Trade of Toolmaking			
Module 4:	Grinding		
Unit 3:	Mounting & Dressing the Grinding Wheel		
	Phase 2		

Published by



## **Table of Contents**

Docun	nent Release History	
Unit C	Dbjective4	
Introd	luction4	
1.0	Ensuring That The Maximum Speed Is Not Exceeded	
1.1	Ensure Maximum Spindle Speed Does Not Exceed Maximum Wheel Speed5	
2.0	Applying Safety Procedures When Mounting Grinding Wheels5	
2.1	Safety Hazards Associated With Surface Grinding5	
3.0	Safely Removing And Refitting All Guards5	
3.1	Safe Removal And Refitting Of Guards5	
4.0	Identifying Appropriate Abrasive Wheels For Various Applications	
4.1	Selection Of The Abrasive Wheel For Grinding Steel Components	
5.0	mounting abrasive wheels on a straight spindle6	
5.1	Use And Function Of Blotters (Paper Washers)6	
5.2	Correct Tightening Of Flange Nuts To Provide The Drive, Tightening Procedures.6	
5.3	Use Of Torque Wrench	
5.4	Safe Mounting Of Abrasive Wheels On A Straight Spindle6	
6.0	Mounting Abrasive Wheels On A Tapered Spindle7	
6.1	Safe Mounting Of Abrasive Wheels On A Tapered Spindle7	
7.0	Mounting A Cup Wheel And A Cut-Off Wheel7	
7.1	Caution When Mounting Cut-Off Wheel I.E. Use Of Spacer7	
8.0	Positioning A Diamond And Safely Dressing And Truing An Abrasive Wheel8	
8.1	Grinding Wheel Faults E.G. Loading And Glazing8	
8.2	Safe Handling Of The Diamond Dresser To Prevent Damage	
8.3	Positioning Of The Diamond Correctly For Dressing The Wheel8	
8.4	Preparation And Dressing Of The Wheel	
Summ	nary9	
Sugge	sted Exercises10	
Questi	ions11	
Answe	ers12	
Recon	nmended Additional Resources13	
Refe	erence Books	

## **Document Release History**

Date	Version	Comments
25/09/2014	2.0	SOLAS transfer

## Unit Objective

On completion of this unit you will be able to apply proper safety procedures when mounting a grinding wheel, identify appropriate grinding wheels for various applications. You will also learn how to dress and true the wheel.

## Introduction

Module four of this course covers grinding. This is the third unit in module four and explains how to apply safety precautions when mounting different types of grinding wheels. This unit also explains how to identify the correct wheel when cutting steel components. It is important that the spindle speed never exceeds the speed limit recommended by the manufacturer.

In Workshops and Toolrooms nowadays there is a big emphasis in maximising productivity, which means getting the job done as quickly as possible. But factors such as speed, competitiveness and increasing productivity must never allow safety to be compromised when checking, mounting and dressing a grinding wheel. It is also important to replace all guards and ensure that they are locked in place, prior to starting any job.



By the end of this unit you will be able to:

- Ensure the maximum spindle speed does not exceed the maximum wheel speed.
- Apply the required safety procedures for the mounting of abrasive wheels.
- Safely remove and refit all guards to safe working condition.
- Identify appropriate abrasive wheels for various applications and steels.
- Mount a straight abrasive wheel with large and small bore on a straight spindle.
- Mount a straight abrasive wheel with large and small bore on a tapered spindle.
- Mount a cup wheel and a cut-off wheel.
- Position the diamond correctly relative to the wheel rotation and safely dress and true an abrasive wheel.

## **1.0 Ensuring That The Maximum Speed Is Not Exceeded**

#### **Key Learning Points**

Ensure maximum spindle speed does not exceed maximum wheel speed.

# 1.1 Ensure Maximum Spindle Speed Does Not Exceed Maximum Wheel Speed

It is important that the grinding wheel is not run beyond the maximum speed limit to that recommended by the manufacturer. Running the grinding wheel past the maximum speed limit could cause the wheel to disintegrate leading to serious injury. It is important therefore to check the recommended speed limits of the grinding wheel and the speed of the grinding machine spindle before mounting the wheel.

