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# DVD-93C

## Gull Wing Rework

*Below is a copy of the narration for DVD-93C. The contents for this script were developed by a review group of industry experts and were based on the best available knowledge at the time of development. The narration may be helpful for translation and technical reference.*

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### *Gull Wing Components*

This is the third video in the Surface Mount Rework Series. In this video we're going to explain each of the techniques for removal and replacement of Gull Wing Surface Mount Components.

There are four types of Gull Wing components that we'll be working with. The first is the Quad Flat Pack or QFP. These components have gull wing leads on all four sides. QFP's come in plastic packages - called PQFP's, and in ceramic packages - or CQFP's. There are also thin plastic packages - called TQFP's.

The distance between the center of each lead is called the pitch. QFP lead spacing can be as wide as 50 mils. Fine pitch components typically have lead spacings of 25 mils and less. QFP's usually require more rework than any of the other gull wing components because of the large number of leads that can bend, become misaligned, or bridge with solder.

In the first video in this series we discussed the importance of lead coplanarity - or levelness. Careful handling of these sensitive components is absolutely essential. For information on component handling and ESD control, see the related IPC video.

The second type of gull wing component is the SOIC - or Small Outline Integrated Circuit. SOIC's have leads on 2 sides, with 50 mil pitch being the most common. They can have as few as 8 leads... to as many as 40.

SOT's - or Small outline Transistors - are the smallest of the gull wing components. SOT's come in various sizes - and lead counts... the most common being 3 leads.

The final type of component is the TSOP - or thin small outline package. TSOP's have leads extending from two sides. There are 50 mil pitch TSOP's and fine pitch versions.

In this video, we'll be using the currently available hand-held tools to perform specific rework operations. We'll be covering Rework Stations in another series of videotapes. Let's begin now with component removal. Some people believe that the fastest and easiest way to remove a gull wing component is to clip each of the leads with a pair of sidecutters. Then they heat each land until the solder melts and the leads can be physically removed.

While this method can work, there are some serious disadvantages. The first being that the component is destroyed in the process. This can be an expensive method of reworking a misaligned component. Keep in mind that misalignment is a major cause of rework. And the cost of a QFP can also range from several dollars to several hundred dollars.

But another important concern is the safety of the board. If the component leads are pulled - even slightly - during the lead clipping process - or before the solder is completely melted, you can rip the land right off the board.

It's actually faster - and more cost effective - to use a tool that is specifically designed to remove gull wing components - without damaging the leads, the component, or the board.

### *Component Removal*

#### *Hand Soldering Iron*

In this section, we'll explain how to use a hand soldering iron - with specialized tips - to remove some of the smaller gull wing components. Let's start with the smallest component type - the SOT.

There is a bifurcated - or forked tip - that is specifically designed to remove the most common SOT package - the SOT23. Before you install the tip into the iron - first make sure that it fits over the component - with just a slight amount of extra space. After the proper tip is installed, and heated up to operating temperature - in the vicinity of 315 degrees C - we're ready to tin the tip. Tinning the tip will help to transfer heat faster - and provide surface tension - to lift the component off the lands. Most technicians prefer to add external flux to the component leads. This will definitely help to transfer heat... but will require some additional clean up. This is a decision you will need to make for each situation.

Now we're ready to place the tip on the flat part of the leads - until you see that all of the solder joints have melted. When you lift the tip - the component will lift off with it. It's a good practice to place the heated component on a heat resistant surface - until it cools off.

At this point there will be old solder remaining on the lands. As we discussed in the previous video on Chip Component Rework - it's always best to remove this solder so it doesn't become a part of the new solder joint. We'll be discussing all of the land preparation techniques for gull wing components during a later section of this video.

The hand soldering iron can also be fitted with special tips - designed to remove SOIC's - with up to 28 leads. This technique is similar to the method we just described. Once again, we'll begin by

fitting the correct tip over the component. Make sure that the tip rests on the flat part - or the foot of the leads - for optimum heat transfer.

Each part of the Gull Wing lead has a specific name. The tip of the lead is called the toe. And the foot extends all the way to the heel of the lead. If the tip rests on the knee - or the bent part of the leads - the transfer of heat will be extremely slow.

