Tonochi's Audio Room – Supplemental Info

Soldering

2019/07/14
2022/01/05 revised

Soldering Technique

Tonochi's soldering technique had been different from the standard method for many years. Recently, I reexamined it, and changed it to more standard one.

Tools

Soldering Iron

The criteria of the soldering iron are as follows:

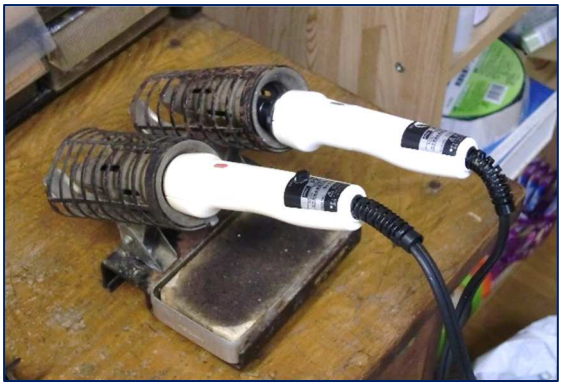
- The heater is 60W or more powerful
- Temperature controlled
- Compact and light

I selected Goot PX-201. It has a 70W heater in it, and is compact and light, and easy to use.
The default tip of PX-201 is a thin cone-shaped type better suited for small soldering spots like IC pins. This tip is too thin for Tonochi Method, and the thick tip is suitable. However, the thin tip is needed for small and densely laid spots, and suitable for small leads/pads whose heat capacity is small, like IC/LSI pins.
I use two units of PX-201; the thickest tip (PX-2RT-5CR, 5mm in diameter) or the second thickest tip (PX-2RT-4CR, 4mm in diameter) is attached to the one, and ~~the default thin~~ a 2mm tip (PX-2RT-2CR) to the other. The thick one is called 'soldering iron A' and thin one 'soldering iron B' hereafter. [2021/12/27 revised]
[2021/12/27 added] {Usually, I use the 4mm tip for the soldering iron A. For the spots that have a large thermal capacity, I use the 5mm tip}

When I am soldering, I turn on the both so that I can use either of them at any moment. If you have only one solder iron, it takes some time to change tips.

I set the target temperature of the solder iron A to 450 deg-C, and the solder iron B is 400 deg-C. I adjust the targets according to the circumstance.

~~Tonochi Method could damage the tip, so I always have spare tips.~~
[2021/12/27 revised] {Tonochi Method isn't so harmful. I found out lately that the solder I have used is the main cause of the damaged tips}



Solder Iron Stand

I have a solder iron stand that accommodates two solder irons and has a cleaning sponge.

When I solder, I get the sponge wet with water.
Dry cleaners are prevailed these days because they don't lower the temperature of the tip. But the wet cleaner (sponge) is the must in Tonochi Method, because I intentionally cool the tip immediately before soldering by using the wet sponge.

Solder

Solder is the second most important thing following the solder iron.
There might still be lead solder available, but it mustn't be used, because it could impair sound quality, and, this is more serious, the lead is poisonous material prohibited to use.

~~I've chosen Wako Technical SR-4NCu.~~
It is silver solder and not so easy-to-use because its melting point is higher than lead solder. But the power of PX-201 is strong enough to melt it. I've got used to use the silver solder.

I believe this silver solder is excellent in sound quality. However, I haven't tried every solder available. There may be superior one I don't know. (If you know it, please let me know)

[2022/01/04 revised] {I found out lately that Wako Technical SR-4NCu is questionable in quality. It was its low quality that damaged tips of the soldering iron. Besides, Wako Technical doesn't disclose the composition ratio, which is the most important specification for a solder. I've decided to use more reliable one; a solder of Sn-3Ag-0.5Cu composition, which JEITA recommends. I chose Hozan HS-304. It embeds Cl-free flux inside it that doesn't need cleaning its residue after soldering}

Though it's called 'silver solder', it corrodes if you leave it in ambient air for long time, because its main component is tin. You can tell it is corroded in two or three months.
I store the solder in a paint can with deoxidant and silica gel. The paint can is well sealed. The solder in the can hardly corrode for five or six years.

