

Unit IV – Tool Sharpening and Reconditioning

Lesson I: Sharpening and Reconditioning a Twist Drill, Lawn Mower Blade, and Chain Saw Chain

Sharpening and reconditioning tools to their original condition has many benefits. Tools that are sharp and in proper condition are safer to use, perform more easily, and produce better quality work. In addition, tools are a major investment and maintaining them is less expensive than replacing them with new ones. This lesson discusses how to sharpen and recondition twist drills, lawn mower blades, and chain saw chains, all common tools used in agriculture. It also describes how to maintain a grinding wheel, which is used to sharpen tools. Your instructor must be present to demonstrate the step-by-step procedures for sharpening and reconditioning and to guide you through them.

Safety Procedures for Using a Bench Grinder

A bench grinder is a common tool used for rough sharpening and for producing the correct bevel on tool blades. Follow the safety procedures listed below when using a bench grinder.

- Wear a face shield and leather apron. Wear other protective clothing or gear, such as a filter mask or respirator, as required by the instructor.
- Unplug the grinder before making any inspections or adjustments, such as changing a wheel.
- Make sure that the guards are in the proper position before starting the grinder.
- Stand to the side of the wheel when starting the grinder and let the wheel run for a short period before using it. Wheels that are going to break usually do so within the first minute of use.
- Move the work slowly back and forth across the face of the wheel to avoid overheating the work or damaging the wheel.
- Do not force work into the grinding wheel. Allow the speed and grit of the wheel to do the work.
- Inspect wheels frequently and do not use a wheel that is damaged or out of round. If the wheel is damaged, consult the instructor about dressing or replacing the wheel. Dressing the wheel means to use a tool to recondition the wheel, making the diameter perfectly

round and the face square. Dressing also removes debris from the abrasive material.

Factors for Selecting Grinding Wheels

To operate a grinder safely and successfully, it is important to select the correct wheel for the job. Manufacturers provide specifications about wheels that will help in the selection process. Some of the specifications are described below.

- **Abrasive material:** Wheels are made of different types of abrasive materials for various grinding purposes. Some are made of natural materials, such as Arkansas stones, and others are made of synthetic materials, such as silicon carbide or aluminum oxide.
- **Grit:** Grit refers to the small abrasive cutting particles in the material. The grit size of a wheel is indicated by a number generally ranging from 10 (most coarse) to 600 (most fine).
- **Grade:** The grade of a wheel indicates its hardness. Grades range from the letter “A” (the softest) to the letter “Z” (the hardest). Tool sharpening is commonly done with a medium-hard wheel.
- **Bond:** The bond refers to the way the abrasive materials are held together to form a wheel. The manufacturing process for grinding wheels includes mixing abrasive materials with a bonding agent and pouring the mixture into a mold. The mold is heated and then cooled to form a solid abrasive. Vitrified bonding, using a silica agent, is one of the most common bonding processes.
- **Dimensions:** This measurement is the outside diameter and width of the wheel. Consult the grinder manufacturer’s specifications for the correct size.

Dressing a Grinding Wheel

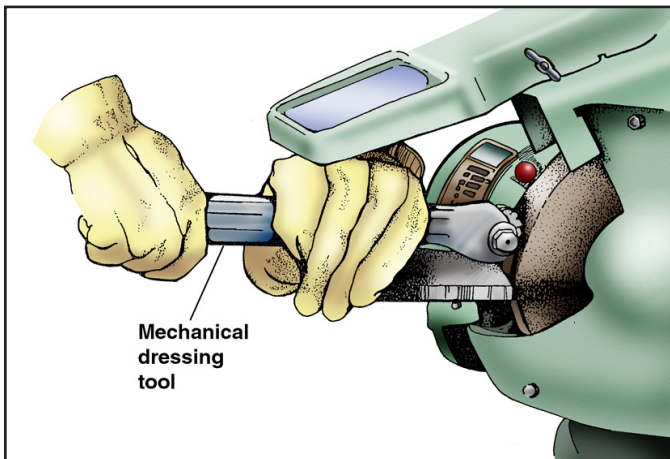
The cutting ability of a grinding wheel is impaired when it becomes out of round or the abrasive material becomes loaded (clogged with debris) or glazed (dulled). A procedure called dressing is performed on a wheel to restore its effectiveness. This procedure requires the operation of the grinder. The safety guidelines used for other grinding procedures should be followed when dressing the wheel. Various types of tools are available,

