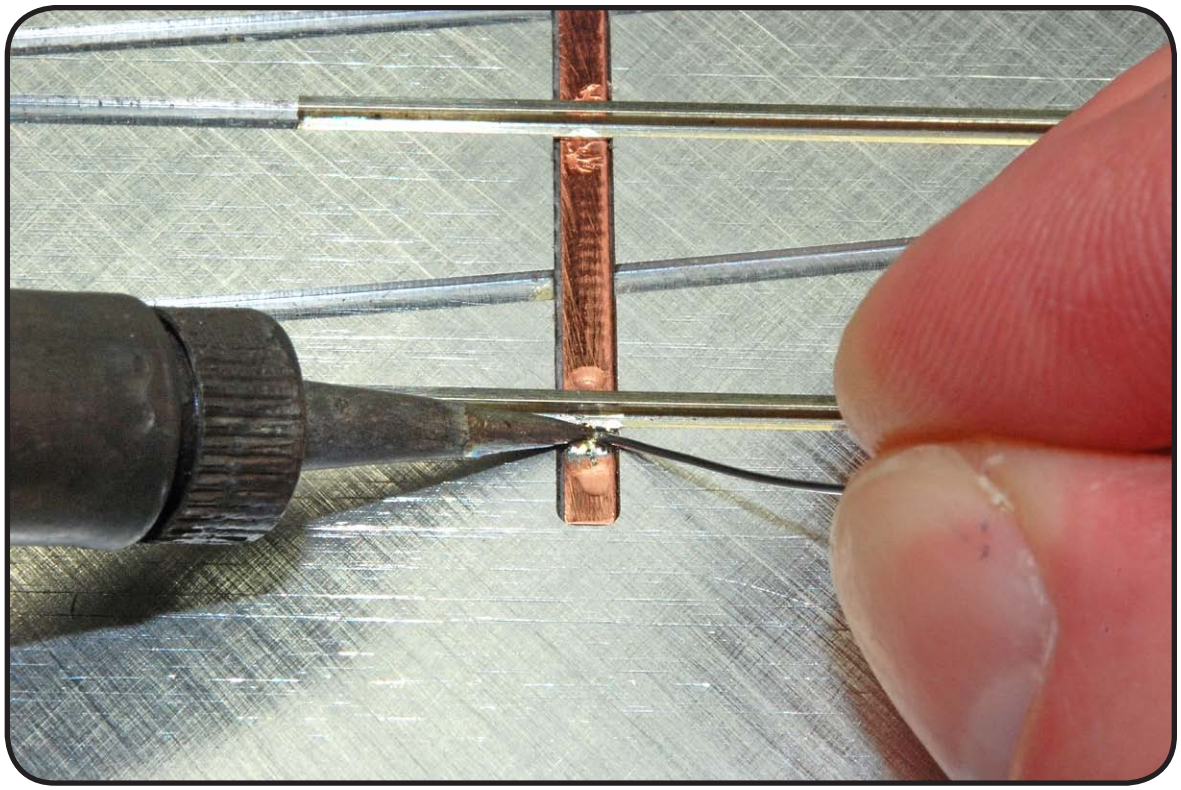
Soldering Trackwork



Application Note

HELPING THE WORLD BUILD BETTER RAILROADS

FAST TRACKS

Fast Tracks Application Note AN01

The latest version of this Application Note is always available for download from the Fast Tracks website at: www.handlaidtrack.com/documents.php.

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Soldering Trackwork in a Fast Tracks Assembly Fixture

The techniques for creating great looking and reliable solder joints aren't hard to master. With a bit of practice, anyone can do it. We have shown thousands of modelers how to get good results with the techniques and tools described in this document.

The instructions we provide here are based on many years of experimenting and experience. Other materials and techniques may also yield good results, but if you are new to soldering, then following these instructions as closely as possible will ensure success.

There are four key elements to creating high quality solder joints for trackwork:

1. Keep your tools and works surfaces clean.
2. Use small diameter solder - .020" or smaller.
3. Use an acid based solder paste flux.
4. Use a good quality iron and tip.

We will cover each of these elements in detail in this document. We have also prepared several soldering demonstration videos that we encourage you to study carefully. Then take some time and practice on some scrap pieces of rail and PC Board ties before "going live".