After the tip is installed and heated to the selected temperature, we need to make sure that it's properly prepared - in order to transfer the heat as efficiently and quickly as possible. We start by removing any hardened oxides with a nonabrasive cleaning tool. We will be cleaning all of the tip surfaces - inside and out - wherever the tip will come in contact with the leads. Next we'll use a dampened sponge cleaning tool that is designed to reach inside these multi-sided tips. This tool will shock any remaining oxides off the heating surfaces.

Now we're ready to tin both sides of the tip with solder. We'll be using a large gauge flux cored solder that is compatible with your assembly process. This fresh solder tinning will speed up the heat transfer - and provide surface tension. As an option we may add external flux to the component leads - to further improve the transfer of heat.

Now the tip is placed over the component - in contact with the foot of the leads - until all of the joints are melted. When the iron is lifted, the surface tension of the solder will lift the component off of the lands. It's important to avoid putting any downward pressure on the tip during the removal process. If you press too hard, you can damage the lands. The weight of the handpiece should be sufficient. Twisting or sliding the tip - before complete solder melt - can also damage the lands and the component leads.

There are also special tips available for removing Thin Small Outline Packages. The technique for removing TSOP's is exactly the same as the SOIC removal process. Small PQFP removal can be performed using four sided tips. Larger PQFP's will generally be too heavy to lift with surface tension alone.

For all multi-leaded components it's important that you melt all of the leads quickly and simultaneously - to insure a safe removal process. If one or two solder joints don't melt - for a number of technical reasons - the component will remain attached to the board. In this case you may have to apply heat for so long that it causes thermal damage to the board. Rocking the tip - to try and melt all of the solder joints - can also damage the lands. As the tip is rocked - there is a concentration of pressure along the four edges of the tip.

### *Thermal Tweezers*

The next tool we'll examine is the continuously heated Thermal Tweezers. This tool has two heaters - one on each side of the hinge mechanism. This means that it can deliver a large amount of heat - for removing larger components. This tool can also safely remove even the smallest components. Let's start with SOT's. We always need to select a set of tips that fit the specific component.

Now we insert the tips into the handpiece - and press them together to make sure they are parallel to each other. After we tighten the set screws, we'll select a tip temperature of 315 degrees C as a general starting point. After the tips heat up, make sure they are properly cleaned. This is one of the most important steps in all of the component removal operations. After the tips are ready, you may want to adjust the hinge mechanism. Some people find this tool easier to operate if the tips only open slightly wider than the component.

The addition of external flux is optional. Once again, the flux will help to transfer heat. Now bring the handpiece over the component and place the tips directly on the foot of the leads. The solder should melt almost instantly. Now grasp the component with a slight tweezing action - and remove it. When this operation is performed properly ... the thermal tweezer handpiece is capable of removing multileaded components - without degrading adjacent solder joints.

Now let's remove an SOIC with the Thermal Tweezers. We begin by selecting tips that match the size of the component. The tips should extend just slightly past the ends of the outside leads. Now install the tips into the handpiece. Since the tips won't touch each other, we'll have to place some type of adjustment tool between them - to make sure the tips are parallel to each other. Then we tighten both of the set screws to lock the tips in position.

After the tips heat up to operating temperature, you'll need to make sure that they are properly cleaned and tinned. Now you're ready to proceed. It's usually a good idea to add external flux during SOIC removal - to make sure that all of the joints are heated quickly.

Now the tips are positioned directly on top of the lands. You'll be able to see when the solder starts to reflow. After all the connections are melted, it's time to apply a very light tweezing action to secure the component between the tips - then lift and remove. Now you can safely set the hot component on a heat resistant surface - until it cools down.

The first important rule for a successful component removal is to make sure that you never try to lift any component before all of the solder joints are molten. This can damage both the component leads and the lands on the board. Another concern is to avoid contacting adjacent solder joints during tip placement. This may lead to premature failure of the partially reflowed solder joint over a long period of time. Thin walled tips are available to help you reach into tight places without contacting adjacent solder joints. The advantage of these tips becomes more important as the spacing between components becomes tighter.