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including a mechanical dressing tool, to dress the wheel. The tool rest on the grinder may need to be adjusted for the dressing tool. If so, it should be moved back to 1/16 in. from the wheel after the procedure is complete.

To dress a grinding wheel, the grinder is turned on and a dressing tool is held with even pressure on the wheel and moved from side to side. See Figure 1.1. If heavy sparking is produced, the dressing tool should be held with more pressure against the wheel. Excessive sparking indicates that the dressing tool is being ground away. When dressing is complete, the grinder is turned off and disconnected from the power. The shape and surface of the wheel are inspected. A successfully dressed wheel should be perfectly round and the face should be flat and square. The abrasive material should be sharp and free of debris.

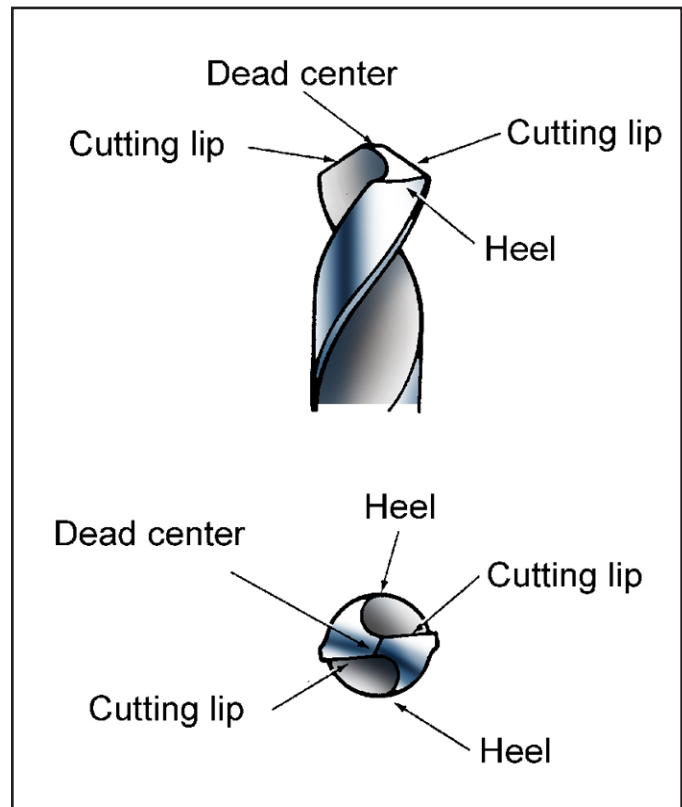
Figure 1.1 – Dressing a Grinding Wheel



Sharpening a Twist Drill

Twist drills should be kept sharp to operate safely and produce good-quality work. The frequency of use and type of material that is drilled affect how quickly the drill becomes dull. For example, a drill used on wood remains sharp for much longer than one used on metal. Twist drills can be sharpened by hand using a grinder. Knowing the parts of the cutting tip on a twist drill is helpful for understanding how to sharpen it. The tip parts are the dead center, two cutting lips, and two heels. See Figure 1.2.