If you do run into problems, check out the troubleshooting section at the end of this document for suggestions.

Mechanical vs. Electrical/Electronic Soldering

While the principles of mechanical and electrical soldering are similar, there are important differences between how mechanical solder joints are created as opposed to soldering wires and circuit boards. If you are experienced with electrical/electronic soldering, then you already have the basic skills needed for mechanical soldering.

However, mechanical soldering does use different materials and techniques to create a mechanically sound joint. Even though you may be experienced in electrical/electronic soldering, we highly recommend that you study this document and related videos carefully to get a clear understanding of how to create a mechanically sound solder joint.

Recommended Soldering Tools

- **Micro Applicator Brushes** (Fast Tracks part TL-0039) — Used to apply small amounts of flux to the PC Board ties and rail.
- **Acid Paste Flux** — Kester SP-30 is a good choice.
- **.020" 60/40 Lead Solder** (Fast Tracks part SP-0003) — Do not try to use lead free solder. It is not suitable for hand soldering trackwork.
- **35W Soldering Iron With Replaceable Tip** — The Weller WP35 is a good choice. We also suggest a conical shaped tip like the ST-7 tip included with the Weller iron that we offer on our website.
- **Wire Brush** (Fast Tracks part TL-0038) — Used for cleaning the solder tip and trackwork.

The Soldering Iron

The best iron for soldering trackwork is a 35W to 45W pencil type iron like the one shown in the tool image on the previous page. Trigger or gun type irons are not recommended.

There are many ways to economize on the tools that you purchase for building trackwork, but buying an inexpensive soldering iron is ***not one of them!*** The $9.95 discount hardware store iron will give you nothing but grief.

If you don't already own one, buy a good quality soldering iron with a replaceable tip. If you already own a soldering iron, but it is not a good quality pencil type iron, set it aside for other types of soldering work and invest in a good quality iron for building trackwork. You should expect to pay between $50.00 and $75.00 for a good iron.

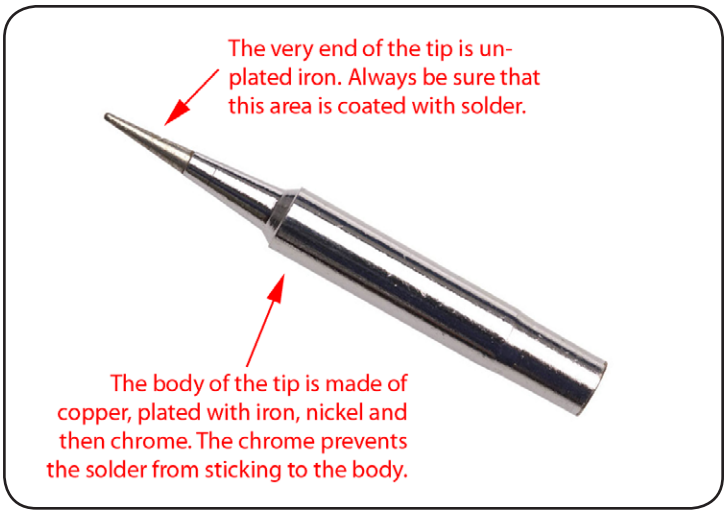
For electronic/electrical soldering the iron is typically stored in a holder while it is not being used. We do not recommend the use of iron holders for soldering trackwork as we have found that the tip often comes in contact with the holder, drawing the heat out of the tip. As a result, when you pick up the iron the tip may not be at full temperature, making it harder to get a good solder joint.

Image 1

Instead you should set the iron on your bench top so that the tip is pointing upwards. (Image 1) Or find a stand that positions the tip upward rather than downward, and does not have any metal parts that will draw heat away from the tip. This will help to keep the tip hot and ready for use. Be sure to keep an area of your workbench clear so that the iron tip does not touch anything.

The Soldering Iron Tip

Image 2



For code 100 and smaller track-work, we recommend that you use a conical type tip like the one shown in Image 2. For trackwork that uses rail larger than code 100, you may want to consider using a screw-driver shaped tip. (The Weller soldering irons that we sell comes with a screwdriver tip. The part number is ST-3 if you want to order additional tips.)

