



About Soldering Stuff

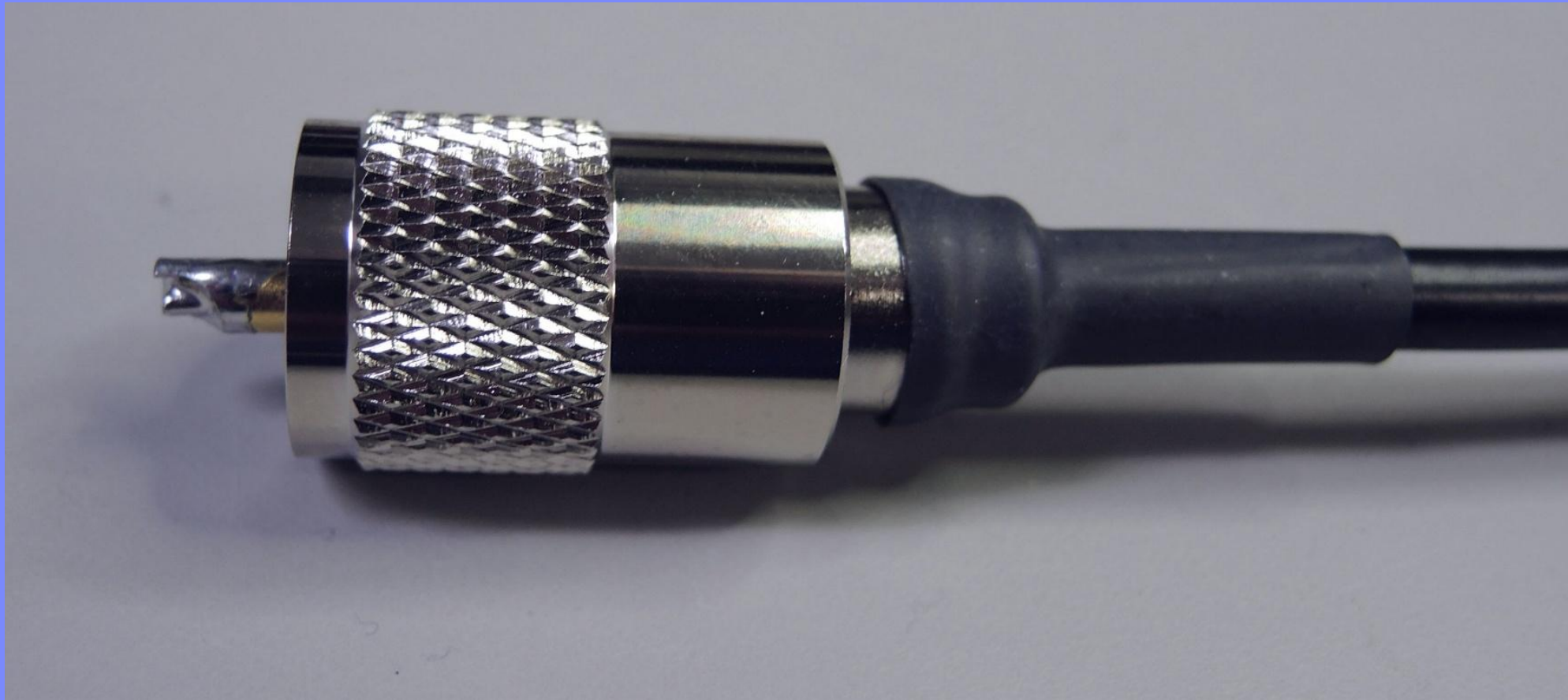
Antenna Focus...Session 3

VE3CZO

In Today's Session we will...

Create a coax jumper cable

- ▶ With two PL259m connectors and a 2 meter length of RG8X coax cable



Connector Quality...