Figure 1.2 – Parts of a Twist Drill

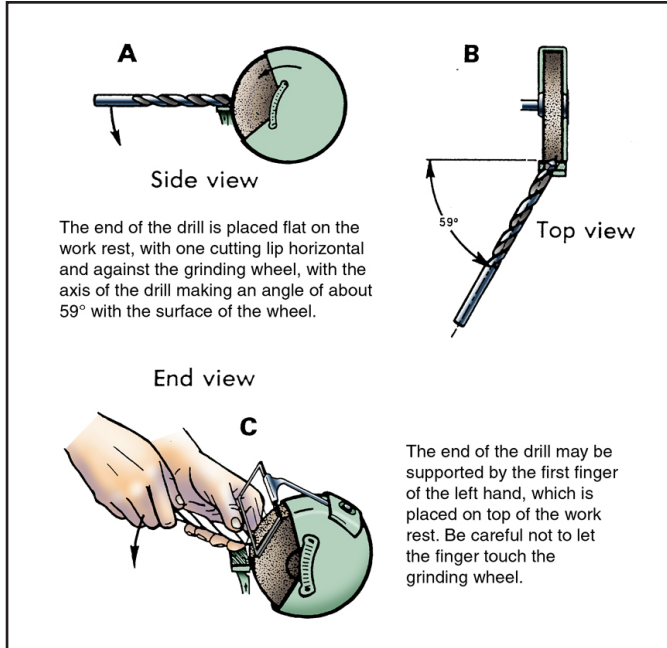


Examining a new or properly sharpened twist drill before beginning the procedure can also be helpful. The dead center of a properly sharpened drill is at the exact center of the drill and the cutting lips are at a 59-degree angle to the centerline of the drill. The angle between dead center and the heel should be 12 degrees for each cutting lip. This angle provides clearance for the bit and support so the cutting lips do not break. A drill should also be inspected to make sure it is not bent. If the drill is bent and cannot be straightened, it should be discarded. A bent drill will produce an oversized hole.

The same safety guidelines used for other grinding procedures should be followed when sharpening a drill. The proper position for sharpening is to hold the drill perpendicular to the face of the wheel with a cutting lip at a 59-degree angle. See Figure 1.3. For grinding the tip on the wheel, the back end of the drill should be lowered as the drill is rotated slightly clockwise. When one lip is sharpened, the procedure is repeated on the other lip.

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Figure 1.3 – Proper Position of the Twist Drill for Sharpening



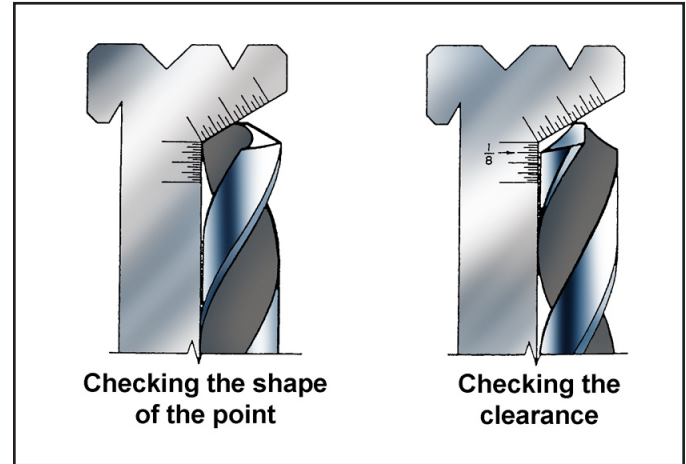
To determine if a twist drill has been properly resharpened, a tool gauge should be used to measure the following criteria.

- Angle formed by the cutting lip and outer edge of the drill: This should be 118 degrees.
- Clearance of the cutting lip: The gap made by the drop of the cutting lip to the heel is measured. For example, a 1-in. drill should have approximately a 1/8-in. gap between the drill and the corner of the tool gauge. See Figures 1.4 and 1.5.

