



**BEAUDESERT STATE HIGH SCHOOL**

**ENGINEERING WORK BOOK**

**3 LEGGED WHEELPULLER**

Time allowed – 11 weeks



## Procedure for making the Wheel Puller

### Legs

1. Mark out on a piece of 20 x 20 squared grid paper the shape required for the legs (see the drawing).
2. Cut out and use this to make a tinplate template, ensuring that the position of the hole is marked and centre punched.
3. Cut a piece of 80 x 10 black mild steel x 50 long (for 3 legs) on the cold saw.
4. Mark out the three legs on this steel using the template, witness mark all round each leg shape and centre punch the position of each hole.
5. Drill the 8.5 diameter holes, using a pedestal drill, clamp the piece to the table, for each hole.
6. Use the Oxy Acetylene cutting torch to cut out the shapes to within 1 mm of the lines if possible.
7. Remove any slag from the legs using a hammer and cold chisel.
8. Use the angle grinder to rough grind to the witness marks.
9. Use a half round bastard file to smooth and square the faces.
10. Use hand 2<sup>nd</sup> cut and then smooth files to finish the surfaces to a smooth and square finish.

### Spindle

1. Cut a piece of 25 AF hexagonal bright mild steel to 193 long using the cold saw.
2. Face both ends to the correct length of 190 overall.
3. Centre drill one end in the centre lathe, and set up the piece in the lathe held by 20 mm, with the other end supported by the live centre.
4. Turn the 20 diameter x 160, with a 10 mm undercut.
5. Chamfer the end for starting the thread.
6. Hold by the 20 diameter (about 30mm out) and drill the 8 diameter x 16 deep hole, then counter sink x 1mm.
7. Use a stock and die to start the M20 x 2.5 thread in the lathe (hand turn) to ensure that the thread is started square, thread up to the width of the die, then finish off the thread in the hand vice.
8. Hold the spindle by the hexagonal head (around 10 out) and chamfer the head using the compound slide set to 45degrees.

## Yoke and Wings

1. Cut 3 pieces 30 x 10 x 30 long from bright mild steel.
2. Mark out, centre punch, and drill the holes at 8.5 diameter, using the pedestal drill – make sure that the work is held in the vice which is clamped to the table.
3. Grind or file the 10 mm radii on one end of each piece.
4. Cut a piece of bright mild steel 25 AF hexagonal bar to 33 long on the cold saw.
5. Face both ends of the piece to a length of 30 mm.
6. Centre drill and drill right through at 16.5 mm.
7. Set up the small tipped boring tool and bore this out to 17.5 mm.
8. Counter sink both ends x 2 mm.
9. Hand turn the cutting of the thread in the centre lathe using the tailstock to ensure that the tap and work piece axes remain parallel.
10. Weld the three lugs onto the hexagonal body.

## Straps

1. Cut the 6 straps from 25 x 6 black mild steel to 65 long.
2. Square a line across the centre of each both ways.
3. Mark lines 20 from the centre out to the ends and use dividers to mark the 12.5 radius semicircular ends.
4. Mark out a further 5 mm from these lines and centre punch the position of the holes.
5. Drill these at 8.5 diameter – use the vice, clamp down the vice to hold.
6. Use the pedestal grinder or file the ends to the shapes marked.

## Hardened Cap

1. Cut a piece of 20 diameter silver steel to 32 long.
2. Face both ends in the centre lathe to a finished size of at least 29 mm.
3. Turn the 8 diameter x 15 spigot, lightly chamfer both 90 corners.

4. Reverse and hold by the 8 diameter spigot (make sure that this is a sliding fit into the end of the spindle).
5. Set the compound slide to 45 degrees and turn the pointed end.
6. Heat up to a cherry red colour using the Oxy Acetylene torch and then quench in the oil bath to harden.

### Competencies covered

#### **Unit 1.1F.1 Undertake interactive workplace communication.**

**Element – 1.1F.1 Communicate information about tasks, processes, events, or skills.**

Criteria		Met
1.1F 1.1	An appropriate choice of communication techniques are used.	
1.1F 1.2	Multiple operations involving several topics are communicated.	
1.1F 1.3	Listening is done without continuous interruptions of the speaker.	
1.1F 1.4	Questions are asked to gain extra information	
1.1F 1.5	Correct sources of information are identified	
1.1F 1.6	Information is selected and sequenced appropriately	
1.1F 1.7	Verbal reporting and written reporting done where required	
1.1F 1.8	Communication is demonstrated in unfamiliar situations	

**Element - 1.1F.2 Take part in group discussion to achieve appropriate work outcomes.**

1.1F 2.1	Responses sought and provided from others in the group	
1.1F 2.2	Constructive contributions are made towards the production processes involved.	
1.1F 2.3	Goals and aims are communicated.	

**Element - 1.1F 3 Represent the views of the group to others.**

1.1F 3.1	Views and opinions of others are understood and reflected accurately.	
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#### **Unit 1.2F Apply principles of occupational health and safety (OH&S) in work.**

**Element – 1.2F.1 Follow safe work practices**

1.2F 1.1	Work is carried out safely to school standards and legislative requirements.	
1.2F 1.2	Housekeeping is undertaken to school standards.	
1.2F 1.3	Responsibilities and duties of students are understood and demonstrated.	
1.2F 1.4	Personal protective equipment is worn and stored to school standards.	
1.2F 1.5	All equipment and safety devices are used to legislative requirements and school standards.	

1.2F 1.6	Safety signs are identified and followed as per instruction.	
1.2F 1.7	All manual handling is carried out to legal requirements and school standards.	
1.2F 1.8	Emergency equipment identified and used as appropriate.	

