NQF BTEC Level 3 National in Engineering

First teaching September 2016

Sample Marked Learner Work

Subject: Engineering
Unit 2: Delivery of Engineering Processes Safely as a Team
Learning Aim: A – Examine common engineering processes to create products or deliver services safely and effectively as a team – Distinction Standard

Contents

You will need to refer to the appropriate specification alongside these sample materials.

Unit 2 from the Level 3 BTEC Nationals in Engineering can be found by typing the following into your web browser (Google Chrome).

http://qualifications.pearson.com/en/qualifications/btec-nationals/engineering-2016.html

Note: The Authorised Assignment Brief (AAB) used for generating this learner work is the same as the one provided by Pearson. Centres are expected to get the AAB fully internally verified prior to being issued to the learners.

Assignment title	**Engineering processes and human factors**
Assessor	
Start date	
Hand-in deadline	
Hours of learner work needed	3 hours
Qualification suite covered	Pearson BTEC Level 3 National Extended Certificate in Engineering Pearson BTEC Level 3 National Foundation Diploma in Engineering Pearson BTEC Level 3 National Diploma in Engineering Pearson BTEC Level 3 National Extended Diploma in Engineering
Unit(s) covered	**Unit 2: Delivery of Engineering Processes Safely as a Team**
Learning aims covered	**A:** Examine common engineering processes to create products or deliver services safely and effectively as a team.
Scenario	You are working as a final year apprentice in a small engineering company. You have been using some engineering processes to [manufacture small components/repair small products*] as part of your team; your manager is pleased with your work and has decided that you should be given some more responsibility. He wants you to look at whether the company is using the most appropriate engineering processes when [manufacturing small components/repairing small products*]. Your manager has asked you to examine a [component they produce/service they deliver*] and to report back on the engineering processes that can be used to [make/deliver*] it, including health and safety factors, and how human factors could affect the performance of these processes. The report will impact upon company investment decisions in the future.
Task	**You are going to evaluate the effectiveness of engineering processes and how human factors affect them.** **To do this:** Your tutor will provide you with a [product that needs to be produced/service that needs to be delivered*] using a range of engineering processes. You need to: • Research the processes used (at least three), including relevant health and safety factors and legislation/regulations; and • Research how these engineering processes can be affected by human factors (individual and team).

	You then need to: Produce a report that evaluates the effectiveness of the engineering processes (at least three) used to [manufacture the product/deliver the service*] and how human factors affect the performance of the engineering processes. Your report should include: • Information on the advantages and limitations of the engineering processes used (at least three) compared with the advantages and limitations of using other possible processes, which should include justifications as to which processes are most effective, by referring to the specific requirements of the [product or service*] – as part of this, you must provide thorough details about how the engineering processes work/operate, including health and safety factors and legislation and regulations that apply; and • Evidence that you have a strong awareness of a range of human factors, and can judge how they impact on the performance of the engineering processes from both an individual and team perspective. **General Note for Assessors:** The processes to be considered for Learning aim A do not have to be the same processes as those used as part of Learning aim C. [* - delete as appropriate]
Evidence you must produce for this task	A report, prepared as an individual, detailing engineering processes and the impact that human factors can have on their performance, using a case study context based on a given engineered product(s) or a given engineering service(s).

Criteria targeted by this task (Distinction first then ALL the lower criteria that are linked):

Criteria	Unit	Criterion reference
Evaluate, using high quality written language, the effectiveness of using different engineering processes to manufacture a product or to deliver a service and how human factors, as an individual and a team, affect the performance of engineering processes.	2	A.D1
Analyse why three engineering processes are used to manufacture a product or to deliver a service and how human factors, as an individual and a team, affects the performance of engineering processes.	2	A.M1
Explain how three engineering processes are used safely when manufacturing a given product or when delivering a given service.	2	A.P1
Explain how human factors, as an individual or a team, affect the performance of engineering processes.	2	A.P2

Sources of information	**Textbooks** Pearson textbook specific to new BTEC Nationals in Engineering

Schrader, G. et al. (2000) *Manufacturing Processes and Materials,* 4th Edition, Society of Manufacturing Engineers, 0872635171.

