

# **T Level Technical Qualification in Engineering, Manufacturing, Process and Control**

**Employer-Set Project  
(8713-033)**

**Sample Brief**

**First teaching from September 2022  
Version 1.0**

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## The employer

DH Engineering Ltd is a medium sized engineering company. It has been in business for 17 years primarily undertaking manufacture of machined components to customer designs.

Machining tasks range from the manufacture of one-off components and assemblies often made by hand on manual machines, through to larger batches of components normally manufactured on CNC machines.

Complex shapes whether in batches, or a single item are all machined on 5 axis CNC machines to reduce the time it would take to produce these manually and reduce the skilled labour required. However, assembly and finishing operations are normally undertaken manually because of the significant cost in creating machinery and AI to undertake what is a complex handling task.

## The project

DH Engineering Ltd has received an order for 350 bespoke shoulder screws which comprise of a:

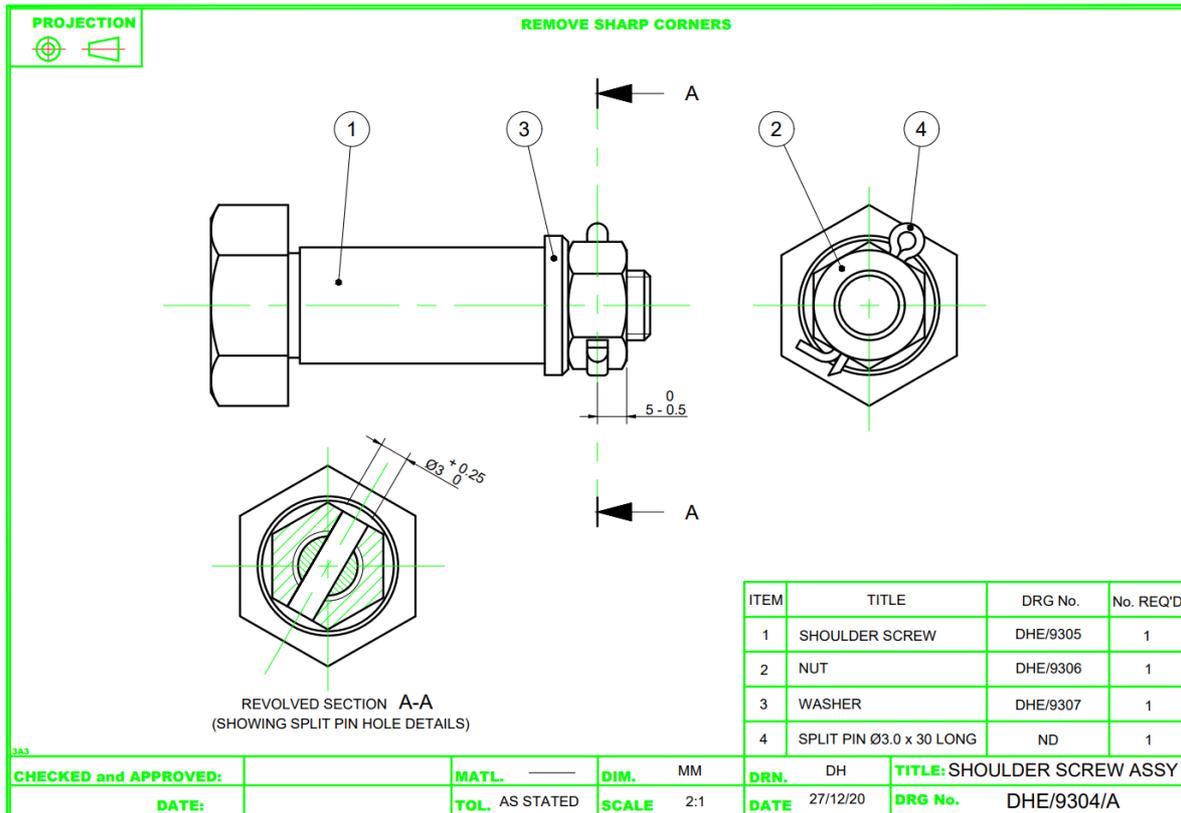
- shoulder screw body
- nut
- washer
- split pin (standard bought in part).

The split pin is to be inserted through a hole drilled through the nut and threaded portion of the shoulder screw body following assembly.

