# T Level Technical Qualification in Engineering and Manufacturing – Manufacturing, Processing and Control

## 8713-332 Machining and Toolmaking Technologies

## Grade standard exemplification material

## Distinction - summer 2024

Version 1-0

| Version and date | Change detail | Section | Question |
|---|---|---|---|
| v1-0<br>Oct 2024 | | | |

# Contents

# Introduction

### Summer 2024 Results

This document is aimed at providers and learners to help understand the standard that was required in the summer 2024 assessment series to achieve a distinction grade for the 8713-332 Machining and Toolmaking Occupational Specialism (OS).

The grade standard exemplification evidence (Grade SEM) provided for the distinction grade displays the holistic standard required across the tasks to achieve the distinction grade boundary in the summer 2024 series.

The aim of these materials is to provide examples of knowledge, skills and understanding that attested to distinction competence in summer 2024. It is important to note that in live assessments a candidate's performance is very likely to exhibit a spikey profile and standard of performance will vary across tasks.

The Occupational Specialism is graded Distinction, Merit, Pass or Unclassified.


The distinction grade boundary is based on a synoptic mark across all tasks. The materials in this Grade SEM are separated into two sections as described below. Materials are presented against a number of tasks from the assignment.

### Tasks

This section details the tasks that the candidate has been asked to carry out. What needs to be submitted for marking and any additional evidence required including any photograph/video evidence. Also referenced in this section are the assessment themes the candidates were marked against when completing the tasks within it. In addition, candidate evidence that has been included or not been included in this Grade SEM has been identified within this section.

In this Grade SEM there is candidate evidence from:

Task 1 Planning
Task 2 Production
Task 3A Quality review
Task 3B Evaluation and recording
Task 3C Handover

**Candidate evidence**

This section includes exemplars of candidate work, photographs of the work in production (or completed) and practical observation records of the assessment completed by centre assessors. This was evidence that was captured as part of the assessment and then internally marked by the centre assessor.

The Occupational Specialism brief and tasks can be downloaded from here.

**Important things to note**:

- We discussed the approach to standard setting/maintaining with Ofqual and the other awarding organisations before awarding this year. We have agreed to take account of the newness of qualifications in how we award this year to recognise that students and teachers are less familiar with the assessments (grading-arrangements-for-vtqsand-technical-qualifications-within-t-levels-in-the-academic-year-2023-to-2024), whilst also recognising the standards required for these qualifications.

- The evidence presented, as a whole, was sufficient to achieve the distinction grade. However, performance across the tasks may vary (i.e. some tasks completed to a higher/lower standard than distinction grade).

# Grade descriptors

**To achieve a distinction, a candidate will be able to:**

Competently and thoroughly interpret technical information, applying technical skills to plan, assess risk and follow safe working methods to practical tasks and procedures to an exemplary standard in response to the requirements of the brief, producing an excellent quality of work that meets tolerances, regulations and standards.

Thoroughly prepare working area, mitigating potential risks prior to commencing tasks and consistently apply exemplary housekeeping techniques during tasks.

Demonstrate exemplary technical practical skills in machining materials to produce components and products using a range of manual and automated equipment and machinery activities that are in line with industry standards and meet the requirements of the brief.

Demonstrate exemplary ability to follow procedures to produce or maintain working components.

Work safely and make informed and appropriate use of tools, materials and equipment within the working environments for machining and commissioning activities.

Identify causes and diagnose problems or common issues related to production control, operating procedures and quality control and have a thorough understanding and the skills to be able to resolve and rectify them.

Consistently and accurately use industry and technical terminology across different communication methods with full consideration of technical and non-technical audiences.

Demonstrate exemplary knowledge and understanding of the principals and processes required for machining and toolmaking.

# Task 1 Planning

| | |
|---|---|
| **Assessment number (eg 1234-033)** | 8713-332 |
| **Assessment title** | Machining and Toolmaking Technologies Occupational Specialism |

| | |
|---|---|
| **Candidate name** | <first name> <surname> |
| **City & Guilds candidate No.** | ABC1234 |

| | |
|---|---|
| **Provider name** | <provider name> |
| **City & Guilds provider No.** | 999999a |

| | |
|---|---|
| **Task(s)** | 1 |
| **Evidence title / description** | Resource list with justifications<br>Completed risk assessment<br>Method statement with justifications<br>Quality check sheet template |
| **Date submitted by candidate** | DD/MM/YY |

# Task 1

**Assessment themes:**

- Health and safety
- Planning and preparation
- Production
- Quality review and evaluation

You must:

- produce a resource list with justifications and measuring equipment calibration check results recorded
- produce a risk assessment
- produce a method statement
- produce a quality check sheet

**Additional evidence of your performance that must be captured for marking:**
N/A

## Candidate evidence

| Hazard | Risk | Control | Likelihood | Severity | Risk Rating |
|---|---|---|---|---|---|
| Revolving machinery | People or clothing in close proximity to revolving machinery may become entangled within the machine causing injury | When operating machinery hands are to be kept away from revolving machinery.<br><br>Guards with limit switches are in place to stop the machine engaging when the operator is in danger.<br><br>E-Stops are also implemented on machines so that it can be stopped in case of emergency.<br><br>All jewellery and lanyards are to be tucked in or removed.<br><br>PPE, workshop overall used to cover up and safety glasses worn at all times.<br><br>No gloves are to be worn while operating revolving machinery. | 1 | 4 | 4 |
| Ejected material | Swarf, cut offs, parts and tooling could become ejected from the machine causing damage to the face and eyes as well as other parts of the body | Safety guards are in place to protect operators from ejected materials and the machine can't be turned on util theses guards are in place.<br><br>PPE, workshop overalls will protect skin from ejected materials and safety glasses are used to protect eyes.<br><br>All swarf buildups to be cleared at regular intervals to prevent mass ejection. | 2 | 2 | 4 |

| | | | | | |
|---|---|---|---|---|---|
| Working within the machine | When working within the machining space of workshop machinery measuring or deburring there is a risk of being cut by tooling or swarf | Safety guards ensure the machine is off when working within the operating space.<br><br>All tooling is to be moved before doing any tasks such as measuring or deburring.<br><br>PPE, workshop overalls to be worn to protect skin from swarf within the machine safety glasses to be worn at all times. | 1 | 3 | 3 |
| Moving around the workshop | When moving around the workshop there is risk of slips trips and falls, when manual handling is involved the risk increases dude to movement of heavy items. This can also include repetitive operations leading to RSI | All movement of heavy objects around the workshop should be done in accordance with manual handling regulations, lifting aids and trolleys are available at all times to help.<br><br>Any coolant leaks noticed should be cleaned up immediately to prevent slips trips and falls.<br><br>Repetitive movements such which are difficult, or stain should use aids such as steps to reduce the risk of developing a Repetitive Strain Injurie. | 2 | 2 | 4 |
| Hazardous substances | Hazardous substances such as coolant, oils, grease and cutting compound are all skin irritants and prolonged exposure can lead to dermatitis | PPE, workshop overalls are worn to protect the skin from hazardous substances and safety glasses are worn to prevent these substances from being slashed into your eyes.<br><br>Barrier crem is available at the entrance to the workshop to be applied before machining, and heavy-duty hand wash is available to be used to | 3 | 2 | 6 |

