Wave Soldering CD-ROM from Bob Willis

For on site use

Download the zip file from the link provided

Save the file to a specific folder on your PC

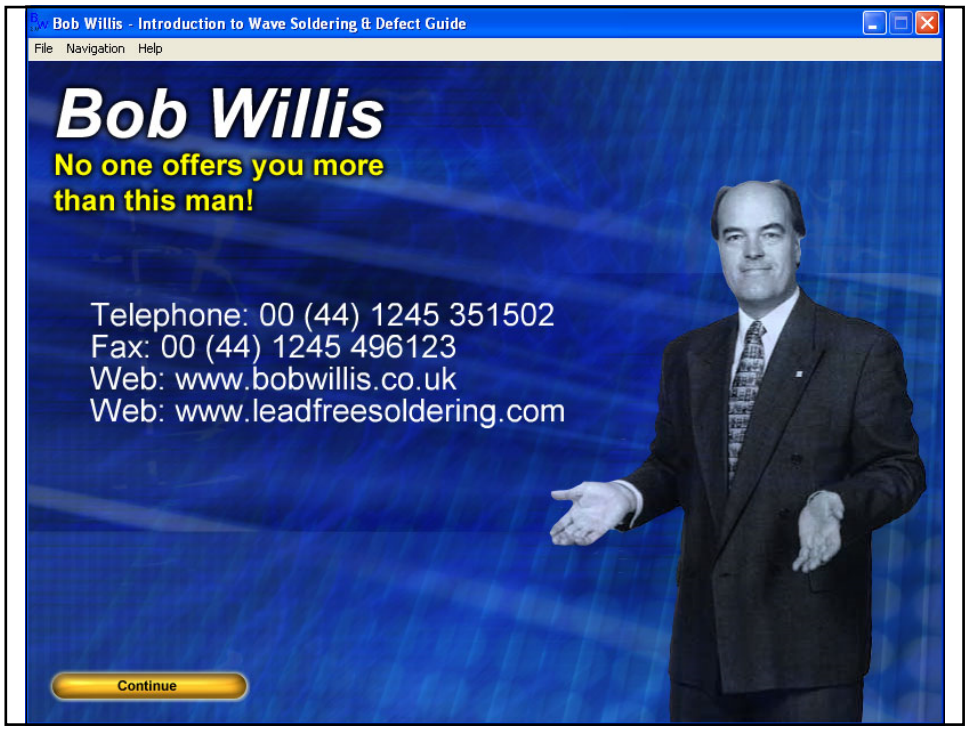
Open the zip file to this folder or another folder

To run the interactive Wave Soldering program select start.exe

The Wave Soldering Guide will now run and you will have access to all of the screens shown in this presentation file

The PPM Monitoring information and Excel Chart are both provided in the zip file to use on site

Many thanks Bob Willis


Bob Willis - Introduction to Wave Soldering & Defect Guide
File Navigation Help
Bob Willis
No one offers you more than this man!
Telephone: 00 (44) 1245 351502
Fax: 00 (44) 1245 496123
Web: www.bobwillis.co.uk
Web: www.leadfreesoldering.com
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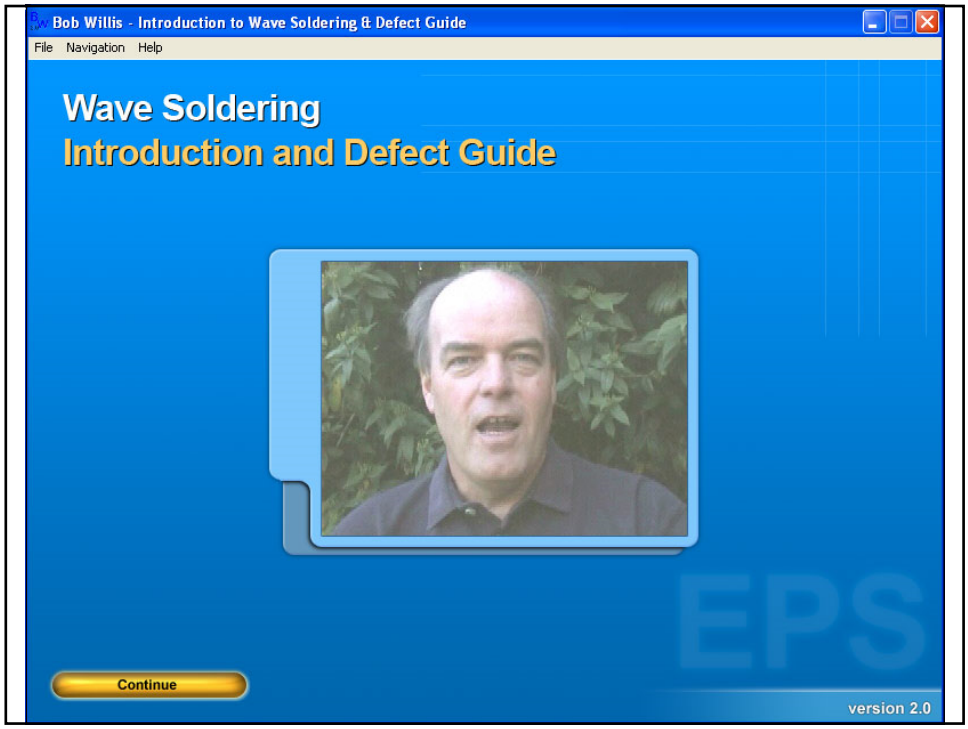
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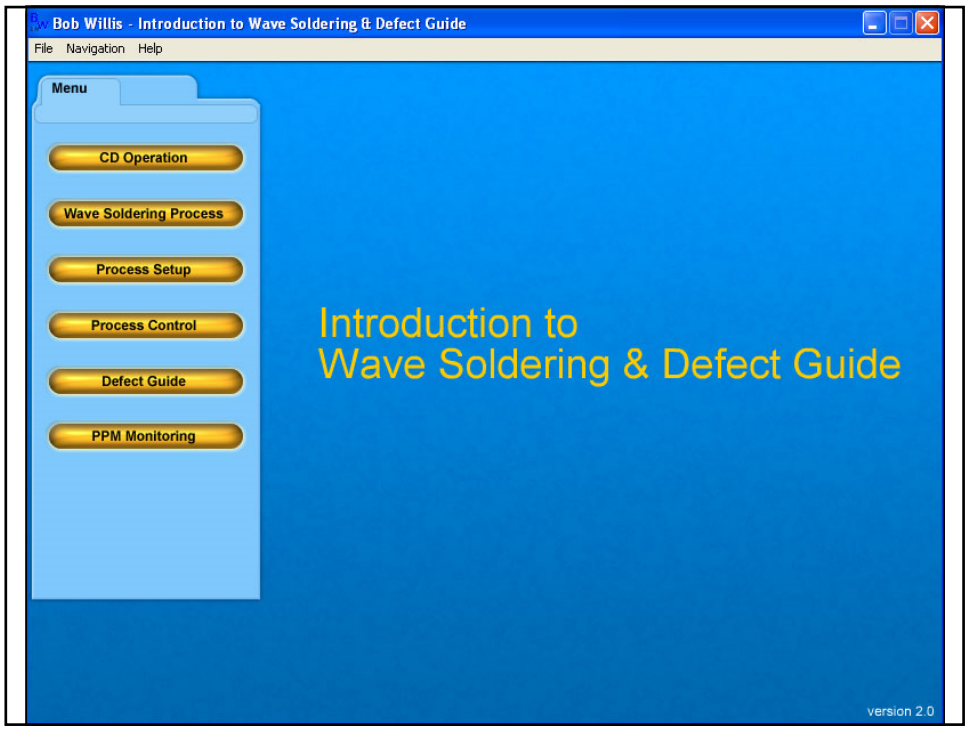
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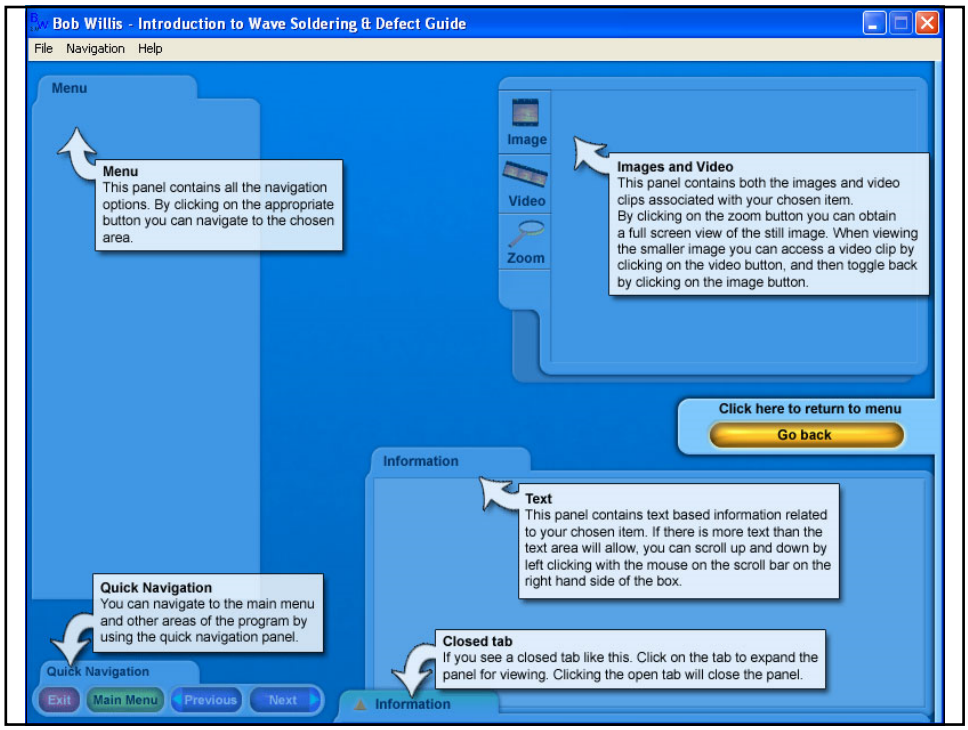
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This panel contains all the navigation options. By clicking on the appropriate button you can navigate to the chosen area.
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Images and Video
This panel contains both the images and video clips associated with your chosen item.
By clicking on the zoom button you can obtain a full screen view of the still image. When viewing the smaller image you can access a video clip by clicking on the video button, and then toggle back by clicking on the image button.
Click here to return to menu
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Text
This panel contains text based information related to your chosen item. If there is more text than the text area will allow, you can scroll up and down by left clicking with the mouse on the scroll bar on the right hand side of the box.
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You can navigate to the main menu and other areas of the program by using the quick navigation panel.