Now let's talk about QFP removal using the Thermal Tweezers. We always begin by making sure that the tips match the size of the component. Remember that we want the tips to rest on the feet of all four sides of the leads. After the proper tips are selected, we install them in the handpiece. Squeeze the tips together to insure alignment, then tighten the set screws. The larger tips will require a special alignment tool.

For the larger PQFP's we may want to use a thermal enhancement technique - other than flux - to further speed up the removal process. The solder wrap - or solder preform process is designed to help improve the heat transfer.

We begin by tacking one end of a solder wire to one of the corner leads. Then we wrap the solder tightly around the component - right at the heel of the leads. You'll have to experiment with the size of the solder wire to find out what works best for each component. After you've selected the correct sized tip - and cleaned and tinned it properly - you may also want to add external flux - all the way around the component. This will help improve the heat transfer.

Now you're ready to position the tips on top of the solder prefill. Gently tweeze the component with the tips. Then after you see that all of the connections have melted, lift the tool straight up. Then place the component onto a heat resistant surface.

The most efficient method to help maximize heat transfer is to melt enough solder so that it bridges across all of the leads. This is called the bridge-fill method. In this case, we don't want to add external flux, since it will decrease the bridging action of the solder. When the bridge is completed, we'll be ready to remove the component. For this operation, the addition of external flux is optional. Now we place the properly sized tips on top of the solder bridge. When the bridge melts, you should feel the tips drop down onto the leads. Then gently tweeze the tips together - and lift the tool straight up.

This heat enhancement or bridge-fill technique does require one additional heating step. But it does help to make sure that all of the solder joints are melted quickly and simultaneously -- which is the key to a safe removal process. It can be difficult - especially on thick multilayer boards - to quickly melt all of the solder joints without solder bridging. The mass of the board will draw some of the heat away from the solder joints. It can take a relatively long time to transfer enough heat to melt all of the solder connections. This lengthy heating process can do significantly more damage than the bridge-fill process. That's why many company's feel the advantages of the bridge-fill technique far outweigh the chance of thermal or mechanical damage to the board. The decision to use this procedure will depend on your company's policy - the thickness of the board and the type and size of the component to be removed.

PQFP's can also be removed without the use of a solder wrap or solder bridge. Once again we need to select the correct tips, and adjust them properly in the handpiece. This time we will need to add external flux - to help transfer the heat to all of the leads.

After we clean and tin the heated tips properly, we're ready to position the tips on the foot of the leads and apply a slight tweezing action to contact the component. It's very important to make sure that you observe complete solder melt before lifting the component. Now tweeze the tips together and lift the handpiece straight up. You want to make sure not to apply too much pressure. Rocking the tip around to melt the solder can result in a lifted land - or bent leads. Always use a light touch for quick reliable component removal. That covers the Thermal Tweezers removal process.

### *Thermal Vacuum Pick*

The final removal tool that we'll be discussing is the Thermal Vacuum Pick. The suction cup in the center of the tip is designed to help lift heavier components - that surface tension alone will not lift. 64 pin PQFP's are about the smallest component this tool is designed to remove. Again, we'll start by matching the tip to the component. Remember that we always want the tip to rest on the foot of the leads.

Now we install the tip into the handpiece - and tighten the set screw. Then we insert the vacuum cup onto the pickup tube. We always want to use the largest vacuum cup possible - to obtain the best suction or lift. After the tip heats up to operating temperature, we need to make sure that it's properly cleaned and tinned.

Now let's perform the first removal operation without using a solder bridge. We'll start by fluxing all of the leads - for faster heat transfer. Next we'll position the tip over the foot of the leads - and look for visual signs of solder melt. After all of the solder is molten, you activate the vacuum - and lift the component straight up. Remember to keep the vacuum activated until after you place the hot component onto a heat resistant material. If you do happen to lift before all of the solder joints are melted, the vacuum cup will release before it causes any damage to the leads or lands. And there isn't any grasping action - that could potentially bend a lead. Remember that QFPs can be very expensive to replace.

Now let's try the removal process once again - using another one of the heat enhancement techniques. Let's use the same size component and tip to demonstrate the faster heat transfer. After we've bridge-filled the component with solder all the way around. We can also add external flux - to help speed up the heat transfer even more.

