Lesson 4

KEY DUPLICATION

Contents

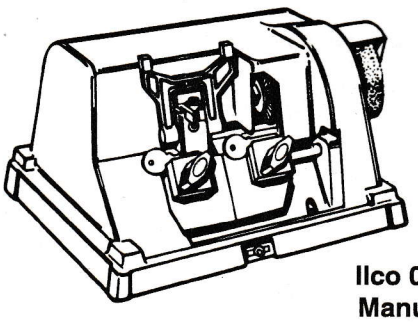
Putting It Together To Build Your Future

It's time to put to work the knowledge you gained in Lesson 2, Key Blank Identification. Key blank identification and key duplication go hand-in-hand. After all, you need to be able to identify a key before you can duplicate it.

In a typical locksmith store today, you may find four or more types of duplication machines. Remember, it is not just having key blanks and duplicating equipment that makes you a locksmith. What sets you apart are the knowledge and skill

- to select the correct key blank and machine and
- to operate the machine properly.

Years ago, locksmiths duplicated keys by hand-filing the blank to match the pattern key. Now motorized equipment does the job. In this lesson, you will learn about the most common types of key duplicating equipment.



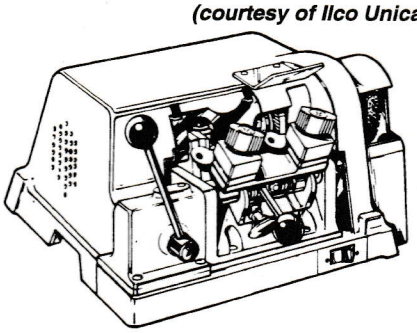
Ilco 025
Manual
Key Duplicator

(courtesy of Ilco Unican)

Different types of machines duplicate different types of keys. Since you will most often duplicate cylinder keys, we will focus on the machines that duplicate those. The most common cylinder key duplicating machines are automatic, semi-automatic, and manual duplicators.

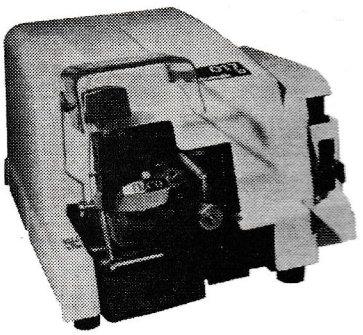
You will also learn about the machines that duplicate flat keys and bit and barrel keys.

Think of each lesson as a building block for future lessons. In this lesson, you're building on what you learned in Lesson 2. Each block increases your knowledge, skills, and experiences.



Ilco 024
Semi-Automatic
Key Duplicator

(courtesy of Ilco Unican)



Ilco 017
Automatic
Key Machine

(courtesy of Ilco Unican)

As your knowledge, skills, and experience increase, your confidence level will also increase. In a very real sense, you are building your future. Just think how hard it is to stop a person with new-found skills and self-confidence!

Objectives

When you have completed this lesson, you should be able to

- ☞ List and describe the function of two parts found on all duplicating machines.
- ☞ List and describe three types of key machine cutters.
- ☞ List three rules you must always follow when operating key duplicating machines.
- ☞ Identify the parts of an automatic cylinder key duplicating machine.
- ☞ Describe the function of each part of an automatic cylinder key duplicating machine.
- ☞ Correctly order the steps necessary for accurate cylinder key duplication on an automatic key duplicating machine, a semi-automatic key duplicating machine, and a manual key duplicating machine.
- ☞ Correctly order the steps necessary for accurate flat key duplication on an Ilco 026 flat key duplicating machine.
- ☞ Identify the three most frequent causes for non-working duplicates.
- ☞ List the three categories of routine maintenance that apply to key duplicating machines.
- ☞ Explain how to check the depth adjustments on a cylinder key duplicating machine.
- ☞ Describe how to make a set of space alignment keys for a cylinder key duplicating machine.

Main Ideas

1. Key Duplicators
2. Cylinder Key Duplicators
3. Other Types of Key Duplicators
4. Making Sure the Duplicate Key Works

Key Duplicators

Common Parts

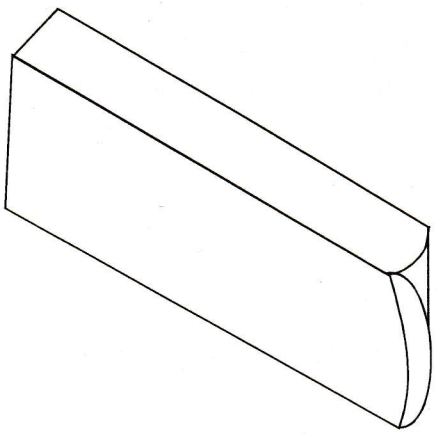
Machines vary from one manufacturer to another. However, the parts and how they work are much the same.

All key duplicators have a cutter guide and a cutter. The cutter guide traces the pattern key while the cutter produces the same pattern on a blank.

The Cutter Guide

Cutter Guide—The part of a duplicating machine which follows the cuts of a pattern key during duplication

The **cutter guide** is similar in thickness and angle dimensions to the cutter used.



The cutter guide may be horizontally adjacent to the cutter or vertically stacked. You will find the horizontal placement on manual and semi-automatic machines. The stacked location is popular on automatic machines.

The Cutter

Cutter—The part of a key duplicating machine that makes the cuts into the key blank

The design of the **cutter** on a key duplicating machine depends on the type of machine. In this section, you'll look at three of the most popular cutters used on duplicating machines.

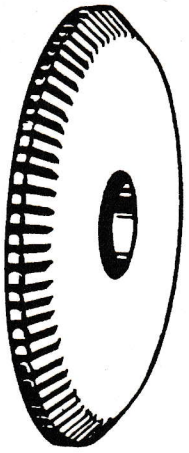
- Ilco P-X23MC
- Ilco P-9MC
- Ilco 45SMS

As you progress through this lesson, refer back to this section.

The Ilco P-X23MC

This cutter is used on the Ilco 025 manual duplicator. It is a milling cutter. That's what the "MC" stands for. You can see noticeable space between the teeth of a milling cutter.

The Ilco P-X23MC has one flat side and one angled side. Notice the angle of the cutter.



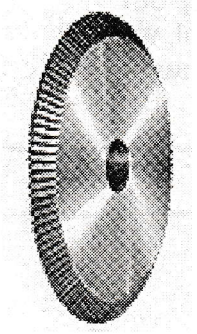
(courtesy of Ilco Unican)

Milling cutters like this one are used on manual key duplicating machines.

Whenever you replace a cutter, make sure the cutter guide matches the angle of the cutter.

Some key machines still have file cutters. These look like a file because their teeth are very close together and do not protrude much. Because file cutters are slow and tend to load up with key material, milling cutters have replaced them on most manual duplicators.

The Ilco P-9MC



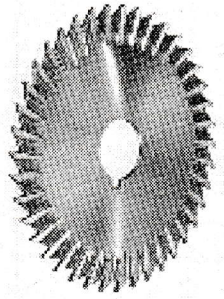
(courtesy of Ilco Unican)

Most automatic and semi-automatic duplicators use cutters similar to this one.

You know this is a milling cutter. How? That's right—the "MC" tells you. This cutter is used on the Ilco 017 automatic duplicator. It varies in shape from the P-9MC, but matches the guide well.

The Ilco 45SMS

Flat key duplicating machines use slotter cutters. The 45SMS is used on Ilco flat key duplicating machines. The "45" stands for the thickness of the cutter (0.045") and the "SMS" stands for "Side Milling Slotter." This cutter has both side and bottom cutting teeth. It also allows for slight side-to-side motion. This is an advantage when cutting keys that have square millings, such as safety deposit box keys.

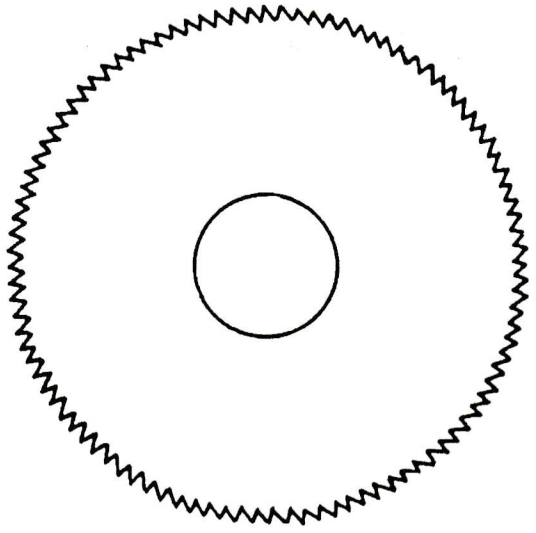


This cutter is used for flat keys.