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If you see a closed tab like this. Click on the tab to expand the panel for viewing. Clicking the open tab will close the panel.
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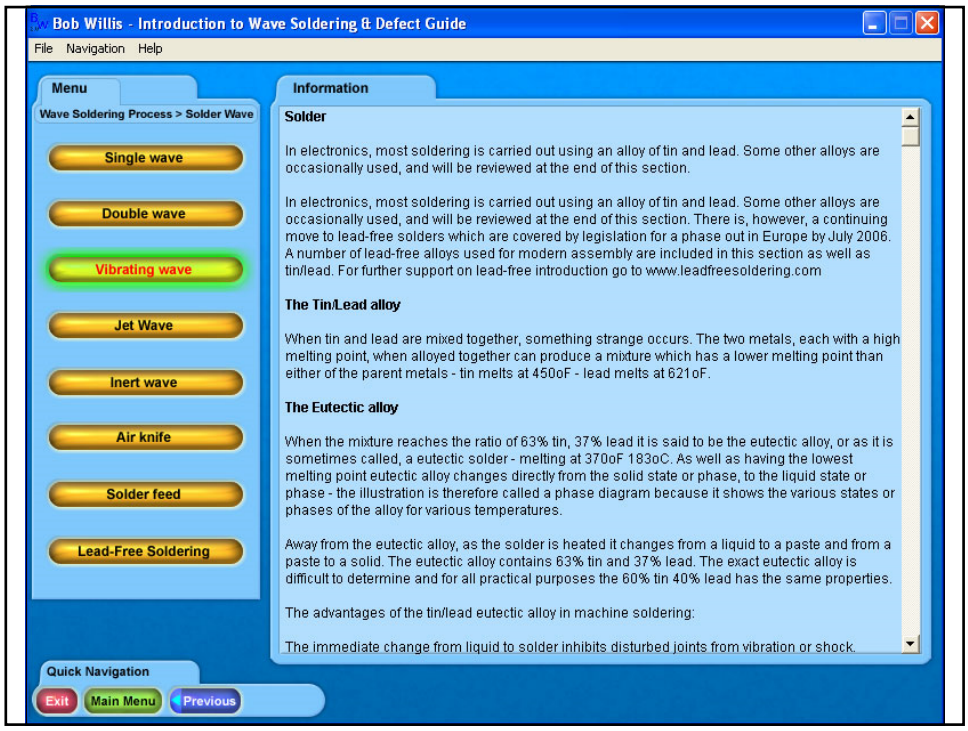
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Solder
In electronics, most soldering is carried out using an alloy of tin and lead. Some other alloys are occasionally used, and will be reviewed at the end of this section.
In electronics, most soldering is carried out using an alloy of tin and lead. Some other alloys are occasionally used, and will be reviewed at the end of this section. There is, however, a continuing move to lead-free solders which are covered by legislation for a phase out in Europe by July 2006. A number of lead-free alloys used for modern assembly are included in this section as well as tin/lead. For further support on lead-free introduction go to www.leadfreesoldering.com
The Tin/Lead alloy
When tin and lead are mixed together, something strange occurs. The two metals, each with a high melting point, when alloyed together can produce a mixture which has a lower melting point than either of the parent metals - tin melts at 450oF - lead melts at 621oF.
The Eutectic alloy
When the mixture reaches the ratio of 63% tin, 37% lead it is said to be the eutectic alloy, or as it is sometimes called, a eutectic solder - melting at 370oF 183oC. As well as having the lowest melting point eutectic alloy changes directly from the solid state or phase, to the liquid state or phase - the illustration is therefore called a phase diagram because it shows the various states or phases of the alloy for various temperatures.
Away from the eutectic alloy, as the solder is heated it changes from a liquid to a paste and from a paste to a solid. The eutectic alloy contains 63% tin and 37% lead. The exact eutectic alloy is difficult to determine and for all practical purposes the 60% tin 40% lead has the same properties.
The advantages of the tin/lead eutectic alloy in machine soldering:
The immediate change from liquid to solder inhibits disturbed joints from vibration or shock.
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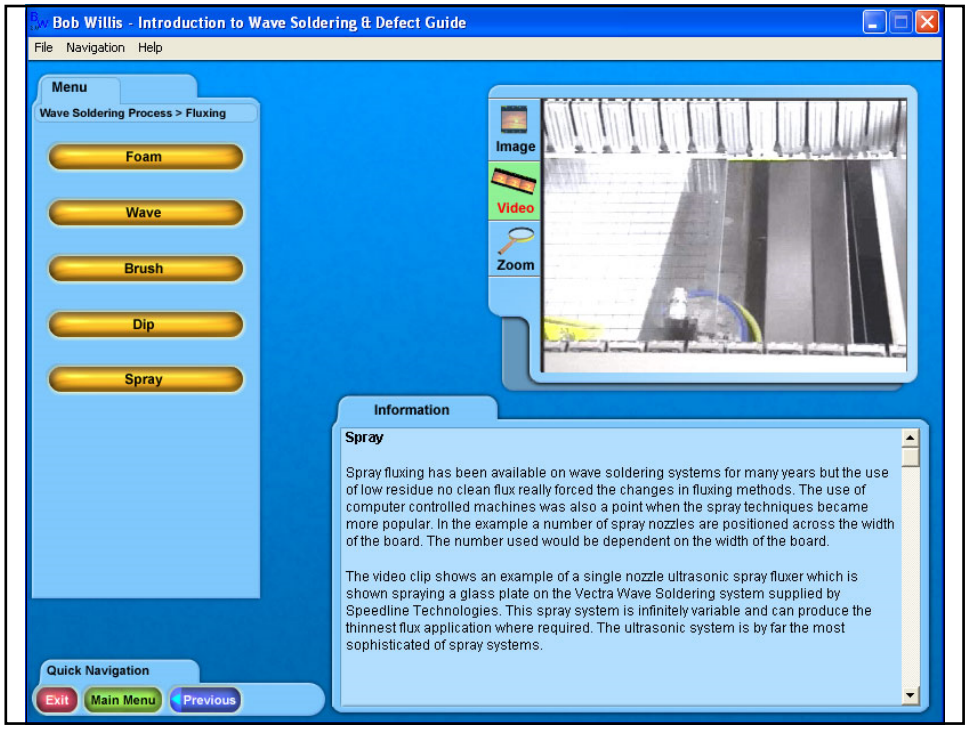
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Spray
Spray fluxing has been available on wave soldering systems for many years but the use of low residue no clean flux really forced the changes in fluxing methods. The use of computer controlled machines was also a point when the spray techniques became more popular. In the example a number of spray nozzles are positioned across the width of the board. The number used would be dependent on the width of the board.