Now we place the tip on top of the bridge-fill - and wait until we feel the tip drop onto the leads. Now activate the vacuum... and lift straight up. Now doesn't that beat clipping several hundred leads - then removing each one with a hand soldering iron? That covers all of the removal procedures for gull wing components. You may not use - or even have - all of the various tools that we've demonstrated. What's important is that you use the tool that works best for you. The key words are: safe... repeatable... reliable... and fast.

### *Land Preparation*

In this next section we're going to cover Gull Wing land preparation. There are two different techniques for removing leftover solder after the component removal process. Let's discuss the solder braid procedure first. Some companies require that you use a thin solder braid to prepare each individual land - one at a time. The use of additional flux is optional. It will help to increase the capillary action of the solder braid.

We're also using a fine point tip - to avoid overlapping the solder braid. Notice how we move the solder braid along the length of each land as the solder melts. Learning how fast to move takes a

little practice... Also see how we apply the tip of the iron onto a clean portion of the braid - each time we begin to clean a new land.

After a certain point, we'll need to clip off the used braid - to make it easier to work with. It's very important not to put any downward pressure against the land. This can easily lift or remove the land.

Other companies use a wider solder braid - which allows them to clean several lands at once. In this case, the solder braid will be transferring additional heat to the board surface in between the lands. If you keep the heat low enough, this shouldn't cause any damage. This technique certainly speeds up the land preparation process.

In this procedure, the braid will be placed across the land. Notice how the width of the braid is slightly less than the length of the lead. The use of additional flux is optional. It will help to increase the capillary action of the solder braid. The chisel tip should be wide enough to cover two or three lands at once. Notice how the braid is lifted each time the solder is melted. This makes sure that the braid doesn't stick to the lands. You'll want to clip the used portion of the braid frequently - to make it easier to work with.

Then just keep repeating the process until all of the lands are prepared. And remember to clean all of the used flux residue off the lands before you begin the component replacement process.

Now let's talk about the Continuous Vacuum Extraction process for land preparation. If you watched the previous videos in this series, you will remember that this particular tool has a heated tip - with a hole in the center. When the operator activates the vacuum switch, the molten solder is sucked up into a storage chamber.

Tip selection will be an important consideration. There are thin - and heavier mass tips available to suit various land sizes and techniques. For our demonstration, we'll be using the heavier mass tip.

We'll begin by installing the tip. After the tip heats up, we'll apply a light coating of solder right on the tip. You may also want to apply an external flux over all of the lands. Both of these steps will help speed up the heat transfer process. Now we position the flat end of the tip over the first few lands.

The vacuum should now be activated, and allowed to run on a continuous basis. The surge of air through the orifice will tend to cool the tip. One advantage of the larger tips is they can maintain their operating temperature better than the thinner tips - since there is a larger mass through which the heat is transferred. Notice how we move the tip along the length of the lands - to remove all of the solder. Once again, it's very important not to put any downward pressure on the lands. We'll continue this process until all of the lands have been desoldered. The final step will be to clean up any residues - before we install the new component.

## *Component Installation*

### *Hand Soldering*

In this next section, we're going to be examining manual techniques for replacing gull-wing leaded components. It is possible to individually hand solder each component lead. People do it all the time... even though it can take as long as ten minutes just to solder one large component. Let's talk about the first recommended procedure for hand soldering a gull wing component - starting with an SOIC.

Before we begin the replacement process, we always make sure that the excess solder has been removed - and all of the flux residue has been cleaned. The easiest and safest way to pickup and position a gull wing component is with a vacuum pickup tool. Position the suction cup in the center of the component - and activate the vacuum. You can usually position an SOIC component onto the lands without the aid of a microscope. Just make sure that all of the leads are centered evenly - from side to side. You also need to make sure that the heel and toe of each lead is centered evenly in the lengthwise direction.

Once you're satisfied with the alignment, we're ready to select a tip for the soldering iron. Tip selection will be based on the width of the component leads. If a chisel tip will fit - it will transfer heat faster than a conical tip. The selection of the solder wire will also depend on the width of the leads. Thinner solder wire will work better with fine pitch leads.

