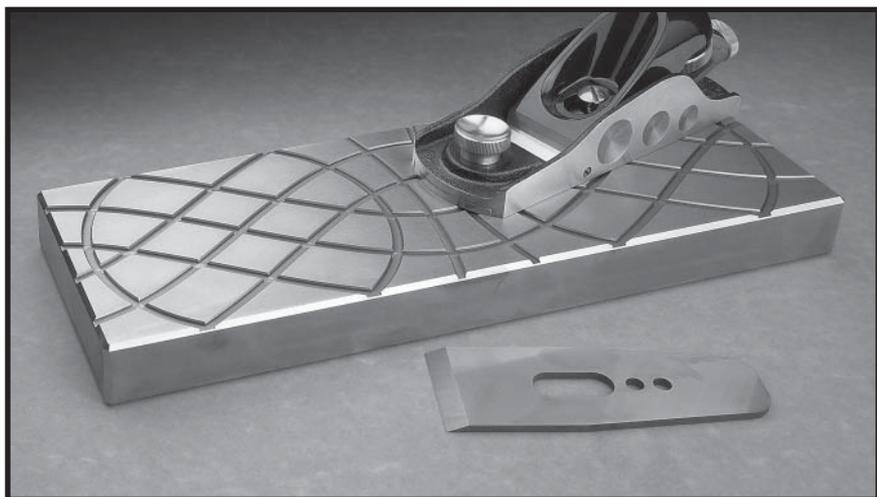


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Lapping Plate



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Lapping is the process of rubbing two surfaces together with an abrasive and a lubricant to improve the quality of at least one of the surfaces. Although lapping can be used to create flat surfaces, in the context of woodworking, lapping better serves to minimize the roughness of a surface – known as surface conditioning.

By minimizing the roughness in the sole of a plane, there is reduced friction between the plane and the workpiece, which in turn reduces abrasion. For blades or chisels, the cutting edge can be made sharper if both intersecting surfaces are free of scratches, even if the back of the blade isn't perfectly flat.

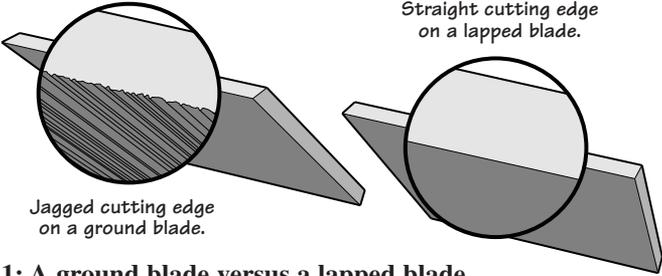


Figure 1: A ground blade versus a lapped blade.

Lapping can remove only small amounts of material. If the sole of your plane or the back of your blade is twisted, wavy or bowed, it will be necessary to sand or grind off the high points prior to lapping.

Lapping is always performed with an abrasive oil slurry, which not only allows the object to slide about the lapping plate (called a lap), but also provides a means to remove abraded particles and worn abrasive.

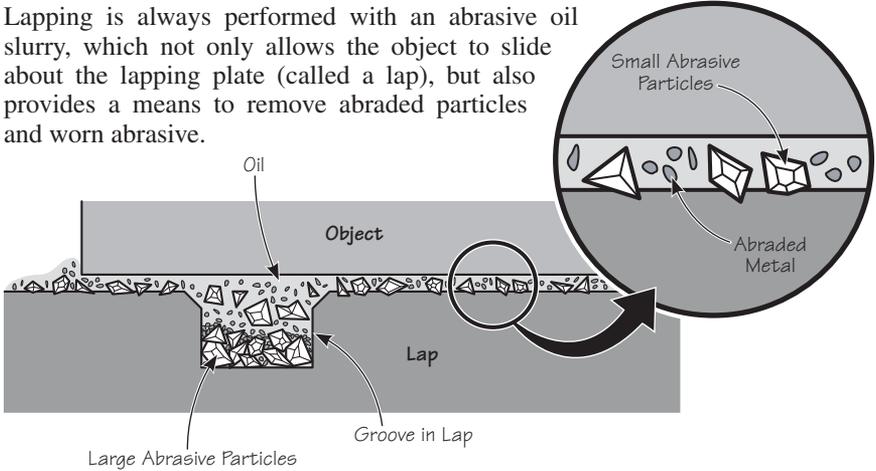


Figure 2: Lapping mechanics.