## 2.0 Applying Safety Procedures When Mounting Grinding Wheels

#### **Key Learning Points**

Safety hazards associated with surface grinding.

#### 2.1 Safety Hazards Associated With Surface Grinding

From a safety point of view, it is important to choose the correct grinding wheel for the job. The wheel should be mounted correctly and run between the speed limits recommended by the manufacturer. Prior to mounting the wheel it should be checked to ensure that it is not cracked. It should also be checked to ensure that it is not out of balance and balanced if required. This should only be carried out by a qualified person. Before starting the wheel ensure that safety glasses are worn, no loose clothing is worn, long hair is tied back and that all guards are fitted correctly.

## **3.0 Safely Removing And Refitting All Guards**

#### **Key Learning Points**

Safe removal and refitting of guards.

#### 3.1 Safe Removal And Refitting Of Guards

The grinding machine should be switched off prior to removing guards, especially the wheel guard. When refitting the guards ensure that they fit correctly and lock them in place.

## 4.0 Identifying Appropriate Abrasive Wheels For Various Applications

#### Key Learning Points

Selection of the abrasive wheel for grinding steel components.

#### 4.1 Selection Of The Abrasive Wheel For Grinding Steel Components

For grinding mild steel components, a wheel that is commonly used is labelled with the symbols, A 46 M 8 V. This type of wheel is made up of *aluminium oxide* (A) grains, which are suspended in a bond of *vitrified clay* (V). The grain size (54), grade (M) and the structure (8) are all in the medium range.

Ref: Black, Bruce J 2004, *Workshop processes, practices and materials*, 3<sup>rd</sup> edn, Elsevier Science & Technology, chapter 10, *Surface grinding; characteristics*, p. 170. ISBN-13: 9780750660730

### 5.0 mounting abrasive wheels on a straight spindle

#### **Key Learning Points**

Use and function of blotters (paper washers). Correct tightening of flange nuts to provide the drive, tightening procedures. Use of torque wrench. Safe mounting of abrasive wheels on a straight spindle.

#### 5.1 Use And Function Of Blotters (Paper Washers)

Blotting paper washers are placed between the flanges and the grinding wheel in order to provide an even pressure around the wheel, when it is locked in place.

#### 5.2 Correct Tightening Of Flange Nuts To Provide The Drive, Tightening Procedures

It is important to tighten the locking nuts in the flange in the correct sequence and to the exact torque value as that recommended by the manufacturer.

#### 5.3 Use Of Torque Wrench

A torque wrench can be used to tighten the locking nut to the exact torque value as that recommended by the manufacturer.

#### 5.4 Safe Mounting Of Abrasive Wheels On A Straight Spindle

The grinding wheel is held on the spindle of the grinding machine and clamped between two flanges of equal size. A locking nut is used to secure the wheel in place. The inside flange is permanently fixed on the spindle and the other is positioned on the outside to hold the wheel in place. A lead or plastic bushing is positioned between the machine spindle and the bore in the wheel. Blotting paper or rubber washers need to be placed between the flanges and the grinding wheel in order to provide an even pressure around the wheel. The locking nut should be tightened sufficiently to hold the wheel firmly without slipping, but should not be over tightened. The grinding wheel safety guard should always be replaced and locked in place.

## 6.0 Mounting Abrasive Wheels On A Tapered Spindle

#### **Key Learning Points**

Safe mounting of abrasive wheels on a tapered spindle.

#### 6.1 Safe Mounting Of Abrasive Wheels On A Tapered Spindle

This type of grinding wheel is held on a central metal hub, which has a tapered bore. The grinding wheel and metal hub assembly is then attached to the tapered spindle of the grinding machine. The locking nut is then screwed against the recessed face of the metal hub.

## 7.0 Mounting A Cup Wheel And A Cut-Off Wheel

#### **Key Learning Points**

Caution when mounting cut-off wheel i.e. use of spacer.

#### 7.1 Caution When Mounting Cut-Off Wheel I.E. Use Of Spacer

A cup wheel is mounted similar to that of a straight wheel as explained above. It is important that the cupped shape is facing outwards and the flange being used has adequate clearance when positioned inside the cup shape. The cut-off is again mounted as above, but spacers need to be positioned between the two flanges and the wheel. Ensure that the flanges used are of equal size for both the cup and cut-off wheel.