| | | | | | |
|---|---|---|---|---|---|
| | | remove any hazardous substances from your skin after machining.<br><br>All hazardous substances when not in use should be stored in a safe secure location as per COSHH regulations | | | |
| Electrical incident | Working with electrical machinery could cause electric shock due to malfunction especially on CNC machines | Machine safety checks make sure that all machine E-Stops are functioning correctly so that in case of malfunction the E-stop can be pressed.<br><br>Rubber mats are also used when operating machinery to reduce the chances of electrical shock. | 1 | 3 | 3 |
| Burns | When machining, parts and swarf are usually hot due to cutting temperatures and can burn the skin when in contact | PPE, overalls are to be worn at all times, these protect the skin from any hot swarf that many come in contact with the skin, safety glasses are also used to protect the eyes from contact with hot objects.<br><br>Machine coolant is to be used to reduce the machining temperatures of particularly hot processes. | 2 | 3 | 6 |
| Noise | The workshop if full of loud machinery that when using for extended periods of time can cause damage to your ears including tinnitus in long the long run | When in the workshop regular breaks from machining are implemented to ensure that ears are given a break from the loud noise.<br><br>Ear plugs are also available to anybody with sensitive ears and can be obtained on request. | 1 | 2 | 2 |

**RISK ASSESSMENT**

| Risk Rating | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 4 | 5 |
| 2 | 2 | 4 | 6 | 8 | 10 |
| 3 | 3 | 6 | 9 | 12 | 15 |
| 4 | 4 | 8 | 12 | 16 | 20 |
| 5 | 5 | 10 | 15 | 20 | 25 |

## OPERATION PLAN

| Op No. | Process | Machine tools and equipment | Speeds and feeds | description | Quality checks | |
|---|---|---|---|---|---|---|
| **Press Tool** | | | | | | |
| 1 | Obtain risk assessment and up to date drawings | CNC Lathe | N/A | Make sure that the risk assessment and drawings are in date and for the corrects part and machine | Check date and revision | |
| 2 | Complete machine safety checks and tool checks | CNC Lathe | N/A | Check all points on the machine safety checks and get them signed off by workshop staff, make sure the correct tools for the job are loaded and match the sheet | Make sure to get signed | |
| 3 | Obtain stock material and debur | CNC Lathe | N/A | Obtain 75 mm x 48 mm Ø Low Carbon Steel and debur | Make sure all sharp edges are removed | |
| 4 | Power on machine and reference | CNC Lathe | N/A | Move the X and then the Z axis back to their limit switches and let them datum themselves | Make sure the machine shown the referenced symbol | |
| 5 | Upload programme and male live | CNC Lathe | N/A | Upload the programme to the machines control and make it live in the machine by selecting it | Check it is live | |
| 6 | Simulate and dry run | CNC Lathe | Running speeds as per programme | Make sure the simulations that you run match the part drawing and that the dry run doesn't have and iritic or dangerous movements | Check against drawings | |
| 7 | Chuck workpiece and set datum | CNC Lathe<br>Chuck key | 1000 rpm<br>Hand feed | Chuck the part as per machine SOP and skim front face to set G54 work offset | Make sure G54 is selected | |
| 8 | Run programme | CNC Lathe | Running speeds as per programme | Control feed by hand for first few cuts to make sure it is cutting correctly | Check size once finished, adjust and run again if needed | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 9 | Reverse part in chuck and set datum | CNC Lathe<br>Chuck key | 1000 rpm<br>Hand feed | Skim face and set G54 datum on end face | Make sure G54 is selected | |
| 10 | Load second side programme and make live in the control | CNC Lathe | N/A | Load the programme and make sure it is live in the control | Check it is the second side | |
| 11 | Simulate and dry run | CNC Lathe | Running speeds as per programme | Make sure the simulations that you run match the part drawing and that the dry run doesn't have and iritic or dangerous movements | Check against drawings | |
| 12 | Run programme | CNC Lathe | Running speeds as per programme | Control feed by hand for first few cuts to make sure it is cutting correctly | Check size once finished, adjust and run again if needed | |
| 13 | Clean down machine | CNC Lathe<br>Dustpan and brush | N/A | Make sure all mechanisms are clean and dry | Sigh of clean down sheet | |
| **Slip Ring** | | | | | | |
| 1 | Obtain risk assessment and up to date drawings | XYZ Lathe | N/A | Make sure that the risk assessment and drawings are in date and for the corrects part and machine | Check date and revision | |
| 2 | Complete machines safety checks | XYZ Lathe | | Make sure that al safety checks are complete and satisfactory | Get list signed by workshop staff | |
| 3 | Obtain material and debur | XYZ Lathe | | Obtain 55mm x Stock Ø Brass bar and debur | Make sure there are no sharp edges | |
| 4 | Secure part in chuck and face to clean | XYZ Lathe<br>Finish cutter | 1320<br>Hand feed | Secure part in chuck 15mm protruding and face to clean 0.2mm cuts at a time, pen the face to make sure it comes clean | Make sure that all sharpie is gone<br>Ensure to use the non-ferrous boring tips | |
| 5 | C/Drill & Drill Ø28 rough hole | XYZ Lathe<br>Bs4 C/Drill<br>Ø13.75 Drill<br>Ø28 Drill | 1000<br>660<br>360<br>Hand feed | C/drill hole halfway up the drill, Drill 13.75 Ø X 20mm, then 28 Ø X 20mm | Ensure coolant is always on | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | Boar Ø30mm X 15mm | XYZ Lathe<br>Boaring bar | 1320<br>0.5mm/s | Boar to Ø30mm X 15mm ensure to use coolant and a slow feed rate | Ensure to use the non-ferrous boring tips | |
| 7 | Turn OD Ø40 X 15mm | XYZ Lathe<br>Finish cutter | 1320<br>0.5mm/s | Turn down to Ø40 X 15mm making sure to take even cuts to help improve cutting condition at a slow feed rate and with plenty of coolant to produce a good surface finish | Ensure to use the non-ferrous boring tips | |
| 8 | Chamfer 1mm X 45° | XYZ Lathe<br>Finish cutter | 1320<br>Hand feed | Set tool post to 45° and zero tool on the face then cut in and down by 2mm on Ø to produce a 1mm X 45° chamfer | Ensure to use the non-ferrous boring tips | |
| 9 | Part off 11mm | XYZ Lathe<br>Part off tool | 660<br>Hand feed | Use feeler gauge to set the length on the front face then wind back to 11mm and part of ensuring to use plenty of coolant | Use a piece of datum bar to catch thew ring to avoid damage to surface finish | |
| 10 | Secure part in chuck and OAL 10mm | XYZ Lathe<br>Finish cutter | 1320<br>Hand feed | Use a parallel to make sure the part is sat flat in the check and then take 0.2mm cuts to bring it down to length constantly checking length | Ensure to use the non-ferrous boring tips | |
| 11 | Clean down and debur | XYZ Lathe<br>Dustpan and brush | N/A | Make sure all mechanisms are clean and dry, and that the part is deburred and free of sharp edges | Sigh of clean down sheet | |
| **Die Block** | | | | | | |
| 1 | Obtain risk assessment and up to date drawings | XYZ Mill & Lathe | N/A | Make sure that the risk assessment and drawings are in date and for the corrects part and machine | Check date and revision | |
| 2 | Complete machines safety checks | XYZ Mill & Lathe | | Make sure that all safety checks are complete and satisfactory | Get list signed by workshop staff | |
| 3 | Obtain material and debur | XYZ Mill | | Obtain 22mm X Stock X 38mm and debur | Make sure there are no sharp edges | |
| 4 | Block material to 50mm x 35mm | XYZ Mill<br>Face cutter | 1600<br>Auto feed | Take 1mm cuts from all sides making sure to debur and rotate after each | Ensure deburred properly otherwise | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | cut to make sure that the block is square | the block won't be square | |
| 5 | Mill OAL 120mm | XYZ Mill<br>Face cutter<br>Leaver clock | 1600<br>Auto feed | Stand the part up in the vice and clock it square then skim the face to clean and flip, clock and then take down to OAL | Ensure part is clocked square otherwise it wont cut square | |
| 6 | 4 Jaw chuck and clock | XYZ Lathe<br>Plunger clock | | Set the part up in the 4-jaw chuck on the lathe and clock it into place using the plunger clock | Make sure that it is within 0.02mm central | |
| 7 | C/Drill & Drill Ø28 rough hole | XYZ Lathe<br>Bs4 C/Drill<br>Ø 13.75 Drill<br>Ø 28 Drill | 1000<br>660<br>360<br>Hand feed | C/drill hole halfway up the drill, Drill 13.75 Ø X 20mm, then 28 Ø X 20mm | Ensure coolant is always on | |
| 8 | Boar Ø30 through hole & Ø40 X 10mm | XYZ Lathe<br>Boaring bar | 1320<br>0.5mm/s | Boar to Ø30mm ensure to use coolant and a slow feed rate then move on to the Ø40 X 10mm again ensuring slow feed and plenty of coolant | Ensure to use the non-ferrous boring tips | |
| 9 | Mill tungs on the side 25mm x 15mm | XYZ Mill<br>16mm tipped cutter.<br>16 mm end mill | 1400<br>900<br>Hand feed | Rough cut the first side taking 1mm cuts al the way down to depth but leaving 0.5mm on the side, then feeler gauge the 16mm end mill to the bottom and zero, then take the 0.5 of the side, then repeat on the other side | Measure after each cut to ensure that the mid will end up in the middle of the part | |
| 10 | Mill end slot | XYZ Mill<br>10mm end mill<br>12mm end mill | 1500<br>1200<br>Hand feed | Rough the slot using the 10mm cutter to take 1mm cuts to 12mm in, all the way down, then finish cut with the 12mm cutter at full depth and strait in to 12mm to produce the final size | Ensure no to go over with the final cut as there is no way to correct it | |
| 11 | C/Drill & Drill Ø8 through hole | XYZ Mill<br>Bs2 C/Drill<br>Ø8 Drill | 2400<br>1200 | C/drill Bs2 on the centre line 10mm in (length defined by lecturer as undefined on drawing), then drill Ø8 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | mm hole through in the same position | | |
| 12 | Clean down and debur | XYZ Mill & lathe Dustpan and brush | N/A | Make sure all mechanisms are clean and dry, and that the part is deburred and free of sharp edges | Sigh of clean down sheet | |