Keeping the tip in tip-top shape is critical to producing sound solder joints. Inadequate or improper tip maintenance is one of the leading causes of soldering problems. Fortunately tip problems are very easy to prevent. Just be sure that the tip is ***always tinned with a thin coating of solder at all times!***

Most tips are made of a copper core which is electroplated with iron to extend its life. The non-working end of the tip is plated with nickel for protection against corrosion and then chrome plated to prevent solder from adhering to it. Only the very end of the tip is un-plated so that it will accept solder. (Image 2)

The un-plated part of the tip will oxidize very rapidly, so keeping the tip coated with solder at all times is critical for slowing the oxidation process and extending the life of the tip. Eventually however, every tip does 'burn out'. You can tell when this happens as you will no longer be able to clean the tip so that it is nice and shiny.

When a tip is burned out, it needs to be replaced. Do not attempt to file or sand the tip to try and extend its life. Instead replace it with a new tip.

To extend the life of the tip and prevent pre-mature burn out, always keep the tip tinned with a thin coat of solder - not only while you are soldering, but also when the iron is idling. So before you set your iron down, always apply a coat of solder to the tip.

When you are finished soldering, you should always prepare the tip for storage by cleaning it and then applying a coating of solder before turning the iron off.

When you install a new tip, the first thing you should do is to apply a thin coating of solder, otherwise the tip will burn out within minutes.

Some Comments About Acid Paste Flux

Soldering nickel silver rail to PC Board ties requires that both surfaces are thoroughly clean and oil free. Acid based flux does a great job of cleaning the surfaces, and will make it much easier to produce a nice looking, reliable solder joint. Especially for modelers who are new to soldering.

Since we are not building an electronic circuit, there are no problems with using an acid based flux for turnout construction. Unlike electronic circuitry, the solder joints we are creating are primarily to provide mechanical strength, so the completed trackwork can be easily scrubbed cleaned with a wire brush to remove any acid residue.

The acid used in acid based flux is quite mild, and we have found that as long as the trackwork is thoroughly scrubbed clean with a wire brush you will not have any long term issues.

Additionally, trackwork built with Fast Tracks tools are designed to be painted, which will seal in any possible remaining acid from oxygen, preventing oxidation and corrosion.

If you are concerned about corrosion over time, then you can also take the additional step of scrubbing the completed turnout in water with some baking soda. This will neutralize any remaining acid after cleaning the turnout with a wire brush. However it has been our experience that this step is really not necessary.

About Solder

Using small diameter (less than .020") will make it much easier to create quality joints, without the need for excess heat and time. It also makes it easier to access tight spots in the switch. The solder that we offer on our website (SP-0003) is a rosin core 60/40 solder (60% tin and 40% lead), however acid core would work just as well. It is just not necessary as the acid paste flux will take care of cleaning the surfaces.

We only recommend the use of lead solder for hand soldering. The newer lead free solders require higher soldering temperatures and a lot more skill to get good results. It is also difficult to tell if you have a good solder joint as lead free solder joints look dull and appear to be 'cold' joints, while in fact they may be just fine. Lead solder is a bit harder to find, but despite what you may hear, it has not been discontinued and is unlikely to be discontinued in the future. As long as it is used properly, it is a safe material to use. We will always have lead solder available on our website.

63/37 solder can also be used. The only important difference is that the melting point of 63/37 is slightly lower (by about 10°) than 60/40 solder.

Preparing The Ties For Soldering

The first step to ensuring a reliable, good looking joint is being sure that the surfaces you are soldering together are impeccably clean.

To clean the PC Board ties, use a wide file and lightly file the surface of the tie until it is shiny and clean. (Image 3) This is a routine that you should use for each and every tie that you solder, as this will ensure both good solder flow and adhesion.