(courtesy of Ilco Unican)

If a slotter cutter has smooth sides, the cutting teeth are on the bottom only. This is not a side milling slotter. It must be used in a plunging motion only. To cut a key with square cuts using this type cutter requires more time than with a side milling slotter cutter.

(courtesy of Ilco Unican)



Key Duplicating Machine Cutters

Cutter	Type of Machine	Design	Type of Key
Ilco P-X23MC	Manual Key Duplicator	Milling Cutter One Flat Side One Angled Side	Cylinder
Ilco P-9MC	Automatic and Semi-Automatic Key Duplicators	Milling Cutter V-Shaped	Cylinder
Ilco 45SMS	Flat Key Duplicator	Side Milling Slotter Cutting teeth on sides and bottom	Flat

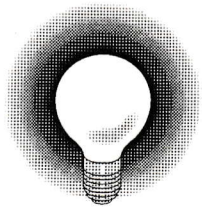
Safety

Whenever you work with any machinery, you must be aware of safety concerns. The following rules apply to all key duplicating machines. Always follow these rules.

1. Always wear eye protection.
2. Do not insert or remove keys while the machine is running.
3. Do not reach into the jaw area while the machine is running.

Safety cannot be stressed enough.

Organize the Main Ideas



This outline will help you organize the information in this section of the lesson. Read through the outline and jot down what you remember about each of the topics listed. If you can't remember details related to one or more of the topics, you may wish to reread the text before you go on.

1. Key Duplicators

   a. Common Parts

      1) The Cutter Guide

      2) The Cutter

   b. Safety

Check Your Knowledge 1

This quiz will help you check what you've learned in this section of the lesson. Read through the questions and jot down your answers. Then check those against the suggested answers at the end of this lesson. If your answers differ greatly from the suggested answers, you may wish to reread the text before you go on.

1. All key duplicators have a cutter guide and a cutter. The cutter guide _____ the _____ while the cutter produces the same _____ on a _____. (Fill in the blanks.)
2. If you can see noticeable space between the teeth of a cutter, it is a _____ cutter. (Fill in the blank.)
3. Milling cutters like the Ilco P-X23MC that have one flat side and one angled side are used on _____ key duplicating machines. (Fill in the blank.)
4. V-shaped milling cutters like the Ilco P-9MC are used on _____ and _____ key duplicating machines. (Fill in the blanks.)
5. When you replace a cutter, make sure the _____ _____ matches the angle of the cutter. (Fill in the blanks.)
6. Side milling slotter cutters like the Ilco 45SMS are used on _____ key duplicating machines. (Fill in the blank.)
7. A slotter cutter that has smooth sides should be used in a plunging motion only. (True or False?)
8. When operating a key duplicating machine, always _____ _____ _____. (Fill in the blanks.)
9. When a key duplicating machine is running, you should never _____ _____ _____ or _____ _____ _____ _____ _____. (Fill in the blanks.)

Cylinder Key Duplicators

Cylinder type key duplicators are operated automatically, semi-automatically, or manually. Automatic and manual machines take about 30 to 40 seconds to duplicate a key. Semi-automatic machines take about 10 seconds.

Type of Duplicating Machine	Time To Duplicate a Key
Automatic	30 to 40 seconds
Manual	30 to 40 seconds
Semi-Automatic	10 seconds

However, even with the automatic version, the locksmith must set up and run the machine.

Automatic Duplicators

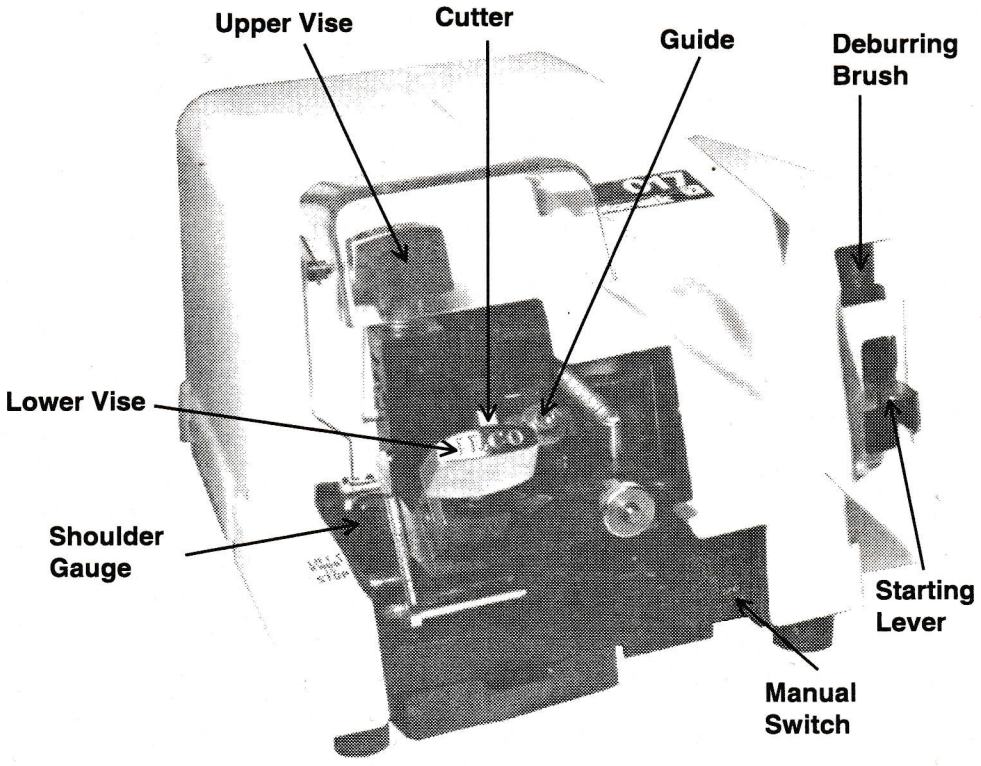
An automatic duplicator completes the duplicating process once the pattern key and blank have been properly placed in the vises. One advantage of automatic duplicators is that they exert the same pressure on each key made, no matter who is operating the machine.

Code Machine—A key machine designed to cut keys to a specific code rather than duplicate them from pattern keys

When duplicating more than one copy of the same pattern key, some locksmiths use an automatic machine next to a **code machine**. The operator can generate a pattern key by code on the code machine. Then the operator can make duplicates on the automatic machine while the code machine is generating another pattern key.

The speed of the code machine is about the same as that of the automatic duplicator. So, depending on the type of duplicating job, running them both can be a good use of machine operator time.

As an example of an automatic duplicator, let's take a look at the Ilco 017 Automatic Key Machine.



The Ilco 017 Automatic Key Machine

(courtesy of Ilco Unican)

Parts and Their Functions

The ***starting lever*** starts the cutting cycle.

The ***vises (jaws)*** grip the pattern key and the key blank during the cutting cycle.

The ***shoulder gauge*** aligns the pattern key with the key blank.

The ***cutter guide*** traces the pattern key.

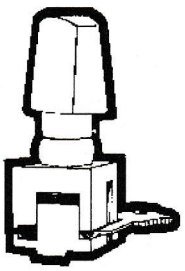
The ***cutter*** produces the pattern traced by the cutter guide on a key blank.

The ***manual switch*** activates the deburring brush.

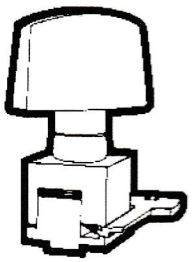
The ***deburring brush*** removes the small burrs from the blade of the duplicate key.

As you can see from the illustration on the previous page, the Ilco 017 uses a stacked, or vertical, vise alignment. The vises on the machine are reversible to let you cut various types of keys. You have two choices of gripping styles.