Mikell P. Groover (2010) Fundamentals of Modern Manufacturing, 5th Edition, John Wiley & Son, Inc.

Serope Kalpakjian, Steven Schmid (2007) Manufacturing Processes for Engineering Materials, 5th Edition, Prentice Hall

Websites

https://archive.org/stream/IntroductionToBasicManufacturingProcessAndWorkshopTechnology/Introduction%20to%20basic%20manufacturing%20process%20and%20workshop%20technology%20%281%29#page/n0/mode/2up

http://www.efunda.com/processes/processes_home/process.cfm

www.peo.on.ca/index.php/ci_id/19394/la_id/1.htm

Note to assessors

We are committed to ensuring that teachers/tutors anlearners have a choice of resources to support their teaching and study.

We would encourage them to use relevant resources for your local area such as local employers, newspapers and council websites.

Resources from various publishers are available to support delivery and training for all Pearson and BTEC qualifications so that learners and teachers/tutors can select those that best suit their needs.

Above are some examples of websites. Further useful resources may be found at http://qualifications.pearson.com/en/support/published-resources.html#step1

Introduction on Learner work

The learner work that follows has been assessed accurately to national standards. This is one example of **Distinction** grade achievement for **Learning Aim A** on an internally assessed unit.

The learner is in Year 12 and is completing the Pearson BTEC Level 3 National Certificate in Engineering at the Sixth from college alongside other qualifications.

The learner has submitted Assignment 1 Learning Aim A and it has been assessed as a Distinction standard.

Commentary

For **Learning aim A**: Examine common engineering processes to create products or deliver services safely and effectively as a team.

This learner has achieved the distinction grade because the assessment evidence provided on the advantages and limitations of the engineering processes used is compared with the advantages and limitations of using other possible processes; this evidence also includes justifications as to which processes are most effective, by referring to the specific requirements of the given product. Thorough details about how the engineering processes work/operate, including health and safety factors and legislation and regulations that apply have also been provided. Furthermore, there is evidence that the learner has a strong awareness of a range of human factors, and can judge how they impact on the performance of the engineering processes from both an individual and team perspective. The assessment evidence is also logically structured and uses correct technical engineering terms with a high standard of written language; as a result, it would be easy to read and understand by a third party, who may or may not be an engineer.

Learner work

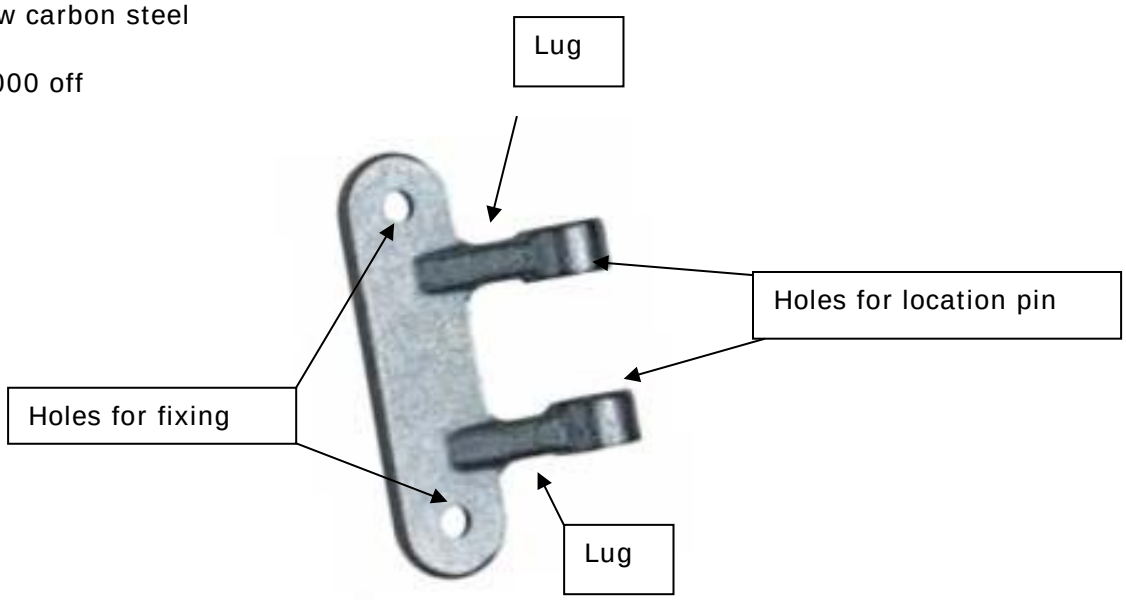
Unit 2 Delivery of engineering processes safely as a team