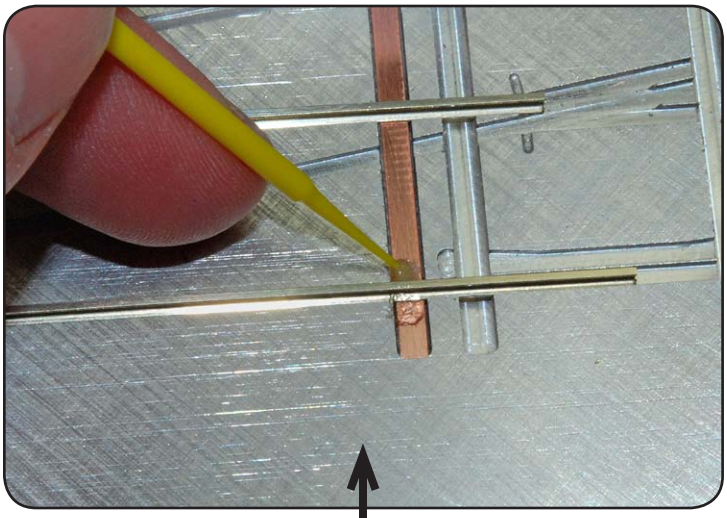
Nickle silver rail typically does not tarnish much over time, but be sure to check the bottom of the rail to be sure it is also clean and bright. If it has any tarnish at all, clean it off with a Brightboy track cleaner.

After you have placed the PC Board Tie and rail into the fixture, apply a small amount of flux to the rail and tie interface. (Image 4)

This is best done with a micro applicator brush. Using these small brushes will help to ensure that only the smallest amount of flux is applied. Using too much flux will result in more solder being applied than needed and will make cleanup more difficult. Be certain to get flux on both the PC board tie and the base of the rail.

Image 3

Image 4



Click The Images For A Larger View!

If you are viewing this document on your computer, and you have access to the internet, click on any image for a larger, high resolution version.

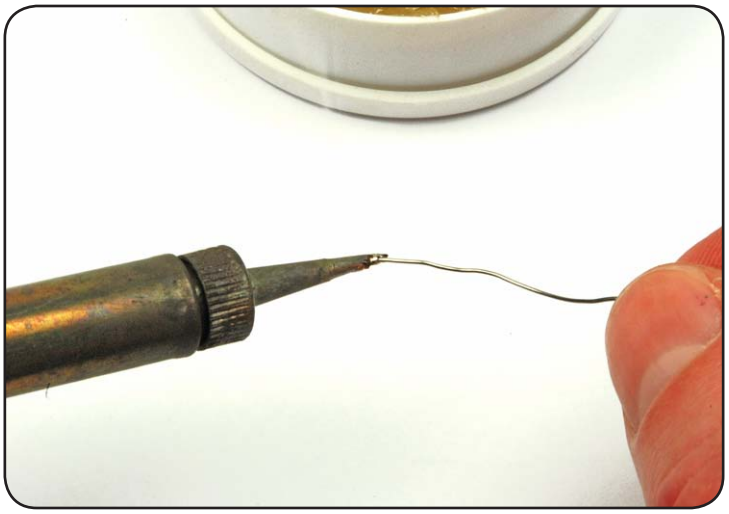
Clean the tip Clean the tip Clean the tip!

Keeping your soldering tip clean and shiny will make the difference between success and failure. Follows is the cleaning routine that we recommend. Get in the habit of repeating this routine regularly. Certainly whenever the tip looks dull or has any encrusted carbon on it.

Testing The Tip

Apply a small bead of solder to a hot tip. (Image 5) If the solder balls up and will not adhere to the tip, go to the next step, clean the tip and then try again. Solder will not stick to a dirty tip or a tip that has carbonized from sitting while hot.

Image 5



Cleaning The Tip

To begin, first apply a bit of solder to the tip. If the tip will not take solder, brush it a bit with a wire brush, and then try again. After you have coated the tip with some solder, quickly dip the tip into the flux. (Image 6) This will instantly clean and coat the tip. (Image 7)

Image 6

Image 7

Clean any residue from the tip with a few quick passes of a wire brush. (Image 8)

When you are finished, the tip should be clean, bright, shiny, and ready to solder.

We do not recommend the use of a wet cleaning sponge typically used for soldering electronic components. Cleaning sponges are suitable for electronics, but tend to cool the tip down, making it harder to create sound, mechanical joints for trackwork.