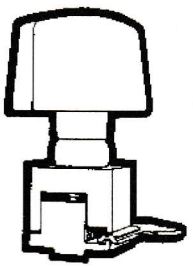
Let's take a look at side views of the vises, with each vise holding a different type of key.



Jaw holding single-sided key



Jaw holding double-sided key



Jaw holding double-sided corrugated key (Schlage)

(courtesy of Ilco Unican)

Since the vises sit one on top of another, place the pattern key in the vise nearest the cutter guide. Insert the blank in the vise nearest the cutter.

Due to the vise arrangement, the shoulder guide slides up on the left side of the carriage to properly gauge the spacing of keys.

The operating lever starts the cutting cycle. The machine automatically shuts off at the end of the cutting cycle. However, if the manual switch has been turned on, the machine will not shut off until you turn the manual switch off.

Remember that the manual switch operates the deburring brush.

The shoulder gauge has a safety switch. This switch must be turned off before the machine will operate.

Duplicating Procedure

To duplicate a standard cylinder key on an Ilco 017 key duplicating machine, you must first place the pattern key and key blank in the appropriate vises and properly gauge them. Once the keys are placed in the vises and properly gauged, follow the steps listed below.

1. Return the shoulder guide and carriage to the starting (resting) position.
2. Press the starting lever to begin the cutting cycle.

   Note: When the cutting cycle is complete the machine will shut off.
3. Remove the keys.
4. Turn the manual switch to "on" and deburr the duplicate key.

Speed is not as critical as safety and accuracy.

When Locksmiths Were Artists and Keys Unduplicated

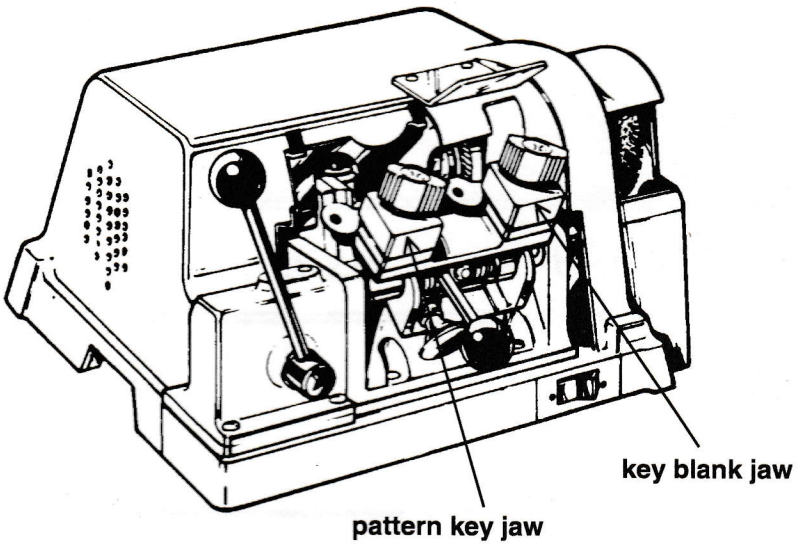
From the 14th through the 17th century, locksmiths were skilled metalworkers and excellent artisans. And they were great artists who became internationally famous. Wealthy and well-born persons throughout Europe hired them to fashion unique locks. These lock and key artisans created locks using the coats-of-arms and other symbolic shapes that represented their noble customers. They also fashioned ornamental locks that coordinated with the architectural styles of the buildings to be secured. In fact, security depended upon the complexity of the locks—and the fact that every lock was one of a kind and its key an unduplicated master.

Semi-Automatic Duplicators

Semi-automatic duplicators are often called lever-operated machines. They are similar in design to manual machines.

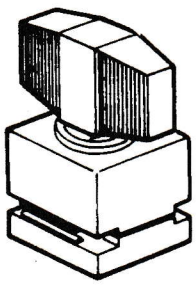
One of the advantages of semi-automatic key duplicators is speed. A manual or automatic machine may take 30-40 seconds to duplicate a key. A semi-automatic can often perform the same operation in 10 seconds or less. This becomes an important factor for large quantity duplicating jobs.

As an example of this type of key duplicator, let's look at the Ilco 024 Lever-Operated Duplicator. The jaw on the left is for the pattern key. The jaw on the right is for the key blank to be duplicated.

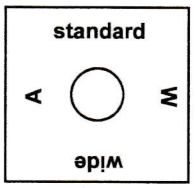


(courtesy of Ilco Unican)

This machine uses a four-way jaw design. This design gives you the ability to accurately clamp different styles of blanks by putting both jaws in the same position. You'll learn more about this when we look at manual duplicators.



This type of jaw can be turned four ways to let you cut four different types of keys.



(courtesy of Ilco Unican)

The carriage of the semi-automatic duplicator has a built-in tension spring that keeps tension against the carriage while the pattern key is traced. So the only operator movements necessary are left to right and right to left motions.

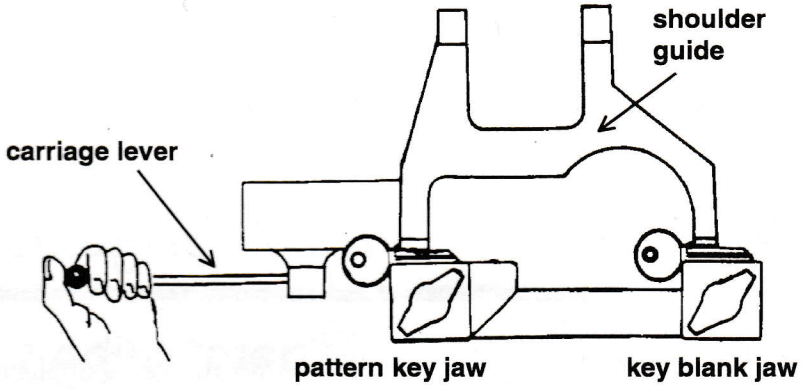
The tension spring also gives the semi-automatic machine one of the advantages of the automatic machine. The cutting pressure is the same regardless of who is operating the machine.

On any key machine using a multiple jaw system, you must use the same jaw style for the pattern key and the duplicate.

If you don't use the same jaw style for both the pattern key and the duplicate, the duplicate key will be too shallow or too deep. Check the jaws before inserting the keys for proper indexing.

Duplicating Procedure

To duplicate a standard key on the Ilco 024 Lever-Operated Duplicator, first place the keys in the appropriate jaws and make sure they are properly gauged.



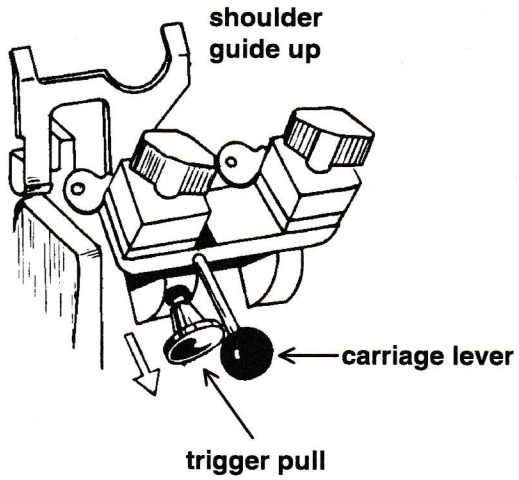
(courtesy of Ilco Unican)

Swing the shoulder guide down to rest on the blade of the key blank. Move the carriage lever clockwise slowly until the key blank shoulder rests against the shoulder guide.

Then follow the steps listed below.

1. Turn the machine on.

2. Move the carriage lever all the way to the left.



(courtesy of Ilco Unican)

3. Push down on the carriage handle and pull the trigger pull toward you. This releases the carriage assembly, letting the carriage ease toward the cutter guide and cutter to duplicate the key.

Do not let go of the carriage until the pattern key is against the cutter guide!