Now we're ready to tack the component in position. Some people like to hold the component down with tweezers or a wooden stick - so that it doesn't move when you tack two of the corners. If you touch a small soldering iron tip right where the toe of the lead sits on the land... you can usually melt enough existing solder to tack the component in position. If you add a drop of flux before you tack the lead... you'll be able to see the solder turn shiny. This will provide a visual verification that the lead is tacked. Others prefer to add a very small amount of solder to their tip, and then touch the tip to the junction between the land and the lead.

Now is a good time to check the alignment of both rows of leads - before you tack the other side. Remember that it's not going to get any better than it is right now. If you need to reposition the component you can melt the tacked joint with your soldering iron - and lift off the component with a vacuum tool.

Now remove the solder from the tack joint - so that the component doesn't sit up off the land when it's replaced on the lands. Once again, we realign the component, and tack the first corner, double check the alignment, and then tack the opposite corner. Now we're ready for the soldering process. It's usually a good idea to add a compatible type of external flux - even though there already is some flux in the solder wire. Additional flux will improve the heat transfer. The tip should rest flush against the top of the lead.

Now contact the lead and the land with the solder wire - away from the tip. This will allow the flux to clean the connection - instead of burning away on the tip of the iron. You don't want to press down on gull wing leads or lands. Even light pressure can bend or skew the lead out of

position - or damage the land. A light touch is about as hard as you can press a pin to your cheek - before you begin to feel any pain.

You can proceed from one joint to the next - rather than skipping leads to avoid heat buildup in the board. There is much less heat being applied to a surface mount board - since there is no need to heat the solder on both sides of a plated through hole. Just keep working your way around - until all of the joints are soldered.

Unless you are using a no clean flux, it's a good idea to clean the flux residue. Your company will provide you with a compatible cleaning solution. A brush can access between the leads and around the component - but you need to be careful not to bend the leads with excessive force. There will also be flux residues underneath the component that you may not be able to remove by hand. Reworked assemblies can also be processed through a cleaning machine - to remove these hidden residues.

Hand Soldering a PQFP is exactly the same as an SOIC - except that the alignment process can be much more challenging. The leads are finer - and much more sensitive to bending or skewing. But the tacking and hand soldering processes are essentially similar. Just be careful not to apply too much pressure or too much solder. Excess solder can easily bridge between the closely spaced leads.

#### *Continuous Flow Solder*

This next installation technique also uses a hand soldering iron - and a wave - or continuous flow of solder - to speed up the installation process. This method works best for multiple leaded devices - especially PQFP's.

We start by aligning and tacking the component - as we did before. After we tack two of the corners, we'll double check the alignment on all four sides of the component. For this particular application, we will need to add external flux. This will keep the solder from balling up - or bridging.

Another important variable is the temperature of the soldering iron. The tip temperature should be in the area of 288 to 315 degrees C. Higher temperatures are not usually necessary - because of the reduced mass of a surface mount joint. Higher temperatures can also degrade both the solder and the tip more rapidly.

The tip we'll be using is a single sided chisel - with a curved indentation on the bottom side. This indentation is designed to hold solder - and help flow it along like a wave. The tip has to be clean and tinnable. A dirty tip just won't be able to pull back the solder properly.

We start by adding solder to the freshly cleaned tip. The amount of solder will be determined by the size and number of leads on each side of the component. It's easy to add too much... this will result in solder bridging. It's better to add less - then come back and add more later if it runs out.

Now we place the chisel portion of the tip in a parallel position over the feet of the leads. If it's not parallel there may not be enough surface tension to move the solder. The tip should glide right above the leads - on a wave of solder. Move the tip along just fast enough so that you can see the formation of each individual solder joint. You need to go slow enough to watch the solder in front of the tip flow around the joint and then back to the heat source. Always remember to watch every joint form properly before you proceed any further. When you finally get to the end of the row - keep moving the tip past the final leads at the same speed as before. This will make sure that the last connections are similar to all the rest.

Some people automatically lift the tip when they get to the end of the row - this will result in solder bridging. Proceeding past the leads in a continuous motion - at the same speed - will eliminate this problem. If you move too fast, you'll leave solder bridges on the leads. Solder bridges can be removed by letting them cool for a few seconds, then add some additional flux.