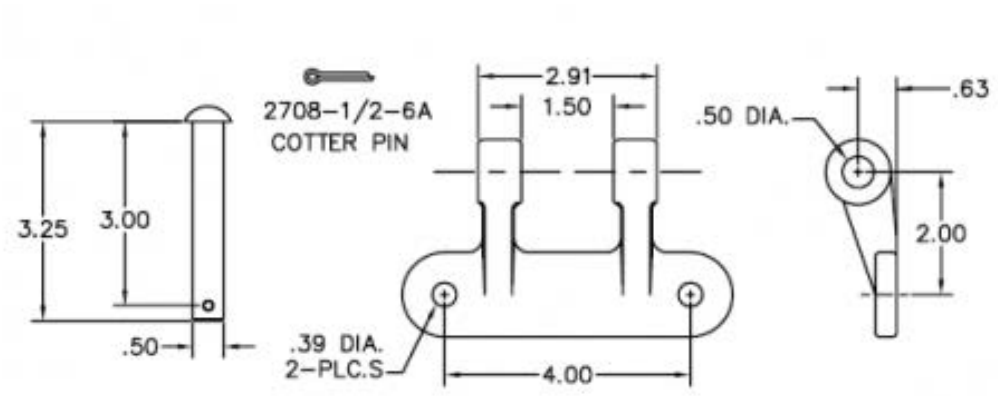
LA A: Examine common engineering processes to create products or deliver services safely and effectively as a team

Component: Hinge butt

Material: Low carbon steel

Quantity: 1000 off



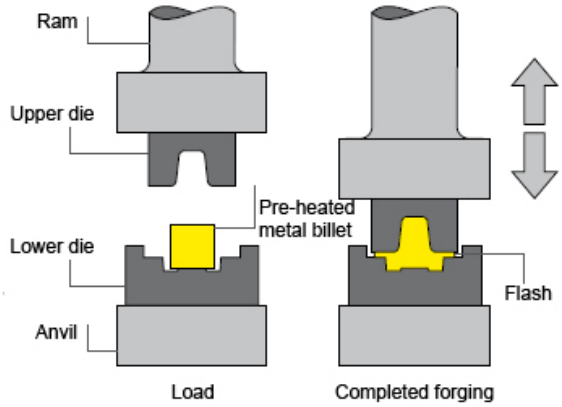


The above component was given to me to research. By looking at the component itself and from my research, I have found out that to make it the following three engineering processes are used:

- Die forging
- Drilling
- Reaming

Information on the processes used, safety and human factors

Die forging



Forging process
http://www.kimbermills.co.uk/processes/press_forging

Before it is drilled or reamed, the hinge butt would be forged, mainly because it would be difficult to produce this kind of complex shape any other way, and the whole component, other than the holes, doesn't need to be to a tight tolerance. It would start as a small billet which would then be heated to red hot to get the right mix of strength and ductility, and it would then be pressed into shape under tons of compressive force using the ram.

The die forging process is where two dies come together and the malleable billet takes the shape of the dies as it is pushed towards their walls. For this type of component it would probably be a closed die for accuracy to make sure the shape is very close to the impression in the die. The ram might go up and down several times depending upon whether the billet needs to be pressed into small cavities, like it would for this component, so the guide pins would be vital to make sure the final forging is as near to the shape of the impression as possible. The dies can be very complicated to make sure the right shape is produced, so they are expensive, which means forging is only used for larger scale manufacture (as would be the case for this component). For this type of component the holes for attaching the hinge butt to the wall or fixing point might be made as part of the forging, but the holes for the location pin will just be indentations or spot faces so they can be drilled and reamed later, as the forged holes wouldn't be accurate enough.

