where there is no room to use thread captivation. For these situations captivation over the bolt head should be used (Figure 6). It must be ensured that the socket head is always accessible through the key access. Ensuring that the head of the bolt is suitably guided is therefore important for this design.

All RH fasteners should be vertically orientated axes to simplify the interface and avoid assembly difficulties. Consideration should also be made for the RH tooling to be used – the space envelope that this will occupy needs to be taken into account at the design stage.

Pop-up fasteners can be designed with the bolt nose under flush (see figure 3 or figure 4) or protruding from the component (see figure 5) to aid hole alignment during assembly.

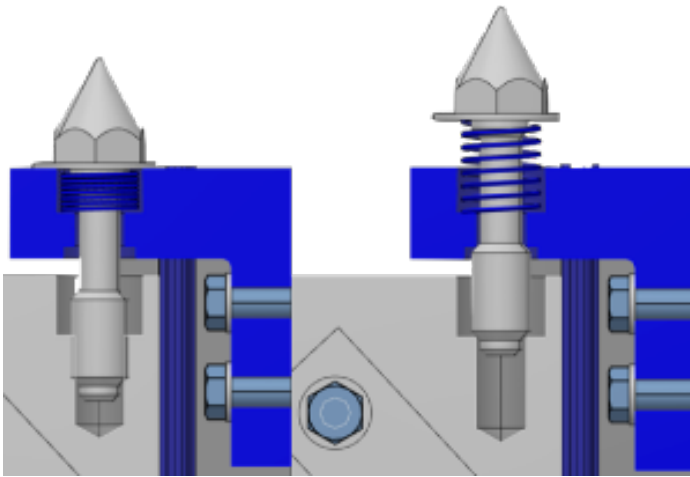
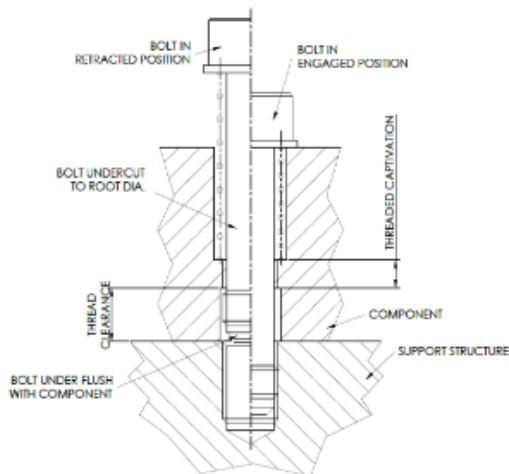


Figure 3 - Thread captivation - spring flush - Hexagonal head example



Note: This design is only suitable for light bolt loads.

Figure 4 - Thread captivation - spring flush - socket head example

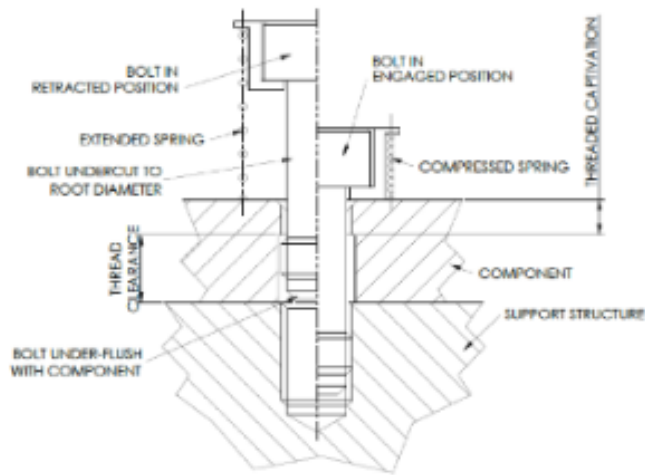


Figure 5 - Thread captivation - spring not flush

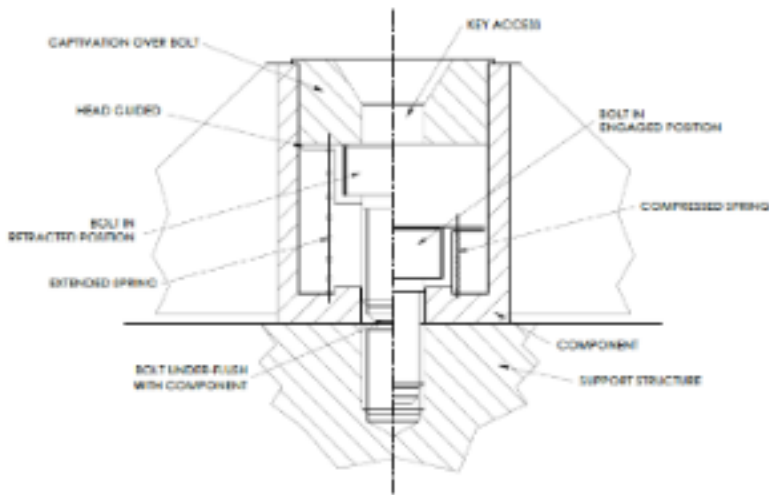


Figure 6 - Captivation over bolt head

Non pop-up fasteners

The design principles applied to pop-up captivated bolts can also be applied to non pop-up fasteners (figure 5). Such captive fasteners can only be used where the protruding bolt does not inhibit assembly. For this reason it is essential that all RH fasteners are on a parallel axis to simplify the assembly process.

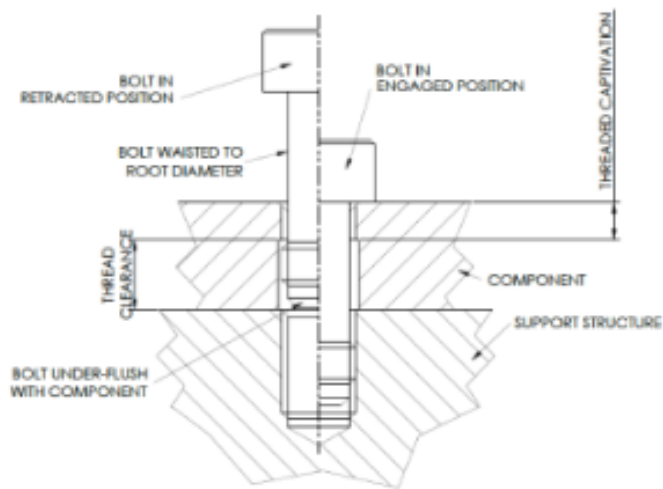


Figure 5 - Non pop-up bolt

Female fasteners

All threads shall conform to the ISO Metric Course thread form to ISO 965-1:2013. The standard thread size range shall be M8, M10, M12, M16 & M20. For larger sizes, seek advice from the ESS RH team.

Joint tightening

Tightening torques for remote handling bolts are limited to those in Table 4. These tightening torque limits allow for the potential need for twice the tightening torque to loosen the fastener. For larger bolt sizes, seek advice from the ESS RH team.

Table 2 - Tightening torques

| | M8 | M10 | M12 | M16 | M20 | Unit |
|--------|----|-----|-----|-----|-----|------|
| Torque | 18 | 37 | 60 | 160 | 300 | Nm |

Detailed instructions regarding torque tightening specific to the equipment being installed (eg. tightening sequence) must be provided to RH operational staff by an appropriate method / procedure.

Standard components

Table 3 - Standard RH fasteners

| Size | Length | Spring | Model number |
|------|--------|--------|--------------|
| | | | |
| | | | |
| | | | |

Related Articles

References

Contributors

Related JIRA issues