The video clip shows an example of a single nozzle ultrasonic spray fluxer which is shown spraying a glass plate on the Vectra Wave Soldering system supplied by Speedline Technologies. This spray system is infinitely variable and can produce the thinnest flux application where required. The ultrasonic system is by far the most sophisticated of spray systems.
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Hot air
Hot air has been used in the past for drying off excessive amounts of flux/alcohol from the base of the board prior to pre-heating. They have been refined today specifically for solvent free fluxes, so-called VOC materials, which use a water carrier. The usual solvent IPA is replaced with water for flux suspension.
The example shows a steel plate with hundreds of holes drilled through the plate. Blowers mounted below the plate force air through the holes on to the base of the board as it passes through the system. Heating the plate allows hot air to evaporate the flux carrier more effectively.
As most process engineers are aware, it is difficult to dry off water with just radiated heat. Blowing hot air across a surface provides fast water evaporation and also provides board heating. Most suppliers of wave soldering machines offer a hot air pre-heat option.
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Lead-Free Soldering
The image shows a board passing through a lead-free solder wave featuring two waves operated with nitrogen at the wave interface.
In electronics, most wave soldering is carried out using an alloy of tin and lead 63/37 melting at 183oC. Some other alloys are occasionally used for specific applications. There is, however, a continuing move to lead-free solders due to legislation for a phase out in Europe by July 2006. A number of lead-free alloys used for modern assembly are included below.
Slowly lead-free is being introduced in Europe and the USA but most countries lag behind Japan and Japanese factories based in other parts of the world. This means that a number of issues need to be addressed on machines quickly. These changes include
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Double wave
Since the introduction of surface mount technology two wave machines have become the norm in industry. A turbulent chip wave and a more stable Lambda wave have been used for a number of years. The chip wave is a turbulent wave with a small contact length. This avoids unnecessary solder skips before entering the more traditional bi-directional wave. The chip wave overcomes the displacement effects of the surface mount components and the gassing effects from the flux which so often prevented the solder wetting the board termination points.
The video clip shows two waves, a standard chip nozzle and a lambda wave with a finger conveyor running through the solder.
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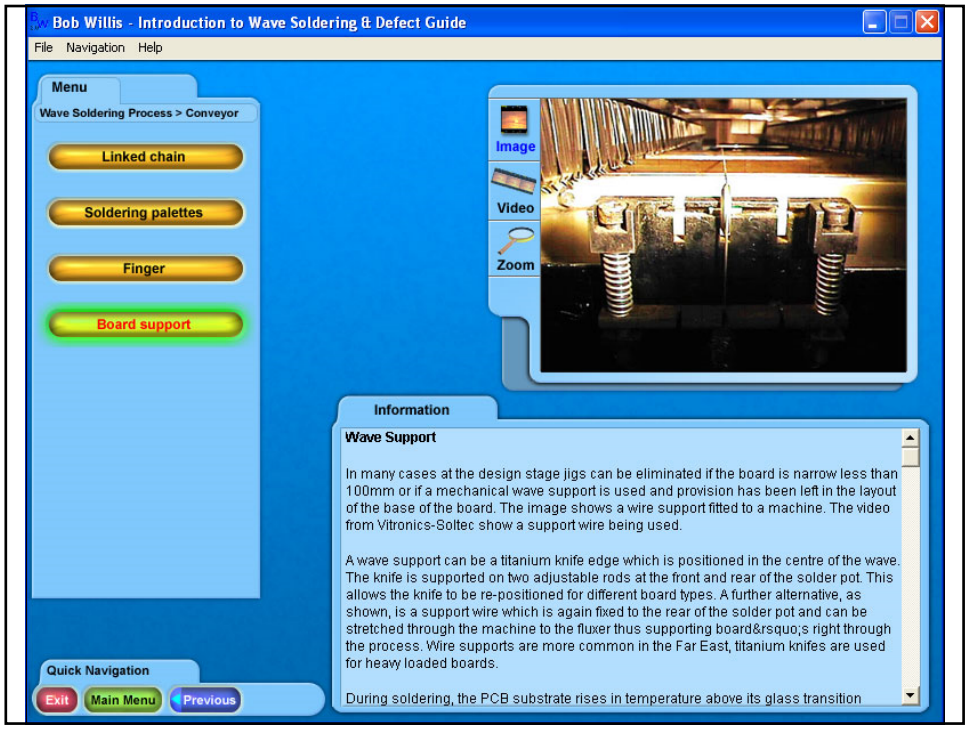
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Soldering palettes
Finger
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Wave Support
In many cases at the design stage jigs can be eliminated if the board is narrow less than 100mm or if a mechanical wave support is used and provision has been left in the layout of the base of the board. The image shows a wire support fitted to a machine. The video from Vitronics-Soltec show a support wire being used.