A.D1
An example of the use of correct technical engineering terms with a high standard of written language

Flashing starts to come out of the sides of the die when forming the shape and because it is thin it cools quicker and solidifies and then acts as a stop, which means the rest of the pre-heated malleable billet gets pushed into the entire die so the shape is accurate. This kind of process can be automated so the billets are just fed in and the forged hinge butts are pushed out of the die when complete. It is important that operators always pick up the flashing once it has been trimmed off (probably using a band saw or trimming press for this type of component) and ensure that it goes in a recycling bin, as this can save the company money and helps to reduce the impact on the environment of making the hinge butts and of the die forging process.

Safety is very important when forging, and the Provision and Use of Work Equipment

Regulations (PUWER) and the Personal Protective Equipment (PPE) at Work Regulations will definitely apply, mainly because the biggest risks to the operators are from burns/the heat and from crush injuries from the action of the ram. To conform with PUWER, interlocking guards can be used to prevent crushing but there is still a risk when the forging is being removed from the die, so long tongs must be provided so the operator can take the hinge butt out without reaching/stretching and placing a hand between the dies (which also helps with conformance to the Manual Handling Regulations) and to minimise the risk from the forging 'sticking' to the die (even if a compound is used to prevent this). The guards also provide a barrier against hot scale being ejected during forging, but to make sure the operator must be provided with eye protection, leather gloves and protective clothing, so they don't get burnt (to conform with the PPE Regulations). The forging process has other health and safety risks (like noise or fumes) but these are the main ones. Guarding and PPE will also be very important when using the band saw so the operator doesn't get cuts to their hands. They could use tooling that holds the forged piece in place when getting rid of the flashing, to keep their hands away from the blade – this is an example of reducing risk.

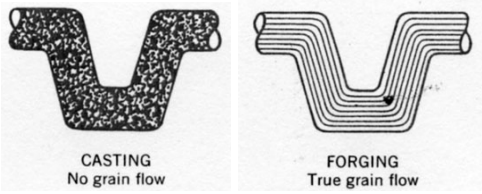
Based on the Health and Safety at Work Act, the employer has to carry out a risk assessment where there are hazards and to remove, reduce or manage them 'as far as is reasonably practicable'; as well as being legally necessary, this is also a professional responsibility, as all involved must act with due care and diligence to make sure no-one gets hurt. Die forging is normally a process that operates at speed as it is a mass production technique, therefore operators must be alert and free from distractions, motivated and well-trained so they don't take risks to meet management demands, for example when they are trying to go quicker to meet a production target and start to sidestep standard operating procedures. If operators feel they need to do this because it might create a bottleneck and have an impact on team bonuses, then there is something wrong with the culture in the workplace and a lack of respect for those on the shop floor, as all workers should be able to raise concerns and be listened too.

A.D1
The learner has produced evidence that shows he can evaluate the impacts that a range of human factor, as an individual and a team, can have on the performance of the engineering process.

This type of component wouldn't be machined, as it is too complex and would take far too long given the scale of manufacture (and these processes would be less safe because there would be more of them). It could also be cast, where liquid metal is poured into a mould and allowed to cool to a near final state, but forging has advantages over casting for this type of component.

For example:

Casting allows for finer details, but this hinge butt is not complicated enough to justify casting;
Castings are relatively heavy and can suffer from defects such as voids or porosity; conversely, forgings have higher strength, ductility and impact/fatigue resistance than a casting because they have true grain flow internally and castings have no grain flow (see below) - the hinge butt will support weight, be used outside and will have to withstand continual movement that can cause wear, so requires the advantages of being forged; and



Grain flow
http://www.brcperformance.com/images/Newsletters/ALL3.jpg

A.D1
The learner has produced evidence that evaluate the relative merits of using different engineering processes to manufacture the product.

Forgings generally cost more (especially the dies), take longer to manufacture and some material is wasted during production (flashing), but this has to be balanced against the advantages of forging when the component is in use – if the component fails it could be dangerous given that it will be supporting weight.

To make the body of the hinge butt, closed die forging is the most suitable process rather than casting, due to the reasons above.