4. After the key is duplicated, push down on the carriage handle until the trigger pull clicks into place.

5. Turn the machine off and remove the keys.

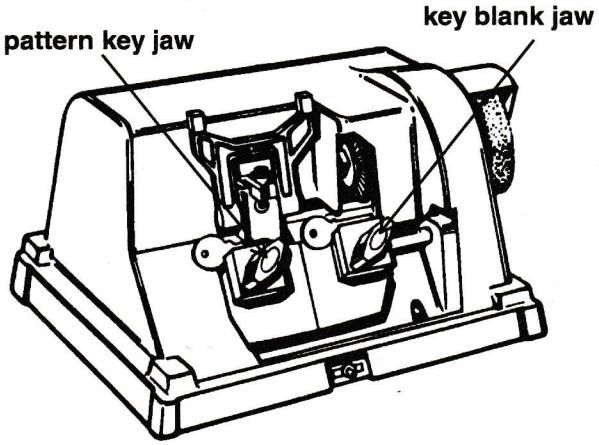
6. Turn the machine on again to use the deburring brush on the duplicate.

Ilco recommends that for extended cutter life you alternate starting tip to bow and bow to tip when using this duplicator.

After you have performed this operation a number of times, it will become one flowing movement.

Manual Duplicators

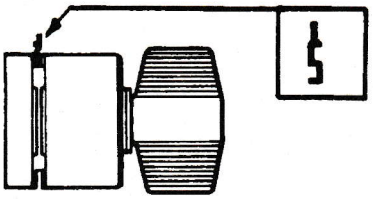
For our example of a manual key duplicating machine, let's look at the Ilco 025 Manual Key Duplicator, one of the most popular manual key machines on the market today. This machine can duplicate most popular cylinder keys.

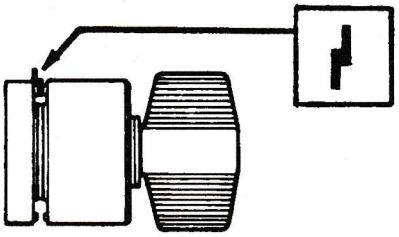


(courtesy of Ilco Unican)

Notice the two jaws on the carriage assembly. This is a four-way design, as in our semi-automatic example.

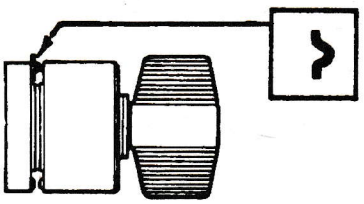
The standard jaw is for most popular keys. Commercial or residential keys are examples of those you will use in the standard jaw.





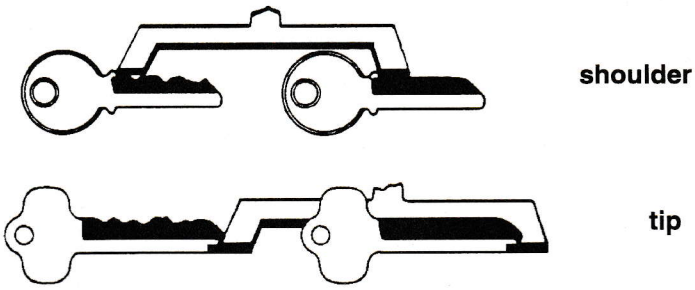
The wide jaw is for blanks having a wide blade.

The A jaw is designed to clamp in the milling of blanks that use a thin built-up ridge within the jaw.

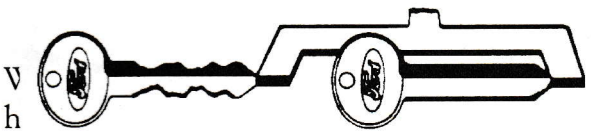


The W jaw (not pictured) is much the same as the A, except that the build-up is thicker. The W jaw is well-suited for Schlage wafer-style keys.

The Ilco 025 can duplicate standard keys with shoulders, keys without shoulders, and keys with recessed shoulders or tips. Note the position of the shoulder guide for each different style.



(courtesy of Ilco Unican)



When operating a manual key duplicator, you must provide the pressure as the machine cuts the key. Different operators will, of course, provide different levels of pressure against the carriage. This can be a disadvantage of using a manual duplicator.

Always wear eye protection when operating a key machine.

Duplicating Procedure

To duplicate a standard key on the Ilco 025 Manual Key Duplicator, first place the keys in the appropriate vises and make sure they are properly gauged. Then follow the steps listed below.

1. Start the motor.
2. With both hands on the rear of the carriage, lift the carriage toward the cutter.
3. Starting just at the right of the shoulder, push the carriage against the cutter guide and move the carriage to the left, tracing the pattern key. You must keep consistent tension against the carriage while tracing the pattern key. Depending on the thickness of the key, you may have to retrace the pattern key left to right, then right to left, a few times.
4. Bring the carriage down to the at-rest position and turn the machine off.
5. Remove the new duplicate and take off any metal burrs with the brush provided.

The more you use a manual duplicator, the more your movements will become one flowing gesture.

Organize the Main Ideas

This outline will help you organize the information in this section of the lesson. Read through the outline and jot down what you remember about each of the topics listed. If you can't remember details related to one or more of the topics, you may wish to reread the text before you go on.

1. Cylinder Key Duplicators

   a. Automatic Duplicators

      1) Parts and Their Functions

      2) Duplicating Procedure

   b. Semi-Automatic Duplicators

      1) Duplicating Procedure

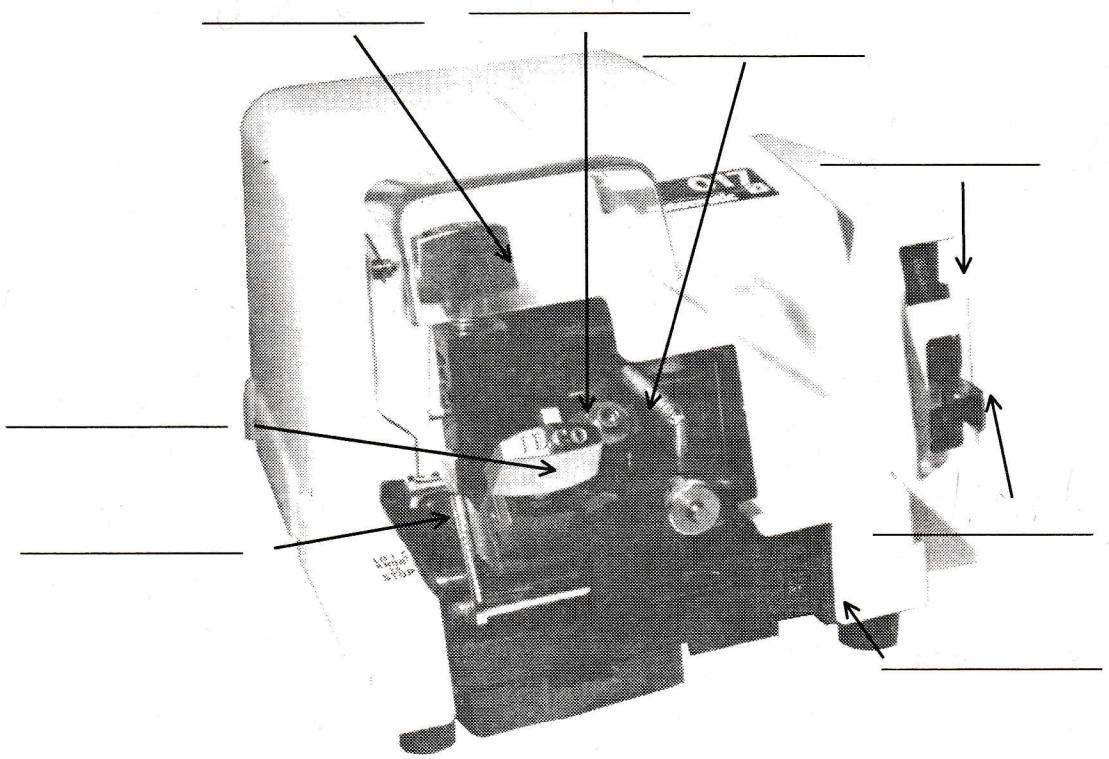
   c. Manual Duplicators

      1) Duplicating Procedure

Check Your Knowledge 2

This quiz will help you check what you've learned in this section of the lesson. Read through the questions and jot down your answers. Then check those against the suggested answers at the end of this lesson. If your answers differ greatly from the suggested answers, you may wish to reread the text before you go on.