Now reposition a clean solderless tip on top of the bridged leads and reheat the joints completely. When you remove the tip the excess solder will follow the heat source. Make sure to always melt both of the solder connections completely during the bridge removal procedure to avoid creating differences in the internal structure of the solder joints.

The important elements of the continuous flow soldering process are lower tip temperature, proper solder amount, moving past the final leads at a continuous rate of speed, and practice. When properly performed, this technique can quickly produce solder joints that are as reliable as the original solder connections.

After the soldering process is complete, remember to clean the flux residue immediately - before it has a chance to harden. The entire assembly should then be recleaned in a cleaning system - to remove any flux residues underneath the component. That completes the continuous-flow hand soldering technique for gull wing leaded devices.

### *Pulse Heat (Hot Bar)*

In this next section, we're going to explain the Pulse Heating - or Hot Bar Method for replacing SOIC's and QFP's. You can use either solder wire - or solder paste with a pulse heating tool - because of the gradual heat buildup. Let's start by using solder paste - on an SOIC component.

First we place the SOIC component onto the lands. After we're sure that the alignment is accurate, we hold the component in place as we tack the two opposite corners - with a hand soldering iron.

Now dispense a line of solder paste over the top of the leads. The amount of paste will vary - depending on the width of the applicator tip, how fast you move and other variables. You'll learn how much paste to apply with experience.

After the paste is applied, we need to select a flat tip - or "hot bar" - that reaches across all of the leads. Press this tip into the handpiece to secure it in place. The heat setting will be determined by

the tool manufacturer. Look up the type of component in the operation manual. Then adjust the heat setting on the power supply to the corresponding number. Now position the tip on the leads while the tool is still cold.

When you're ready, press the foot switch to activate the heat. The paste will preheat - and drive out all of the moisture or solvents inside the paste. After you see that all of the solder paste has melted completely, lift your foot off the switch and keep the tip in place while all of the connections cool. Once the solder is solidified, you can lift the tool off.

There are two reasons that these tips can stay in contact with the solder during the cooling process. The first being that they heat and cool rapidly. The second is they are nontinnable - which means that solder will not stick to the tips.

Now repeat the soldering operation on the other side of the component. This is just one way to use solder paste with this particular tool.

You can also apply a bead of solder paste across the lands before you position the component. There are some advantages and disadvantages to this method. One advantage is that the tackiness of the solder paste can make it a little easier to align the component. There's also no chance of bending the component leads with the applicator tip. But if you don't position the component accurately over the lands - you can smear the paste around as you move the component into the proper position.

Now we select a tip to match the component size. There may not be long enough tips to solder all of the component leads at once. Once again, we need to check the recommended heat settings specified by the manufacturer - for this type of component. You may want to tack two of the leads - or hold the component in position with a tweezers or some other type of holding tool.

Then we position the hot bar on top of the leads, and activate the heat. When the solder paste melts completely deactivate the heat - and keep the tip motionless on the leads - until you see the solder change color - or solidify.

Now reposition the tip over the rest of the leads in the first row - and repeat the soldering process. Notice that the tip is longer than it needs to be. This shouldn't cause a problem - as long as it's not touching another component or solder joint. Another option would be to select a shorter tip - that fits in the available space.

Then just keep working your way around the component - until all the leads are soldered. And remember to clean the flux residue as much as possible - and rewash the entire assembly after you finish with it.

It's also possible to use flux-cored solder with the pulse heating tool. We begin by adding flux to all of the lands. In order to create solder prefills on all of the lands, we'll be using the same tip that we used before - the single-sided chisel tip - with the concave undersurface.

Once again, we apply a ball of solder onto the tip. Knowing how much to add is something that's learned by experience. Then position the tip over the first land - and slowly move it across the row of lands until a small fillet of solder is formed on each land. Remember to go slow enough so that the surface tension keeps the solder moving at the same speed as the tip. When you come to the end of the row - just keep moving the tip past the end at the same rate of speed. After all of the lands are properly prefilled - with an even amount of solder - it's a good idea to clean the used flux residue before we continue.

Now we can position and tack the component on top of the solder prefills and solder the component as we did before. Always be careful not to remove the hot bar during the solder solidification process. This will disturb the hardening process - and result in weak solder joints. We continue with this process until all of the joints are properly soldered. And remember to clean the flux residue when you finish. This completes the pulse heat - or hot bar method for applying Gull Wing Components.

