LEARNING OBJECTIVES
After studying this chapter, students will be able to:
- Identify the various types of offhand grinders.
- Dress and true a grinding wheel.
- Prepare a grinder for safe operation.
- Use an offhand grinder safely.
- List safety rules for offhand grinding.

INSTRUCTIONAL MATERIALS
Text: pages 183–190
   Test Your Knowledge Questions, pages 189–190
Workbook: pages 61–64
Instructor’s Resource: pages 153–160
   Guide for Lesson Planning
   Research and Development Ideas
   Reproducible Masters:
   11-1 Grinding Machine Operation
   11-2 Adjusting Grinder Tool Rest
   11-3 Using Wheel Dressers
   11-4 Test Your Knowledge Questions
   Color Transparency (Binder/CD only)

GUIDE FOR LESSON PLANNING
Have students read and study Chapter 11, paying attention to the illustrations. Reproducible Masters can be used on the overhead projector or copied and distributed to the class. Review the assignment and discuss or demonstrate the following:
- Definition of grinding. Use Reproducible Master 11-1.
- When offhand grinding is usually used.
- Types of offhand grinders.
- Checking grinding wheels for safe operation.
- Importance of properly adjusted tool rest. Use Reproducible Master 11-2.
- How to dress a grinding wheel. Use Reproducible Master 11-3.
- When to use a dry-type grinder.
- When a wet-type grinder is used.
- Safety procedures to be observed when using offhand grinding machines.

When demonstrating offhand grinding techniques, be sure that:
- Equipment is properly adjusted with all guards and safety devices in place.
- Students/trainees are wearing approved eye protection.
- Grinding wheels are solid, dressed, and running true.
- Students understand what metals can or cannot be ground on shop/lab grinding machines.

Briefly review the demonstrations and encourage students to ask questions.
Technical Terms

Review the terms introduced in the chapter. New terms can be assigned as homework, extra credit, or used for a quiz. The following list is also given at the beginning of the chapter.

- abrasive belt
- grinding machines
- bench grinder
- concentricity
- flexible shaft grinders
- pedestal grinder
- precision microgrinder
- reciprocating
- hand grinder
- temper
- tool rest
- wheel dresser

Review Questions

Assign Test Your Knowledge questions. Copy and distribute Reproducible Master 11-4 or have students use the questions on pages 189–190 and write their answers on a separate sheet of paper.

Workbook Assignment

Assign Chapter 11 of the Machining Fundamentals Workbook.

Research and Development

Discuss the following topics in class or have students complete projects on their own.

1. How are natural sandstone grinding wheels made? Secure samples of natural sandstone and compare them with manufactured abrasives. What, in your opinion, makes the manufactured abrasive superior to the natural product?
2. Research the term MOH SCALE. Prepare a chart showing the common abrasives in order of their hardness. Secure samples to mount on the chart.
3. Grinders used by 18th century workers required them to work in an unusual position. Prepare a brief presentation for the class on how they worked, some of the health problems they had because of their job, and some of the articles they produced. Create visual aids (photos, drawings, transparencies), for use during the presentation.
4. Borrow an old fashioned natural sandstone grinding machine. Demonstrate its use to the class.
5. True and dress the grinding wheels used on the machines in the shop.
6. Secure a list of the various grades and types of grinding wheels available from a typical abrasive manufacturer.

TEST YOUR KNOWLEDGE ANSWERS, Pages 189–190

1. Grinding is an operation that removes material by rotating an abrasive wheel or belt against work.
2. Evaluate individually.
3. offhand
4. c. Work is manipulated with fingers until desired shape is obtained.
5. Dry type and wet type. The dry type does not use a flow of coolant on wheel. The wet type uses a flow of coolant over wheel.
6. 1/16, 1.5, pulled, rest, wheel
7. Supporting it on a section of wire and lightly tapping it with a light metal bar or screwdriver handle. A good wheel will give off a clear ringing sound.
8. c. Stand to one side of the grinder when using the machine.
9. burn
10. wet
11. crowned; It will minimize the amount of contact between the wheel and the work. This reduces the risk of the work being damaged or destroyed by excessive heat.
12. checking it for soundness
13. Evaluate individually. Refer to Section 11.4.

WORKBOOK ANSWERS, Pages 61–64

1. belt, disc
2. d. All of the above.
3. roughing, finish grinding
4. c. keeps the wheels constantly flooded with fluid
5. d. All of the above.
6. Serious injury could result if the cloth is pulled into the wheel.
7. d. All of the above.
8. wheel dresser
9. c. use the face of the wheel, not the sides
10. grooves/ridges
11. a. Diamond-impregnated
12. c. being damaged or destroyed by excessive heat buildup
13. greater
14. d. All of the above.
15. Evaluate individually. Refer to Section 11.4.
Grinding Machine Operation

Grinding Wheel

Abrasive Belt

Driver pulley

Worktable

Abrasice Belt Machining
Adjusting Grinder Tool Rest

1/16" (1.5 mm) Maximum clearance
Using Wheel Dressers

Move the tool back and forth over the face of the stone.

Industrial diamonds are also used to dress and true grinding wheels. The guide block is used for grinders with slotted tool rests.
Offhand Grinding

Name: __________________________ Date: __________ Score: ______

1. Describe the grinding operation.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2. How do abrasive belt grinders differ from abrasive wheel grinders?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

3. Bench and pedestal grinders are used to do _____

4. The grinding technique referred to in the preceding statement is so named because:
   a. It can only do external work.
   b. Work is too hard to be machined by other methods.
   c. Work is manipulated with fingers until desired shape is obtained.
   d. All of the above.
   e. None of the above.

5. Name the two types of pedestal grinders. How do they differ?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

6. The tool rest should be about _____ inches or _____ mm away from the grinding wheel or belt for safety. This prevents the possibility of work being _____ between the tool _____ and _____.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Offhand Grinding (continued)
Name: ________________________________

7. How can grinding wheel soundness be checked? ________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

8. Since a grinding wheel cannot be checked each time the grinder is used, it is recommended that the operator:
   a. Not use the grinder.
   b. Check with the instructor whether the wheel is sound.
   c. Stand to one side of the grinder when using the machine.
   d. All of the above.
   e. None of the above.

9. Work will _____ if it is forced against the wheel with too much pressure.

10. Carbide-tipped tools are usually sharpened on a ____ grinder.

11. The face of wheel on a wet-type grinder is ____ slightly. Why is this done?_________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

12. Never mount a grinding wheel on a grinder without _____.

13. List four safety precautions to be observed when operating a grinder.
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Chapter 11   Offhand Grinding