## QUALITY CHECK SHEET

| Dimension (mm) | Tolerance | Equipment used | Size measured (mm) | Satisfactory (Y/N) | Comments |
|---|---|---|---|---|---|
| **Press Tool** | | | | | |
| Ø28.00 | | | | | |
| Ø48.00 | | | | | |
| 65.00 | | | | | |
| 22.00 | | | | | |
| 5.00 | | | | | |
| R2.00 | | | | | |
| M16x2 – 6g | | | | | |
| 3.00 X 2.50 DEEP UNDERCUT | | | | | |
| **Slip Ring** | | | | | |
| Ø40.00 | | | | | |
| Ø30.00 | | | | | |
| 10.00 | | | | | |
| 1 X 45° CHAMFER | | | | | |
| **Die Block** | | | | | |
| 120.00 | | | | | |
| 50.00 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 35.00 | | | | | |
| 25.00 | | | | | |
| 25.00 | | | | | |
| 15.00 | | | | | |
| 20.00 | | | | | |
| 18.00 | | | | | |
| 12.00 | | | | | |
| Ø8.00 | | | | | |
| Ø30.00 | | | | | |
| Ø41.00 X 10 DEEP | | | | | |

## RESOURCE LIST

| Tooling | Quantity |
|---|---|
| CNC Lathe | 1 |
| Chuck key | 1 |
| Dustpan and brush | 2 |
| XYZ Lathe | 1 |
| Finish cutter | 2 |
| Bs4 C/Drill | 1 |
| Ø 13.75 Drill | 1 |
| Ø 28 Drill | 1 |
| XYZ Lathe | 1 |
| Boaring bar | 2 |
| Part off tool | 1 |
| XYZ Mill | 1 |
| Face cutter | 1 |
| Leaver clock | 1 |
| Plunger clock | 1 |
| 16mm tipped cutter. | 2 |
| 16 mm end mill | 2 |

| | |
|---|---|
| 10mm end mill | 2 |
| 12mm end mill | 2 |
| Bs2 C/Drill | 2 |
| Ø8 Drill | 2 |

# Task 2 Production

| | |
|---|---|
| **Assessment number (eg 1234-033)** | 8713-332 |
| **Assessment title** | Machining and Toolmaking Technologies Occupational Specialism |

| | |
|---|---|
| **Candidate name** | <first name> <surname> |
| **City & Guilds candidate No.** | ABC1234 |

| | |
|---|---|
| **Provider name** | <provider name> |
| **City & Guilds provider No.** | 999999a |

| | |
|---|---|
| **Task(s)** | 2 |
| **Evidence title / description** | Press die tool |
| **Date submitted by candidate** | DD/MM/YY |

# Task 2

**Assessment themes:**

- Health and safety
- Planning and preparation
- Production
- Quality review and evaluation

You must:

- prepare the work area
- produce the press die tool components using both manual and pre-programmed computer numerical control (CNC) machinery to specification
- apply a suitable surface treatment to the finished components
- assemble the press die using the finished components
- reinstate the work area following the production of the press die tool.

**Additional evidence of your performance that must be captured for marking:**

- assessor observation to include:
    - set up and use of manual and pre-programmed CNC workshop machinery
    - the production of the individual press die tool components
    - tool skills, application and usage
    - application of hand skills
    - checks carried out before, during and after production
    - work area prior to, during and on completion of tasks.