A wave support can be a titanium knife edge which is positioned in the centre of the wave. The knife is supported on two adjustable rods at the front and rear of the solder pot. This allows the knife to be re-positioned for different board types. A further alternative, as shown, is a support wire which is again fixed to the rear of the solder pot and can be stretched through the machine to the fluxer thus supporting board’s right through the process. Wire supports are more common in the Far East, titanium knifes are used for heavy loaded boards.
During soldering, the PCB substrate rises in temperature above its glass transition
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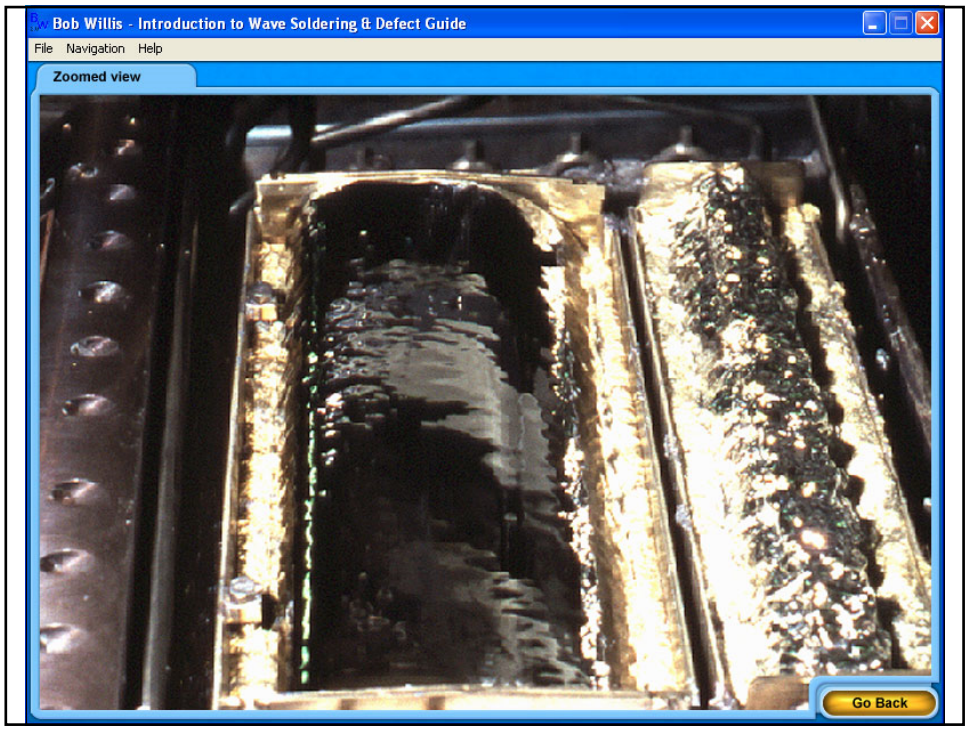
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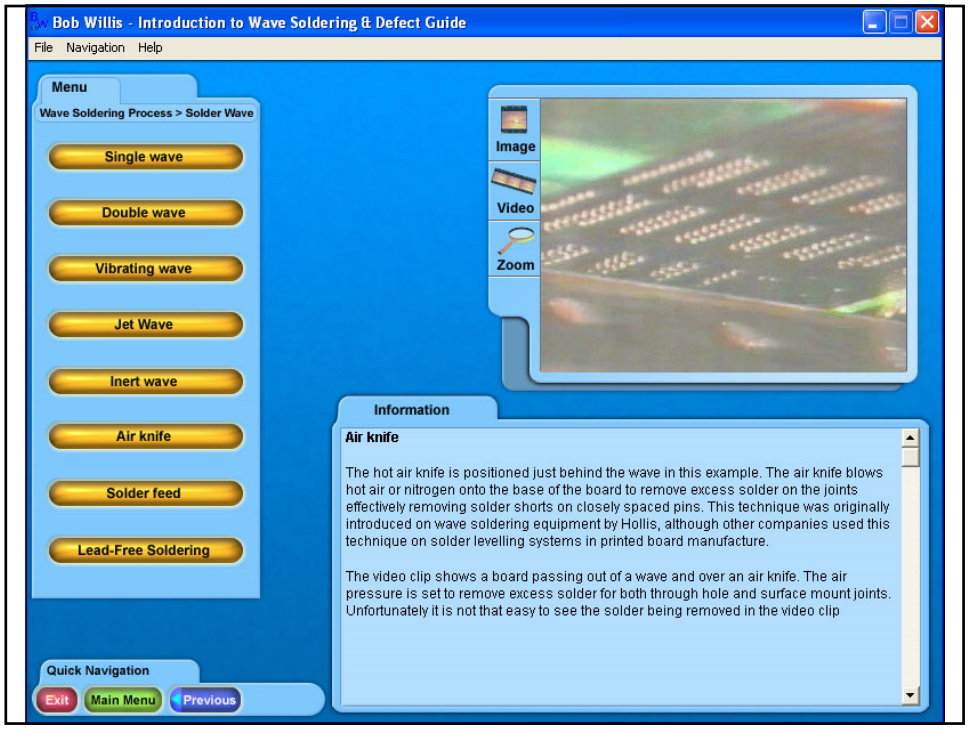
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Air knife
The hot air knife is positioned just behind the wave in this example. The air knife blows hot air or nitrogen onto the base of the board to remove excess solder on the joints effectively removing solder shorts on closely spaced pins. This technique was originally introduced on wave soldering equipment by Hollis, although other companies used this technique on solder levelling systems in printed board manufacture.