Important Notes

The lapping plate is made of soft iron and will wear over time. These instructions provide information on how to ensure the lap remains flat for a lifetime. Furthermore, the lap should not be used

- for flattening water stones, as the oil lubricant will ruin the water stone.
- with water as a lubricant, as water will rust the lap.
- for flattening oil stones, as any residual grit on the lap can be transferred to the stone, resulting in scratches during honing.
- as a replacement for a honing stone, as the grooves are unsuitable for a honing guide and the blade bevel can be seriously damaged.

Choosing an Abrasive

While silicon carbide and aluminum oxide are ideal lapping abrasives (since they become finer with use), diamond should not be used because it will impart new scratches onto the surface as the object is lapped.

Guidelines

600x: When a flat and ground blade needs only 0.001" or less of material removal to condition the surface.

400x: When the slightly rougher texture of a plane sole requires more initial abrasion.

280x: For twisted, wavy or linished objects, or when considerable material removal may be required.

While all the abrasives can achieve the same result, the coarser the abrasive, the longer it will take to achieve a smooth surface. Then again, a coarser abrasive is far more efficient at eliminating high points.

Choosing a Lubricant

Although any oil is suitable for lapping, the ideal lapping oil is of medium viscosity, similar to that of olive oil. If the oil is too thin, it will flow away easily, making it difficult to maintain a film on the lap. If it is too thick, it can be difficult or impossible to clean the lap and the object that was lapped. The oil must also be chemically compatible with the abrasive and environmentally benign for subsequent clean-up. Mineral oil is a good overall choice.

Conditioning the Lap

As received, the lapping plate will need to be conditioned prior to first use. Conditioning coats the lap with a uniform film of oil and abrasive and beds some of the abrasive into the surface of the lap. This optimizes the time spent lapping and ensures uniform results. Conditioning is needed only when the lap surface is free of abrasive. The residual abrasive left on the lap from a previous session eliminates the need to recondition the lap (unless you are switching to a finer grit).

To condition the lap:

1. Apply a thin coat of oil onto the entire lap surface. This can be done with a spray or squirt bottle. The object being lapped can be used to spread the oil. This coating provides adhesion for the abrasive as well as preventing most of the abrasive from simply filling up the grooves. Oil should be added until the entire lap has been coated.
2. Place a teaspoon of abrasive in the center of the lap. Use the object to distribute the abrasive. Most of the lap surface should become coated with a thin layer of moist abrasive. It may be necessary to add more abrasive.
3. Wet any of the dry abrasive areas with additional oil, if necessary, and move the object about to mix the oil and abrasive together. The lap has now been conditioned.



Figure 3: Conditioning the lap.

If lapping is a frequent activity, time can be saved by pre-mixing slurry – one part abrasive to roughly ten parts of oil. This slurry can be used to bring a lap back up to fresh working grit more quickly than a complete reconditioning. Pre-mixed oil slurry can be used only on a lap that has already been conditioned and has a light coating of oil and abrasive. Slurry applied to a lap which has been cleaned or never used will not coat the lap surface.

Gripping the Object

Prior to lapping, determine how you will be holding the object. Since most lapping sessions can last upwards of half an hour, this can become very important. Also, once lapping commences and the object becomes coated in oily slurry, it can be difficult to change to a completely different means of holding the object.

A plane sole should be lapped while the plane is assembled, but with the blade retracted. Not only does this provide a convenient means to hold the plane, but also takes into account any distortion resulting from the plane assembly. An adjustable toe or frog that extends to the sole should be lapped together with the rest of the plane.

To fully lap the back of a small blade (e.g., block plane or spokeshave), an auxiliary blade holding jig, such as one made from a block of wood with double-sided tape, is highly recommended.

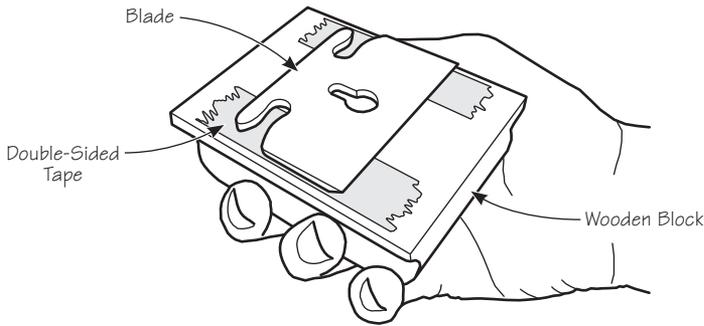


Figure 4: Simple blade holding jig.