Connector Quality

- ▶ Low VSWR... PL-259 PTFE connectors typically 1.15:1 while phenolic and poor fit may be > 1.4:1
- ▶ Look for specs – VSWR vs frequency - Power handling
- ▶ Buy from industry recognized manufacturers
 - Amphenol RF Molex TE Connectivity Huber+Suhner

What to look for in a PL-259

- ▶ Connector materials – brass with silver or nickel plating to make soldering easier
- ▶ Connecting thread precision – well defined, smooth, and easy to engage with mating connector
- ▶ Dielectric material – Teflon rather than phenolic
- ▶ Center pin integrity – solid, does not wobble, copper or brass material sometimes gold plated
- ▶ Weight and feel – heavy, not light & fragile

Coax Cable Quality...



Determining Cable quality

- ▶ Established manufacturer providing consistent product with quality components and solutions supported with data sheets
 - Belden Amphenol Andrew Times Microwave TE Connectivity Huber+Suhner
- ▶ Braid weave coverage, single or double or more braid

What to look for...

- ▶ Attenuation
- ▶ Impedance variance from 50 ohms
- ▶ Power handling
- ▶ Center conductor material
 - 100% pure copper or copper clad steel
- ▶ Jacket rating UV-resistant
- ▶ Shielding – minimize EMI and RFI
 - % shielding coverage (gaps between braid weave) >90%
 - Single vs. double shielding or better – dual braid – braid + foil

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Coax Cable Quality...



Cheap cables worth it? No but...

- ▶ We're using XRDS-RF RG8X a 'value brand' from Amazon for this build
 - Not as good as the manufacturers listed above...
 - Electrical performance should meet spec for the cable type
 - Physical build quality for example outer jacket UV resistance or extreme temperature performance may not be as good
 - Little or no customer support – for example difficult to find a datasheet
- ▶ Acceptable for short run indoor use

And FYI here's the cost breakdown of the items you received paid from your registration fee

Estimated Cost Per Attendee	
Item	\$ with HST
RG8x 2m lengths	5.65
PL259m connectors	9.93
Plato side cutters	2.75
Exacto knife & blades	2.68
1/2" heatshrink for PL259's	0.92
heatshrink for wire joints	1.26
solder	0.72
14 & 18 ga wire	1.57
Solder flux	3.24
Total	28.72

Power Loss vs. Attenuation



Attenuation (dB) Power Loss (%)

0	0
0.5	10.9
1.0	20.6
1.5	29.2
2.0	36.9
2.5	43.8
3	50
6	75
10	90

Power Loss vs. VSWR



<i>VSW</i>	<i>Power Reflected (Loss) (%)</i>
1:1	0
1.5:1	4
2:1	11
3:1	25
6:1	50

Attenuation vs. Frequency



Frequency MHz	Attenuation (dB per 30m)					
	RG174	RG8x	RG213	LMR400	LMR600	7/8" Heliax
10	3.3	0.9	0.7	0.4	0.2	0.11
30	5.5	1.5	1.2	0.7	0.4	0.19
50	6.6	2.3	1.6	0.9	0.5	0.25
144	10.8	4.6	2.8	1.5	0.9	0.43
220	13.0	6.0	3.5	1.8	1.1	0.53
450	19.2	8.6	5.1	2.7	1.6	0.77
900	27.0	12.8	7.4	3.8	2.3	1.12
1200		15.9	9.0	4.4	2.7	1.30
2400			13.7	6.7	3.7	1.70

Maximum Power vs. Frequency



Frequency MHz	Maximum Power					
	RG174	RG8x	RG214	LMR400	LMR600	7/8" Heliax
10	300	1000	3500	3300	6900	>15000
30	215	800	2750	3300	5510	13400
50	150	600	1700	2570	4240	10300
144	75	350	900	1470	2410	6000
220	55	300	600	1200	1970	5000
450	34	175	350	830	1350	3300
900	21	100	200	580	930	2300
1200	14	50	160	500	700	1900
2400	10	30	100	330	520	1300

So how much loss is acceptable?



RF power is expensive to make

RF receiver sensitivity loss is NOT recoverable unless pre-amps are used

- ▶ Each S-unit represents approximately 6dB

Complete RF path from transceiver to antenna...

- ▶ My rule of thumb...keep the loss less than 3dB and of course the lower the loss the better.

Crimp or Solder?