1. Label the parts of the automatic duplicating machine shown below.



(courtesy of Ilco Unican)

2. On an automatic duplicating machine, the manual switch starts the cutting cycle. (True or False?)

3. The automatic duplicating machine turns off at the end of the cutting cycle unless the manual switch is turned on. (True or False?)

4. The _____ _____ aligns the pattern key with the key blank. (Fill in the blanks.)

5. What does the deburring brush do?

6. After placing the pattern key and key blank in the appropriate vises and properly gauging them, you need to complete four additional steps when duplicating a key on an Ilco 017 automatic cylinder key machine. The steps for doing that are listed below. Put these steps in the correct order by placing number 1 in front of the first step, number 2 in front of the second step, and so forth.

   _____ Press the starting lever to begin the cutting cycle.

   _____ Return the shoulder guide and carriage to the starting (resting) position.

   _____ Turn the manual switch to "on" and deburr the duplicate key.

   _____ Remove the keys.

7. When using an Ilco 024 or 025 key machine with a four-way vise jaw system, the jaw on the left is for the _____ _____ and the jaw on the right is for the _____ _____. (Fill in the blanks.)

8. After placing the pattern key and key blank in the appropriate vises and properly gauging them, you need to complete six additional steps when duplicating a key on an Ilco 024 semi-automatic cylinder key machine. The steps for doing that are listed below. Put these steps in the correct order by placing number 1 in front of the first step, number 2 in front of the second step, and so forth.

   _____ Move the carriage lever all the way to the left.

   _____ Push down on the carriage handle and pull the trigger pull toward you. This releases the carriage assembly, letting the carriage ease toward the cutter guide and cutter to duplicate the key.

   _____ Turn the machine on.

   _____ Turn the machine off and remove the keys.

   _____ After the key is duplicated, push down on the carriage handle until the trigger pull clicks into place.

   _____ Turn the machine on again to use the deburring brush on the duplicate.

9. After placing the pattern key and key blank in the appropriate vises and properly gauging them, you need to complete five additional steps when duplicating a key on an Ilco 025 manual cylinder key machine. The steps for doing that are listed below. Put these steps in the correct order by placing number 1 in front of the first step, number 2 in front of the second step, and so forth.

   _____ With both hands on the rear of the carriage, lift the carriage toward the cutter.

   _____ Start the motor.

   _____ Bring carriage down to the at-rest position and turn the machine off.

   _____ Starting just at the right of the shoulder, push the carriage against the cutter guide and move the carriage to the left tracing the pattern key.

   _____ Remove the new duplicate and take off any metal burrs with the brush provided.

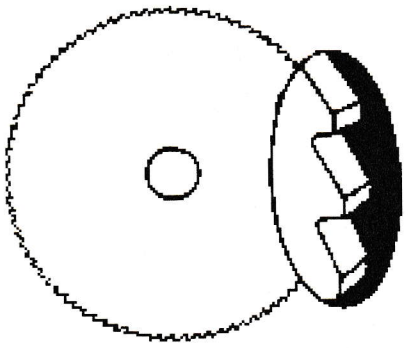
Other Types of Key Duplicators

Cylinder keys are the most used and most often duplicated. However, as a locksmith, you also may be asked to duplicate any one or more of the other types of keys used today. In this section, you'll learn about flat key and bit and barrel key duplicating machines.

Flat Key Duplicators

Flat type keys, as you learned in Lesson 2, are still very popular today. Some of these keys are like cylinder keys in that they are milled to fit different keyways. When a flat key is milled, it is not totally flat on both sides.

One difference between a cylinder key and a milled flat key is the shape of the cut. A milled flat key has a straight cut versus an angle cut used on regular cylinder keys.

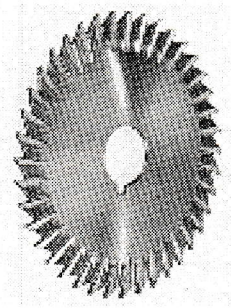


(courtesy of Continental Micro)

Obviously, we cannot use one of the types of machines we discussed earlier in this lesson to duplicate this style of key. The cutting process requires the plunging motion of a flat cutter. However, some manufacturers do use the same chassis and change the cutter guide and cutter to make a flat key duplicating machine.

Ilco has done that with their 026 model. Except for cutter and cutter guide, it is almost exactly the same machine as the 025.

However, the 026 differs from other flat key duplicating machines because it uses a side milling slotter cutter that allows slight side-to-side movement.



This Ilco 45SMS cutter is used for flat keys.

(courtesy of Ilco Unican)

Remember the Ilco 45SMS you learned about on page 6 of this lesson? Go back and reread the information about that cutter. Other flat key duplicating machines use slotter cutters that do not have side cutting teeth. These types require a plunging motion only with no side-to-side motion.

Duplicating Tips

When you prepare to duplicate a flat type key, keep these tips in mind.

1. The thickness of the blank should be the same thickness as the pattern key.

2. The width or height of the blank can exceed the width or height of the pattern key if you are willing to file the width down across the whole blank.

3. The blank can be longer, but should not be shorter than the pattern key.

4. The width of the tip on the blank should not exceed the width on the pattern key. If it does, it may be shaved either with a flat file or in the machine.

5. Using a key blank that matches the customer's key exactly is always easier than modifying a key blank.

Make sure you check the style of cutter on your flat steel machine before proceeding!

Duplicating Procedure

To duplicate a flat type key on the Ilco 026 Flat Key Duplicator, follow the steps listed below.

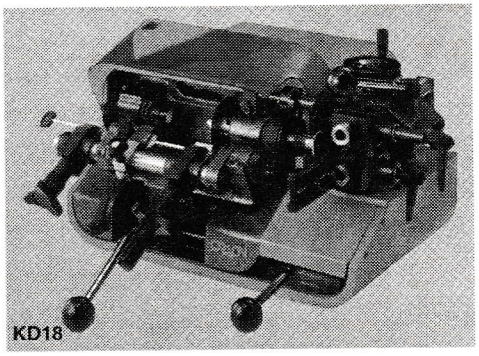
1. Insert the blank in the right vise. Make sure most of the body of the blank is within the vise area.
2. Lower the shoulder guide and move the vise so that the stop at the end of the key rests against it.
3. Insert the pattern key in the left vise, pushing the end of the key against the shoulder guide.
4. Put the shoulder guide back to the at-rest position.
5. Turn machine on and start plunge cuts with the throat cut, proceeding to the lever cuts until all cuts are completed.
6. Turn machine off. Remove the new duplicate and deburr.

Bit and Barrel Key Duplicators

The popularity of bit and barrel keys has decreased in recent decades, but they remain in use in older homes and antique furniture. So you may need to cut bit or barrel keys at some point in your career.

Some locksmiths prefer not to stock and cut the keys. Some stock and hand file the keys. Some have a bit and barrel key duplicator. It is a judgment call that has to be made based on customer demand.

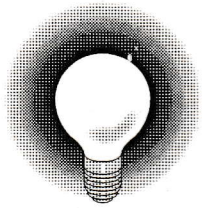
Ilco model KD18 is a machine designed to duplicate bit keys.



(courtesy of Ilco Unican)

Remember, some of these keys use some or all of the following: lever cuts, ward cuts, and ward grooves.

Organize the Main Ideas



This outline will help you organize the information in this section of the lesson. Read through the outline and jot down what you remember about each of the topics listed. If you can't remember details related to one or more of the topics, you may wish to reread the text before you go on.

1. Other Types of Key Duplicators

   a. Flat Key Duplicators

      1) Duplicating Tips

      2) Duplicating Procedure

   b. Bit and Barrel Key Duplicators

Check Your Knowledge 3

This quiz will help you check what you've learned in this section of the lesson. Read through the questions and jot down your answers. Then check those against the suggested answers at the end of this lesson. If your answers differ greatly from the suggested answers, you may wish to reread the text before you go on.

1. All flat key duplicating machines have side milling slotter cutters. (True or False?)
2. When duplicating a flat key, the _____ of the blank should be the same _____ as the pattern key. (Fill in the blanks.)
3. When duplicating a flat key, the blank can be longer, but should not be shorter than the pattern key. (True or False?)
4. The steps for duplicating a flat key on the Ilco 026 are listed below. Place them in the correct order by writing a number 1 on the blank next to the first step, number 2 on the blank next to the second step, and so forth.

