

Coax Connector Preparation and Assembly for a PL259

Coax technology has come a long way in the past several decades but nothing takes the place of good solid coax connections. The industry has pretty much gone to crimp connectors and I've seen them used in RF applications up to 2Ghz without any degradation to signal quality. We have to choose the coaxes and connectors for each job and in amateur radio that usually translates to different varieties of RG-58, RG-8U, RG-8X or one of the cable TV type coaxes. They all have their place and use in our hobby. Some are better suited for inside and others for outside uses. I'll state some facts up front for those that have forgotten or may not know. If you are using coax that has either a copper shield or silver or nickel tinned braid you can choose solder or crimp type connectors. If you are using RG-6 type coax or some really cheap copy of RG-8 you will have to use a crimp-on connector. One way to check if you are not sure is to expose the braid and see if it will take solder. I prefer crimp-on connectors for two reasons. They don't require soldering and in most cases are superior in strength. One caveat is that their use outside requires the same care to exposure to the elements as any connector or connection that is exposed to the weather. They are a tad more expensive to well beyond what most would be ready to pay. The need for a tool to do the crimping can run the gamut from 10's of dollars to 100's of dollars. Most hams are pretty cheap and I don't have to say anything more there. Solder type connectors seem to give a little better chance of a superior bond, especially at RF so it depends on the application. If the connector is not made properly it is almost not worth the effort and can cause problems that are hard to diagnose or overcome. Crimp type connectors are easier to apply but the choice is up to you. Whatever you use a good connection will give the best overall longevity and performance.

Tools:

I will try to stick with the tools that most hams have or have access to for coax/connector bonding.

1. Safety glasses or eye protection
2. Solder: The best is "silver bearing" followed by typical 60/40 **use only rosin core type**
3. Soldering iron: I mostly use a Weller solder gun (100/140) or an iron of at least 75 watts
4. Small triangle file (used to clean the surfaces to be soldered)
5. Pocket knife of the folding type
6. Electricians scissors or sharp flush cutting diagonal cutters.
7. **Rosin core flux**, in a small can
8. Pliers, crescent, or open end wrenches suitable for the connector
9. Appropriate crimp tool if crimp-on connectors are used
10. Some times a small bench vise is handy but not necessary if you don't have it
11. Volt-ohm meter either digital or analog
12. Plenty of bright light

The PL259 is one of the most common connectors in amateur radio. For a buck or two more per copy I would prefer using the silver plated connector. It solders better and when showing signs of corrosion doesn't seem to degrade performance. The silver oxide is just as good a conductor as the silver itself.



RG-8 coax is a match for the PL-259 and comes in several varieties. Well known brands use heavier braid coverage and are typical examples of better quality coax. If you want a good RF connection these coaxes are the best choice. There are several ID numbers that manufactures use to identify their coaxes such as 8237, 8214, 9913, and some are marked with the familiar RG-8 RG-8U, RG-8A/U RG-213, RG-214, etc. All of the coaxes listed are compatible with the PL259.



The first and most important thing to remember is to slip on the outside shell of the PL259 before soldering the rest of the connector to the coax. This is really important if the other end already has been terminated or connectorized. I've ruined a few coax connections this way. The best thing to do is cut the end and start over. You can recover the connectors with a little work and reuse the pieces again.



The first cut should be made with a sharp pocket or box cutter type knife. Your goal will be to cut the outer jacket and shield wire as well as the inner insulation between the shield and center conductor without scoring the center conductor. This is done by feel since you can't see where the blade is without the parts removed first. I generally go by feel and lighten the pressure when I know I'm through the shield wire. Cutting all the shield wires completely is important so it's flush with the insulation. Place the connector as shown below beside the coax with the end of the



PL259 about 1/8" of the coax overlapping the connector. This will allow the center conductor to protrude through the end of the connector when assembled. Score the coax jacket as indicated above and even with the back of the knurled ring on the connector. Cut carefully through the shield wire and into the poly insulator just short of the center conductor. This is a feel thing and if you don't apply too much pressure with the knife it shouldn't score the center conductor. When finished remove the outer jacket and shield exposing the poly insulation. There should not be any shield wires protruding from the cut coax at this time. If there are a few just cut them flush with the outer jacket as best you can. Discard the removed outer jacket and shield.