Soldering a PL259m to coax

- ▶ Why choose solder when crimp is available?
 - Today we'll use solder because this is a soldering course
 - You still have to connect the center conductor typically by soldering.
 - NB. Crimping requires less heat!

Solder Advantages

- ▶ Tooling is SIMPLE!
- ▶ Minimum tools and materials are used – solder & flux
- ▶ More tolerant of non-optimum technique

Solder Disadvantages

- ▶ Takes more time to terminate than other methods
- ▶ Risk of poor and cold solder joints
- ▶ Care must be taken to control the heat applied as to not distort the cable dielectric

Proper Cable Prep is a must



Every cable to connector is bit different

- ▶ Outer jacket to cable end strip length
- ▶ Amount of exposed shield
- ▶ Amount of exposed insulator
- ▶ Length of stripped center conductor



Assembling a PL259m-PL259m Jumper...



The first step is rather important

- ▶ Slip 3cm length of heat shrink, the PL259 coax shell, and the reducer over the end of the coax in this order

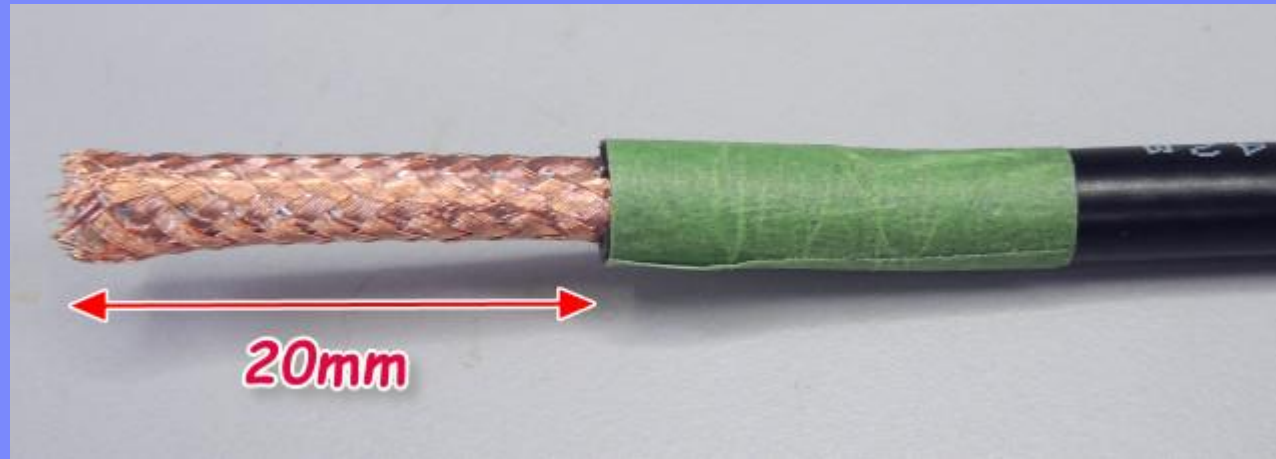


Assembling a PL259m-PL259m Jumper...



Step two

- ▶ Using the Exacto knife scribe a ring around the coax cable 20mm from the coax end and strip off the outer jacket.
- ▶ I often use a piece of masking tape as a guide especially on larger diameter cables to help achieve a clean 90 deg. cut