# Candidate evidence

Production

- ***preparation of tools and equipment***

The candidate selected the correct measuring equipment and checked calibration status against the serviceability chart. He also visually checked calibration for himself. On the depth micrometre he took it to the surface table and checked it zero'd correctly.

The run out of the 3 jaw chuck was checked as a standard procedure for start up on the lathe. As was the vice parallelism on the Mill.

The candidate ensured all tool heights were correct on the lathe and changed the tips to non-ferrous ready for machining the brass slip ring. The coolant was checked before the machine was used.

He carried out the CNC SOP checklist to its full extent on the first end, on the second end he did leave the chuck key in, unattended for a short period of time. But did remove this before I had to mention it to him as a safety concern.

- ***application of hand skills***

The candidate prepared the blank die block by thoroughly deburring the workpiece. He ensured he removed all the burrs in order to not machine the block incorrectly. During the process he ensured all burrs were removed before moving on to the next process. This was generally completed with a hand file, but a deburring tool was also selected for the 12mm slot and the back edge of the 30mm hole.

- ***set up and use of workshop machinery***

**CNC**

During the CNC set up procedure the jog button was pressed rather than the cursor arrow within the program, which may have caused the machine to hit its limit switch after referencing. The learner had not experienced this before, so I had to intervene in order to get them back to where he was before in order to carry on.

When setting up the solid blank definition in the graphic, he set up the wrong material diameter.

**Mill**

When blocking up the die block he ensured each side was labelled with a number, so when he took it out to debur he could reference each side. He then rotated it clockwise and placed the last edge against the fixed jaw to machine the next side square. Once all faces were machined he measured and referenced the DRO.

When producing the features on the die block he wobble barred the block to establish his centre datum. He then produced everything else from this datum without removing the block. This meant he had thought about all the processes and that they would be central to the block. This shows a deeper level of thought process has gone into the machining method.

**Lathe**

In his planning he said he was going to machine the OAL of the slip ring by placing it in a 3 jaw with a parallel behind it. Remove the parallel before turning the machine on and face the length to size. An open question was asked about how this would affect the part with a thin wall thickness and damage to the component. He did draw his own conclusion that he would continue this process and I would monitor it closely due to it not being held on by much. He only took 0.1mm cuts until the desired width was achieved. He was able to break both edges due to this process.

- ***checks carried out before, during and after production***

Each machine has a SOP for setting up and tidy down. The candidate ticked all the safety checks off and got a lecturer to sign it. This included isolating the machine with the appropriate PPE on.

When on the thread end of the CNC part he did not check the thread before removing the part, therefore lost his references if it was incorrect, he also didn't check the u'cut size.

Followed his planning to clock the die block into the 4 jaw chuck. He used the stylus DTI on each edge and adjusted each jaw accordingly. He did clock this in efficiently, but could have thought of how to get it central more effectively in the first place. He was very proficient with the process of clocking in a 4 jaw chuck.

He did not rely on a digital calliper for measuring, he selected a range of different measuring equipment that he checked was calibrated and used these to check sizes, he then changed the DRO accordingly. This was his standard practice for the mill and lathe. This enabled him to manufacture well within the specified tolerance.

When he did his final quality checks he again used a range of measuring equipment that he checked were calibrated. He used slip gauges to measure the width of the u’cut and then the digital height gauge to measure the length of the thread.

- **work area prior to, during and on completion of tasks.**

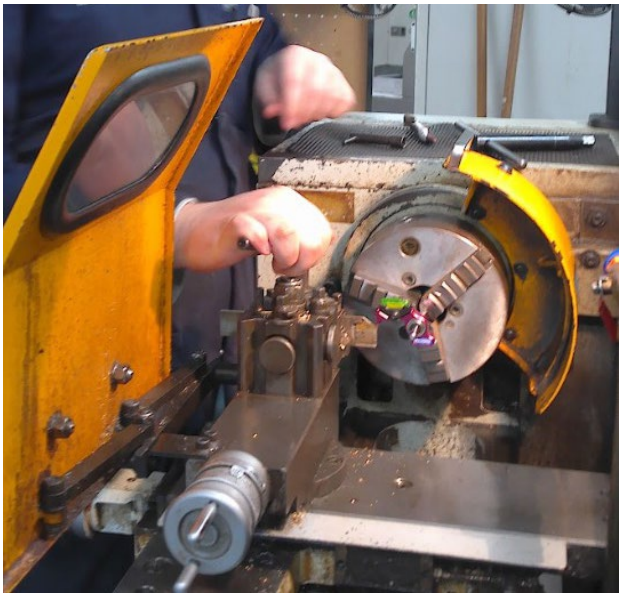
The candidate ensured the work area was clean and tidy with all hand tools in place on the shadow board before starting the task.

The work area was managed during the task, except when blocking up the excess, swarf did build up and was not managed quick enough. On the lathe when drilling and boring using coolant this did splash outside of the machine. No attempt was made with additional guards to prevent this and this did build up significantly. This was mopped up as soon as the task was finished.

The machine was cleaned down to a good standard and the brass swarf was cleared out thoroughly before the next task to make sure no material was mixed. The swarf was separated and placed in the designated container. All hand tools and measuring equipment were returned to the storage area. Coolant chart was checked and the machine isolated. This is all in the clean down SOP chart which was completed and signed off by a lecturer.

safe isolation procedures whilst wearing the correct PPE for each machine used ( HS, PP, P )

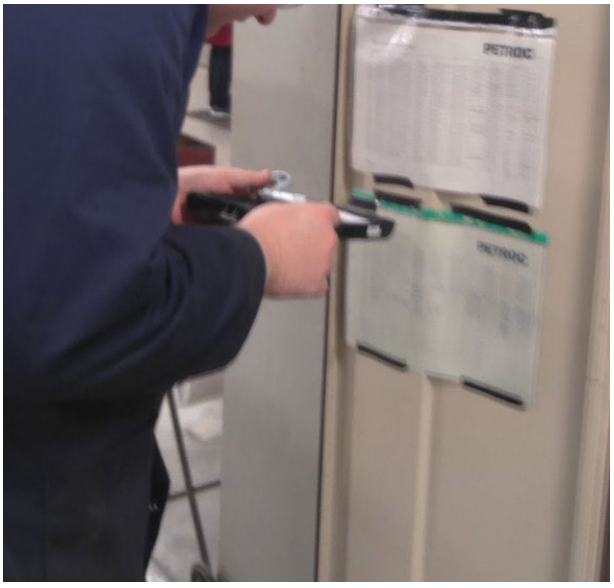
- pre - use checks of appropriately selected tools and equipment/preparation of resources ( PP )



All lathe tools were check to find if they were on centre height before starting the turning operations. Particular when the 4 jaw chuck was being used as this couldn't hold the centre finder to assist with the height of the tool. This was forward planning.