Silica gel is a common item and available at a general store. On the contrary, I haven't spotted the deoxidant at near-by shops. I reuse deoxidant enclosed in cat food bags.

I save other corrosion-prone items like solder wick together with solder in the can.

Other Tools

Other than the solder and the solder irons, long-nose pliers, diagonal pliers, wire strippers, cutters and solder wick are necessary for soldering. There aren't any particular criteria for those tools.

For each tool, it's better to have two sizes, large/small. Especially, the smallest long-nose plier is very convenient.

Procedure

My soldering technique is based on the premise that parts are never removed once they are soldered. As for parts that are to be changed, another technique is applied. I'll say the details later.

Cleaning Leads

You should use new parts when you build an amplifier. But it's not unusual that you have no other choice but use old parts. In that case, the leads of the parts should be cleaned before soldering.

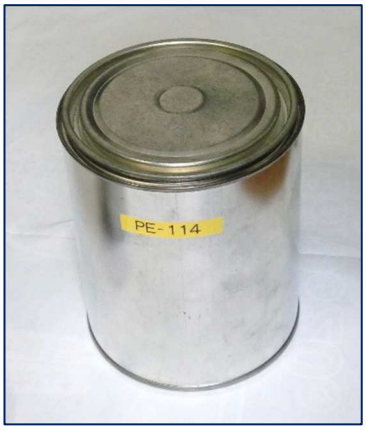
The easiest way to remove smudge on the surface of the leads is rubbing them with a diagonal plier. It is simple yet effective. Be careful not to rub too strongly.

Another method, where high-tech equipment is used, is cleaning electric parts with an ultrasonic cleaner. Today's ultrasonic cleaners are rather cheap. I have one of them, and use it from time to time.

The remaining parts after building an audio device should be kept in an air-tight container with deoxidant and silica gel in it, just like solder. By doing so, the parts can be used as maintenance parts or for the next work.

Ultrasonic cleaner
Citizen SW5800. I used it to clean eyeglasses and a hair brush in daily life.

Air-tight container (paint can)
It is a paint container. I put in parts with deoxidant and silica gel. The label shows the model number, and makes it easy to find necessary parts later.



Temporal Mounting

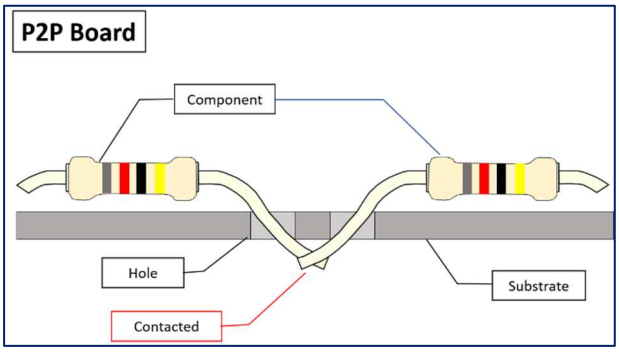
Before soldering, hook leads of components or conductors of wires on the terminal, so that the conductors are electrically contacted eath other.
Don't solder them until all the leads to the soldering joint are hooked.

As for PCBs, leads are not hooked, but at least contacted each other.

For components that are expected to remove later, don't wind their leads around the terminal post but hook them loosely.
For components that are supposed to change often, using a socket is recommendable.