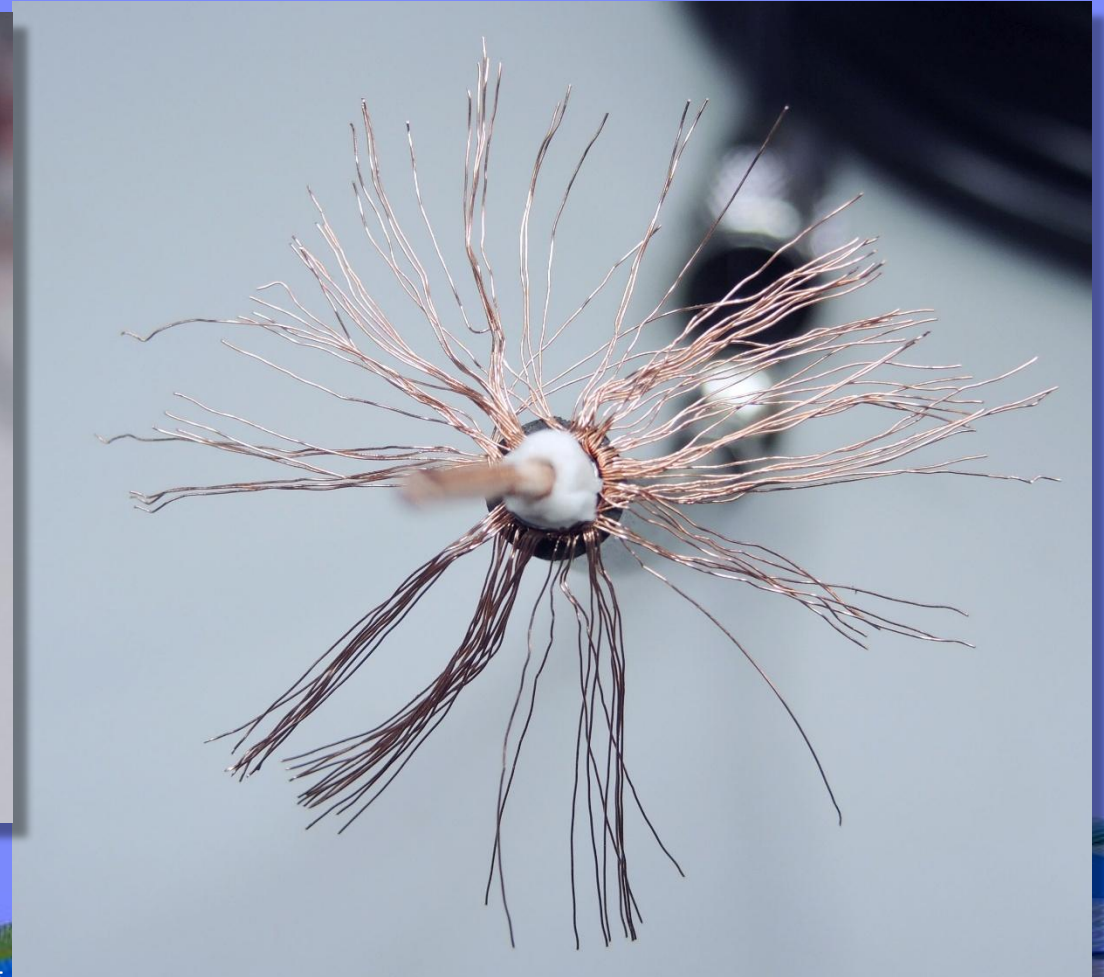