The video clip shows a board passing out of a wave and over an air knife. The air pressure is set to remove excess solder for both through hole and surface mount joints. Unfortunately it is not that easy to see the solder being removed in the video clip
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Click on defect to show a larger view and information on possible cause.
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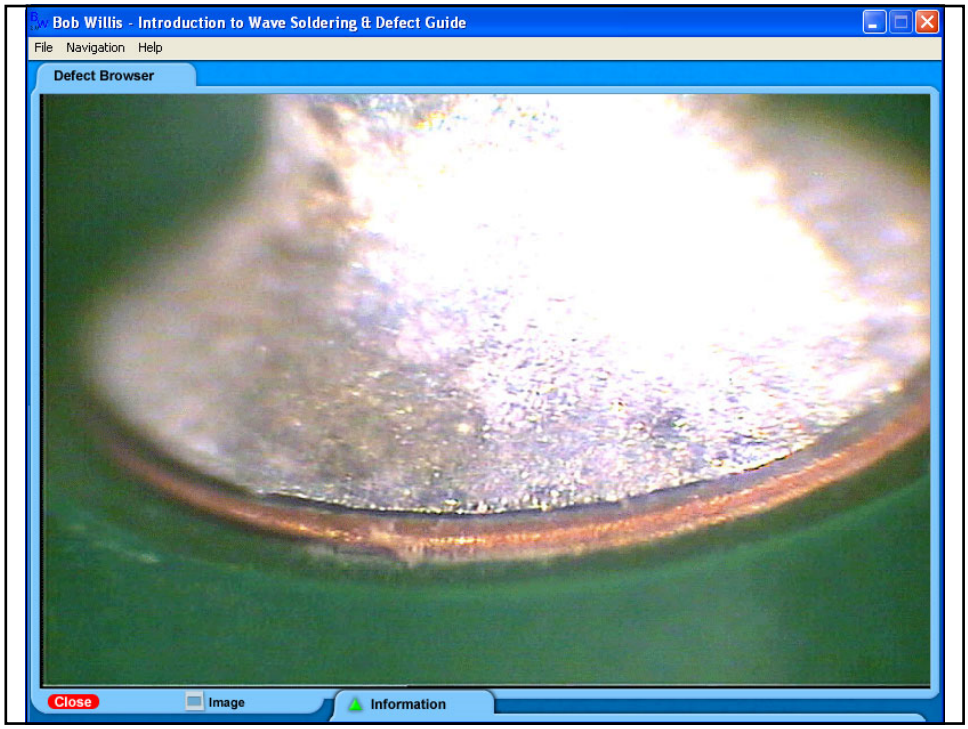
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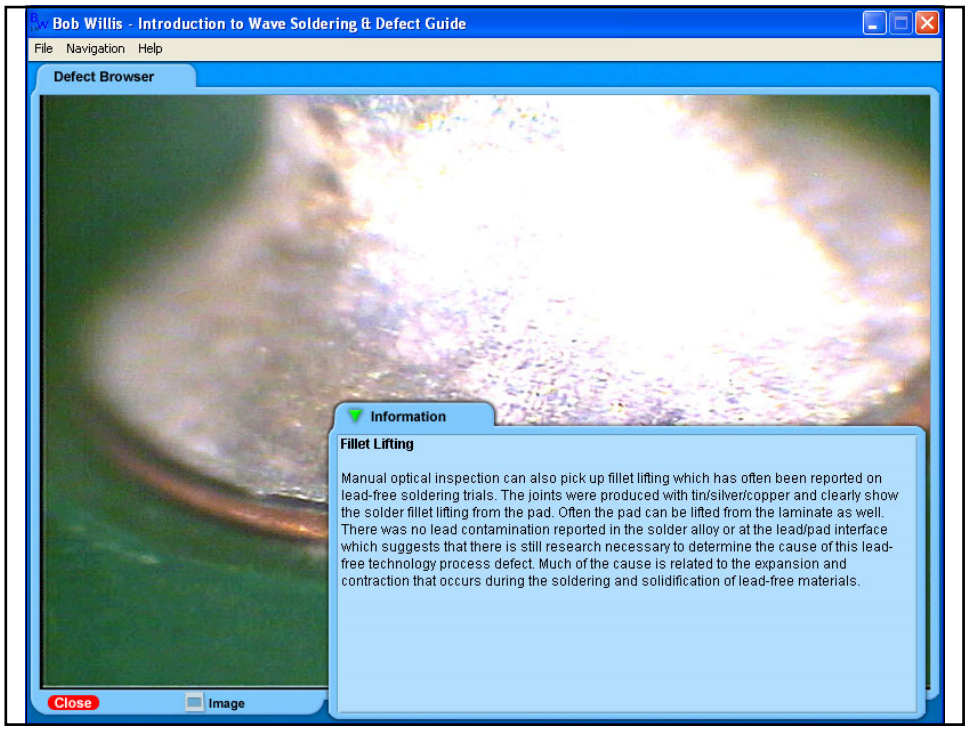
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Fillet Lifting
Manual optical inspection can also pick up fillet lifting which has often been reported on lead-free soldering trials. The joints were produced with tin/silver/copper and clearly show the solder fillet lifting from the pad. Often the pad can be lifted from the laminate as well. There was no lead contamination reported in the solder alloy or at the lead/pad interface which suggests that there is still research necessary to determine the cause of this lead-free technology process defect. Much of the cause is related to the expansion and contraction that occurs during the soldering and solidification of lead-free materials.