Hook leads on terminals

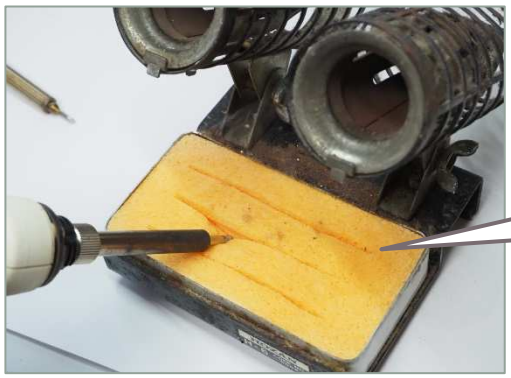
PCB assy
Insert components so that the leads are contacted



Soldering

Follow the steps below:

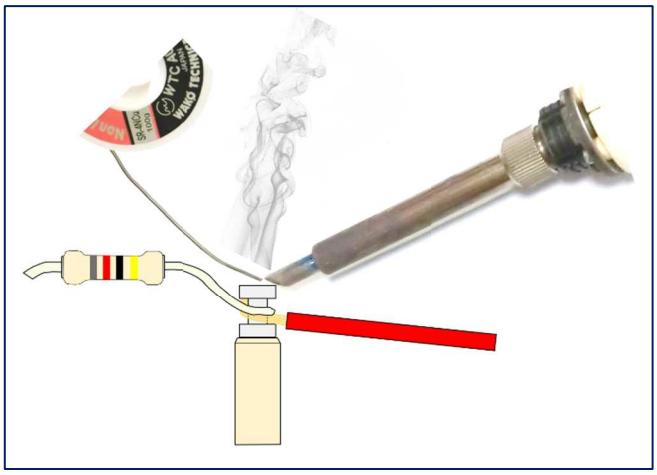
1. Cool the tip of the solder iron
   Rub the tip against the wet sponge to clean and cool it. Do it to drop the temperature of the tip by roughly 50 deg C.



I made slits in the sponge with a cutter. They're helpful when you clean the tip

2. Put the tip and the solder on the soldering spot and melt the solder
   Wait till the heater of the soldering iron turns on (the indicator is on), then ~~put the tip and the solder on the conductors to be soldered. Feed in the solder between the tip and the conductors as it melts.~~ [2022/01/04 revised]

{put the tip on the soldering spot and wait about three (3) seconds to heat up the conductors. Then, feed in the solder between the tip and the conductors as it melts} In the figure below, the position of the tip isn't precise. Put the tip against the position where the solder should be infiltrated most, the stripped wire, for example.
Normally, the temperature of the tip declines sharply once it touches the conductors, but, in the Tonochi Method, it increases gradually, because the heater is on at this moment due to the cleaning of the tip conducted beforehand.



3. ~~Keep the tip on the soldering spot till most of flux is burnt~~
~~The tip should be on the soldering spot until the smoke becomes thin. Most textbooks on electronics say the proper period is 2 to 3 seconds, though, I recommend 5 to 6 seconds. If the thermal capacity of the site of soldering is large, longer period is necessary.~~
~~As you know, too much heating can damage the component. It is the knack to stop heating immediately before the part is damaged. You have to experience much enough to grasp this limitation. I learned it by heating many parts that were not valuable till they were broken.~~
[2022/01/04 revised] {The tip should be on the soldering spot for about three (3) seconds. The main component of the Pb-free solder is tin, and it is oxidized even at the room temperature. At high temperature, tin is oxidized quickly, so the tip shouldn't be on the soldering spot more than three seconds. With the preheating, the period of three seconds is long enough. The flux of HS-304 is burned out so quickly. I think it's less likely the residue remains in the solder after soldering}

Cleaning

After soldering, clean the soldering joint with a cotton bud wet with ethanol.
As for PCBs, use flux cleaner spray.

Of course, you should clean soldering joints, but, to be honest, I often skip it. If it a soldering joint looks clean, I tend to leave it as it is, saying to myself, "Well, it may be OK." Actually, it usually doesn't matter, because there is little burnt residue thanks to Tonochi Method.

[2022/01/05 revised] {The flux of HS-304 is not necessary to clean after soldering. Actually, there remains no residue to my eyes}

Effects

I'm not ambitious about disseminating Tonochi Methods, but this soldering method is recommendable. It contributes to good sound quality, though it is a bit troublesome. Besides, its reliability is one of the strong points.