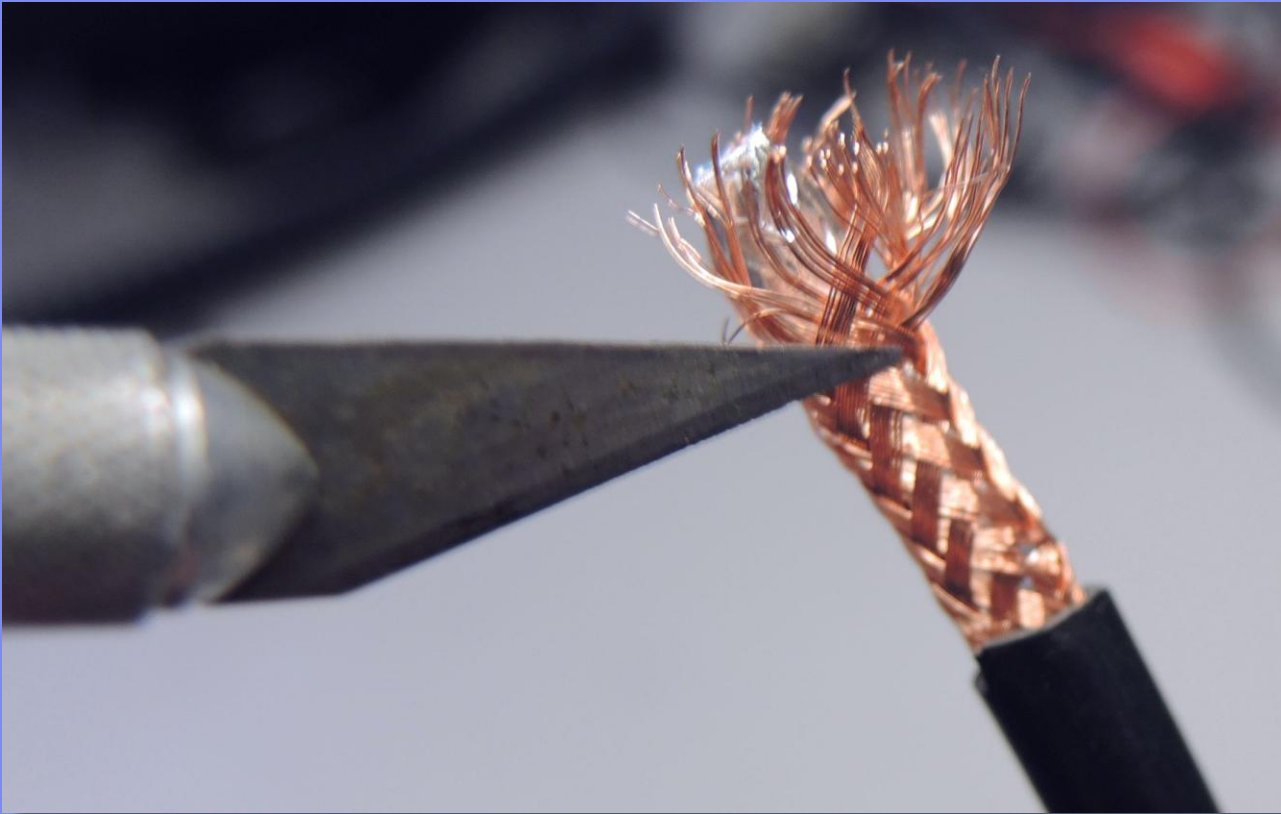