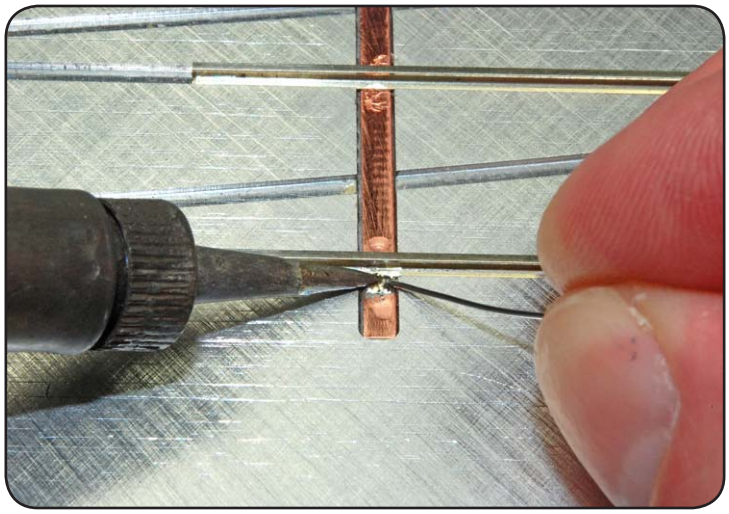
Image 8

The Soldering Process

To start soldering, touch the tip to the top of a PC Board tie and up against the base of the rail. The flux will instantly melt and start to sizzle, this is the best time to start soldering.

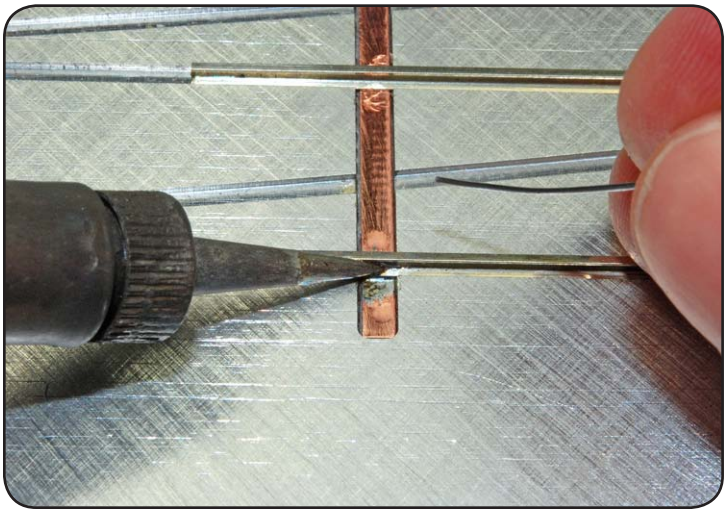
Touch the solder to the tip and the top of the tie to start it melting then work it into the flux. Where the flux flows, the solder will follow. (Image 9)

Image 9



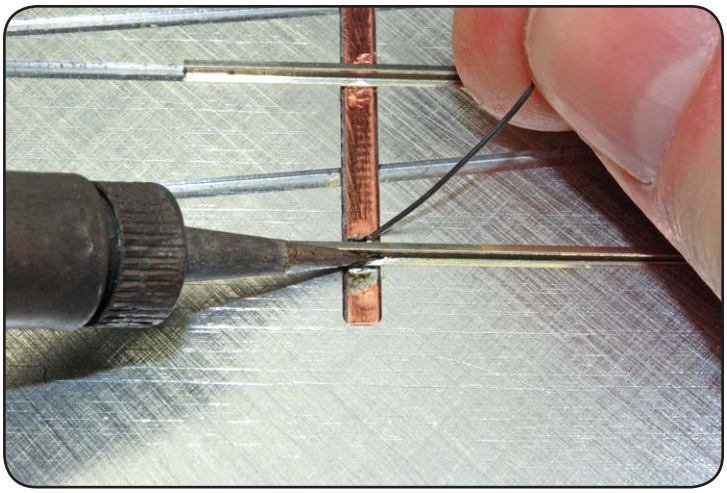
While the solder is still fluid, move the tip up onto the base of the rail and hold it in place. (Image 10)

Image 10



While holding the tip on the base of the rail, apply solder to the opposite side of the rail. If everything is clean and properly prepared, there will be enough heat transfer through the rail to melt the solder on the opposite side which will draw fluid solder beneath the rail, creating a very solid solder joint. (Image 11)