Figure 1.4 – Drill Size and Proper Clearance of Cutting Lip

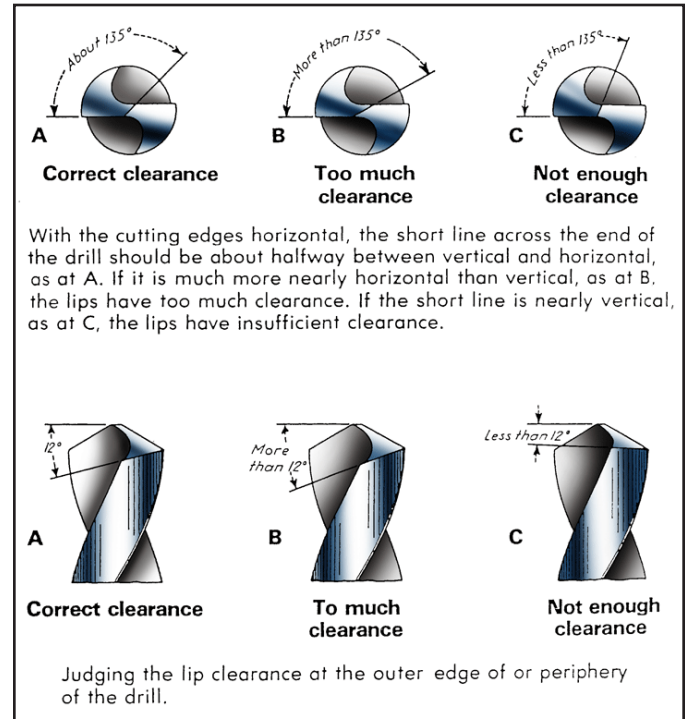
For 12° Clearance	
Drill size	Amount of drop
1/4"	1/32"
1/2"	1/16"
3/4"	3/32"
1"	1/8"
other sizes	prorated amount

Figure 1.5 – Checking the Shape and Clearance of a Twist Drill With a Tool Gauge



The clearance of the cutting lip can also be checked visually. When the cutting lips are placed in horizontal position, the angle between the dead center line and the cutting lip should be approximately 135 degrees. An angle greater than 135 degrees indicates too much clearance, whereas an angle less than 135 degrees indicates not enough clearance. See Figure 1.6.

Figure 1.6 – Judging Lip Clearance



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Sharpening a Lawn Mower Blade

A lawn mower blade should be sharpened frequently because a sharp blade requires less power, produces a cleaner and more even cut, and does less damage to plants. A mower blade can be sharpened with a file or a portable grinder.

Safety rules for sharpening mower blades include the following.

- Before removing the blade, disconnect the spark plug wire and secure it so it cannot come in contact with the spark plug and accidentally start the mower. Disconnect an electric mower from its power source.
- Wear gloves when removing or installing the blade to protect the hands from scrapes and cuts.
- If using a grinding wheel to sharpen the blade, wear safety goggles or a face shield and any other protective gear recommended by the instructor. Follow all of the assigned safety and use procedures for a portable grinder.
- If using a file to sharpen the blade, wear safety goggles and leather gloves.
- Follow instructions in the owner's manual for the lawn mower and guidelines from the instructor for correct sharpening procedures.

When a lawn mower blade is sharpened, the cutting side of the blade is restored to its original angle. A typical angle for a lawn mower blade is 45 degrees. The noncutting side is kept flat. A grinding wheel or file can be used to sharpen the cutting edge of the blade to its original angle. See Figure 1.7. Any nicks and burrs should be ground off the noncutting side of the blade to keep it flat.

An equal amount of metal should be taken off both ends of the blade during the sharpening procedure to keep the blade in balance. A blade is out of balance when one end is heavier than the other end. An improperly balanced blade causes the mower to vibrate, which could damage the shaft, bearing, and body of the mower. The balance of a blade can be checked with a blade balancer or by inserting a rod in the center hole of the blade. The blade sits level when it is properly balanced. See Figure 1.8.