### *Hot Air Pencil*

In this final section we're going to use the Hot Air Pencil to install Gull Wing Components. You can choose either a straight or a curved single jet tip... based on your personal preference. You can also use a flat end tip - depending on the density of the components.

After you select a tip, you'll need to adjust the air temperature and pressure. A general recommendation is to start with the temperature between 426 and 482 degrees C. Remember that air is much less efficient than direct contact - or conductive heating. Next we'll set the air pressure gentle enough to provide sufficient heat - but not so high that it blows away the solder paste - or affects adjacent solder joints.

Now you can decide how you want to apply the solder. The quickest method will be to apply solder paste directly onto the lands. Then we carefully position the component - so that we don't slide it around and make a mess with the solder paste. After we're satisfied with the alignment, we'll hold the component with a tweezers or holding tool - or tack it into position.

Now we can begin the heating process. We position the tip about 2 centimeters - or almost an inch away from the solder paste. We'll be heating the entire row of leads with the hot air. After the moisture or solvents begin to dry out of the solder paste - and the top of the solder paste begins to melt, you're ready to move the tip in a little closer and melt all of the solder paste on the first lead or two. You need to move across the row slowly enough to insure proper joint formation.

On the opposite row, we'll be repeating the same process. Preheat the solder paste, then move the tip in closer to melt the solder paste. Then keep moving the tip slowly - and watch the solder melt completely - until you finish the last lead in the row. If you move too slowly - the solder joints will end up with a crusty gray appearance. It does takes a little practice to get the right speed. And remember to clean the flux residue right away - so that it doesn't have a chance to harden.

Now let's install an QFP with the solder paste applied on top of the leads. We begin by tacking the component in position with a hand soldering iron. Then we apply the solder paste on top of the leads. In this case the leads are already touching the lands - which is the ideal position.

After the paste is applied, you can begin the preheating or predrying process on one row of leads. We'll use the same technique - whether the paste is applied before or after component placement. When the solvents have separated from the paste, it's time to move the tip over to the first lead and in a little closer. Now watch the solder melt - and flow around the first lead -- all the way to the heel. Remember to move slowly - at a steady pace - until you reflow the entire row of leads.

We continue using these same techniques until all of the leads are soldered. And don't forget to remove the flux residue right after you finish.

We can also use solder prefill method with the hot air pencil... using the same prefill technique that we explained earlier. We always start by applying flux to the lands - so that we don't have to do this after we add solder to the tip. This delay would keep the hot solder on the tip for a longer period of time than is advisable.

After the fluxing is complete, we're ready to apply the solder to the tip. We want to add just enough solder to the tip so that the surface tension will push the solder along - rather than leave a glob of solder on the first few lands. A little practice will help more than anything else. Keep adding solder to the tip, and pass the tip over the lands parallel to the surface. You don't want to put any pressure on the lands - just glide over the tops.

After you finish prefilling the lands, it's a good idea to clean the used flux residue. This will make sure that it doesn't contaminate the solder when we reflow it again.

We're ready to place the component on the lands in its approximate position. Now we add flux on top of the leads and lands. Then we adjust the component so that the leads are properly centered on the lands. Once you're happy with the accuracy of the final alignment, we need to hold the component in place with tweezers or a holding tool.

Now we apply the heat to the first few leads. Notice that we don't have to preheat or predry the solder - as we did with solder paste. We can just start melting the prefills - and watch the solder flow all the way around the leads before we move along.

We also need to press down slightly on the top of the component - to push the leads down into the molten solder. The pressure should remain constant so that the leads don't move as the solder joints are cooling. Keep pressing on the component and moving forward with the tip at a steady pace until all of the joints in that row are melted and cooled. You can see the color of the solder change as it cools.

You may notice that solder joints that are created with hot air are a slightly different color than those made with a soldering iron. The reason is that the hot air method introduces more oxidation into the solder - from the oxygen in the air. These slightly discolored solder joints are perfectly acceptable.

That covers most of the common techniques and hand tools for removing and installing Gull Wing leaded components. In the next video in this series, we'll be discussing J-Leaded Components.