## 8.0 Positioning A Diamond And Safely Dressing And Truing An Abrasive Wheel

#### Key Learning Points

Grinding wheel faults e.g. loading and glazing. Safe handling of the diamond dresser to prevent damage. Positioning of the diamond correctly for dressing the wheel. Preparation and dressing of the wheel.

#### 8.1 Grinding Wheel Faults E.G. Loading And Glazing

The surface of the wheel becomes *loaded* when small particles become embedded in the space between the grains of the wheel. This is recognised by the rapid reduction of the cutting action of the wheel. *Glazing* is caused by grinding a hard material with a wheel that has too hard a bond. The abrasive particles become dull when the bond is too strong to allow them to break out.

#### 8.2 Safe Handling Of The Diamond Dresser To Prevent Damage

When the wheel becomes loaded it needs to be dressed with diamond tool. It is important that the diamond tool holder is securely locked onto the magnetic table or in a grinding vice. When a wheel becomes glazed it should be dressed and then removed to be replaced with a wheel which has a softer bond.

Ref: Black, Bruce J 2004, *Workshop processes, practices and materials*, 3<sup>rd</sup> edn, Elsevier Science & Technology, chapter 10, *Surface grinding; dressing*, p. 165. ISBN-13: 9780750660730

#### 8.3 Positioning Of The Diamond Correctly For Dressing The Wheel

The diamond tip should be held in the holder at an angle of 10° to 15° or more, tilting in the direction of the rotating wheel. This will ensure that the diamond itself does not become flat, which would blunt the newly exposed abrasive grains.

Ref: Black, Bruce J 2004, *Workshop processes, practices and materials*, 3<sup>rd</sup> edn, Elsevier Science & Technology, chapter 10, *Surface grinding; dressing*, p. 165. ISBN-13: 9780750660730

#### 8.4 Preparation And Dressing Of The Wheel

The grinding wheel is dressed by placing the diamond and its holder onto the magnetic chuck and lock in place. The centre of the wheel is positioned over diamond tip the then lowered slowly until it touches the diamond. Using the cross traverse hand wheel the diamond dresser is moved across the surface of the grinding wheel. The wheel is then lowered by a small amount and the process is repeated until the worn grains are removed and new ones exposed.

Ref: Black, Bruce J 2004, *Workshop processes, practices and materials*, 3<sup>rd</sup> edn, Elsevier Science & Technology, chapter 10, *Surface grinding; dressing*, p. 165. ISBN-13: 9780750660730

## Summary

**Ensuring that the maximum speed is not exceeded**: It is important that the grinding wheel is not run beyond the maximum speed limit to that recommended by the manufacturer. Running the grinding wheel past the maximum speed limit could cause the wheel to disintegrate leading to serious injury. It is important therefore to check the recommended speed limits of the grinding wheel and the speed of the grinding machine spindle before mounting the wheel.

**Applying safety procedures when mounting grinding wheels**: From a safety point of view, it is important to choose the correct grinding wheel for the job. The wheel should be mounted correctly and run between the speed limits recommended by the manufacturer. Prior to mounting the wheel it should be checked to ensure that it is not out of balance and balanced if required. This should only be carried out by a qualified person. Before starting the wheel ensure that safety glasses are worn, no loose clothing is worn within the working area, long hair is tied back and that all guards are fitted correctly.

**Safely removing and refitting all guards**: The grinding machine should be switched off prior to removing guards, especially the wheel guard. When refitting the guards ensure that they fit correctly and lock them in place.

**Identifying appropriate abrasive wheels for various applications**: For grinding mild steel components, a wheel that is commonly used is labelled with the symbols, **A 46 M 8 V**. This type of wheel is made up of *aluminium oxide* (A) grains, which are suspended in a bond of *vitrified clay* (V). The *grain size* (54), *grade* (M) and the *structure* (8) are all in the medium range.