Website references:

http://www.doitpoms.ac.uk/tlplib/metal-forming-2/forging.php

https://www.forging.org/impression-die-forging-process-operations

http://www.atcgroup.com.au/CustomCastingForging/TheDifferenceBetweenCastingForging.aspx

https://www.worksafe.vic.gov.au/forms-and-publications/forms-and-publications/hot-pressing-and-forging-machines-minimising-the-risk-of-injury

http://www.hse.gov.uk/pubns/indg291.pdf

http://www.hse.gov.uk/pubns/indg174.pdf

http://www.healthyworkinglives.com/advice/work-equipment/manual-handling

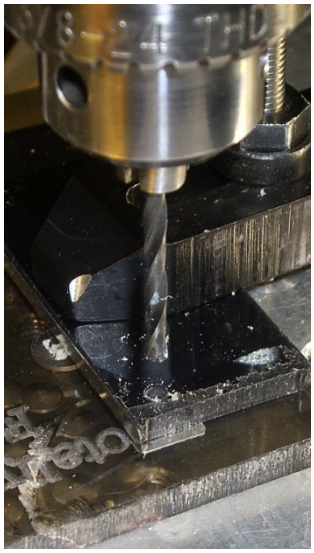
http://www.hse.gov.uk/pubns/hsc13.pdf

http://ewh.ieee.org/cmte/pa/Status/Professional.html

http://www.engc.org.uk/engcdocuments/internet/Website/UK-SPEC%20third%20edition%20(1).pdf

http://www.reliability.com/healthcare/articleshcp/june_08_The%20effects%20of%20distractions%20on%20human%20performance.pdf

Drilling



Drilling metal
https://softsolder.files.wordpress.com/2011/05/cimg5887-drilling-thin-sheet-metal.jpg

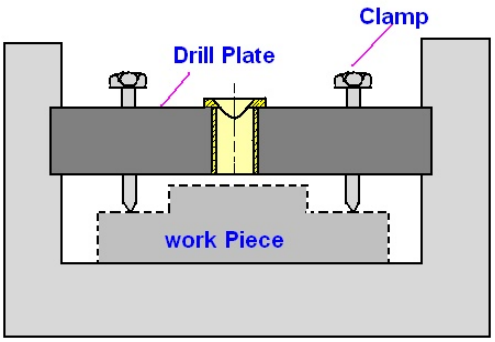
The holes for the location pin would then be drilled into the ends of the lugs of the hinge butt, as it is the most effective way to make holes of the size and depth required and doesn't require much skill, and the drills can be replaced/ground very easily when they wear.

The hole is made by pressing the cutting edge of the rotating drill bit against the component (normally the operator does this manually). As it moves down the metal swarf comes out through the flutes and the hole is created. The surface finish doesn't tend to be very good as the drill bit is embedded in the component which is why the hole is then often finished by another method or sometimes a coolant is used, which can help. As the holes are quite a small diameter the spindle speed when drilling will need to be quite fast.

Drilling is a very straightforward process but holding or clamping the component in the right place to make sure it can be drilled in the right place can be difficult, because the component needs to be held perpendicular to where it will be drilled, or the drill bit might 'wander' from where the hole needs to be, or the hole might be drilled oversize. For this component, the spot faces from forging will help so this doesn't happen, but it will still be difficult to get the spot faces into the correct position because of the shape of the rest of the hinge butt.

In this case a lot of hinge butts are being made as they wouldn't be forged otherwise, so it would be a good idea to make a drilling jig that the component can be placed in to make sure the spot face is positioned correctly for drilling every time, without the need for time-consuming set-up. The component would be placed into the jig, tightened or clamped into place with location plates and then drilled. The bush on the jig would guide the drill bit so it drills in the correct place and so the jig isn't damaged. If the jig was made correctly the hinge butt could just be flipped over so the lugs can be drilled separately, which would mean the depth of the drilling would be reduced, in order to improve drilling accuracy, as deep holes also lead to 'wander'. Using a drilling jig would also improve safety as clamping accuracy and consistency would be ensured as far as possible.

A.D1
An example of the use of correct technical engineering terms with a high standard of written language.