Remove the poly insulation by crushing the poly with a pair of pliers. Squeeze enough to flatten the diameter about half. Release the pliers and rotate the coax 90 degrees and squeeze again. You may do this several times as it breaks the bond between the center conductor and the poly insulation. Grab the crushed poly with the pliers and remove with a counter clockwise twist. Belden twists the center conductor in the same direction and removing the poly in this manner keeps a tight twist on the center conductor. The finish cut should not show any excess poly or shield wires protruding from the cut surfaces. Placing the PL259 body next to the cut should look similar to the upper right picture with the center conductor overlapping the end of the connector about 1/8". This will be removed before solder is applied.

The second cut removes only the outside jacket back from the first cut to expose the copper braid that will be soldered to the PL259 connector. Place the PL259 body so the first cut is even with the knurled part of the connector as in picture. Using a sharp knife just score the jacket enough to see a clear mark on the surface. Score the jacket in a straight circle. Some people use a piece of electricians tape for a guide. Just wrap it around the coax jacket where the cut needs to be made. Using the pointed end of the cutter insert where the ring is exposed and cut toward the end of the coax while trying not to cut into the braid. Again it's a feel as well as eye hand coordination.



At this point it is important to visualize the finished cut to ensure that there aren't any substantial amounts of braid that have been cut through by mistake. You need as many braid wires intact as possible. With one hand grab the braid and twist it in a clockwise direction. **Two cautions; be aware that any wire fragments can and will try to stick into a finger so do this carefully. Please observe that any of these wire fragments that get in you eyes will probably need to be removed by a professional.** The reason I do this is that the threaded interior part of the connector that the coax is placed is formed in this direction. While making this clockwise twist with your fingers keep the braid as even as possible and assure that none of the braid wires are contacting the center conductor. Although I don't tin the exposed braid it can be done. Use as little solder as possible if tinning the braid before assembly and make sure you don't add significantly to the diameter of the braid itself.



Start the body of the connector over the prepared coax being careful not to disturb the braid. Center the center conductor to pass through the tip of the connector. When the back of the connector touches the outer jacket of the coax apply pressure and a clockwise rotation to start the inside threads of the connector over the coax. Push and turn by hand until it becomes difficult to continue. Using a set of pliers or channel locks grab the knurled part of the connector and turn clockwise while holding the coax with your other hand until it bottoms out. You should see the braid appear in the 4 holes of the connector. I try to twist the connector just enough to get equal amounts of braid in each hole. When finished it should look very similar to the picture below. Trim the exposed center conductor from the coax flush with the tip of the connector.



Before solder is applied to the body of the connector it needs to be free from any accumulations. I use a knife or a file to remove the surface contamination from the area of the connector to be soldered. I try to file or scrape around the solder holes. I remove just a little of the metal to make sure the surface is clean. If your using silver plated connectors I would very lightly rough the same areas before soldering. Apply solder to the connector tip and fill the opening.



Before applying heat to the connector you can apply a small amount of rosin solder flux(optional) to the area around the holes. Apply heat from the soldering gun or iron trying to make contact with the body of the connector, holes, and the braid while applying the solder. I use a twisting motion with the soldering gun while the solder begins to melt. I then move to the next hole and do the same until I have solder in each hole. Keep applying the heat around the connector until the solder flows smoothly over the openings and fills the holes. It takes quite a bit of heat to get the solder to smooth out so just keep applying heat until it does. One caution: when using foam core coax such as Belden 8214 the foam will melt and try to escape out the holes. It can be done but would be better if a silver plated or a crimp-on style connector is used.



A finished connector will look similar to the picture above. If done properly the bond to the braid and housing will last the life of the coax. In the final assembly it is a good idea to check continuity with a Volt-Ohm meter(VOM). Check to make sure a short does not exist between the center of the connector and the body connected to the braid. Also check end to end conductivity for both center and shield provided you have both ends of the coax available. If one end is connected to an antenna you could run in to problems testing continuity. Some antennas show a dead short or very low resistance when a VOM is used. Baluns and tuners could also show a short to testing, so it is better to check the coax from end to end without anything connected. I hope this has been a help and saves you a little time and trouble in the future.

That's it and good luck. KL7FG

Jan 13, 2008