Figure 1.7 – Using a File to Sharpen a Lawn Mower Blade

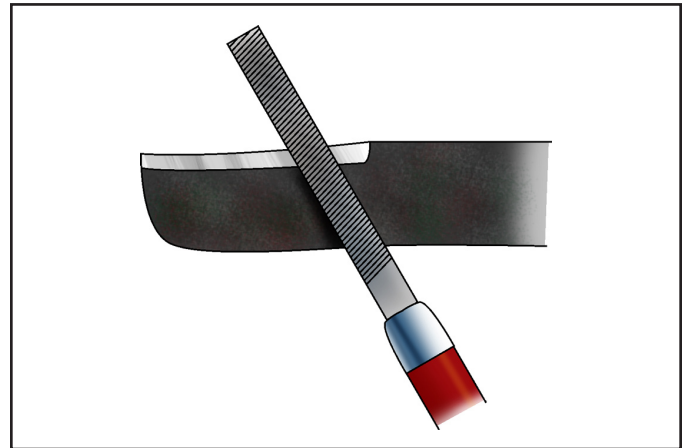
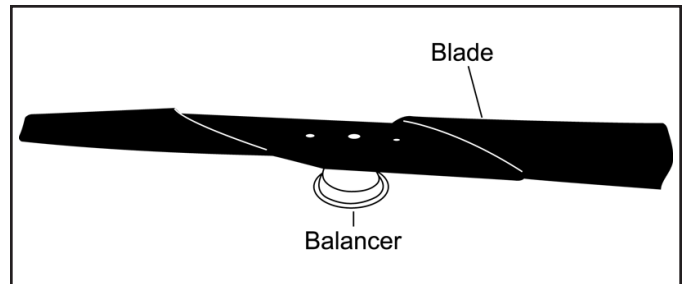


Figure 1.8 – Checking the Balance of a Lawn Mower Blade With a Balancer



Sharpening and Maintaining a Chain Saw Chain

A chain saw chain also becomes dull through use and needs to be sharpened frequently. The benefits of a sharp chain saw include the ability to cut more wood faster, reduced operator fatigue, increased work site safety, and reduced wear and tear on the chain saw.

Factors affecting how often the chain needs to be sharpened include the frequency of use and the type of wood being cut. For example, hardwoods dull a chain quicker than softwoods. The following are signs that a chain needs sharpening.

- The chain tends to “walk” sideways while cutting.
- The cut produces fine powdery shavings instead of chips.
- The cut takes longer to make.
- More pressure is required to make the cut.
- The cut produces the smell of burned wood.

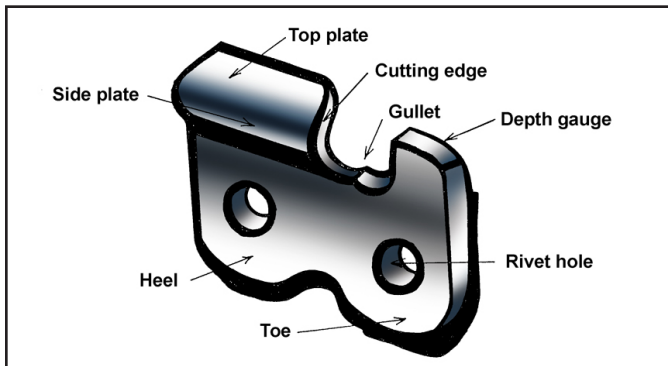
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Safety rules for making repairs or adjustments to a chain saw are as follows.

- Before making any adjustments or repairs to the saw, disconnect the spark plug wire and secure it so it cannot come in contact with the spark plug and accidentally start the saw. Disconnect an electric chain saw from its power source.
- Wear leather gloves when working with the blade to protect hands from the cutters.
- Wear safety goggles and leather gloves when using a file to sharpen the chain.
- Follow instructions in the owner's manual for the chain saw and guidelines from the instructor for correct work procedures.

