Premature Tip Failure

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Background

Soldering Iron Tips are the “razor blades” of our business. They are a consumables item used within every market segment that we serve. They are also the number one item of which we receive the most complaints. Remember that all tips will fail at some point. They are a sacrificial product, which just like a dull razor blade, will need to be replaced a number of times during the life of the soldering iron. There are a myriad number of reasons that can cause premature tip failure which include:

- plating problems
- external damage to the tip
- mating low wattage tips to high wattage irons
- use of strong fluxes
- long duty cycle times.
- etc.

Perception as a Failure Mechanism

Operator perception can be a leading factor in the perception of failed tip. As an example, Hexacon Electric started on a process to streamline the tip product lines. The Durotherm style tips in the smaller tip diameters were some of the first products to be discontinued. In their place we continue to offer the same tip style in an Xtradur style. Not only does the Xtradur style offer to continue the tip shape for the customer, but in most cases the Xtradur tip can usually be offered at a savings of up to 20% over its Durotherm counterpart.

We no sooner offered the Xtradur tip when we started to receive complaints that the Xtradur tips were not as good as the Durotherm tips which were previously offered. In point of fact the exposed portion of both an Xtradur and Durotherm tip that is visible when inserted into a plug style soldering iron is identical. Both working surfaces are manufactured and plated in an identical manner. The difference in the tips has always been in the manufacture of the shank portion of the tip. The customer perceived the Durotherm as a better tip when in fact its performance and life span is the same as its Xtradur counterpart.

The objective way to quantify this type of performance is to note when the tip(s) is placed in service, its service conditions, and when it is removed from service. As soon as the customer starts looking at tip life in this manner, the majority of tips complaints soon vanish.

The Operator as a Failure Mechanism

The vast majority of tip failures in the field can be set at the feet of the operators themselves. Even a little carelessness on the part of the operator can cause a significant rise in premature tip failure and subsequent complaints. The operator will usually notice that the tip is starting to get a dull gray finish and then turns black. If they continue to use the tip it is likely to become pitted and rough and will not accept solder at all. A tip which will not accept tinning will not provide the proper heat transfer to make a proper solder connection in a timely manner.

While there are many causes for premature tip failure, the greatest by far is the failure to properly tin the tip when returning it to the storage holder in between soldering operations. Whenever the soldering iron is returned to the holder it must be coated with a heavy coating of solder. This is the one time where the “bigger the blob … the better the job” applies. The correct scenario for making the connection is as follows:

- Pick-up the soldering iron and swipe on a thoroughly wetted sponge. [The steam that comes off a wet sponge literally blasts off most of the oxides and leaves a spotless surface to accept solder.]
- Lightly tin the tip and proceed to make the solder connection(s)
- Heavily tin the tip and return the tip to holder.

Failure to follow these basic steps can all but destroy a tip in a matter of minutes. Whenever a ‘clean’ or lightly tinned tip is placed in the holder and allowed to cook it can be ruined in just a few minutes. At first a grayish oxide will form that causes the tip to become progressively harder to tin. The solder does not coat the tinnable surface of the tip, but rather has a tendency to ‘ball-up.’ As the damage to the tip progresses the tip becomes very dark in color and the solder not only balls-up, but leaps right off the surface of the tip. Depending upon the point at which the failure mechanism is discovered, the tip may be salvageable although its overall life will be shortened.

Analyzing the Failure

The first step in analyzing a tip failure is to go back to the basics and answer a series of questions. How many tips are involved, when were they placed in service, etc. Hexacon Electric provides a *Tip Failure Questionnaire* which is available from the plant or any authorized Hexacon Manufacturing Representative. The key points that this form will investigate are:

- Tip Number.
- Quantity.
- Date purchased / From.
- Solder:
    - Brand
    - Alloy
    - Wire diameter
    - Flux type
    - Activity level
    - Core size
- Soldering Iron:
    - Brand
    - Model
    - Temperature setting
- A description of the Soldering Application [Is it a Manual Soldering Application, Fixtured, Robotic or some other type of soldering operation].
- Your perception of the failure [Right or wrong, the completeness of this section often leads to the failure mechanism].
- How long after being placed into service did any dewetting or fractures appear on the tip surface?
- How long has this tip style been in use at this facility with this model iron?
- Temperature and humidity in the work area.
- Were these tips held in your tool crib? If yes, for how long and under what storage conditions.
- Has your authorized Hexacon Manufacturing Representative been consulted in regards to this problem? If yes who visited and when.

It is important to hold on to failed tips. If Hexacon Electric elects to replace the tips as part of a warranty replacement, we will only replace tips on a one-for-one basis. Additionally, the company will normally need to examine some of the tips to aid in determining the cause of failure.

Salvage

After determining the cause of tip failure the next most often asked question is what, if anything, can be done to salvage the tips that have been damaged. Tips that have not been too heavily damaged can have their life extended somewhat by doing some maintenance on the tips. The following procedure is what I do with my demonstration tips and tips that I utilize at trade shows:

1. Heat the tip in a soldering iron to the point where the solder on the tip just becomes molten.
2. Wipe all the solder from the tip.
3. Remove the tip from the soldering iron and set aside to cool completely.
4. Repeat steps 1 – 3 for all remaining tips.
5. Examine the tips and discard any with moderate to heaving pitting or plating failures. They are a lost cause.
6. Set up a solder pot [setting between 500°F and no more than 700°F] containing either Sn63/Pb37 or Sn60/Pb40 solder and small container of Rosin, Mildly Activated, flux. Note that even in a no-clean operation you really need the RMA flux to recover the tips. The no-clean fluxes are just not active enough for this operation. In extreme cases the use of RA flux might be advisable.
7. Tips that have heavier oxidation [black spots or streaks] may be further cleaned with either a sal amoniac bar or Hexacon Tip Scrubber [TS-10]. Go easy with either of these cleaning tools as both are abrasive and you are already working with a damaged tip.
8. Holding the tip in a pair of pliers, first dip the tip in the solder flux and then dip the fluxed tip into the solder pot to a depth which goes up to the top of the original tinning. Hold the tip in this manner for 20 to 30 seconds. Carefully withdraw the tip and set aside.
9. Repeat steps 7 – 8 for the remaining tips.

You will likely be able to perform the above only one time before the tip meets its demise. I should also note that once the underlying base copper is exposed that it will start to leach into the molten solder on the tip as well as the connections. Once this starts to happen the plating will usually start to flake off and complete failure will come pretty quickly. The above procedure is at best a stop gap measure to get the most from the tip. It is intended to keep you going while your replacement tips are being manufactured.

Summary

While there are a number of factors contributing to premature tip failure, the operator's care of the tip remains the leading cause of failure. Following three simple steps …

- Swipe on a thoroughly wetted sponge.
- Lightly tin the tip and proceed to make the solder connection(s)
- Heavily tin the tip and return the tip to holder.

… will dramatically improve tip life if the operator's have not been returning the soldering iron to the holder with a tinned tip.

All premature failures should be carefully documented and reviewed in order to make a determination of failure. Tips that have failed may be required for examination and should be held if seeking a warranty replacement. A *Tip Failure Questionnaire* is available from Hexacon or any authorized Hexacon Manufacturing Representative.