   _____ Insert the pattern key in the left vise, pushing the end of the key against the shoulder guide.

   _____ Insert the blank in the right vise. Make sure most of the body of the blank is within the vise area.

   _____ Lower the shoulder guide and move the vise so that the stop at the end of the key rests against it.

   _____ Turn machine on and start plunge cuts with the throat cut, proceeding to the lever cuts until all cuts are completed.

   _____ Put the shoulder guide back to the at-rest position.

   _____ Turn machine off. Remove the new duplicate and deburr.

Making Sure the Duplicate Key Works

The three most frequent causes for duplicate keys failing to operate a lock correctly are

1. worn or improperly cut pattern key,
2. improper maintenance, and
3. improper depth and/or spacing adjustments on the machine.

The Pattern Key

Pattern Key—A key which is used in a key duplicating machine to create a duplicate key

A key duplicating machine typically cuts a key blank to match what we'll refer to as a **pattern key**. In other words, the machine uses the pattern key to make a copy.

Think about what happens on a copy machine when you copy from a copy instead of from an original. You get better copies from the original than from the copy. Right? The same is true for keys.

A key which is duplicated from a pattern key can be only as accurate as the pattern key.

A pattern key may be a factory original or it may be a duplicate key. If the pattern key is a factory original, the copy will be more accurate than if the pattern key is a duplicate key. Customer keys are often duplicate keys. When this is the case, you will be making a copy from a copy.

Let's face it: many people have keys that they use hundreds of times a year in their auto, home, or business. They often wait until a key starts to hang up or stick before obtaining a replacement. Also, they may possess duplicate keys that have reached their last generation.

What is meant by the last generation? If you use a new, factory produced, original key, the duplicate becomes second generation. If you then use this second generation key as the pattern key, the next duplicate becomes the third generation, and so on.

Quality key duplicating machines often produce working duplicates only to the 7th or 8th generation. That means the 6th generation operates the lock, but the 7th may not.

What causes this? Key machines are very close in space and depth tolerances, but they are not exact. The tolerances in locks can range from a few to many thousandths of an inch.

Let's say you produce generations on a machine that is adjusted with 0.002" space and depth differential. Then, at the sixth generation you will have 0.010" difference from the 1st generation key. Many times the keys presented for duplication may be third, fourth, or fifth generation. This is one reason that key machines need regular and proper maintenance.

Remember that the finished product can be only as accurate as the pattern key. A customer may bring you a non-working key and expect you to duplicate it. Of course, you can do that. But the duplicate won't work either.

If a customer brings you what appears to be a worn pattern key, ask if the key works before proceeding.

Routine Maintenance

Regular and proper maintenance for key duplicating machines includes

- cleaning the machine,
- lubricating the machine, and
- inspecting the cutter.

Cleaning the Machine

Clean the brass chips from the machine at least daily, depending on the number of keys duplicated. Pay particular attention to removing chips from the vise area. They could keep the keys from properly seating. Also, if chips are not removed, they can invade the motor, electrical switches, and carriages, which can be dangerous for the machine operator.

Lubricating the Machine

Many of the machines today have sealed bearings in the motors and carriages. Consult the owner's manual for

- lubrication points,
- the proper type of lubrication, and
- lubrication schedule.

Inspecting the Cutter

Inspect the cutter on a regular basis, probably weekly, for any teeth that may have chipped. If the cutter is chipped, consider replacing it right away.

Do not dispose of a chipped cutting wheel. Often they can be repaired by the company that sharpens your cutters.

Checking Depth and Spacing Adjustments

This section applies primarily to cylinder-type key duplicators. When a new machine is shipped from the factory, it usually is accurately adjusted and ready for operation. But you should always check the depth and spacing adjustments before duplicating keys.

Checking Depth Adjustment

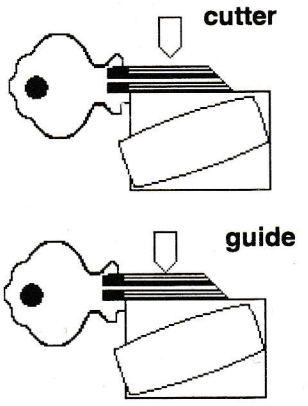
Follow the steps below to check depth adjustment.

1. Using two key blanks of the same style, seat one in the pattern key vise and one in the duplicate vise.
2. With the motor off, move the carriage so the key in the pattern vise rests against the cutter guide.
3. Turn the cutter wheel or motor pulley by hand to see if the cutter is making contact with the key in the duplicate vise.

If the cutter does not touch the key in the upper vise, the machine may be cutting too shallow. Look in the operator manual that came with your duplicating machine to find out how to adjust for a deeper cut.

INCORRECT

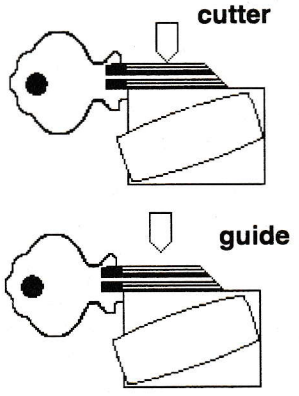
Cuts will be too shallow.



If no contact is made in the lower vise, the machine will cut too deep. Again, look in the operator manual that came with your duplicating machine to find out how to adjust for a more shallow cut.

INCORRECT

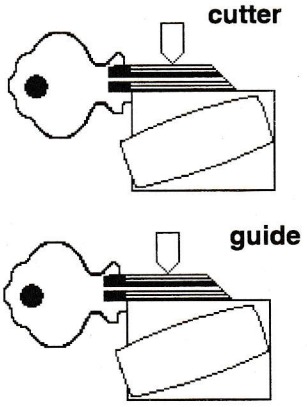
Cuts will be too deep.



If the cutter is just barely scraping the blank, the depth adjustment likely is very close.

CORRECT

Adjustment is very close.



If the depth adjustment is close, perform steps 4 and 5 to check the variance.

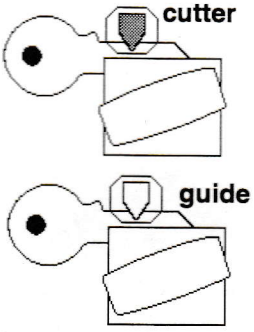
4. Duplicate a key from a factory original.

5. Using a key micrometer or dial calipers, check the depth of the original against the duplicate.

A 0.001" variance or less is the goal.

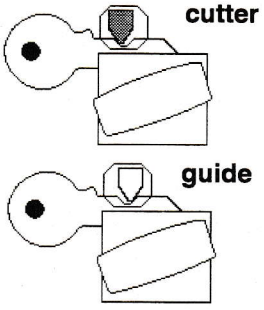
Checking Spacing Adjustment

Now let's check the spacing. Shown below are some common illustrations of proper and improper space alignment.



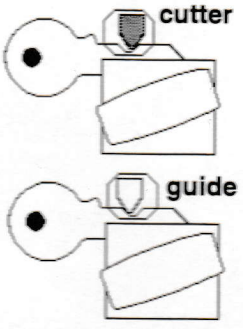
CORRECT

Machine is properly adjusted for spacing.



INCORRECT

Cuts will be too close to the shoulder.



INCORRECT

Cuts will be too far from the shoulder.

Many key duplicating machines arrive from the factory with a set of space alignment keys. These usually are solid brass, thicker than a normal blank. They have a notch or cut in them that fits the cutter guide and cutter angle.

If you don't have a set of space alignment keys, follow these steps to make one.

1. Take two key blanks of the same style and clamp both of them, one on top of the other, in the cutter side vise. Make sure the shoulders are lined up so the keys are exactly one on top of the other.

2. Turn on the machine and let the carriage make a plunge cut in the blanks. You have made two "pattern" space alignment keys using a random cut.

Now use those space alignment keys to check spacing alignment.

1. Turn off the machine and put one of the space alignment key blanks you made in the pattern key vise. Leave the other space alignment key where it is.

2. After shoulder gauging the keys, keep the motor off and take the carriage toward the cutter guide and cutter to see if the keys line up.

If the keys line up, the space alignment on the machine is fine. If they don't, check the operator manual that came with your duplicating machine for instructions about how to adjust the machine.