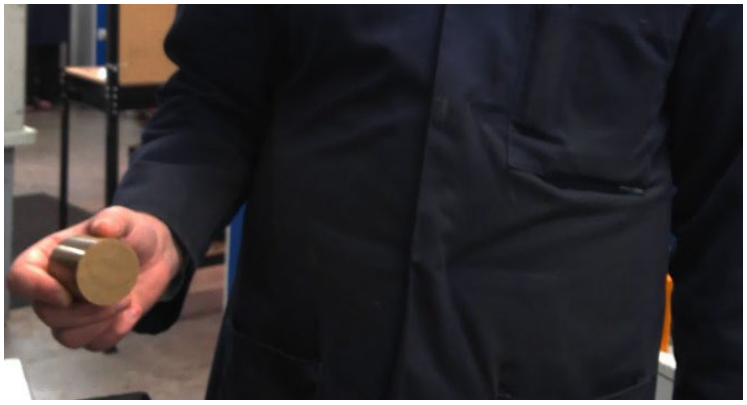
- the condition of the work area after the production activity has been completed, to include the checking and returning of tools and equipment to the correct storage area and waste disposed of correctly ( HS , P )

- correct use of appropriate measuring equipment, including calibration checks ( P, QRE )



All measuring equipment was checked out against the serviceability record. [redacted] also did visual checks on the equipment for example checking the depth mic was reading 0 by checking it on the surface table.

• materials selected for production ( P , QRE )

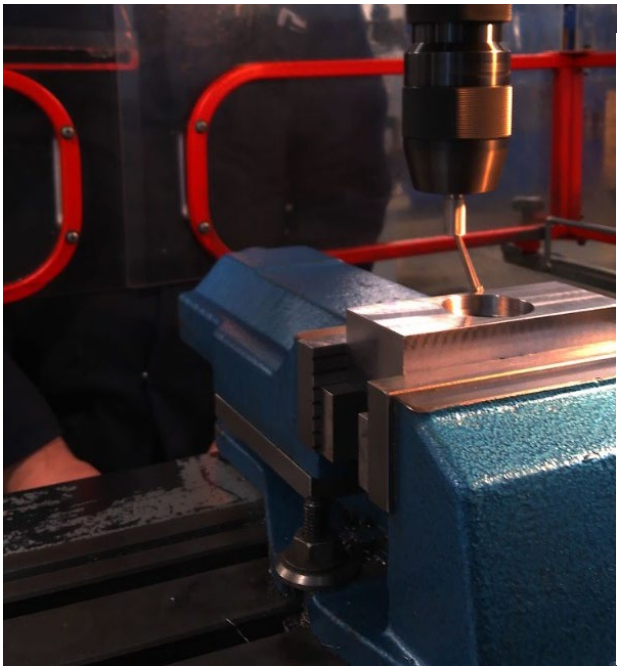


The correct billet of material was selected for the task. This one is for the slip ring.

• the candidate taking measures to avoid excess material waste ( P )

A large drill has been used to remove as much excess material as required before boring the brass bush.

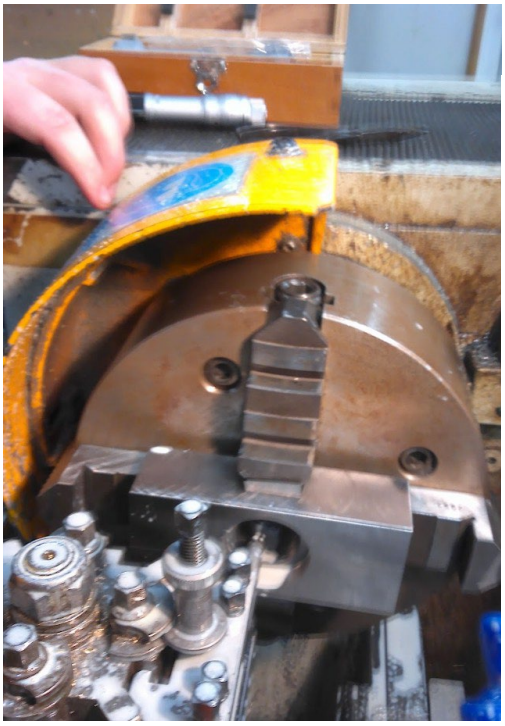
• production methods and techniques (machining, fitting, assembly, testing) demonstrating industry standard eg deburring, datum edge ( P )



Datuming the centre of the die block, this then allowed all the other processes to be calculated from the centre.

- in-production checks undertaken (checking for accuracy, faults, machine performance) (P)

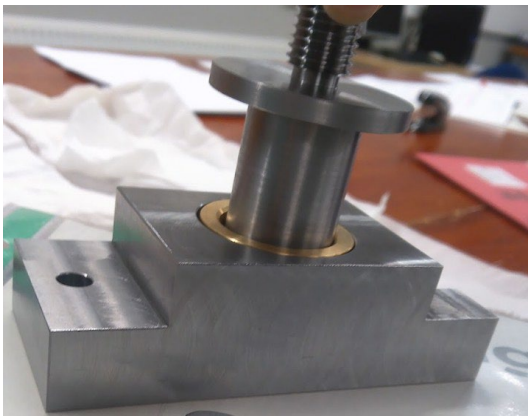
• production methods and techniques (machining, fitting, assembly, testing) demonstrating industry standard eg deburring, datum edge (P).



Using the final finishing boring tool to bore out the final sizes of the bore in the die block.

• application of surface treatment ( P )

• showing full assembly ( P , QRE )



• quality of completed assembly ( P, QRE )

# Task 3A Quality review

| | |
|---|---|
| **Assessment number (eg 1234-033)** | 8713-332 |
| **Assessment title** | Machining and Toolmaking Technologies Occupational Specialism |

| | |
|---|---|
| **Candidate name** | <first name> <surname> |
| **City & Guilds candidate No.** | ABC1234 |

| | |
|---|---|
| **Provider name** | <provider name> |
| **City & Guilds provider No.** | 999999a |

| | |
|---|---|
| **Task(s)** | 3A |
| **Evidence title / description** | Completed quality check sheet |
| **Date submitted by candidate** | DD/MM/YY |

# Task 3A

**Assessment themes:**

- Planning and preparation
- Quality review and evaluation

You must:

- carry out a full quality inspection of the completed press die tool
- record findings using the quality check sheet.

**Additional evidence of your performance that must be captured for marking:**

- completed press die tool
- assessor observation to include:
    - use of measuring equipment
    - checks for tolerances and accuracy.

# Candidate evidence

3A Quality review

- *use of measuring equipment*

The candidate selected a range of measuring equipment and checked against the serviceability record. He also completed his own visual check before using each piece of measuring equipment. During the inspection process he determined the tolerance and the most accurate piece of measuring equipment he could use to measure the part. When measuring the length of the thread, he used slip gauges as comparators to obtain a size for the undercut width and then used the digital height gauge to zero off the top and then take a measurement to the top of the slip gauges. The go and no-go gauge was used to check the M16 thread.