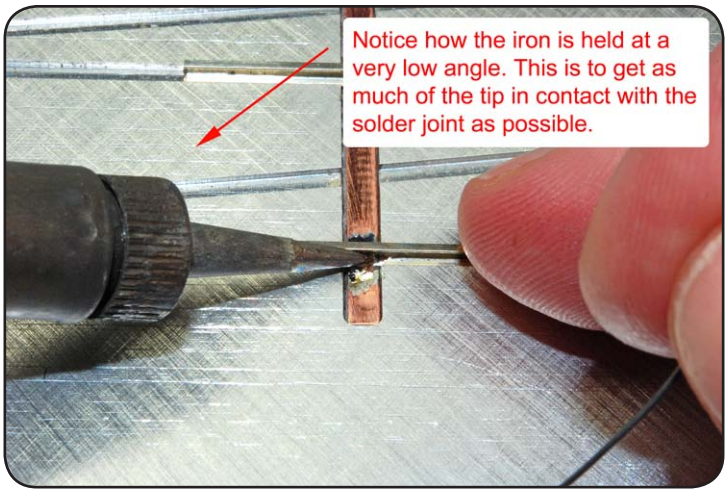
Image 11



Hold the tip of the iron on the rail to keep the rail hot for a second or two longer to allow the solder to thoroughly liquefy and flow under the rail. (Image 12)

If you study Image 12 you will notice that the iron is held at a very oblique angle - almost parallel to the assembly fixture. Holding the iron at this angle will help to transmit as much heat as possible from the tip to the work surface. Try to avoid holding the soldering iron at a vertical angle.

Image 12



Finishing

Finally, remove the tip from the rail while holding the rail steady with a finger. Keeping the rail in place while the solder joint 'freezes' is critical for both a reliable solder joint and accurate work. This only takes a second or two. (Image 13)

The completed solder joint should be smooth, flat and shiny. Once cleaned and painted, the solder joints will be virtually invisible. (Image 14)

Image 13

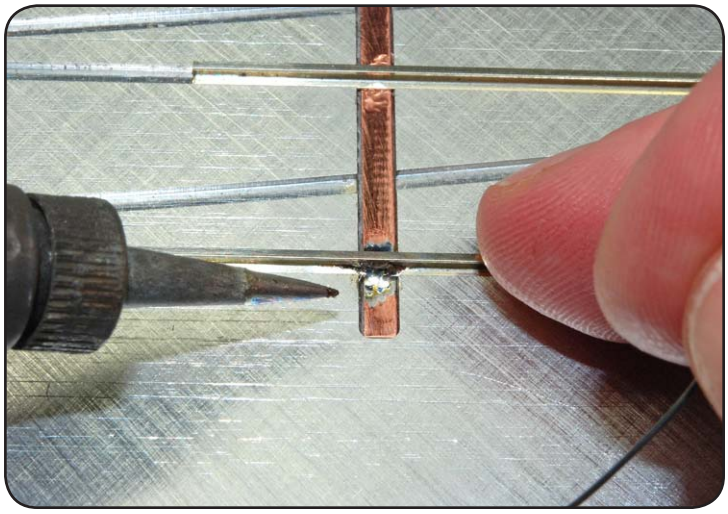
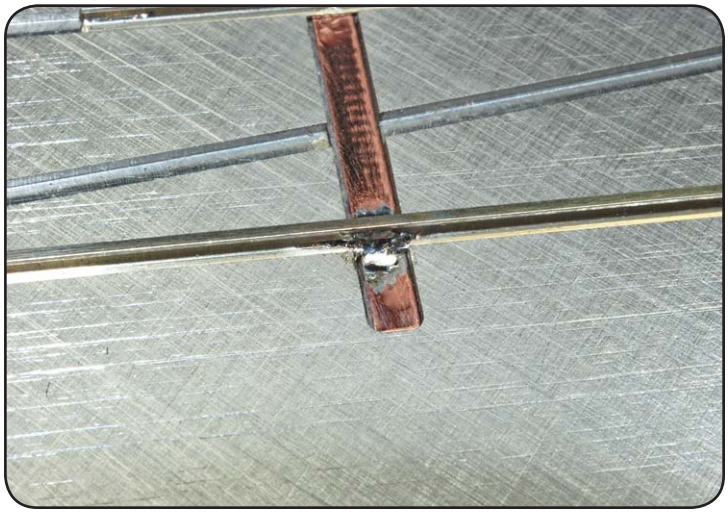
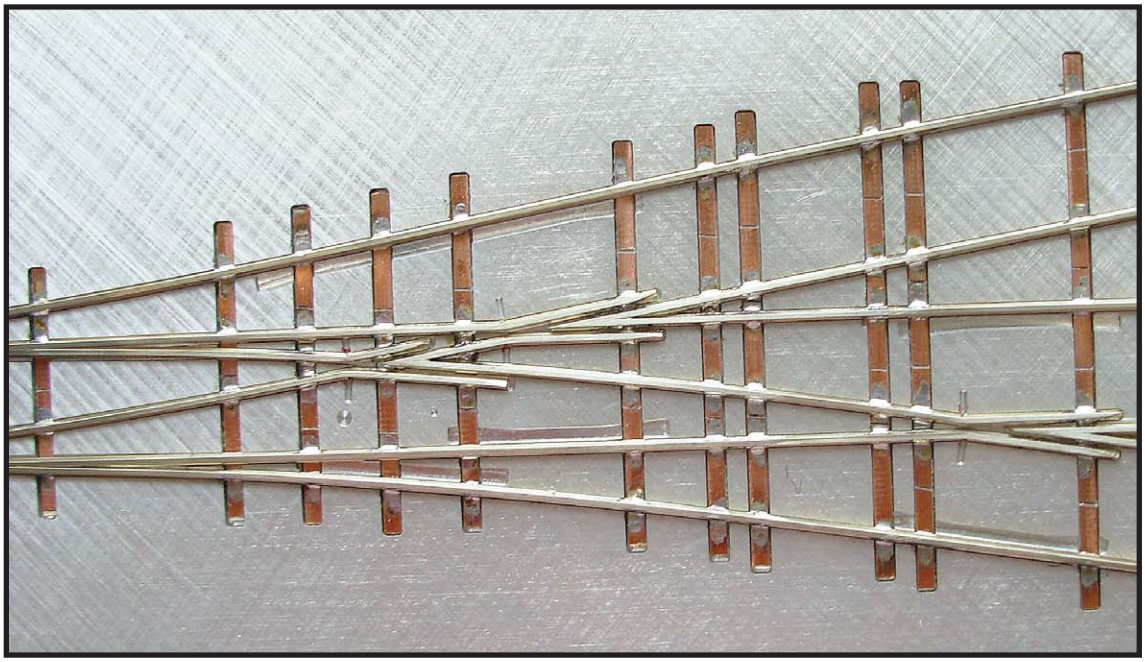