#### **Element – 1.2F.2 Report workplace hazards**

1.2F 2.1	Workplace hazards identified and reported to teacher.	
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#### **Element – 1.2F.3 Follow emergency procedures**

1.2F 3.1	Identifies the means of contacting appropriate personnel in the event of an accident	
1.2F 3.2	Emergency and evacuation procedure understood and carried out.	
1.2F 3.3	School evacuation procedures followed	

### **Unit 1.3F Apply quality procedures**

#### **Element - 1.3F.1 Take responsibility for own quality**

1.3F 1.1	Concept of supplying product or service to meet customer needs or requirements understood and applied.	
1.3F 1.2	Accepts the “right first time” concept as a personal responsibility	

#### **Element – 1.3F.2 Apply standard procedures of workplace quality to own job**

1.3F 2.1	Quality system procedures followed.	
1.3F 2.2	Conformance to specifications ensured.	

### **Unit 1.4F Plan to undertake a routine task**

#### **Element – 1.4F.1 Identify task requirements**

1.4F 1.1	Instructions for procedures are obtained, understood and if necessary, clarified.	
1.4F 1.2	Relevant specifications for task outcomes are obtained, understood, and if necessary, clarified.	
1.4F 1.3	Task outcomes are identified	
1.4F 1.4	Task requirements, such as completion time and quality measures are identified.	

#### **Element – 1.4F.2 Plan steps required to complete task**

1.4F 2.1	Based on specifications and instructions provided, the individual steps or activities required to undertake the task are understood, and if necessary, clarified.	
1.4F 2.2	Sequence of activities required to be completed are identified in plan.	
1.4F 2.3	Planned steps and outcome are checked to ensure conformity with	

	instructions and relevant specifications.	
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### Element – 1.4F.3 Review plan

1.4F	3.1	Outcomes are identified and compared with (planned) objectives, task instructions, specifications, and task requirements.	
1.4F	3.2	If necessary, plan is revised, to better meet objectives and task requirements.	

## Unit 2.5C11 Measure with graduated devices

### Element – 2.5C11.1 Use graduated devices to check dimensions or variables

2.5C11	1.1	Selects appropriate device or equipment to achieve required outcome.	
2.5C11	1.2	The correct and appropriate measurement technique used.	
2.5C11	1.3	Measures accurately to the finest graduation of the instrument.	

### Element – 2.5C11.2 Maintain graduated devices

2.5C11	2.1	Routine care and storage of devices undertaken to manufacturers specification or standard operating procedure.	
2.5C11	2.2	Checks and maintains routine adjustments to devices e.g. zeroing.	

## Unit 7.32A Use workshop machines for basic operations

### Element – 7.32A.1 Determine job requirements

7.32A	1.1	Job requirements interpreted.	
7.32A	1.2	Appropriate machine selected to meet requirements.	

### Element – 7.32A.2 Set up machine

7.32A	2.1	Tools are selected where appropriate.	
7.32A	2.2	Cutting tools are sharpened as required.	
7.32A	2.3	Tools are correctly installed using standard operating procedures.	
7.32A	2.4	Appropriate guards are set and adjusted as required.	

### Element – 7.32A.3 Operate machine

7.32A	3.1	Material to be machined is positioned and secured.	
7.32A	3.2	Machine is operated appropriately to suit job and material requirements.	

### Element – 7.32A.4 Check finished component

7.32A	4.1	Machined component checked against requirements and predetermined finish.	
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## Unit 18.1A Use hand tools

### Element – 18.1A.1 Use hand tools

18.1A	1.1	Appropriate hand tools selected according the task requirements.	
18.1A	1.2	Hand tools are used to produce required outcomes to job specifications which may include finish, tension, size or shape.	
18.1A	1.3	All safety requirements are adhered to before during and after use.	
18.1A	1.4	Unsafe or faulty tools are identified and marked for repair, according to designated procedures, before, during, and after use.	
18.1A	1.5	Routine maintenance of tools, including hand sharpening undertaken according to standard operational procedures, principles, and techniques.	
18.1A	1.6	Hand tools are stored safely in an appropriate location, according to standard operational procedures, and manufacturers' recommendations.	

## Unit 18.2A Use power tools/hand held operations

### Element – 18.2A Use power tools

18.2A	1.1	Appropriate power tools selected according to the task requirements.	
18.2A	1.2	Power tools used following a determined sequence of operation, which may include, clamping, alignment and adjustment to produce desired outcomes to job specifications which may include finish, size or shape.	
18.2A	1.3	All safety requirements are adhered to before during and after use.	
18.2A	1.4	Unsafe or faulty tools are identified and marked for repair, according to designated procedures, before, during, and after use.	
18.2A	1.5	Operational maintenance of tools , including hand sharpening undertaken according to standard operational procedures, principles, and techniques.	
18.2A	1.6	Power tools are stored safely in an appropriate location, according to standard workshop procedure, and manufacturers' recommendations	

### Machinery and equipment used

300 mm rules, scribes, centre punches, hammers, pedestal drill, pedestal grinder, hacksaw, metal work vice, cold cutting saw, centre lathe, HSS tool bit and straight or right hand tool holder, centre drill, live centre, stock and die, tap wrench, oxy acetylene cutter and heating torch, angle grinder, hand files, tinsnips.

## **Record keeping**

All criteria which have been successfully met by each student, must be recorded on the students **Engineering Competencies Student Booklet** as soon as possible, but no less often than at the end of each semester.