It is important to be familiar with the design of a chain saw chain before beginning the sharpening procedure. Chains vary in the design of their cutting links (cutters). The differences are seen in the cutting teeth and depth gauges. The parts of a cutter are the rivet hole, depth gauge, gullet, cutting edge, top plate, side plate, heel, and toe. See Figure I.9.

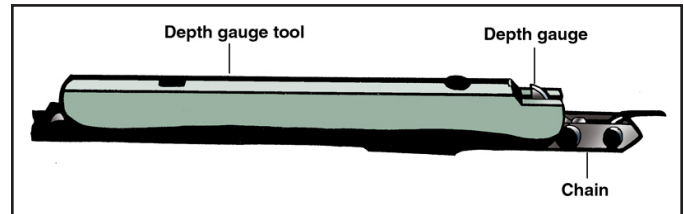
Figure I.9 – Parts of a Cutter on a Chain Saw Chain



A chain saw chain can be sharpened with a round file and a file guide. The file guide is used to maintain the round file at the proper depth and angle while the cutting edges of the cutter are filed. The design of these tools can vary depending on the chain saw. Operators should consult the manufacturer's recommendations for the correct chain-sharpening tools in order to maintain correct angles, shape, and proportions of the cutters. The depth gauges on the cutters should also be checked and adjusted as needed. As a general rule, depth gauges should be checked every third or fourth sharpening. Depth gauges control

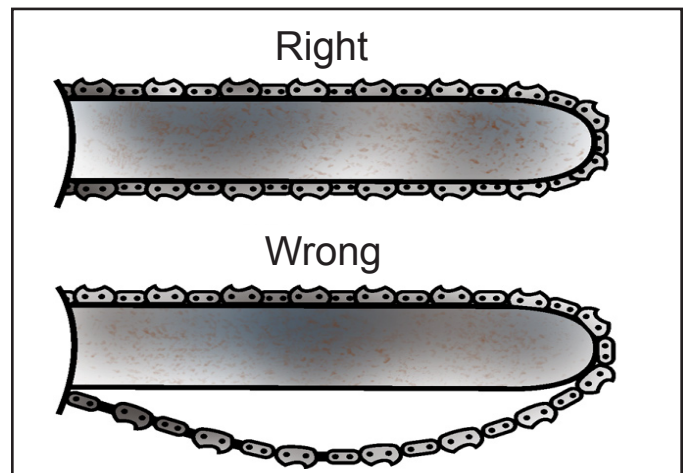
the thickness of the chips that the cutters will cut. Tools for this procedure are a depth gauge tool and a flat file. The depth gauge tool is a specific tool recommended by the manufacturer. It is used to determine if the depth gauges are the proper height. If the top of a depth gauge on a cutter extends above the depth gauge tool, it should be filed off with the flat file. In filing a depth gauge, it is important to maintain its original shape. See Figure I.10.

Figure I.10 – Depth Gauge Tool



Checking the tension of the chain and adjusting it as needed is another essential procedure for safe operation and good performance of a chain saw. If the chain tension is too loose, the chain has a greater tendency to kickback or jump off the bar, which is dangerous. A loose chain can also increase the wear on parts of the saw. If the chain tension is too tight, the chain may bind, which can lead to accidents and increase the wear on parts. The manufacturer's and instructor's guidelines for the proper procedure should be followed when adjusting the tension of a chain. Chain tension should be adjusted only when the chain is cold. If the chain tension is adjusted properly, the chain moves freely when rotated but does not hang loose from the bar. See Figure I.11.

Figure I.11 – Correct and Loose Tension of the Chain on a Chain Saw



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Summary

Tools that are sharp and in good condition are necessary for high-quality work and safe operation. Many sharpening and reconditioning procedures are done with grinders and hand files. Some of the most common procedures for tool maintenance in agricultural mechanics are dressing a grinding wheel, sharpening a twist drill, sharpening and balancing a lawn mower blade, and sharpening and adjusting the tension of a chain saw chain.

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