Since there is little reason to lap the entire back of a large plane blade, as the benefit is limited to the leading edge, the rest of the blade can be used as a handle.

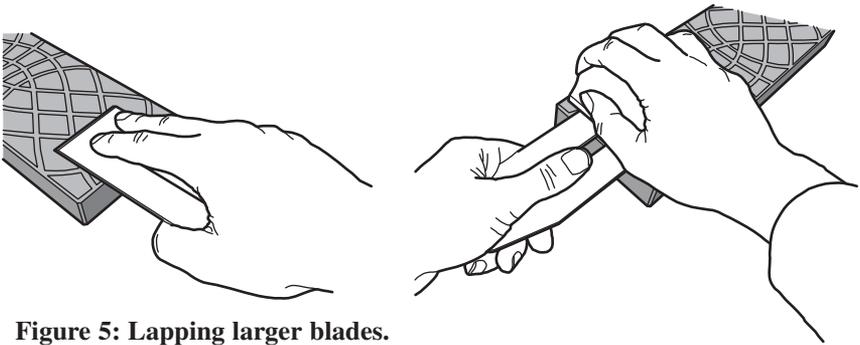


Figure 5: Lapping larger blades.

This approach can work well for short lapping sessions, but if considerable lapping is expected, the same blade holding jig used for the small blades can be used to guide the working end of a larger blade.

The cross section of a chisel blade makes it difficult to grip directly, but a chisel does come with a handle. Use one hand to guide the chisel and the other to apply pressure, keeping the blade in contact with the lap.

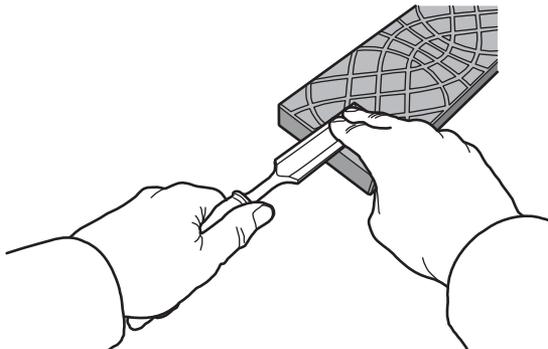


Figure 6: Lapping a chisel.

Lapping Methodology

Lapping entails moving the object around on the lap surface until you have achieved the desired condition. The exact technique used is up to whoever is lapping and what feels comfortable. However, the following guidelines should help to achieve good results.

- Use a newsprint underlay. Lapping is a rather messy process. Oil laden with metal, dust and abrasive tends to permeate the immediate environment. Using a newsprint underlay (four or so sheets thick) will keep the mess to a minimum by absorbing oil and make clean-up that much simpler.
- Clamp the lap in place. Despite its weight, the lap can shift and slide about in use. Clamping it in place alleviates the frustration of unexpected shifting and eliminates the possibility that the lap will accidentally slide off the working surface.
- Raise the lap to a proper height. Lapping requires repeating the same motion for a long period of time. Raising the lap so that the working surface is a few inches below the user's elbow can reduce the risk of injury associated with this activity.

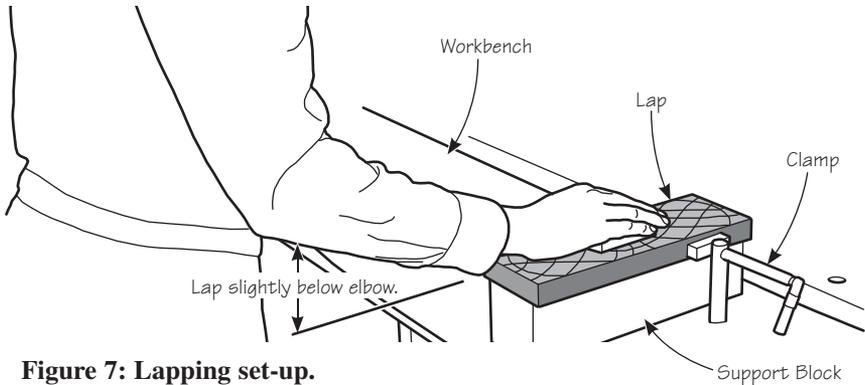


Figure 7: Lapping set-up.

