

REFLOW HOT PLATE

A functioning reflow system can be made from a \$10 hot plate from Walmart, a \$5 circular saw blade from Home Depot, and three screws and two washers from Ace Hardware. It does not require a reflow controller or any thermocouple temperature feedback. Instead, the hot plate is turned on for specific intervals at two points in the reflow process, and that produces a temperature profile that approximates the standard profile for 63/37 leaded solder paste. Pictures of, and links to, the components are included in the Pictures folder and in the Links.rtf file.

Hot Plate

The hot plate should be modified so the saw blade lies about 7mm above the top of the heating elements. This is accomplished by removing the bottom cover and replacing three existing screws with M4 0.7P 30mm metric machine screws, with small washers on two of the screws, then replacing the bottom cover.

Circular Saw Blade

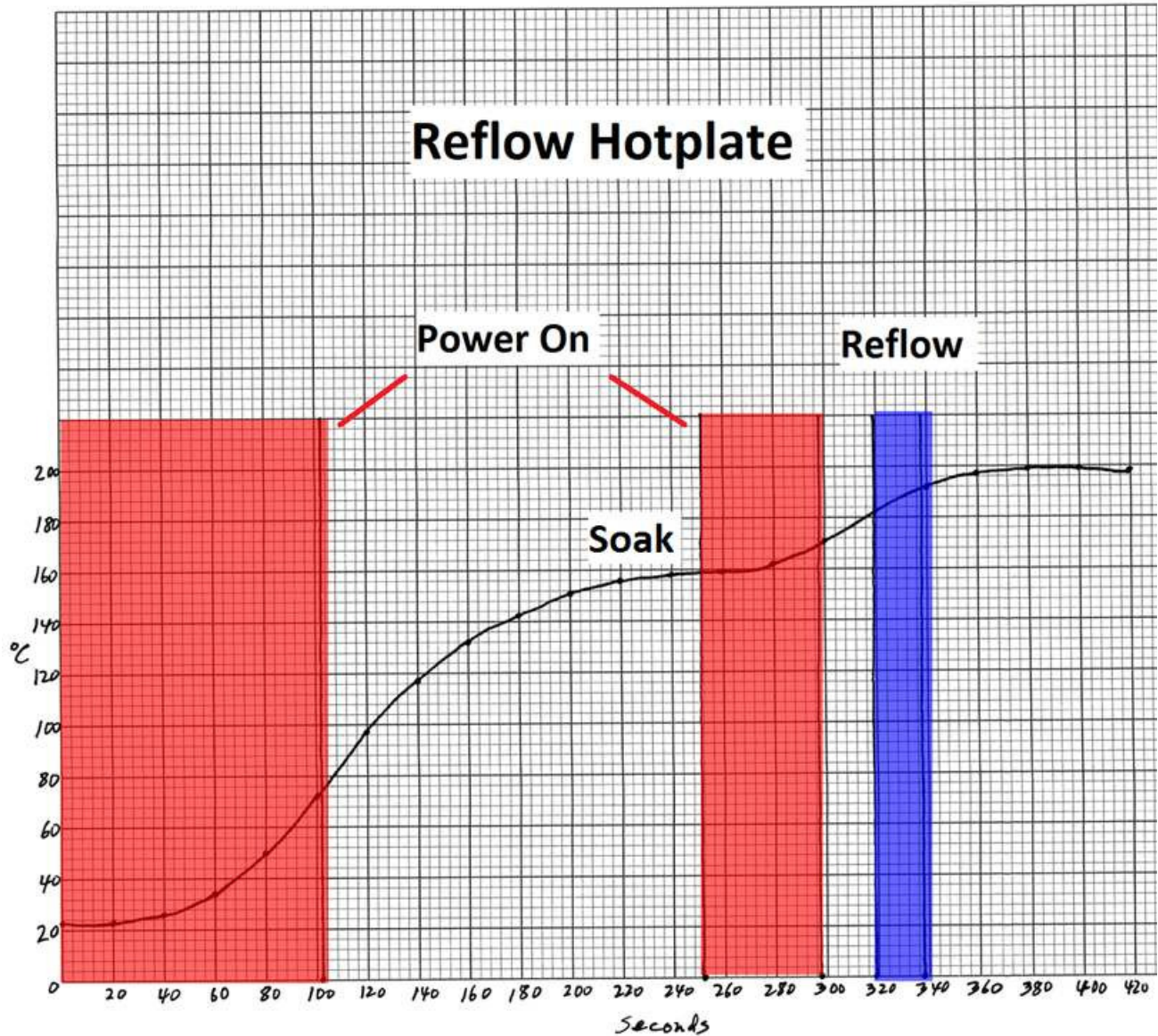
The saw blade needs to be cleaned of all printing, labels, and any anti-rust compound. Acetone was used for that, but paint thinner or charcoal lighter may work as well. Then before the first reflow use, the hotplate and saw blade should be turned on at high heat, outdoors, to burn off any remaining stinky stuff.

Reflow Procedure

The hot plate can be turned on and off with the temperature knob, or by plugging in and unplugging. The reflow process begins with placing the PC board on the saw blade, with everything at room temperature, then turning the hot plate ON and OFF per the following schedule:

ON for 102 seconds
OFF for 150 seconds
ON for 46 seconds
OFF for 100 seconds

0:00 ON
1:42 OFF
4:12 ON
4:58 OFF
~5:18 REFLOW BEGINS
6:38 MAX TEMP



Cool Down

After reflow has completed, the saw blade should be carefully removed from the hot plate with hotpads or oven mitts and placed on a heat-tolerant surface to cool off. The solder will still be molten at that point. This is needed because the hot plate will not cool down fast enough on its own.

Board Placement

Placement of the board on the saw blade is not critical, but a particular hot plate may produce areas on the saw blade that are slightly hotter or cooler than the rest of the blade, so some experimenting may be needed to locate the largest area which gives consistent results. The portion of the board which is over the center hole will still reflow, but may take a few seconds longer to do so. So it is best to avoid the center hole if the board is small enough, or the board can be gently moved around on the saw blade so as to equalize the temperature.

Temperature Profile

Temperature will continue to rise for a considerable time after the power is turned off. Ideally, reflow should NOT occur during the "soak" stage, but should begin about 20 seconds after the second power interval ends. If reflow occurs during the soak stage, then the first power interval may be shortened. If reflow doesn't complete at all, then the second power interval, or possibly both intervals, may be extended. Temperature will peak approximately 100 seconds after the second turn-off, but reflow should have been completed, and the saw blade removed, well before that. But if reflow has not completed by then, it's unlikely it will ever complete.

Alternatives to Manual Control

With only two full-power intervals being required, this system doesn't need a controller. But the duty-cycle controller described elsewhere in this repo can be used to avoid having to watch the clock each time. However, a simpler solution might be to make a voice recording of one reflow session, with countdowns to each turn-on and turn-off point, and then just replay that mp3 file for each subsequent session.

Factors Affecting Performance

Original work on this project was done in Winter, with room ambient temperature of about 70°F. Starting at a higher temperature will ratchet up the curve by a few degrees. In addition, variations in mains line voltage can have an effect. These factors should not materially affect the reflow process, but it may be a good idea to do a test with an old board with solder paste placed at various points to see when reflow occurs relative to the power intervals. Components aren't needed for testing - it's the melting point of the solder paste that matters.

U.S. Mains

All of this is for the 120VAC mains system in the U.S.