Before making adjustments, unplug the machine. Read the owner's manual and make sure you thoroughly understand it. You must know the proper procedure and have the tools needed.

Organize the Main Ideas

This outline will help you organize the information in this section of the lesson. Read through the outline and jot down what you remember about each of the topics listed. If you can't remember details related to one or more of the topics, you may wish to reread the text before you go on.

1. Making Sure the Duplicate Key Works

   a. The Pattern Key

   b. Routine Maintenance

      1) Cleaning the Machine

      2) Lubricating the Machine

      3) Inspecting the Cutter

   c. Checking Depth and Spacing Adjustments

      1) Checking Depth Adjustment

      2) Checking Spacing Adjustment

Check Your Knowledge 4

This quiz will help you check what you've learned in this section of the lesson. Read through the questions and jot down your answers. Then check those against the suggested answers at the end of this lesson. If your answers differ greatly from the suggested answers, you may wish to reread the text before you go on.

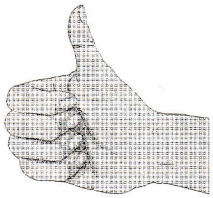
1. List the three most frequent causes for non-working key duplicates.

2. Define "pattern key."

3. Routine maintenance for key duplicating machines includes _____ the machine, _____ the machine, and _____ the cutter. (Fill in the blanks.)

4. List the three steps for checking depth adjustments on a cylinder key duplicating machine.

5. List the two steps for making a set of space alignment keys.



Now You Can Do It!

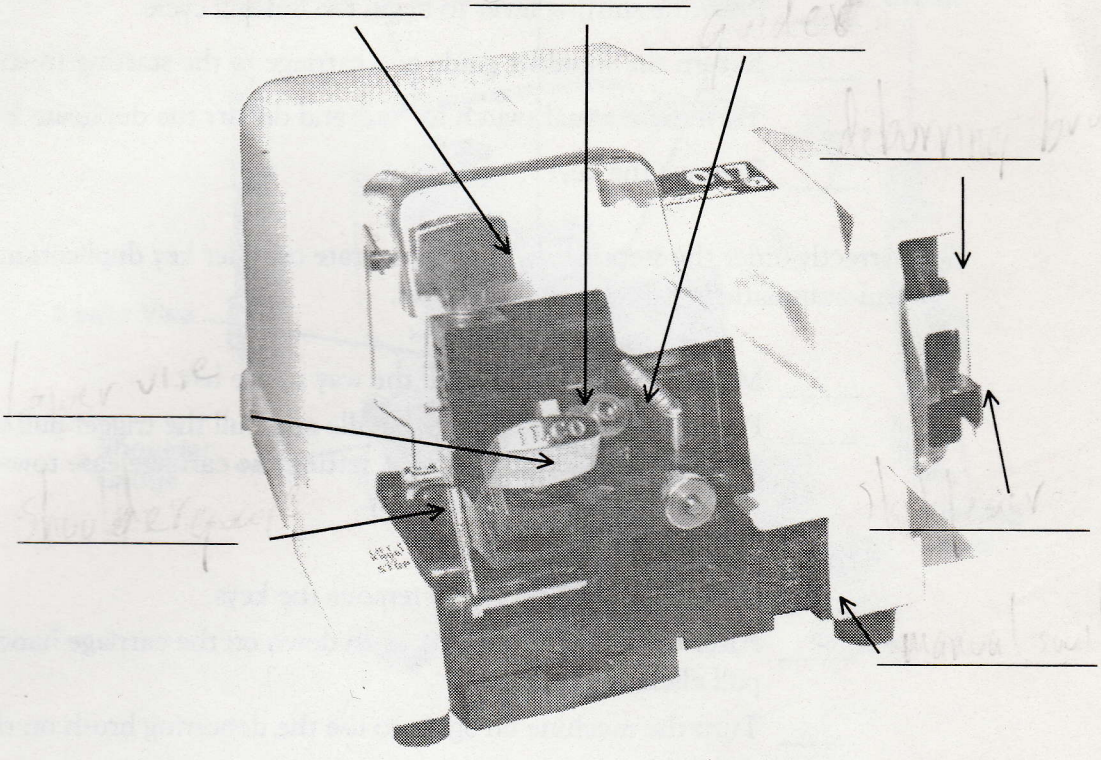
You've reached the end of the lesson, but what have you learned? Let's find out. First complete the exercise below using only your memory. Next go back to the text to complete and/or check your answers.

1. List and describe the functions of two parts found on all duplicating machines.

2. List and describe three types of key machine cutters.

3. List three rules you must always follow when operating key duplicating machines.

4. Identify the parts of an automatic cylinder key duplicating machine. (Label the illustration below.)



(courtesy of Ilco Unican)

5. Describe the function of each part of an automatic cylinder key duplicating machine (which you labeled in the above item).

6. Correctly order the steps necessary for accurate cylinder key duplication on an Ilco 017 automatic key duplicating machine.

_____ Press the starting lever to begin the cutting cycle.

_____ Return the shoulder guide and carriage to the starting (resting) position.

_____ Turn the manual switch to "on" and deburr the duplicate key.

_____ Remove the keys.

7. Correctly order the steps necessary for accurate cylinder key duplication on an Ilco 024 semi-automatic key duplicating machine.

_____ Move the carriage lever all the way to the left.

_____ Push down on the carriage handle and pull the trigger pull toward you. This releases the carriage assembly, letting the carriage ease toward the cutter guide and cutter to duplicate the key.

_____ Turn the machine on.

_____ Turn the machine off and remove the keys.

_____ After the key is duplicated, push down on the carriage handle until the trigger pull clicks into place.

_____ Turn the machine on again to use the deburring brush on the duplicate.

8. Correctly order the steps necessary for accurate cylinder key duplication on an Ilco 025 manual key duplicating machine.

_____ With both hands on the rear of the carriage, lift the carriage toward the cutter.

_____ Start the motor.

_____ Bring carriage down to the at-rest position and turn the machine off.

_____ Starting just at the right of the shoulder, push the carriage against the cutter guide and move the carriage to the left, tracing the pattern key.

_____ Remove the new duplicate and take off any metal burrs with the brush provided.

9. Correctly order the steps necessary for accurate flat key duplication on an Ilco 026 flat key duplicating machine.

_____ Insert the pattern key in the left vise, pushing the end of the key against the shoulder guide.

_____ Insert the blank in the right vise. Make sure most of the body of the blank is within the vise area.

_____ Lower the shoulder guide and move the vise so that the stop at the end of the key rests against it.

_____ Turn machine on and start plunge cuts with the throat cut, proceeding to the lever cuts until all cuts are completed.

_____ Put the shoulder guide back to the at-rest position.

_____ Turn machine off. Remove the new duplicate and deburr.

10. Identify the three most frequent causes for non-working duplicates. (List them.)

11. List the three categories of routine maintenance that apply to key duplicating machines.

12. Explain how to check the depth adjustments on a cylinder key duplicating machine.

13. Describe how to make a set of space alignment keys for a cylinder key duplicating machine.

Stop for Review

To answer the following questions, circle the letter next to the correct response. Only one correct response is provided for each question.