Drill jig (the bush is in yellow)
http://4.bp.blogspot.com/_2_P6uqc8P3w/TN2BBWMHxaI/AAAAAAAAAIE/u_XFoZ59INM/s1600/open+type+jig.bmp

Again, guarding and PPE (especially eye protection) would be very important to ensure compliance with PUWER and the PPE Regulations when drilling, but one of the biggest risks with this process is its simplicity, as often people take short cuts, such as not clamping down the component properly, forgetting to wear safety glasses or they leave the drill running when changing components, which can result in serious accidents. If someone gets hurt and has to stay off work for over 7 days it becomes a 'reportable injury', as specified in the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) and the Health and Safety Executive may become involved to see if there has been non-compliance with safety regulations or negligence. The employer should keep records of accidents and could adapt the process if the risk has increased, for example by requiring the use of an interlocked shield, like the below:

Drill shield
http://blog.iqsdirectory.com/plant-facility/safe-guarding-life-and-limb-in-the-workplace-with-machine-guards/

Drilling can be a very monotonous activity but the operators must still make sure they have the right experience and attitude to carry out the work appropriately, for example if the operator doesn't check the drill bit is sharp and has a keen edge it can impact on the accuracy of the hole and make it difficult for a colleague in their team to carry out further operations on the hinge butt (like reaming, see below). The drill bit starting to go blunt due to friction is a common error so this can be predicted by the operator, especially if they start having to push down harder when drilling, which is also more hazardous as the risk of slipping is increased. They should act with integrity in situations like this, as if an operator finished a shift and hadn't changed a blunt drill bit and someone else needs to carry on drilling the same batch of hinge butts it is disrespectful and introduces and avoidable danger to the process. Fatigue can't be blamed especially if management provide time/checklists for changeover, and this kind of thing can cause conflict as operators get annoyed at the disrespect paid to them by others, which can lead to communication issues and inefficiency.

A.D1
The learner has produced evidence that shows he can evaluate the impacts that a range of human factors, as an individual and a team, can have on the performance of the engineering process.

The main alternatives to drilling would be to punch the holes for the pin or to create the holes during the forging process. Both of these alternatives have disadvantages:
Punching would not really be suitable given the thickness of the lugs, as the force required could distort the shape of the holes (especially around the 'breakout') and could impart structural defects to the material around the punched area – given that the hinge butt is a component that supports weight, this could mean it would fail;

Creating the holes during forging could not guarantee the accuracy needed to make sure the holes line up for the location pin, so the holes would need to be bigger to make sure the pin can go through them both, meaning they would have more clearance and the pin would not be a tight fit – this would mean the hinge butt would not allow for smooth operation in use and might wear more quickly; and

Drilling (and then reaming) may cost more due to the requirement for a jig and the time required, but again this has to be balanced against the advantages of using this process in terms of the strength/durability and accuracy of the component in use.

To produce the holes in the lugs of the hinge butt, drilling would be more appropriate than punching or forging, due to the reasons above.

A.D1
The learner has produced evidence that evaluate the relative merits of using different engineering processes to manufacture the product.

Website references:

http://www.efunda.com/processes/machining/drill.cfm

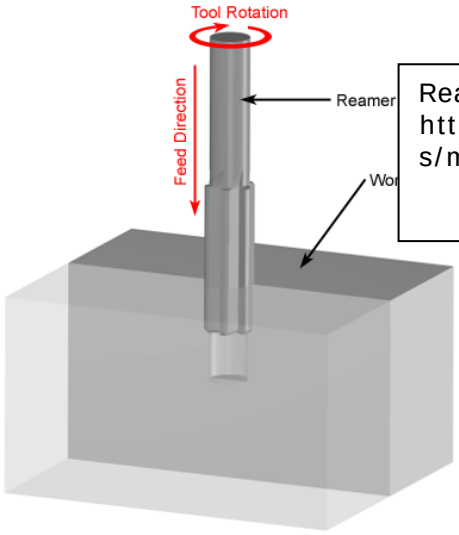
http://www.manufacturinget.org/home/tech-4571-tool-design/jig-design/

http://www.hse.gov.uk/pubns/indg453.pdf

http://www.nickols.us/factors_affecting_performance.htm

https://www.boundless.com/management/textbooks/boundless-management-textbook/groups-teams-and-teamwork-6/managing-conflict-55/the-impact-of-interpersonal-conflict-on-team-performance-276-3939/

Reaming



Reaming
http://www.custompartnet.com/wu/images/milling/reaming-mill.png

After drilling the holes for the location pin into the lugs of the component they would be reamed. You can get reamers with a taper shank so the chuck can just be removed with a drift after drilling and the reamer inserted into the drive spindle, or some machines have an indexing head that can hold more than one tool and then the drilling and reaming operations can be done one after the other.

