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# **Document Release History**

Date	Version	Comments
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# **Unit Objective**

On completion of this unit you will be able to identify the need to balance a grinding wheel and also learn how to true and dress the wheel.

# Introduction

Module four of this course covers grinding. This is the fourth unit in module four and describes the hazards associated with an out of balance wheel. It is important to note that an out of balance wheel can actually break up when running at high speed and this can result in serious injury. At a minimum an out of balance wheel will result in poor surface finish on the workpiece and can cause bearing wear on the spindle. These issues will be discussed in more detail later.

It is important to understand how a grinding wheel is balanced on the balancing stand, but this task should only be carried out by a qualified person. However you will need to learn how to true and dress the wheel. The grinding wheel may need to be dressed a number of times while grinding a workpiece.



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

- Describe the hazards associated with an out of balance wheel.
- Identify the need to balance a grinding wheel.
- Rough-true the wheel taking the necessary precautions.
- Set the balancing stand correctly.
- Statically balance a grinding wheel.

# **1.0** The Hazards Associated With An Out Of Balance Wheel

## **Key Learning Points**

Out of balance wheels cause: poor finish, loss of close tolerances, excessive wear on the wheel, bearing wear. Positioning of the diamond dresser. Moments of force, centrifugal force, moments of inertia.

## 1.1 Out Of Balance Wheels Cause: Poor Finish, Loss Of Close Tolerances, Excessive Wear On The Wheel, Bearing Wear

An out of balance wheel can result in poor finish and a loss of close tolerances on the workpiece. It can also lead to excessive wear on the grinding wheel and cause wear on the bearings.

Ref: Black, Bruce J 2004, *Workshop processes, practices and materials*, 3<sup>rd</sup> edn, Elsevier Science & Technology, chapter 10, *Surface grinding; balancing*, p. 166. ISBN-13: 9780750660730

## **1.2 Positioning Of The Diamond Dresser**

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

## **1.3** Moments Of Force, Centrifugal Force, Moments Of Inertia

When the wheel is running at high speed, centrifugal forces are exerted outwards from the central axis. If the wheel is out of balance it is subjected to unbalanced centrifugal forces, which will cause the problems listed above and could cause the wheel to break up and disintegrate leading to serious injury and damage the workpiece.

# 2.0 Identifying The Need To Balance Grinding Wheels

## **Key Learning Points**

Advantages of wheel balancing: machine and diamond dresser life is increased, balancing permits increased production, greater accuracy and superior surface finish.

## 2.1 Advantages Of Wheel Balancing

A poor finish on the workpiece or the loss of close tolerances may be rectified by dressing the wheel, but if this does not work, then it should be checked to see if it is out of balance. This should only be carried out by a qualified person. A balanced wheel that has been trued and dressed will result in increased productivity, greater accuracy and a better surface finish.

Ref: Black, Bruce J 2004, *Workshop processes, practices and materials*, 3<sup>rd</sup> edn, Elsevier Science & Technology, chapter 10, *Surface grinding; balancing*, p. 166. ISBN-13: 9780750660730

## **3.0 Rough-Truing The Wheel**

#### **Key Learning Points**

Reason for rough truing, precautions if coolant is used.

## 3.1 Reason For Rough Truing, Precautions If Coolant Is Used

When a new wheel has been mounted on the grinding machine spindle, it is necessary to true the face of the wheel. Truing is carried out by means of a diamond dressing tool. Dressing is also carried out by a diamond tool and is performed during the grinding process to clean and open up the face of the grinding wheel. When a large amount of material needs to be removed from the workpiece, it may more productive to rough grind the workpiece with a rough open faced wheel and then finish it with a fine wheel to get a good surface finish. This can also be achieved by using one wheel only. Never leave the coolant running when the wheel is stopped, as the coolant will soak into one side of the wheel, which will cause it to be out of balance when turned on, which could cause the wheel to break up and disintegrate leading to serious injury and damage the workpiece.

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

## 4.0 Setting The Balancing Stand Correctly

#### **Key Learning Points**

Use of the correct procedure to balance the wheel.

## 4.1 Use Of The Correct Procedure To Balance The Wheel

The balancing stand should be positioned on a flat rigid surface prior to balancing the grinding wheel. Some balancing stands are equipped with a leveling screw and a bubble level.

Ref: Black, Bruce J 2004, *Workshop processes, practices and materials*, 3<sup>rd</sup> edn, Elsevier Science & Technology, chapter 10, *Surface grinding; balancing*, p. 166. ISBN-13: 9780750660730

# 5.0 Statically Balancing A Grinding Wheel

## **Key Learning Points**

Use of the balancing stand with knife edge rollers or parallel ways. Use of the best procedure to balance the wheel. Tighten the weights sufficiently to hold their position. Truing and dressing the grinding wheel.

# 5.1 Use Of The Balancing Stand With Knife Edge Rollers Or Parallel Ways

The balancing stand may have four knife edged wheels on which the mandrel and wheel assembly are positioned. Not all balancing stands have wheels, but may instead have two knife edged rails.