Sound Quality

As for sound quality, I believe the best way is the Tonochi Method. I don't have any objective evidence to prove it, but I can't come up with better methods.
At least I can say that any soldering troubles like incomplete soldering couldn't occur as long as you follow the Tonochi Method. Actually, I've never experienced any soldering troubles since 1974 when I invented this method.

Reliability

As for reliability, I can show an actual achievement. The audio device that Tonochi Method was applied to for the first time is MA-201 (the first NOBODY-branded device). I used MA-201 for 43 years (1974-2017). Soldering troubles never happened. The half of the soldering joints are made in 1974, and they are still in good condition.

The target durability of NOBODY works is 50 years. I think this goal can be achieved with a large margin as long as soldering concerned. As a matter of fact, 100-year durability could be achievable.

Soldering joints soldered in a product line at a factory are not so reliable as Tonochi Method.
Normally, a given time for soldering in a product line is only one second a joint. The flux remains in the solder, so the solder will begin corroding in about 10 years, and be completely corroded in 20 years. Obviously, the corroded solder doesn't conduct electric current.
I have experienced many such troubles with manufactured amplifiers and cables. However, this problem is not a problem for manufactures because expected life of most electronic devices is 10 years or so.

The photo below is an example: the tonearm cable of Grace G-1040.
When the cable got broken, I destroyed the RCA plug, and found the corroded solder. However, the cable is better than the others, because it was nearly 30 years since I bought it.

Changing Parts

As mentioned before, for parts to be changed, don't wind up the lead on the terminal so that the lead can be pulled out when the solder is melted.
When the part whose lead is wound around the terminal should be removed, cut the lead with a nipper.

[2022/01/05 revised] {Parts that are likely to be replaced should be mounted by methods other than soldering such as using sockets}

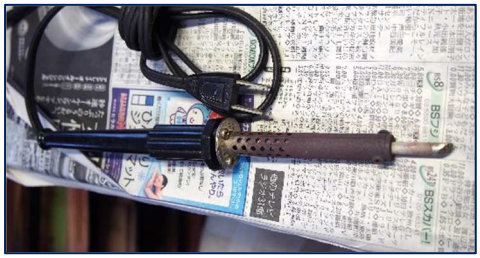
Additional Information

Birth of Tonochi Method

I invented this method in 1974, when I was 17 years old. Many soldering troubles occurred then. Especially, a tube amplifier that was my first DIY amplifier had some serious soldering problems. I was appalled that the soldering joints crumbled when I pulled the leads of the parts, though the amplifier was only two years old.
This experience made me consider the better method.

The year before, I did some part-time work at a factory where electronic equipment was manufactured. I learned professional soldering there. Tonochi Method is the improved version of that.

There were no temperature-controlled soldering irons nor silver solder in 1974, so the early Tonochi Method was a bit different from the current one. The common things are: powerful soldering irons, thick tips, a wet solder cleaner and a relatively long period of soldering time.



Soldering irons I used in my youth

👈 30W type

60W type 👉

Impression about the Solder of Industry Standard

[2022/01/05 added]

I realized the low quality of the solder for audio, Wako Technical SR-4NCu, at last after I've used it for nearly 20 years. It has bad wetting, low solderability and the flux that is hard to be burnt out and contains chlorine. Probably, the flux is the cause that damages the tip of the soldering iron.

On the contrary, Hozan HS-304 doesn't have those problems. By using it, you can solder easily like using a conventional Pb solder. I believe other solders that comply with the JEITA recommendation have the same quality as Hozan.

I innately tend to be attracted by things 'special': special constructions, special materials, and so on. Especially, the term 'for audio' and high prices attract me much.
As I accumulate experience in audio, I am getting wary of deception. As for the solder, however, it's too late for me to realize I was cheated.

Audio is already mature field, so it is a proper way to see 'special' is less likely to be better than 'standard'. I'll continue to be careful about things special.

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NOBODY Audio
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