Whilst all of the individual components have been manufactured on a CNC machine, assembly needs to be undertaken by hand, and the hole for the split pin is drilled manually. This is due to the complexity of holding the screw body, fitting the washer, screwing on the nut followed by cross drilling and insertion of a split pin. Whilst it is possible to automate this process, it would be uneconomic.

The current arrangement is to hold the assembly in a standard Vee-Block and drill the hole using a centre drill, followed by standard twist drill. However, there is a problem with this method as the current method is resulting in holes being drilled out of position on the flat of the nut and not passing through the centre of the thread and not exiting the nut in the correct position.

This is leading to increased scrap rates and takes a significant amount of time to correctly drill each assembly. Figure 1 below shows the final assembly with the split pin inserted through the drilled hole and gives the size and position of the hole to be drilled.



**Figure 1 Shoulder Screw Assembly and Split Pin Hole Details**

Given the number (350) of assemblies to be drilled, and the issue with inaccurate drilling, it has been decided that a drill jig is required to reduce the drilling operations to one single activity and remove any marking out operations and centre drilling operation. This will significantly reduce the time taken to accurately align and clamp the assembly, will remove the requirement to centre drill, ensure accurate alignment and remove the principle source of defects.

It is possible to automate the assembly, drilling, and insertion of the split pin but the costs of doing this are significant. Drilling by hand using simple workshop tooling and marking out techniques is possible, however would require an additional centre drilling operation after marking out and take a significant amount of time. The most economic approach is for a simple drill jig to be designed which, when manufactured, will allow the workpiece assembly to be firmly held in the correct orientation and a quick single drilling operation undertaken.

## Project tasks

As an Engineering Technician, you are tasked with designing a simple drill jig which can be used to hold the component assembly ready for drilling so that the cross hole can be efficiently, and accurately, drilled using a simple workshop pillar drill as shown in Figure 1. To assist the design process the sizes of the individual components are identified in figure 2, figure 3, and figure 4 below. Your drill jig must ensure that the hole is drilled through the centre of one face of the nut, pass through the centre of the Shoulder Screw thread and exit through the centre of the opposing centre face of the nut, as shown in the assembly drawing in Figure 1, within  $\pm 0.5\text{mm}$  of the nominal position.