- *checks for tolerance and accuracy*

All dimensions were checked except the centrality of the hole, slot and bore. All sizes were within tolerance. The go and no-go gauge was used to check the M16 thread. All dimensions were checked except the centrality of the hole, slot and bore. All sizes were within tolerance.

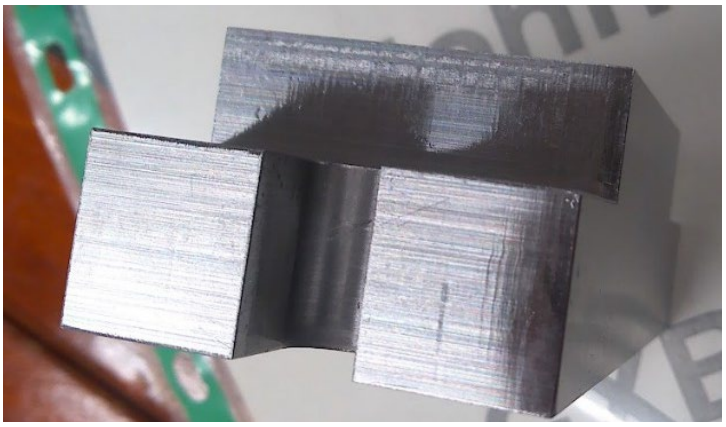
The defect identified in the part was marks from the 4 jaw chuck. He had used shim as protection.

• use of appropriate measuring equipment ( QRE )

Many different measuring techniques used to do the final checks. Here [redacted] has placed the correct size slip gauges in the U'cut and then used the digital height gauge to measure the length of the thread in the CNC part.

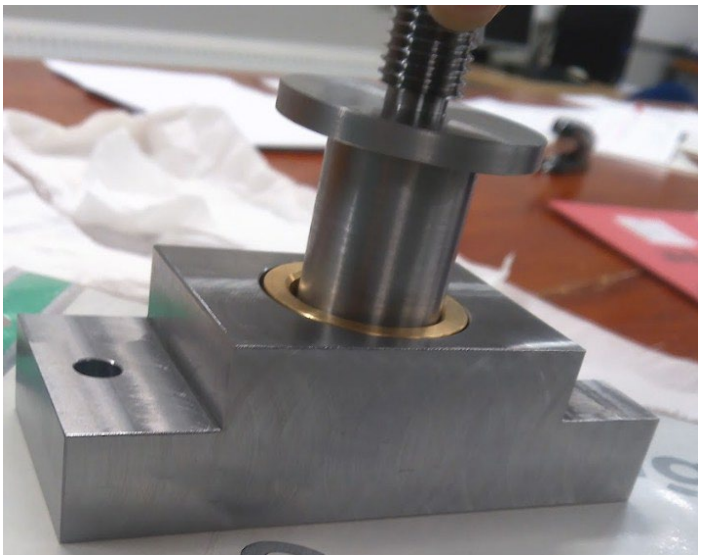
• assembly conforms to specification eg dimensions and design ( QRE )

• defect identification (where appropriate) ( QRE )



Limited marks, however there are very faint 4 jaw marks, despite using shim to protect his work.

• showing the components and full assembly ( QRE )



• quality of completed assembly ( QRE ) .

## Quality check sheet

| Dimension (mm) | Tolerance | Equipment used | Size measured (mm) | Satisfactory (Y/N) | Comments |
|---|---|---|---|---|---|
| **Press Tool** | | | | | |
| Ø28.00 | +/- 0.25 | 25-50 micrometre | 28.00 | Y | |
| Ø48.00 | +/- 0.25 | 25-50 micrometre | 48.00 | Y | |
| 65.00 | +/- 0.25 | 50-75 micrometre | 65.025 | Y | |
| 22.00 | +/- 0.25 | Digital vernier height gauge | 22.00 | Y | |
| 5.00 | +/- 0.25 | 0-25 micrometre | 5.03 | Y | |
| R2.00 | +/- 0.25 | Radius gauge | R2.00 | Y | |
| M16x2 – 6g | +/- 0.25 | M16x2 Go/No Go | N/A | Y | Poor finish at start of thread due to lack of coolant |
| 3.00 X 2.50 DEEP UNDERCUT | +/- 0.25<br>+/- 0.10 | Slip pack and vernier | 2.96 x 2.48 | Y | |
| **Slip Ring** | | | | | |
| Ø40.00 | +/- 0.25 | 25-50 micrometre | 40.00 | Y | |
| Ø30.00 | +/- 0.25 | 25-30 bore micrometre | 30.00 | Y | |
| 10.00 | +/- 0.25 | 0-25 micrometre | 10.00 | Y | Scratches on the back face from parallels when machining OAL |
| 1 X 45° CHAMFER | +/- 0.25 | Steel rule | 1 x 45° | Y | |
| **Die Block** | | | | | |
| 120.00 | +/- 0.25 | 100-125 micrometre | 120.02 | Y | 4 jaw chuck marks from boring |
| 50.00 | +/- 0.25 | 50-75 micrometre | 50.02 | Y | Face cutter tool marks visible |
| 35.00 | +/- 0.25 | 25-50 micrometre | 35.00 | Y | Scratches from swarf build up during boring |
| 25.00 | +/- 0.25 | Depth micrometre | 24.97 | Y | |

| | | | | | |
|---|---|---|---|---|---|
| 25.00 | +/- 0.25 | Depth micrometre | 25.03 | Y | |
| 15.00 | +/- 0.25 | Depth micrometre | 11.04 | Y | |
| 20.00 | +/- 0.25 | 0-25 micrometre | 19.95 | Y | |
| 18.00 | +/- 0.25 | Depth micrometre and 10mm pin | 17.99 | Y | |
| 12.00 | +/- 0.25 | Slip pack | 11.98 | Y | |
| Ø8.00 | +/- 0.25 | Ø8 pin | N/A | Y | |
| Ø30.00 | +/- 0.25 | 25-30 bore micrometre | 25.995 | Y | |
| Ø41.00 X 10 DEEP | +/- 0.25 | Ø41 go/no go gauge. Depth micrometre | N/A 10.06 | Y | |

# Task 3B Evaluation and recording

| | |
|---|---|
| **Assessment number (eg 1234-033)** | 8713-332 |
| **Assessment title** | Machining and Toolmaking Technologies Occupational Specialism |

| | |
|---|---|
| **Candidate name** | <first name> <surname> |
| **City & Guilds candidate No.** | ABC1234 |

| | |
|---|---|
| **Provider name** | <provider name> |
| **City & Guilds provider No.** | 999999a |

| | |
|---|---|
| **Task(s)** | 3B |
| **Evidence title / description** | Quality inspection report |
| **Date submitted by candidate** | DD/MM/YY |

# Task 3B

**Assessment themes:**

- Quality review and evaluation

You must:

- produce a quality inspection report evaluating the production of their finished press die tool. The report should typically be 800 words. This must include:
    - finished sizes of components and confirmation the press die tool conforms to the dimensional requirements of the specification
    - an explanation of the quality checks undertaken and the reasons for their use
    - an evaluation of the fitness for purpose of the finished press die tool and method of production used with reasoning and justifications
    - a concessions list for every facet of the press die tool that does not conform to the specification, reasons for occurrence and how to prevent reoccurrence
    - any improvements or adaptions required to the press die tool, including any reasoning and justifications if adaptions or improvements are not required.