Image 14





Troubleshooting

1. **The solder just won't "take".**
   Cause: Surfaces are not clean, or soldering iron not hot enough.
   Solution: This problem is almost always caused by dirty surfaces. Be sure that both surfaces are clean and shiny, and that you have applied a thin coating of flux. Also be sure that the iron is hot enough and that the flux sizzles and 'boils' just before you apply the solder.

2. **The finished joint is dull and grainy-looking.**
   Cause: The soldered pieces were moved before the solder solidifies, or not enough heat.
   Solution: Be sure you hold the pieces in place until the solder completely solidifies. Also be sure that you have enough heat so that the solder completely liquefies and flows between the surfaces.

3. **The solder will not melt or flow.**
   Cause: Soldering iron not hot enough, or dirty tip.
   Solution: Be sure the iron is at full temperature and that the tip is cleaned and tinned.

4. **The solder joints just look ugly**
   Cause: Dirty surfaces or tip. Soldering iron not hot enough.
   Solution: If the resulting solder joint is not nice and flat and shiny, then the solder did not properly 'flow'. To get the solder to flow, you need to be sure that the surfaces are impeccably clean and shiny, and that the iron is at full temperature before you touch the solder to the tip of the iron.

5. **The copper is coming off the PC Board Ties**
   Cause: Soldering iron too hot, or left on the surface to long.
   Solution: Be sure you are using a 35W to 45W iron and remove the iron from the surface as soon as the solder has 'flowed'.

6. **The solder joint fails (especially on the throwbar)**
   Cause: The iron was not hot enough, or the solder did not completely liquefy and flow between the soldered surfaces.
   Solution: Be sure the soldering iron is at full temperature and that the solder fully liquefies and flows between the soldered surfaces.

7. **The soldering iron is not getting hot enough**
   Cause: Extension cord too long or defective iron.
   Solution: You should plug the iron directly into a wall socket. If you need to use an extension cord, be sure that it is heavy enough for the rated current of the iron and the length of the cord. (Two wire lamp cords are NOT heavy enough!)