The holes would be drilled slightly undersize giving an allowance for reaming and then they would be reamed straight away so the component doesn't need to be repositioned in the jig, although a reamer has a taper at the end of it to make sure it self-centres into the hole. Reaming is very similar to drilling but it only takes off a minimal amount of material to improve the surface finish and size accuracy of the hole. The reamer can just be pressed down into the drilled hole by the operator but more often than not an automatic traverse or feed (for consistency) and coolant (for lubrication) are used so the surface finish is improved even further. Coolant is important for reaming as without it the reamer can start to rub and the holes can go oversize (which can also create a lot of heat and be dangerous). The spindle speed when reaming is also important as this can also affect the finish – it normally needs to be quite slow in comparison to the drilling speed.

A.D1
An example of the use of correct technical engineering terms with a high standard of written language.

Reaming would be very suitable for this component as the holes are through holes, which means there doesn't need to be clearance at the bottom of the hole for swarf to go into, as the chips will just fall through.

The safety considerations for reaming would be similar to drilling (chuck guard/eye protection etc), but as coolant/lubricant is being used during the process the Control of Substances Hazardous to Health (COSHH) Regulations will apply, because bacteria and fungi can grow within the fluid which cause asthma or skin conditions, so in this case it will need to be replaced at regular intervals and barrier cream provided. These are 'control measures' and it could be a 'standard operating procedure' for the coolant to be switched off when the chuck is not rotating. In addition, to comply with COSHH, training could be provided to make sure operators are aware of the dangers of using coolant and how to use/dispose of it safely, as the latter could have an adverse impact on the environment.

At this stage it will become obvious if team members have taken short cuts or not worked to quality standards, as a plug gauge will be used to check the hole and reaming is one of the final processes that can only be completed accurately if the other processes have been. The hinge butts could very easily end up as rework or scrap at this point if they cannot be reamed accurately, and a lot of time/cost will have been wasted. If this has happened, feedback must be provided to the operators at fault so they recognise the importance of working as a team, and the need to value quality and to check their work in progress as they go along because of the impact it can have on subsequent operations. Those at fault should be encouraged to be honest and to take more responsibility for their actions in future, and to recognise that they currently have limitations and need more support with their role to make sure they can perform at the right standard. The more experienced operators will need to help the less experienced for the benefit of the team in this case.

A.D1
The learner has produced evidence that shows he can evaluate the impacts that a range of human factors, as an individual and a team, can have on the performance of the engineering process.

After drilling the holes could be bored rather than reamed, but reaming has advantages for the hinge butt component:

A boring tool normally has only one edge for cutting (unlike a reamer) so it can't be fed through the hole as quickly as a reamer (which has a lot of cutting edges/flutes), and it wears much more quickly, which is time-consuming and costly when making large numbers of a component (like the hinge butt);

A boring tool can straighten the drilled hole rather than just following it as a reamer does, but this shouldn't be a problem for this component as the holes are not deep and are drilled through which should prevent lateral movement of the location pin in use; and

Like a drill, a reamer can be bought to a standard size to suit the job so it requires less set-up when compared to boring, and this would also mean less skill, time and cost for a component like the hinge butt.

To finish the holes in the lugs of the hinge butt, reaming would be more appropriate than boring, due to the reasons above.

A.D1
The learner has produced evidence that evaluates he relative merits of using different engineering processes to manufacture the product.