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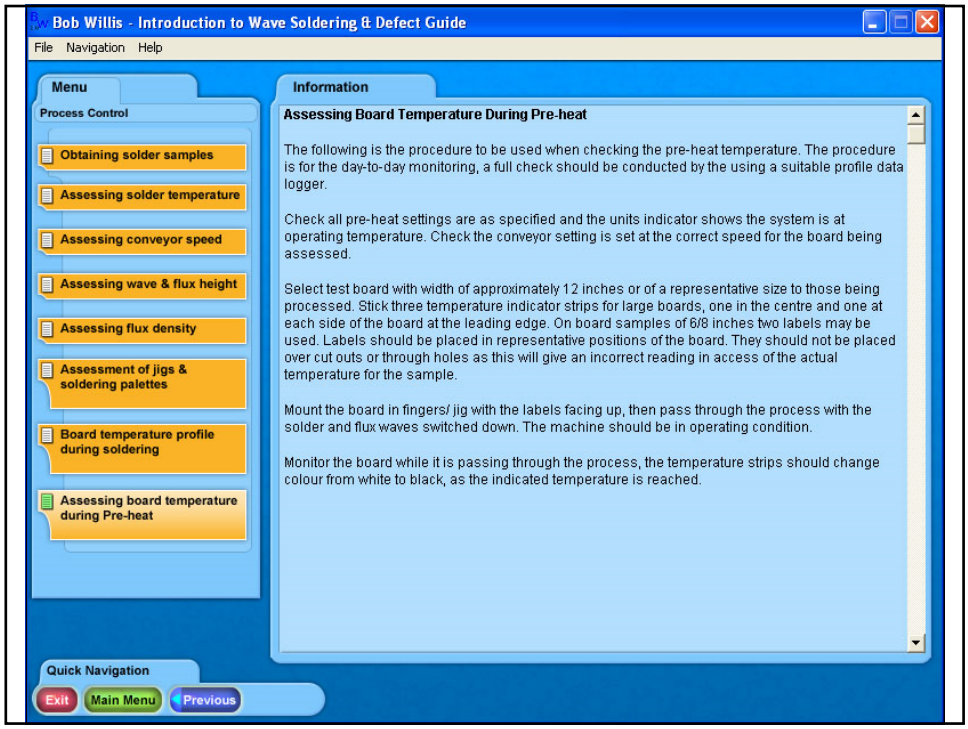
Image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Assessing Board Temperature During Pre-heat
The following is the procedure to be used when checking the pre-heat temperature. The procedure is for the day-to-day monitoring, a full check should be conducted by the using a suitable profile data logger.
Check all pre-heat settings are as specified and the units indicator shows the system is at operating temperature. Check the conveyor setting is set at the correct speed for the board being assessed.
Select test board with width of approximately 12 inches or of a representative size to those being processed. Stick three temperature indicator strips for large boards, one in the centre and one at each side of the board at the leading edge. On board samples of 6/8 inches two labels may be used. Labels should be placed in representative positions of the board. They should not be placed over cut outs or through holes as this will give an incorrect reading in access of the actual temperature for the sample.
Mount the board in fingers/ jig with the labels facing up, then pass through the process with the solder and flux waves switched down. The machine should be in operating condition.
Monitor the board while it is passing through the process, the temperature strips should change colour from white to black, as the indicated temperature is reached.