Assembling a PL259m-PL259m Jumper...



Step Three

- ▶ Separate the coax braid down to the outer jacket. Distribute the braid evenly around the cable

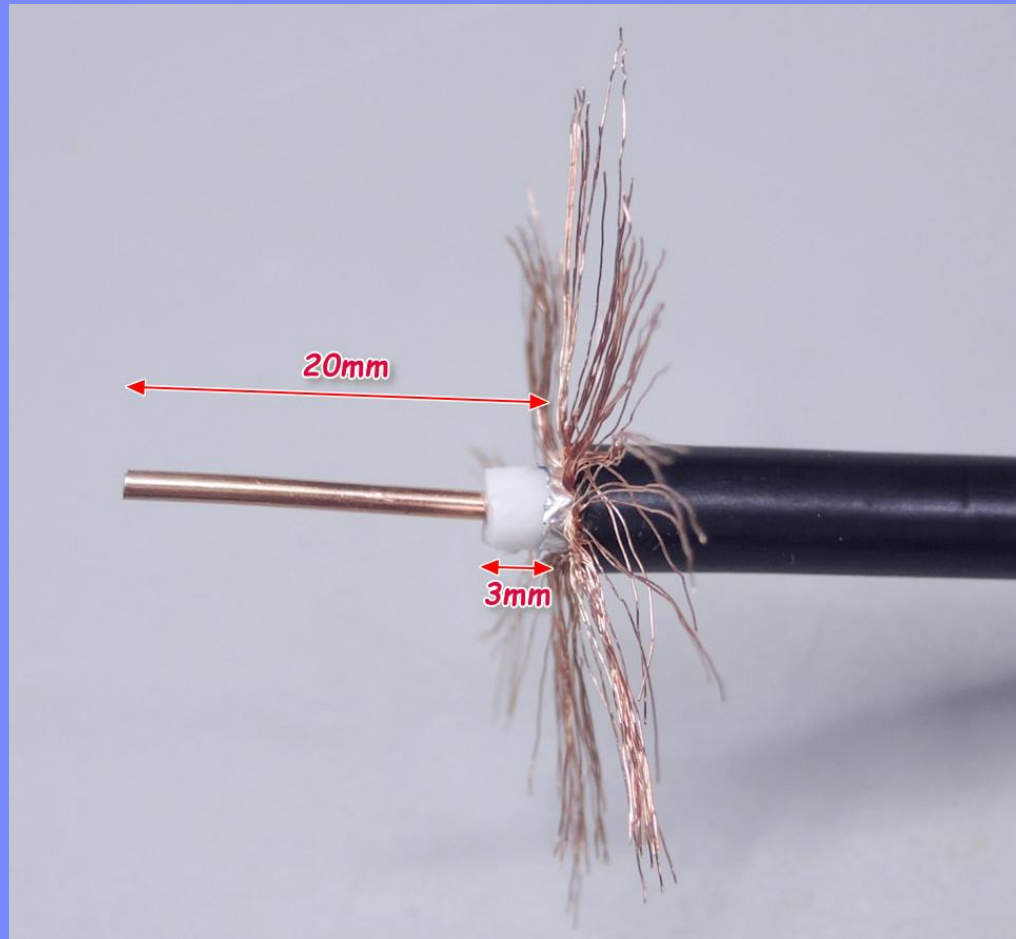


Assembling a PL259m-PL259m Jumper...



Step Four

- ▶ Strip the inner insulation layer from the center conductor leaving 3 to 5mm beyond the braid
- ▶ Remove the aluminum foil from the exposed 3mm section of inner insulator



Assembling a PL259m-PL259m Jumper...



Step Five

- ▶ Bring the reducer forward to the braid, fold the shield wires along the reducer and trim the shield wires so that they are just short of the reducer's thread.



Assembling a PL259m-PL259m Jumper...