Website references:

http://www.efunda.com/processes/machining/drill_ream.cfm

http://americanmachinist.com/machining-cutting/cutting-tool-applications-chapter-11-reaming-and-tapping

http://shopmetaltech.com/cutting-tools/finish-boring-vs-reaming.html

http://www.hse.gov.uk/pubns/indg136.pdf

http://www.raeng.org.uk/publications/reports/statement-of-ethical-principles

https://easa.europa.eu/essi/ecast/wp-content/uploads/2013/01/RRM-training-syllabus-Chapter-5-Human-Performance-and-Limitations-Instructors-notes-version-1.01.docx

Computer Numerically Control (CNC) drilling and reaming

The drilling and the reaming could also be completed on a CNC machine tool rather than on a conventional drill; the process would be faster, as both the drill bit and the reamer could be set-up in the turret so they could just rotate around automatically when needed, and a CNC machine is totally enclosed, which is much safer; however, the cost of both the machine and the tooling to hold the hinge butt might make this option unviable. The costs of the machine and tooling would have to be considered against how many hinge butts are to be made and whether the time savings are worthwhile, especially given that the body would still need to be forged, which in itself is costly.

Website references:

https://www.dlsweb.rmit.edu.au/toolbox/furnishindustry/toolbox/shared/resources_mw/ask_expert/tony/advantages.htm

Learner Assessment Submission and Declaration

This sheet must be completed by the learner and provided for work submitted for assessment.

Learner name: Owen Ford		**Assessor name:** Martin Berry
Date issued: 5/10/16	**Completion date:** 19/10/16	**Submitted on:** 19/10/15
Qualification: BTEC Level 3 National Extended Diploma in Engineering		
Assessment reference and title: Engineering processes and human factors		

Please list the evidence submitted for each task. Indicate the page numbers where the evidence can be found or describe the nature of the evidence (e.g. video, illustration).

Task ref.	Evidence submitted	Page numbers or description
For LA A	Report	All
Comments for note by the Assessor:		

Learner declaration

I certify that the work submitted for this assignment is my own. I have clearly referenced any sources used in the work. I understand that false declaration is a form of malpractice.

Learner signature: O Ford **Date:** 19/10/16

ASSESSMENT RECORD SHEET			
Programme	**Pearson BTEC Level 3 National Extended Diploma in Engineering**	**Learner name**	**Owen Ford**
Assignment title	**Engineering processes and human factors**	**Assessor name**	**Martin Berry**
Unit no. & title	**Unit 2: Delivery of Engineering Processes Safely as a Team**	**Targeted assessment criteria**	**A.P1, A.P2, A.M1, A.D1**
Issue date	**5/10/16**	**Submission deadline**	**19/10/16**
First submission / resubmission?*	**First**	**Date submitted**	**19/10/16**
Resubmission authorisation by Lead Internal Verifier*		**Date**	

* All resubmissions must be authorised by the **Lead Internal Verifier**. Only **one** resubmission is possible per assignment, providing:

- The learner has met initial deadlines set in the assignment, or has met an agreed deadline extension.
- The tutor considers that the learner will be able to provide improved evidence without further guidance.
- Evidence submitted for assessment has been authenticated and accompanied by a signed and dated declaration of authenticity by the learner.

Any resubmission evidence **must be submitted within 10 working days of receipt of results of assessment.

Targeted criteria	Criteria achieved? (Yes / No)	Assessment comments
A.P1	Yes	Well done, you have clearly explained how three engineering processes are used safely when manufacturing a component.
A.P2	Yes	You have also clearly explained how human factors affect the performance of engineering processes.
A.M1	Yes	In your work there is clear analysis as to why the three engineering processes are used to manufacture the component and how human factors, as an individual and a team, can affect the performance of the engineering processes.
A.D1	Yes	There is also clear evaluation, using high quality written language, of the effectiveness of using the different engineering processes to manufacture the component and how human factors, as an individual and a team, affect the performance of the engineering processes.

General comments
Well done Owen, great work. I like the way you have referenced all your internet links and made use of images where appropriate.

Assessor declaration	I certify that the evidence submitted for this assignment is the learner's own. The learner has clearly referenced any sources used in the work. I understand that false declaration is a form of malpractice.		
Assessor signature	M Berry	**Date**	21/10/16
Learner comments	I'm pleased with this. I put a lot of effort into it.		
Learner signature	O Ford	**Date**	21/10/16