**Additional evidence of your performance that must be captured for marking:**

- completed press die tool.

# Candidate evidence

3b

**Introduction**

I've been tasked with producing a press die tool for use in the deep draw press room of the inhaler company, the tool will be made from low carbon steel and brass.

**Production process**

The press tool is made of three parts, the Die Block which in the base of the tool, the brass Slip Ring which is the wearing part that can easily be replaced and the Press Tool which is produced on the CNC lathe.

- **Die Block**
  This part its produced on the manual vertical mill out of low carbon steel. The Die block started as a block of steel 60 x 40 x 125 mm, I then blocked it down to size at 50 x 35 mm using a face cutter and rotating after each cut to ensure the block is square, I then used an end mill and took the block down to length by skimming material off the end to 120 mm, after this I moved the part onto the lathe where I fitted the 4 jaw chuck and clocked the part in centrally, after this I drilled a Ø25mm hole through the part to start the bore, I then rough turned the boar out to 29mm and 40 mm respectively before using the carbide finish boring bar to take the bore to final size at Ø30 and Ø41 x 10, I then moved the part back to the mill and removed the material to form the profile of the side tongues on both sides, I did this by using the 16 mm tipped cutter the take the profile to depth leaving 0.5 mm on the width to finish using a 16mm end mill, after this I moved onto the slot which I roughed out with a 10mm end mill taking 1mm cuts at a time and then finished it with a 12mm end mill plunging to depth and then winding out to form the slot, finally I drilled the un-dimensioned Ø8mm hole on the other side by first C/Drilling then drilling the Ø8 through all
- **Slip Ring**
  This part is produced on the manual lathe out of brass. The sip ring started as a Ø45 length of brass, the first thing I did was face the part to clean using the finishing cutter with a non-ferrous tip, I then C/Drilled and Drilled a Ø28mm hole to start the boar, I then proved out the non-ferrous boring bar and took the boar to Ø30 after this I turned the 1 x 45° chamfer on the front edge of the bore, then I turned the O/D to size using

the finish cutter, once it was to size at Ø40 I parted of the part at 11mm leaving 1mm stock on, I then turned the part around in the chuck and secured it, and used parallels to make sure it is level, I then took the part to length and broke all edges.

- **Press Tool**

  The press tool was produced on the CNC lathe out of low carbon steel, I turned on the machine and referenced its location, I then loaded the program into the machine control, from this point I was able to simulate in wire frame and solid model what the machine is going to do and from here I could check for any problems, after simulation I would dry run the program without a part to check that the tools don't crash with the machine or move in the wrong way, after I'm happy everything is ok I can load a part and run the program while controlling the feed so that I can check tool positions before the cut is made, once this is done and if the part is on size it can be removed and this process can be completed for the second side

## Quality Inspection

- **Calibration**

  All measuring equipment used is calibrated and recorded on the workshop calibration chart with the measuring equipment's serial number and date of calibration, this ensures that all measuring equipment is fit for purpose, furthermore prior to use I checked the zero of the measuring equipment by winding to zero cleaning the faces and using slips/gauge pins to make sure they are measuring correct.

- **Visual Inspection**

  During the inspection time I visually inspected the part for any defects such as scratches and tool marks and checked the surface finish of all faces.

  - swarf scratches on the bottom face of the die block from boring in the lathe
  - tool marks on the side faces of the die block from the face cutter
  - 4 Jaw chuck teeth marks on the Side of the die block due to thin shim
  - Scratches on the back face of the slip ring due to using parallels to square.

- **Dimensional checks**

  During the inspection time I measured and recorded every dimension on the drawing using a variety of measuring equipment making sure to check their calibration before use, once I had measured the size and noted it down, I would compare it with the required dimension on the drawing and cross reference with the tolerances to ensure that the dimension was conforming to the specification.

Where possible I tried to use the most accurate form of measuring available, I could have used a vernier caliper for all dimensions but it just wouldn't be accurate enough so where possible I have used micrometers which are accurate to 0.01mm although in some cases they can be accurate to 0.002mm and all bore micrometers are accurate to 0.005mm this ensures that important sizes such as the bores are to the correct size.

| Dimension (mm) | Tolerance | Equipment used | Size measured (mm) | Satisfactory (Y/N) | Comments |
|---|---|---|---|---|---|
| **Press Tool** | | | | | |
| Ø28.00 | +/- 0.25 | 25-50 micrometre | 28.00 | Y | |
| Ø48.00 | +/- 0.25 | 25-50 micrometre | 48.00 | Y | |
| 65.00 | +/- 0.25 | 50-75 micrometre | 65.025 | Y | |
| 22.00 | +/- 0.25 | Digital vernier height gauge | 22.00 | Y | |
| 5.00 | +/- 0.25 | 0-25 micrometre | 5.03 | Y | |
| R2.00 | +/- 0.25 | Radius gauge | R2.00 | Y | |
| M16x2 – 6g | +/- 0.25 | M16x2 Go/No Go | N/A | Y | Poor finish at start of thread due to lack of coolant |
| 3.00 X 2.50 DEEP UNDERCUT | +/- 0.25<br>+/- 0.10 | Slip pack and vernier | 2.96 x 2.48 | Y | |
| **Slip Ring** | | | | | |
| Ø40.00 | +/- 0.25 | 25-50 micrometre | 40.00 | Y | |
| Ø30.00 | +/- 0.25 | 25-30 bore micrometre | 30.00 | Y | |
| 10.00 | +/- 0.25 | 0-25 micrometre | 10.00 | Y | Scratches on the back face from parallels when machining OAL |
| 1 X 45° CHAMFER | +/- 0.25 | Steel rule | 1 x 45° | Y | |
| **Die Block** | | | | | |
| 120.00 | +/- 0.25 | 100-125 micrometre | 120.02 | Y | 4 jaw chuck marks from boring |
| 50.00 | +/- 0.25 | 50-75 micrometre | 50.02 | Y | Face cutter tool marks visible |
| 35.00 | +/- 0.25 | 25-50 micrometre | 35.00 | Y | Scratches from swarf build up during boring |
| 25.00 | +/- 0.25 | Depth micrometre | 24.97 | Y | |
| 25.00 | +/- 0.25 | Depth micrometre | 25.03 | Y | |
| 15.00 | +/- 0.25 | Depth micrometre | 11.04 | Y | |
| 20.00 | +/- 0.25 | 0-25 micrometre | 19.95 | Y | |
| 18.00 | +/- 0.25 | Depth micrometre and 10mm pin | 17.99 | Y | |

| | | | | | |
|---|---|---|---|---|---|
| 12.00 | +/- 0.25 | Slip pack | 11.98 | Y | |
| Ø8.00 | +/- 0.25 | Ø8 pin | N/A | Y | |
| Ø30.00 | +/- 0.25 | 25-30 bore micrometre | 25.995 | Y | |
| Ø41.00 X<br>10 DEEP | +/- 0.25 | Ø41 go/no go gauge.<br>Depth micrometre | N/A<br>10.06 | Y | |

- **Quality checks**

  During production Quality Checks where constantly being taken to ensure that the part would remain in size but also to ensure that the tools where still cutting on size, for example if the readout says Ø30 you expect the tool to have cut Ø30 but instead it may have cut 0.1mm under weather that be because of tip wear or datum drift we don't know and therefore the readout needs to be adjusted to make sure that the tool is cutting on size, these in-production quality checks are vital to ensuring that the part is produced correctly. Furthermore, other in production checks such as coolant checks ensure that vital parts of the system are functioning correctly, in the case of the coolant checks if it is too week, it won't cool or lubricate the part whereas if it is too strong it could become hazardous to the skin.