Step Six

- ▶ Screw the PL259 inner shell onto the reducer

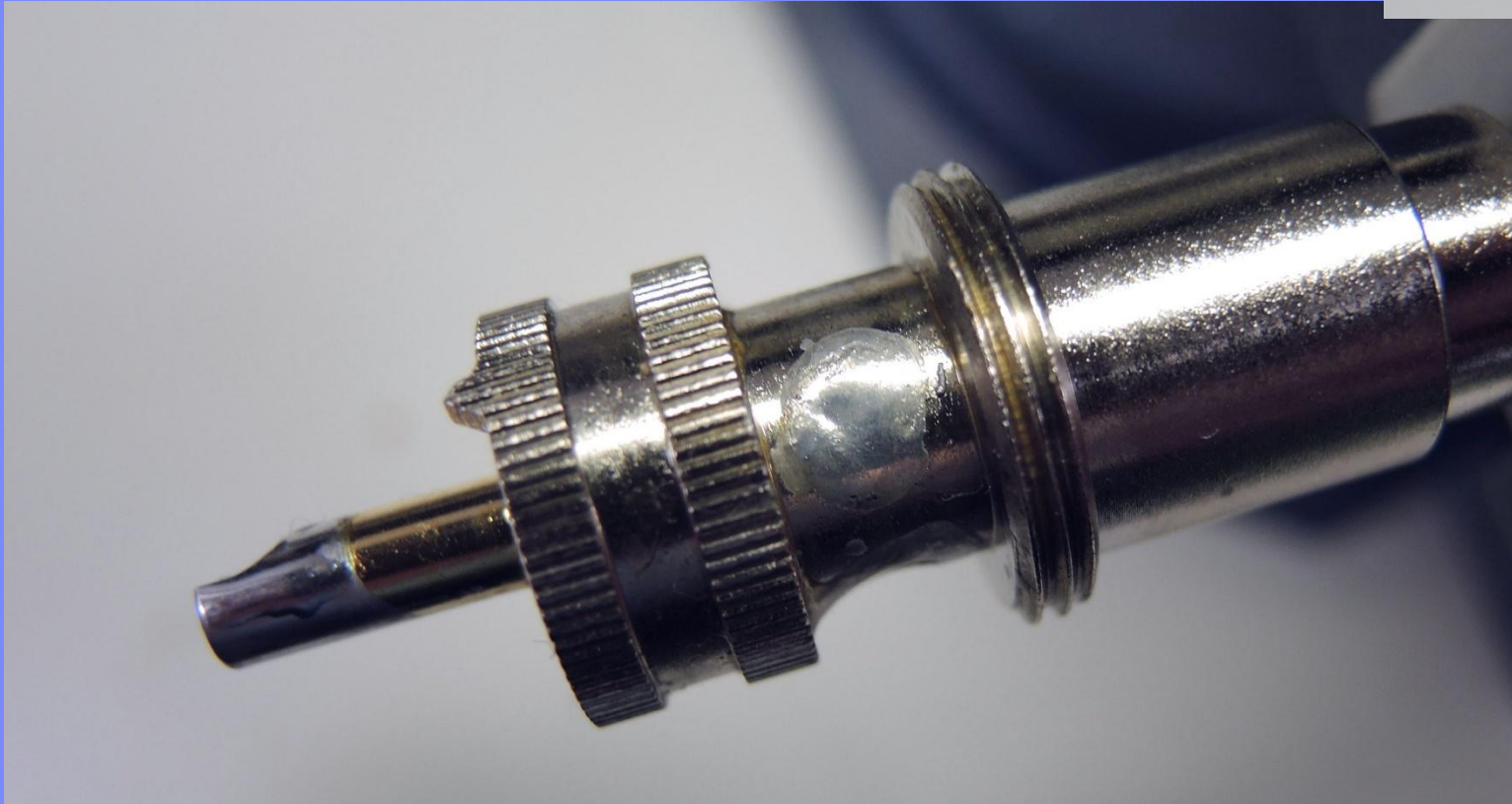


Assembling a PL259m-PL259m Jumper...



Step Seven

- ▶ Apply solder paste then solder the coax shield onto the reducer through each of the four holes. Apply enough heat to make sure the braid is well wetted with solder.



Assembling a PL259m-PL259m Jumper...