**Mounting abrasive wheels on a straight spindle**: The grinding wheel is held on the spindle of the grinding machine between two flanges of equal size and a locking nut. The inside flange is permanently fixed on the spindle and the other is positioned on the outside to hold the wheel in place. A lead or plastic bushing is positioned between the machine spindle and the bore in the wheel. Blotting paper or rubber washers need to be placed between the flanges and the grinding wheel in order to provide an even pressure around the wheel. The locking nut should be tightened sufficiently to hold the wheel firmly without slipping, but should not be over tightened. A torque wrench can be used to tighten the locking nut to the exact torque value as that recommended by the manufacturer. The grinding wheel safety guard should always be replaced and locked in place.

**Mounting abrasive wheels on a tapered spindle**: This type of grinding wheel is held on a central metal hub, which has a tapered bore. The grinding wheel and metal hub assembly is then attached to the tapered spindle of the grinding machine. The locking nut is then screwed against the recessed face of the metal hub.

**Mounting a cup wheel and a cut-off wheel**: A cup wheel is mounted similar to that of a straight wheel as explained above. It is important that the cupped shape is facing outwards and the flange being used has adequate clearance when positioned inside the cup shape. The cut-off is again mounted as above, but spacers need to be positioned between the two flanges and the wheel. Ensure that the flanges used are of equal size for both the cup and cut-off wheel.

**Positioning a diamond and safely dressing and truing an abrasive wheel**: When the wheel becomes loaded it needs to be dressed with diamond tool. It is important that the diamond tool holder is securely locked onto the magnetic table or in a grinding vice.

## **Suggested Exercises**

- 1. What is the purpose of having blotters (paper washers) at each side of the grinding wheel?
- 2. Why is important to run the grinding wheel within the speed limit as recommended by the manufacturer?
- 3. What precautions do you take when mounting a cup wheel or a cut-off wheel?
- 4. Explain the meaning of loading and glazing.
- 5. Explain how to use a diamond dresser to dress a grinding wheel.

## Questions

- 1. A grinding wheel has the markings: A 54 J 5 V, explain what it means.
- 2. When the grinding wheel is clamped onto the spindle of the grinding machine, what is used to ensure an even clamping pressure at each side of the wheel?
- 3. Explain how to safely mount a cut-off wheel on the spindle.
- 4. What happens to the grinding when it becomes loaded and what is used to remove the particles from the loaded wheel?
- 5. Explain how the grinding wheel is dressed.

## Answers

- 1. For grinding mild steel components, a wheel that is commonly used is labelled with the symbols, A 54 M 8 V. This type of wheel is made up of aluminium oxide (A) grains, which are suspended in a bond of vitrified clay (V). The grain size (54), grade (M) and the structure (8) are all in the medium range.
- 2. Blotting paper washers are placed between the flanges and the grinding wheel in order to provide an even pressure around the wheel, when it is locked in place.
- 3. The cut-off wheel is thinner than the standard wheel and must therefore be mounted between two spacers, which in turn are placed between the two flanges and locked in place. Ensure that the flanges used are of equal size.
- 4. The surface of the wheel becomes loaded when small particles become embedded in the space between the grains of the wheel. This is recognised by the rapid reduction of the cutting action of the wheel. Theses particles are removed by dressing the wheel with a diamond dresser.
- 5. The grinding wheel is dressed by placing the diamond and its holder onto the magnetic chuck and lock in place. The centre of the wheel is positioned over diamond tip the then lowered slowly until it touches the diamond. Using the cross traverse hand wheel the diamond dresser is moved across the surface of the grinding wheel. The wheel is then lowered by a small amount and the process is repeated until the worn grains are removed and new ones exposed.

## **Recommended Additional Resources**

#### **Reference Books**

Black, Bruce J 2004, *Workshop processes, practices and materials*, 3<sup>rd</sup> edn, Elsevier Science & Technology.

ISBN-13: 9780750660730

Simmons, Colin H & Maguire, Dennis E 2004, *Manual of engineering drawing*, 2<sup>nd</sup> edn, Elsevier Science & Technology.

ISBN-13: 9780750651202

Bird, John 2005, *Basic engineering mathematics*, 4<sup>th</sup> edn, Elsevier Science & Technology. ISBN-13: 9780750665759