1. Two parts found on all key duplicating machines are the _____.
   a. side milling slotter and cutter guide
   b. four-way jaw design and side milling slotter
   c. cutter guide and cutter
   d. two-way jaw design and cutter guide

2. The _____ traces the pattern key.
   a. cutter
   b. jaw
   c. carriage
   d. cutter guide

3. The _____ produces the shape of the pattern key on a key blank.
   a. cutter
   b. jaw
   c. carriage
   d. cutter guide

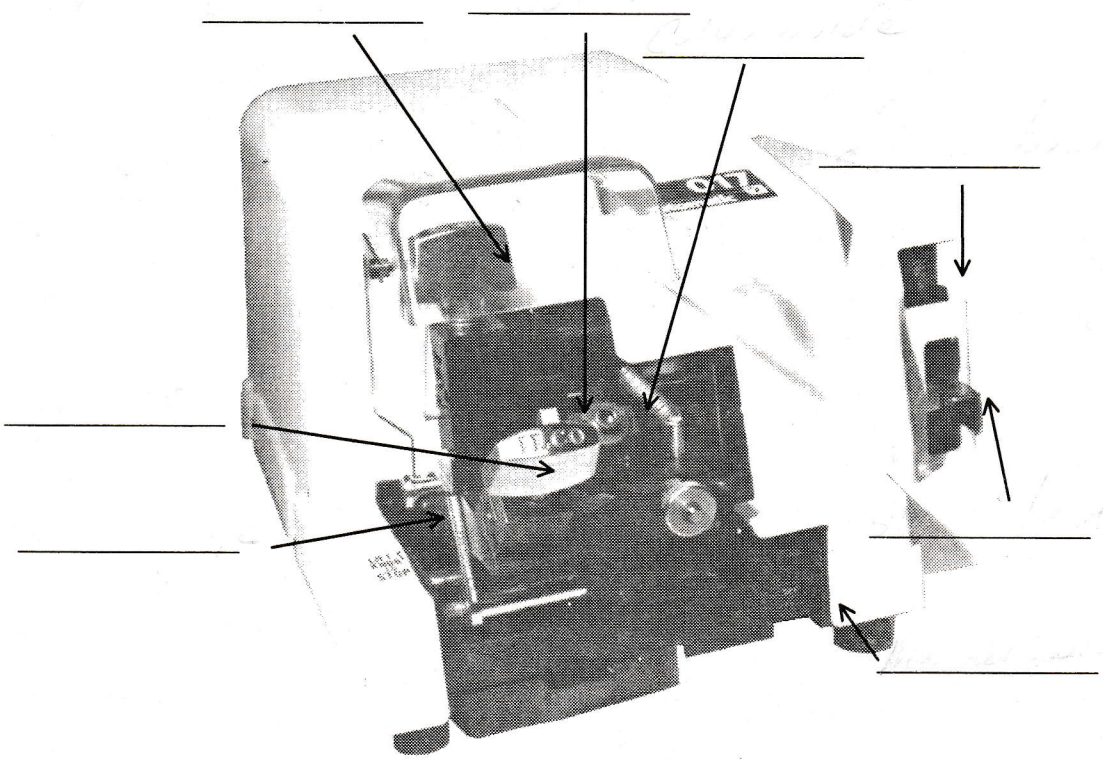
4. The Ilco P-X23MC used on a manual key duplicating machine is a _____.
   a. milling cutter with one flat side and one angled side, and is used to cut flat keys
   b. V-shaped milling cutter used to cut cylinder keys
   c. milling cutter with one flat side and one angled side, and is used to cut cylinder keys
   d. side milling slotter cutter with teeth on sides and bottom used to cut flat keys

5. The Ilco P-9MC used on an automatic key duplicating machine is a _____.
   a. milling cutter with one flat side and one angled side, and is used to cut flat keys
   b. V-shaped milling cutter used to cut cylinder keys
   c. milling cutter with one flat side and one angled side, and is used to cut cylinder keys
   d. side milling slotter cutter with teeth on sides and bottom used to cut flat keys

6. The Ilco 45SMS used on a flat key duplicating machine is a _____.
   a. milling cutter with one flat side and one angled side, and is used to cut flat keys
   b. V-shaped milling cutter used to cut cylinder keys
   c. milling cutter with one flat side and one angled side, and is used to cut cylinder keys
   d. side milling slotter cutter with teeth on sides and bottom used to cut flat keys

7. When operating a key duplicating machine, you should NOT _____.
   a. work as fast as you can no matter what, since speed is the most important consideration
   b. wear eye protection
   c. turn the machine off before inserting or removing keys
   d. turn the machine off before reaching into the jaw area

8. Label the parts of the automatic cylinder key duplicating machine pictured below.



(courtesy of Ilco Unican)

To answer the following questions, circle the letter next to the correct response. Only one correct response is provided for each question.

9. The manual switch on an automatic cylinder key duplicating machine _____.
   a. starts the cutting cycle
   b. activates the deburring brush
   c. stops the cutting cycle
   d. returns the shoulder guide and carriage to the starting position.

10. The starting lever on an automatic cylinder key duplicating machine _____.
   a. starts the cutting cycle
   b. activates the deburring brush
   c. stops the cutting cycle
   d. returns the shoulder guide and carriage to the starting position.

11. Return the shoulder guide and carriage to the starting position, press the starting lever to begin the cutting cycle, remove the keys, turn the manual switch to "on," and deburr the duplicate key are the steps for key duplication on _____.
   a. an Ilco 025 manual cylinder key duplicating machine
   b. an Ilco 026 flat key duplicating machine
   c. an Ilco 017 automatic cylinder key duplicating machine
   d. an Ilco 024 semi-automatic duplicator

12. Turn the machine on; move the carriage lever all the way to the left; push down on the carriage handle and pull the trigger pull toward you; push down on the carriage handle until the trigger pull clicks into place; turn the machine off and remove the keys; and turn the machine on again to use the deburring brush on the duplicate are the steps for key duplication on _____.
    a. an Ilco 025 manual cylinder key duplicating machine
    b. an Ilco 026 flat key duplicating machine
    c. an Ilco 017 automatic cylinder key duplicating machine
    d. an Ilco 024 semi-automatic duplicator

13. Start the motor; lift the carriage toward the cutter; starting just at the right of the shoulder, push the carriage against the cutter guide and move the carriage to the left, tracing the pattern key; bring the carriage down to the at-rest position and turn the machine off; and remove the new duplicate and take off any metal burrs with the brush provided are the steps for key duplication on _____.
    a. an Ilco 025 manual cylinder key duplicating machine
    b. an Ilco 026 flat key duplicating machine
    c. an Ilco 017 automatic cylinder key duplicating machine
    d. an Ilco 024 semi-automatic duplicator

14. Insert the blank in the right vise, making sure most of the body of the blank is within the vise area; lower the shoulder guide and move the vise so that the stop at the end of the key rests against it; insert the pattern key in the left vise, pushing the shoulder of the key against the shoulder guide; put the shoulder guide back to the at-rest position; turn the machine on and start plunge cuts with the throat cut, proceeding to the lever cuts until all cuts are completed; and turn machine off and remove the new duplicate and deburr are the steps for key duplication on _____.
    a. an Ilco 025 manual cylinder key duplicating machine
    b. an Ilco 026 flat key duplicating machine
    c. an Ilco 017 automatic cylinder key duplicating machine
    d. an Ilco 024 semi-automatic duplicator

15. _____ is NOT a frequent cause for non-working duplicates.
    a. Worn or improperly cut pattern key
    b. Improper maintenance
    c. Defective factory original key
    d. Improper depth and/or spacing adjustments on the machine

16. Key duplicating machines do NOT require routine _____.
    a. cleaning
    b. rebuilding
    c. lubricating
    d. cutter inspection

17. Using two key blanks of the same style, seat one in the pattern key vise and one in the duplicate vise; with the motor off, move the carriage so the key in the pattern vise rests against the cutter guide; and turn the cutter wheel or motor pulley by hand to see if the cutter is making contact with the key in the duplicate vise are the steps for _____.
    a. key duplication on an automatic cylinder key machine
    b. making a set of space alignment keys
    c. checking depth adjustment on a cylinder key duplicating machine
    d. checking space alignment on a cylinder key duplicating machine

18. If the cutter is just barely scraping the blank when you check for depth adjustment, you should _____.
    a. duplicate a key from a factory original and use a micrometer or dial calipers to check for a variance of 0.010" or less between the original and the duplicate
    b. duplicate a key from a factory original and use a micrometer or dial calipers to check for a variance of 0.005" or less between the original and the duplicate
    c. duplicate a key from a factory original and use a micrometer or dial calipers to check for a variance of 0.001" or less between the original and the duplicate
    d. duplicate a key from a factory original and use a micrometer or dial calipers to check for a variance of 0.10" or less between the original and the duplicate

19. Take two key blanks of the same style and clamp both of them, one on top of the other, in the cutter side vise; turn on the machine; and let the carriage make a plunge cut in the blanks are the steps for _____.
    a. key duplication on an automatic cylinder key machine
    b. making a set of space alignment keys
    c. checking depth adjustment on a cylinder key duplicating machine
    d. checking space alignment on a cylinder key duplicating machine