- **Functionality and Fit for Purpose**

  The part that I have created is exactly as the drawing specifies however this part will not complete its function or Purpose due to the fact that the locational part for this assembly, the slip ring, has a 1mm fit with the part next to it, this means it will never sit in the same place meaning every part that is produced will be different and therefore there can be no standardization to the production of the end product. A good fit for the part would be at 0.01 – 0.02 mm unilateral tolerance which would create a transition fit which would allow the slip ring to slip in and out of place while not moving and holding very tight tolerances. This is crucial as the position of the ring when the sheet metal is formed will determine weather or not it will form correctly and whether it will be the correct size.

- **Defects**

  I identified no dimensional defects or defects that will affect the fit form or function of the part, I did identify some defects with the finish of the part some of which were production marks others where postproduction scratches and marks.

  - swarf scratches on the bottom face of the die block from boring in the lathe
    - remove swarf produced when boring after every cut.
  - tool marks on the side faces of the die block from the face cutter
    - ensure all tips are new and that they match.
  - 4 Jaw chuck teeth marks on the Side of the die block due to thin shim
    - Use thicker or more shim to protect the faces of the part when turning.
  - Scratches on the back face of the slip ring due to using parallels to square.
    - Use thicker parallels to reduce scratches from sharp edges.

## Health and Safety

Health and safety throughout production is key to ensuring a safe working environment, during the assessment I was wearing PPE at all times, this included safety gasses, workshop overalls and steel toed safety boots I also made sure to follow health and safety regulations throughout such as manual handling regulations for when I was lifting and moving the 4 Jaw chuck on and off the machine and I was adhering to the COSHH regulations by doing my coolant checks to make sure that the coolant is not hazardous to the skin.

## Evaluation

- **Part**
  the assembly that I have made I believe is well made and has been produced to a high standard, all the dimensions are within tolerance the surface finish is extremely good despite one not being stated on the drawing and all the parts ‘fit’ as they are supposed to.
- **Process**
  at some points in my process I have added extra unnecessary steps and overcomplicated processes. Looking back, I could have parted of the slip ring to length and deburred it by hand to reduce the risk and I had to change how I milled the OAL on the Die Block because it was too tall to stand upright and mill the top, so I had to lye it down and mill the side.

## Conclusion

Overall, I believe that the parts I have produced are of a high quality and show a high level of competence in the machine shop, furthermore the use of quality processes to ensure the parts dimensional conformance throughout the production process. The drawings provided however are of a poor quality with little to no defined tolerancing, there is an un-dimensioned hole and there is no fit whatsoever. All things considered other than the drawings I think it went well.

# Task 3C Handover

| | |
|---|---|
| **Assessment number (eg 1234-033)** | 8713-332 |
| **Assessment title** | Machining and Toolmaking Technologies Occupational Specialism |

| | |
|---|---|
| **Candidate name** | <first name> <surname> |
| **City & Guilds candidate No.** | ABC1234 |

| | |
|---|---|
| **Provider name** | <provider name> |
| **City & Guilds provider No.** | 999999a |

| | |
|---|---|
| **Task(s)** | 3C |
| **Evidence title / description** | Assessor observation of handover meeting |
| **Date submitted by candidate** | DD/MM/YY |

# Task 3C

**Assessment themes:**

- Quality review and evaluation

You must:

- hold a meeting with the supervisor to complete handover procedures, including:
    - confirmation of work completed
    - overview of findings in quality inspection report
    - suggested improvements to design or production process
    - handover of completed press die tool and quality inspection report.

**Additional evidence of your performance that must be captured for marking:**

- handover materials consisting of:
    - quality inspection report (from Task 3b)
    - the completed press die tool (from Task 2).

# Candidate evidence

3C Handover (11.50 mins)

The candidate started with a good introduction to the handover then continued to discuss his completion of the risk assessment, wearing of PPE, S.O.P checklist, and coolant checks before starting work.

He then went onto discuss the assembly identifying the individual parts from the drawing and how they fit together. He discussed the split ring being a wearing part and voiced his concerns on the excessive clearance between the counterbore and the slip ring.

He then went onto discuss the manufacture of parts starting with the die holder which he discussed where he had taken datums from and how he had found them using a wobble bar then went through the manufacturing process in a logical order discussing blocking up and the cutters used throughout the process also identifying workholding and the use of parallels, plunge machining and direction of feed.

The split ring was discussed next with another detailed process explanation identifying non ferrous tools used, a method of manufacture using a parallel to position the component for second end facing. The die tool also had a detailed explanation covering all aspects of the CNC machine and the S.O.P document used. He then went onto discuss the calibration of tools and equipment and how he had achieved a 1.6um surface finish on all parts but surface finish was not stated on the drawing.

I would have liked to hear more critical analysis with regards to mentioning the rotation against the fixed jaw when blocking up and using centre drills before drilling which I know he used these methods, forgot to mention single block when using the CNC machine and the fact that he forgot to check the thread before taking it out. He discussed a few minor scratches and how they could be avoided in the future and that all the components were within the specified tolerance stated on the drawing and the fixture fits together as the assembly drawing intends.

He then went onto discuss improvements in his process which included the change in his method statement when machining the OAL then went onto discuss suggested improvements to the drawing which included using soft jaws for the second end of the split ring changing the fit on the split ring to a transition fit using unilateral tolerances which example sizes were given, discussed how the fit would improve the concentricity of the press

alignment, and how and additional holding method is needed to hold the plate more accurately. Finishing off by mentioning the missing dimension for the 8 mm hole.

He rounded off the presentation by handing over the assembled parts to me with the accompanying evaluation and quality report for submission. Overall a good use of technical vocabulary, problems identified and resolved, potential improvements identified and the handover completed in the appropriate manner.

## Get in touch

The City & Guilds Quality team are here to answer any queries you may have regarding your T Level Technical Qualification delivery.

Should you require assistance, please contact us using the details below:

Monday - Friday | 08:30 - 17:00 GMT

T: 0300 303 53 52

E: **technicals.quality@cityandguilds.com**

W: **http://www.cityandguilds.com/tlevels**

Web chat available **here**.