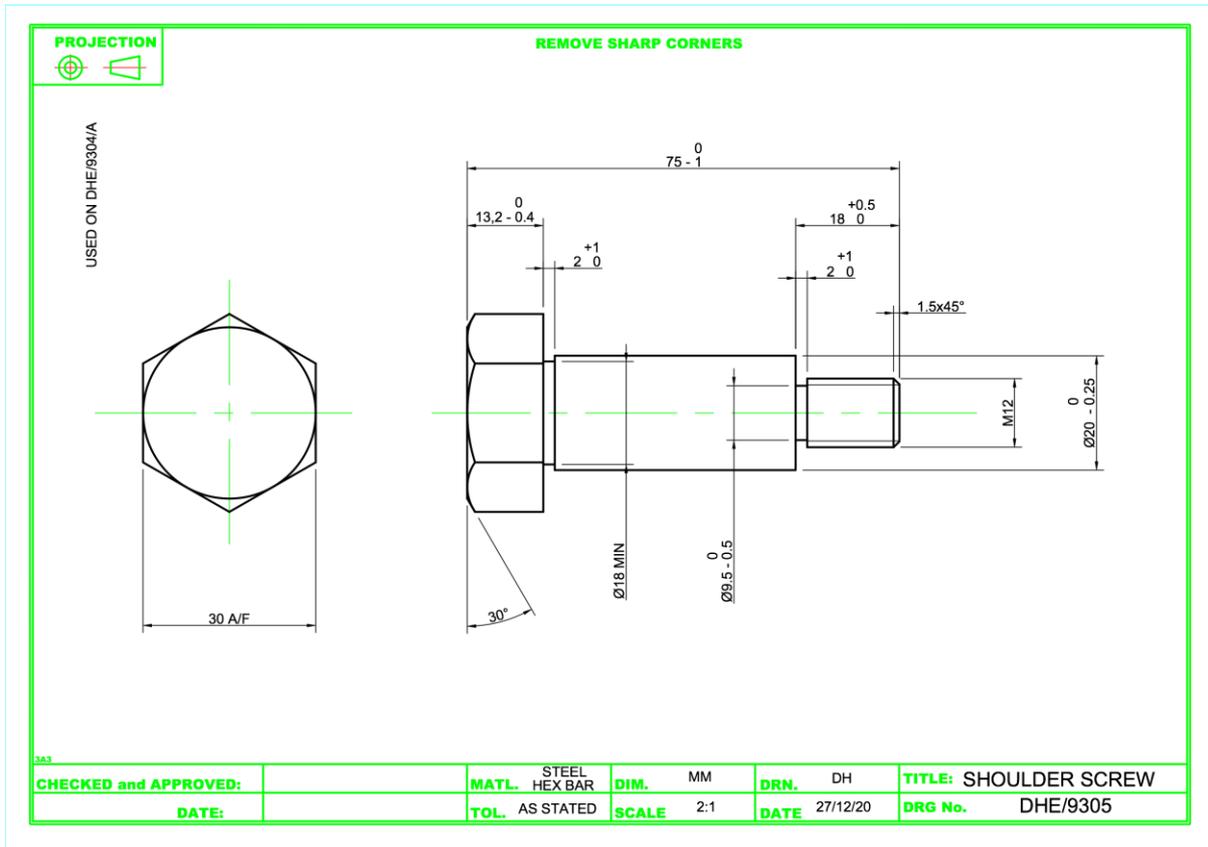


Figure 2 Shoulder Screw Body

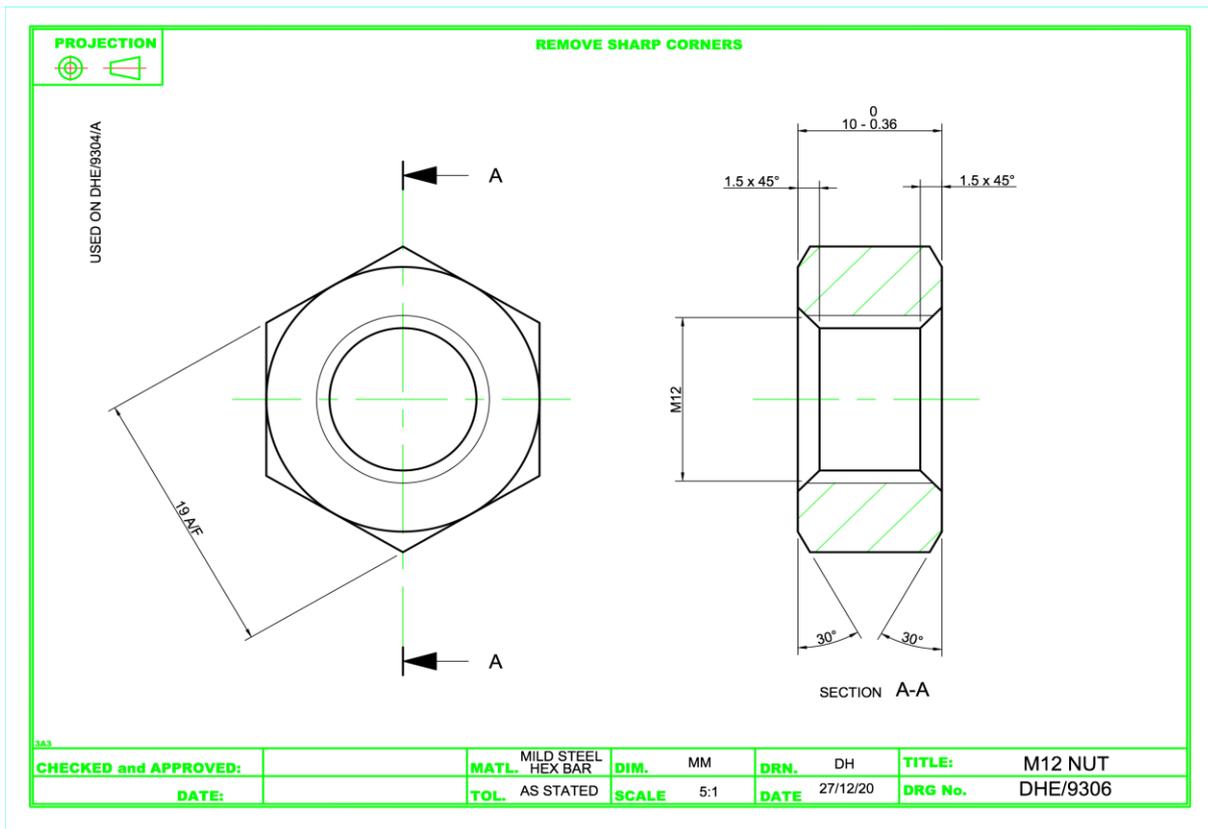


Figure 3 Nut

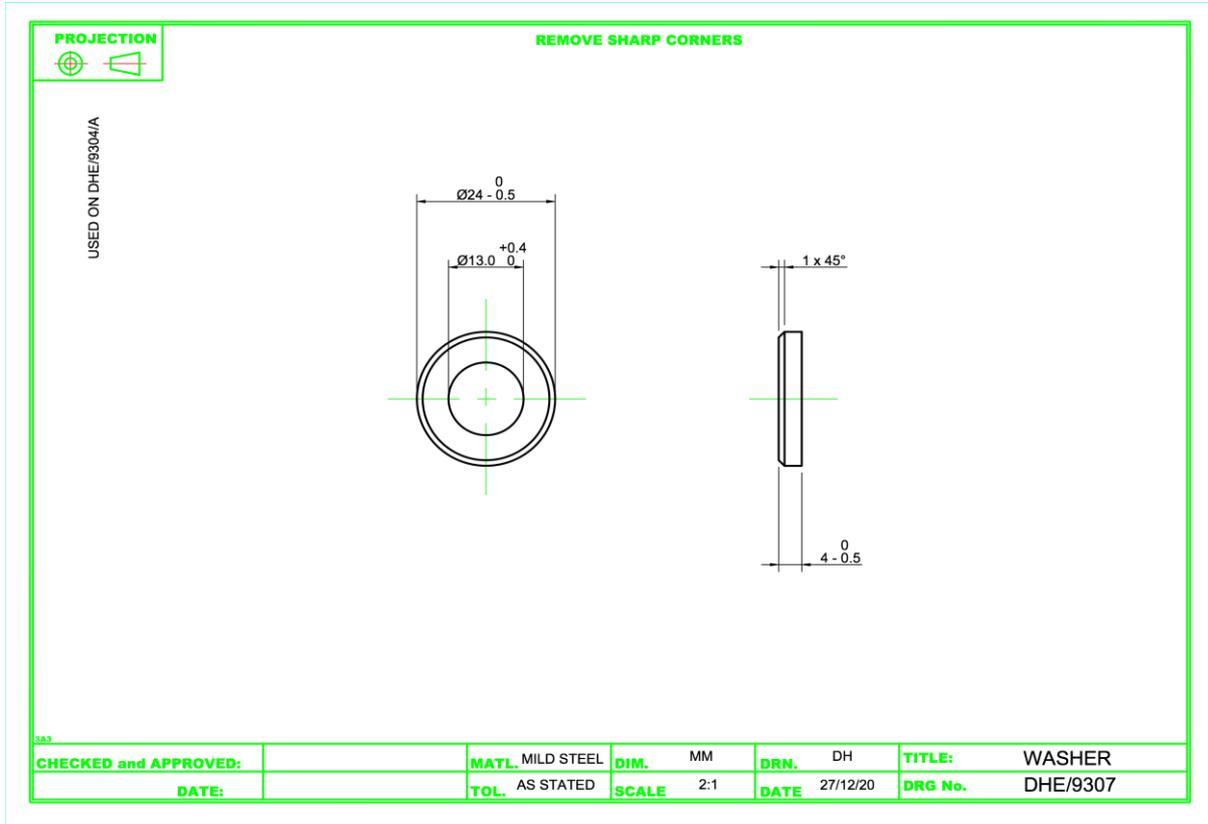


Figure 4 Washer

## Specific issues

The DH Engineering Ltd Manager has identified some specific issues which relate to this task:

- the hole has to be drilled through the centre of the flat of the nut on both the entry and exit sides in accordance with the assembly drawing as shown in Figure 1
- the basic design of the dimensioned drill jig assembly has a tight timeline for completion and must be ready in 1 weeks' time
- the jig must be designed so it is capable of being used by semi-skilled operators using hand operations only, and the jig must not require any automation.

## General issues

The Engineering Manager has also noted the following more general considerations that relate to this project brief:

- health and safety risks and issues i.e. consider mass, and ergonomic issues
- component insertion/extraction
- checks required to ensure quality outputs.

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