Ref: Black, Bruce J 2004, *Workshop processes, practices and materials*, 3<sup>rd</sup> edn, Elsevier Science & Technology, chapter 10, *Surface grinding; balancing*, fig.10.9, p. 166. ISBN-13: 9780750660730

## 5.2 Use Of The Best Procedure To Balance The Wheel

The grinding wheel should be tested for balance prior to it being mounted on the grinding machine. The wheel is first mounted on at the centre of a spindle or mandrel. The mandrel and wheel assembly are positioned on the knife edged wheels of the balancing stand. If the wheel is out of balance, the heavy side of the wheel will come to rest underneath. The wheel can be balanced by removing lead from the lead bush or if the wheel is assembled with the flanges, weights on the flanges can be adjusted until the wheel is balanced.

Ref: Black, Bruce J 2004, *Workshop processes, practices and materials*, 3<sup>rd</sup> edn, Elsevier Science & Technology, chapter 10, *Surface grinding; balancing*, p. 166. ISBN-13: 9780750660730

## 5.3 Tighten The Weights Sufficiently To Hold Their Position

It is very important to tighten the weight sufficiently so that they do not loosen when the grinding wheel is rotating at high speeds.

## 5.4 Truing And Dressing The Grinding 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. When rough grinding the workpiece, traverse the diamond dressing tool quickly across the face of the wheel. When a fine finish is required, the diamond tool should be traversed slowly across the face of the wheel.

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

The hazards associated with an out of balance wheel: An out of balance wheel can result in poor finish and a loss of close tolerances on the workpiece. It can also lead to excessive wear on the grinding wheel and cause wear on the bearings. When the wheel is running at high speed, centrifugal forces are exerted outwards from the central axis. If the wheel is out of balance it is subjected to unbalanced centrifugal forces, which will cause the problems listed above and could cause the wheel to break up and disintegrate leading to serious injury and damage the workpiece.

**Identifying the need to balance grinding wheels:** A poor finish on the workpiece or the loss of close tolerances may be rectified by dressing the wheel, but if this does not work, then it should be checked to see if it is out of balance. A balanced wheel that has been trued and dressed will result in increased productivity, greater accuracy and a better surface finish.

**Rough-truing the wheel:** When a new wheel has been mounted on the grinding machine spindle, it is necessary to true the face of the wheel. Truing is carried out by means of a diamond dressing tool. Dressing is also carried out by a diamond tool and is performed during the grinding process to clean and open up the face of the grinding wheel. When a large amount of material needs to be removed from the workpiece, it may more productive to rough grind the workpiece with a rough open faced wheel and then finish it with a fine wheel to get a good surface finish. This can also be achieved by using one wheel only. This is done by traversing the diamond dressing tool quickly across the face of the workpiece.

**Setting the balancing stand correctly:** The balancing stand should be positioned on a flat rigid surface prior to balancing the grinding wheel. Some balancing stands are equipped with a leveling screw and a bubble level. The balancing stand has four knife edged wheels on which the mandrel and wheel assembly are positioned.

**Statically balancing a grinding wheel:** The grinding wheel should be tested for balance prior to it being mounted on the grinding machine. The wheel is first mounted on at the centre of a spindle or mandrel. The mandrel and wheel assembly are positioned on the knife edged wheels of the balancing stand. If the wheel is out of balance, the heavy side of the wheel will come to rest underneath. The wheel can be balanced by removing lead from the lead bush or if the wheel is assembled with the flanges, weights on the flanges can be adjusted until the wheel is balanced.

# **Suggested Exercises**

- 1. What problems can an out-of-balance grinding wheel cause?
- 2. Why do you never run coolant onto a grinding wheel when it is in the stationary position?
- 3. Explain how to use a diamond dresser to dress a grinding wheel.
- 4. Explain how to setup a balancing stand.
- 5. Explain how to balance a grinding wheel on a balancing stand.

# Questions

- 1. Why is important to balance the grinding wheel?
- 2. How is the grinding wheel dressed with the diamond dresser?
- 3. Why is important to balance the grinding wheel?
- 4. What are the two balancing stands that can be used to balance the grinding wheel?
- 5. Explain how to balance a grinding wheel.

# Answers

- 1. An out of balance wheel can result in poor finish and a loss of close tolerances on the workpiece. It can also lead to excessive wear on the grinding wheel and cause wear on the bearings.
- 2. 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.
- 3. A balanced wheel that has been trued and dressed will result in increased productivity, greater accuracy and a better surface finish.
- 4. The balancing stand may have four knife edged wheels on which the mandrel and wheel assembly are positioned. Not all balancing stands have wheels, but may instead have two knife edged rails.
- 5. The wheel is first mounted on the centre of a spindle or mandrel. The mandrel and wheel assembly are positioned on the knife edged wheels of the balancing stand. If the wheel is out of balance, the heavy side of the wheel will come to rest underneath. The wheel can be balanced by removing lead from the lead bush or if the wheel is assembled with the flanges, weights on the flanges can be adjusted until the wheel is balanced.

# **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