- Be patient. When using grit that is properly matched to the object being lapped, a typical minimum lapping time is 20 minutes for fine abrasives and 30 minutes for coarse abrasives. After the initial lapping session, clean the object and check the progress. Additional 10 to 15 minute sessions may be needed to achieve the desired results.
- Use a figure-eight pattern. Regardless of the object being lapped, optimal results are achieved when the object is moved about the lap in a long, slow figure-eight pattern, as shown in **Figure 8**. This technique continuously redistributes the slurry around the lap, keeping it

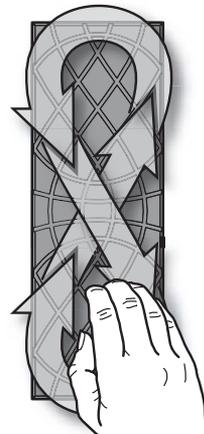


Figure 8: Figure-eight pattern.

uniformly oiled. It also prevents a uniform scratch pattern from being imparted to the object or the lap, as well as extends the life of the lap by encouraging uniform wear.

- Use the entire surface. Ideally, the entire lapping surface should be used, but for small objects, this may not be feasible. When lapping a plane sole or the entire back of a blade, the stroke pattern should cover the entire lap and extend beyond the edge of the lap a few times. Not only does this help in extending the life of the lap, but also it ensures that, when the object being lapped is slid off the edge of the lap (hydraulic lock makes it difficult to lift straight off), there are no burrs or dry abrasive along the edge that could scratch the object.
- Avoid adding grit halfway through a lapping session. Since the abrasive grit becomes finer over time, adding grit will have the effect of restarting that session, increasing the time needed to lap, but not improving the results. However, should you not hear the distinctive grinding sound, it indicates that there is not enough grit on the lap. In this instance, more abrasive will be needed. Also, as you examine the results of the first lapping session and you discover that the surface is more wavy or curved than initially thought, it may be necessary to switch to a coarser grit.

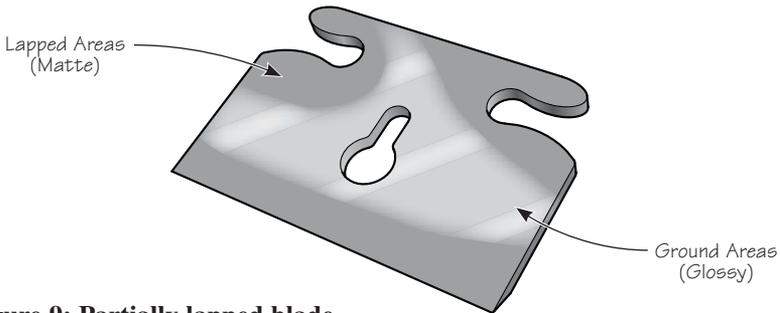


Figure 9: Partially lapped blade.

- Occasionally add oil. A well-oiled surface is essential to quality lapping results. Over time, the lap will naturally lose oil (typically by spilling off the sides). Allowing the lap to dry out can spoil both the lap and the object being lapped.
- Apply sufficient force. When lapping the sole of a plane or the entire back of a blade (using a suitable jig), the operator's hand and the weight of the object impart enough force to result in useful strokes. For larger objects for which only a portion of the surface is being lapped, it will be necessary to impart some downward force to keep the object in contact with the lap. See **Figure 6**.

Cleaning the Lapped Object

To clean slurry off a plane sole, it is best to wipe it with a paper towel or facial tissue saturated with water. It will take some time to fully remove the slurry. With each wipe, use an unused portion of the paper towel (or a fresh tissue). Rubbing risks imparting new scratches, so wipe gently. Clean blades with soap under running water. Dry all lapped objects with paper towel or cotton rags.

Note: Do not use Kraft paper towel, as it contains abrasive contaminants that can easily scratch a lapped surface.

Cleaning the Lap

After each session, tip the lap up on its side and allow the oil to drain for one to two hours. This provides enough time for the slurry to flow through the grooves and drain out the side. Ideally, this should be done over several sheets of newsprint to capture the excess oil.

If desired, wipe the lap surface once with paper towel or newsprint to remove any excess grit. This should be done while the lap is still oily to minimize the scratching that will occur.

Note: Do not scrape or rub the lap, as this can damage the working surface.

Storing the Lap

Store the lap in a dust-free location, in a sealed bag or a suitable container. Ideally, the lap should be lightly oiled before storage to prevent rusting. However, if the lap is merely drained after use but not wiped dry, the oil that remains will provide sufficient protection and the abrasive that remains will minimize the conditioning that will be necessary during the next lapping session.

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