Step Eight

- ▶ Solder the coax center conductor to the PL259

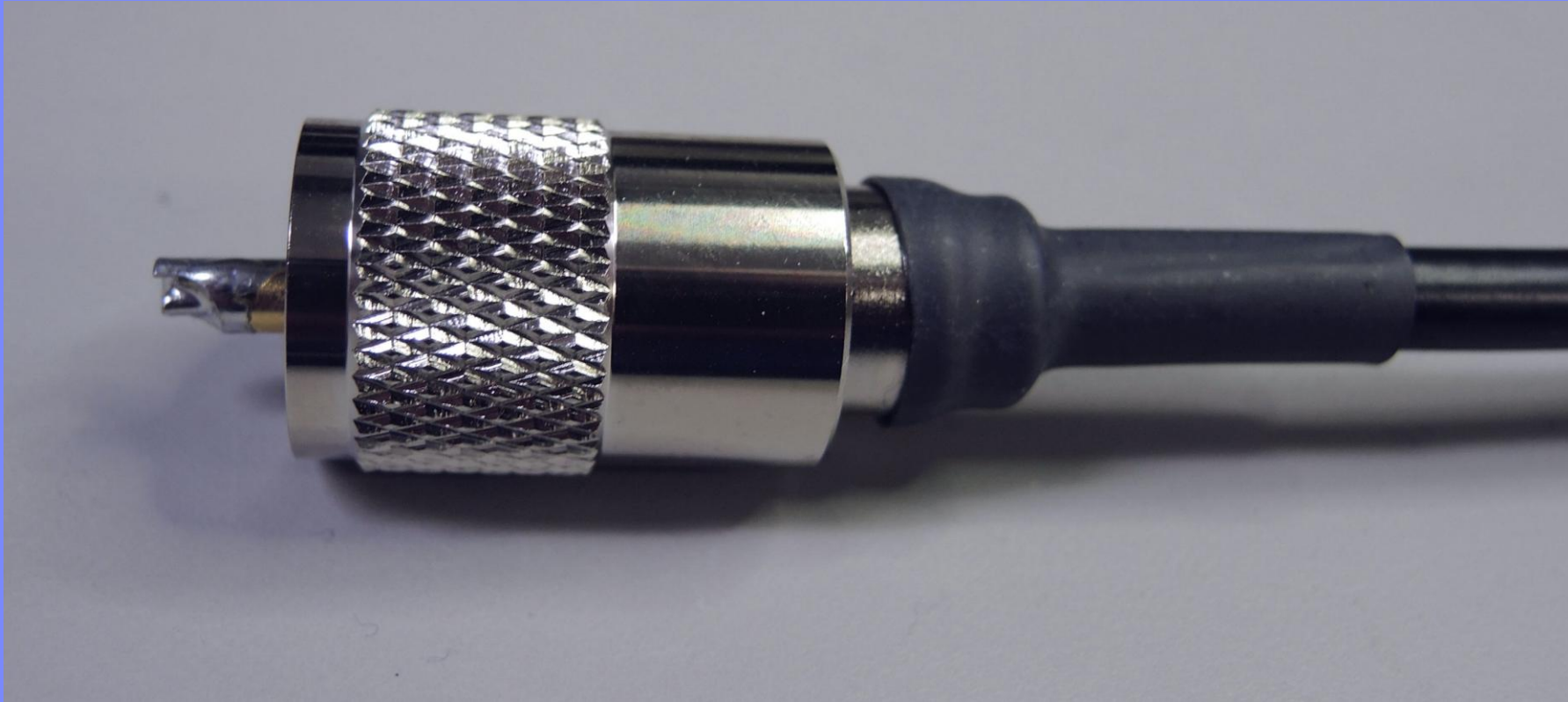


Assembling a PL259m-PL259m Jumper...



Step Nine

- ▶ Screw the PL259 outer shell over the inner shell and push it as far forward as it will go
- ▶ Bring the heat shrink forward so that it partially covers the reducer and apply heat to shrink it

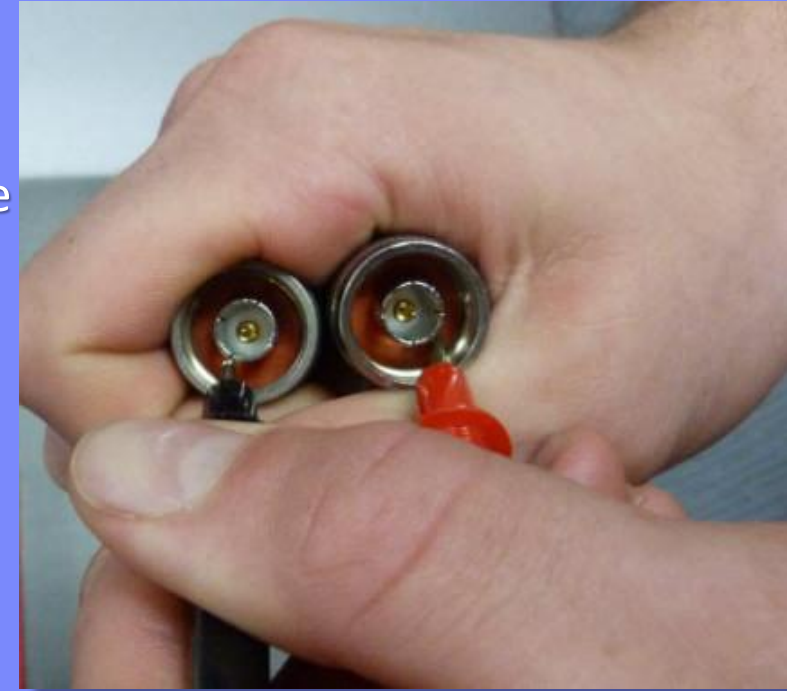


Assembling a PL259m-PL259m Jumper...



Last Steps

- ▶ Use a continuity checker make sure the PL259 inner and outer leads are not shorted together
- ▶ Repeat installing a PL259 on the other end of the jumper cable
- ▶ Do another continuity test this time...
 - Make sure the center conductor to shield is open
 - There is continuity between center pins at both ends of the cable
 - There is continuity between ground shield at both cable ends



Watherproofing your Jumper...

DX Engineering Video

- ▶ <https://www.youtube.com/watch?v=CcHiHCw0lsY>