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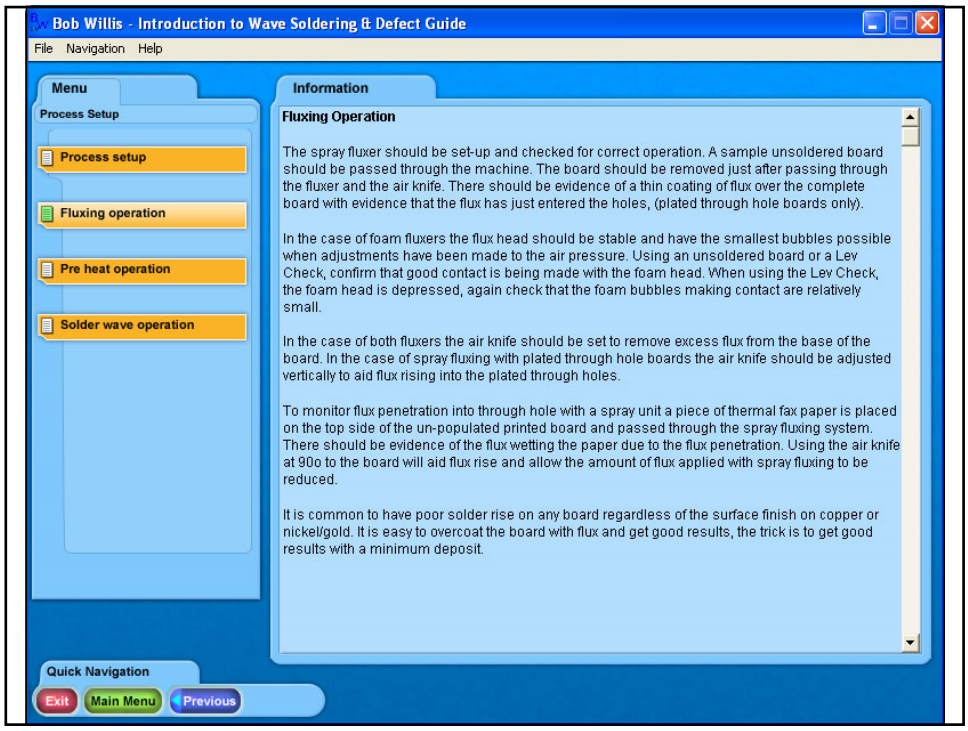
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Fluxing Operation
The spray fluxer should be set-up and checked for correct operation. A sample unsoldered board should be passed through the machine. The board should be removed just after passing through the fluxer and the air knife. There should be evidence of a thin coating of flux over the complete board with evidence that the flux has just entered the holes, (plated through hole boards only).
In the case of foam fluxers the flux head should be stable and have the smallest bubbles possible when adjustments have been made to the air pressure. Using an unsoldered board or a Lev Check, confirm that good contact is being made with the foam head. When using the Lev Check, the foam head is depressed, again check that the foam bubbles making contact are relatively small.
In the case of both fluxers the air knife should be set to remove excess flux from the base of the board. In the case of spray fluxing with plated through hole boards the air knife should be adjusted vertically to aid flux rising into the plated through holes.
To monitor flux penetration into through hole with a spray unit a piece of thermal fax paper is placed on the top side of the un-populated printed board and passed through the spray fluxing system. There should be evidence of the flux wetting the paper due to the flux penetration. Using the air knife at 90o to the board will aid flux rise and allow the amount of flux applied with spray fluxing to be reduced.
It is common to have poor solder rise on any board regardless of the surface finish on copper or nickel/gold. It is easy to overcoat the board with flux and get good results, the trick is to get good results with a minimum deposit.
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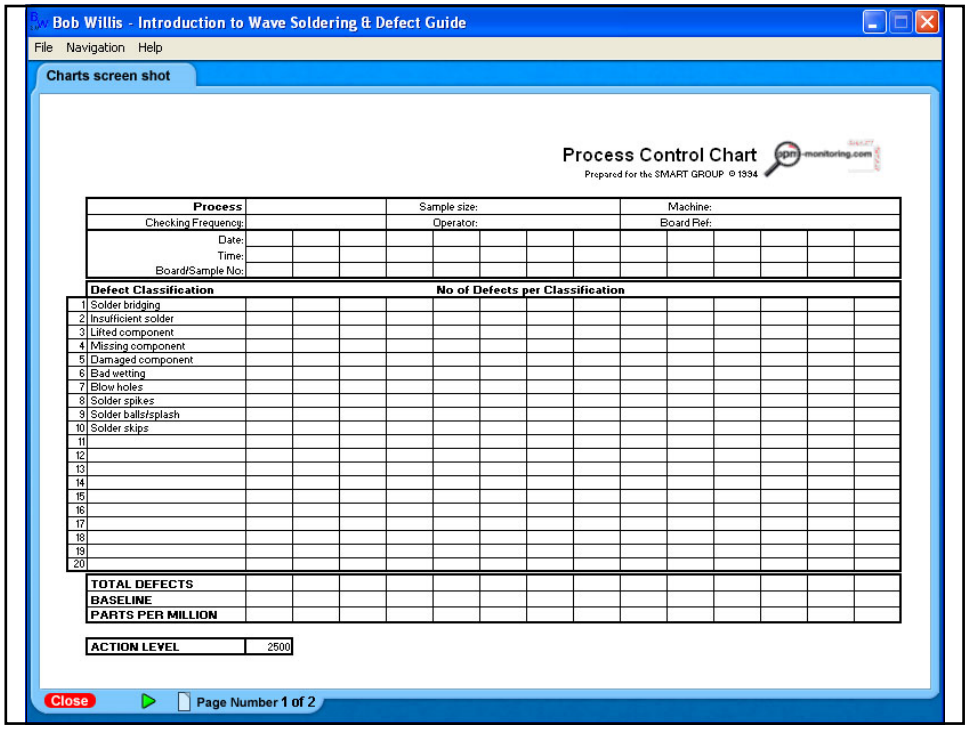
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Charts screen shot
Process Control Chart
Prepared for the SMART GROUP © 1994
Process
Checking Frequency:
Date:
Time:
Board/Sample No:
Sample size:
Operator:
Machine:
Board Ref:
Defect Classification
No of Defects per Classification
1 Solder bridging
2 Insufficient solder
3 Lifted component
4 Missing component
5 Damaged component
6 Bad wetting
7 Blow holes
8 Solder spikes
9 Solder balls/splash
10 Solder skips
11
12
13
14
15
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17
18
19
20
TOTAL DEFECTS
BASELINE
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