

## CONSTRUCTION DETAILS FOR ZS6BKW ANTENNA

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Summerland Amateur Radio Club, Australia 17 July 2015

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### PREAMBLE

This article details how I made a ZS6BKW multi-band antenna for a permanent home installation. The construction is designed to withstand severe winds and also provide a high level of protection from corrosion.

The antenna shown gives a low SWR over much of the amateur bands of 40, 20, 18, 12 and 10 metres. 80 and 15 metres are usable with a good trans-match, but a dedicated antenna would be much better for those bands.

This article is intended to supplement an article to be submitted for publication in the WIA magazine 'Amateur Radio'.

Some parts suppliers are mentioned in [green text](#). I have no connection with any of these companies.

### PARTS LIST

#### For the centre support:

[Plumbing from Eagles](#). [Stainless hardware from the Bolt Barn](#)

PVC pressure water pipe, class 18 (thickest), 40 or 50mm diameter.

2 x pipe caps

Clear pipe cement and primer (acetone or a commercial solvent)

3 x stainless steel eye bolts M5 (for 40mm pipe) or M6 (for 50mm pipe)

6 x flat washer s/s

3 x plain nut s/s

3 x nyloc (self-locking) nut s/s

3 x swage and s/s thimble to suit your wire size

1 short plastic shaft (see text)

Short length of self-amalgamating tape

Encapsulating material (Neoprene, polyurethane or epoxy) (do not use roof/gutter sealants)

[Bunnings usually stock tubes of Neoprene \(Parfix brand\)](#)

#### For the balun:

Parts to suit your preferred type of balun. I use ferrite sleeve ('choke') baluns, constructed with 25mm HP pipe, RG8-X coaxial cable [The Wireman \(US\)](#) and 8 of Amidon ferrite beads type FB-31-5621. [Direct from Amidon \(US\)](#). Available on order from [TTS Systems \(Aus\)](#) You could also use RG213 with the larger size 1024 beads.

A transformer type balun (windings on ferrite toroid) is an alternative, however I have not tried this. [The SARC shop has a few kits left for these baluns – toroid and wire only.](#)

#### Wire and feeder:

Wire, about 29 metres.

Feeder, about 13 metres. [Davis RF, via Amateur Radio Supplies \(US\)](#)  
[Andrew Communications](#) has 450 ohm line, I haven't seen it. You would need to check the velocity factor to determine the length required.

Extra short flexible wire pieces for the loops (see text).

2 x end insulator

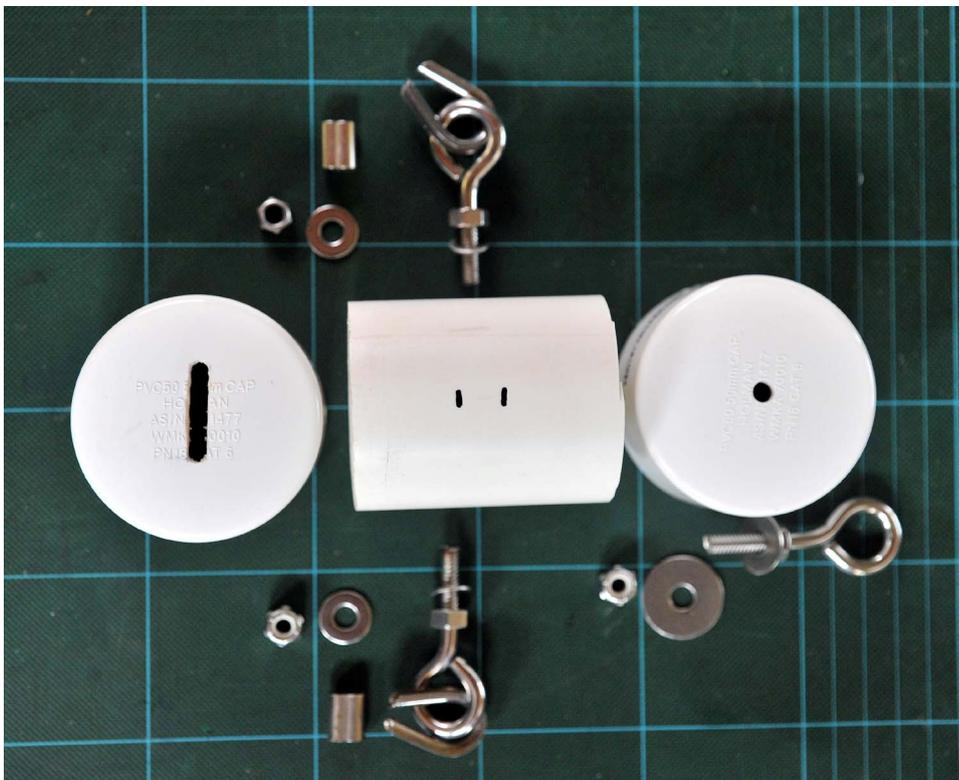
While any type of wire can be used for the dipole, I prefer to use wire that is low-stretch: hi-flex hi-tensile insulated wire as shown in the photos, or hard-drawn (stranded, if the antenna is to be used in the field). I started with 14.2 metres a side and trimmed back –note that this does NOT include the centre loops, it is the length from the thimble to the end insulator

The feeder could be any type of 440 or 450 ohm line parallel feedline. I highly recommend the type used in the antenna shown, which is approx. 30% stranded copper clad steel with 'window' insulation. It is very robust, reasonably flexible and easy to solder.

I started with 12.5m and trimmed back. However, the final length required is dependent on the velocity factor. The length is critical to getting the best multi-band performance. I managed to get it right first time, but if you are using a different line, the best idea would be to cut it long, and trim gradually while testing with an analyser before fitting the balun. Refer to my article in AR magazine about this.

## CONSTRUCTION

The photo below shows the parts of the centre support laid out for assembly.



Take one cap (top cap) and drill the hole for the top eye bolt.

Take the second cap and cut a slot for the ladder line,

Make the slot oversize, to accommodate a wrap of self-amalgamating tape as strain relief.

Measure and cut a short length of 40 or 50mm pipe, long enough so that when the caps are fitted to each end, there is 5 to 10mm pipe showing between the caps.

Insert an eye bolt into the top cap, with a washer and plain nut screwed fully on.

Mark where to cut off the excess length, allowing about 3 threads beyond the nut.

Cut the bolt with an angle grinder and fit it to the cap with a washer and nut on the outside and a washer and nyloc nut on the inside.

Cement the short piece of pipe into the top cap and allow it to set.

Drill two holes in the pipe for entry of the wire loops that will come from the thimbles. These should be on opposite sides, a few mm from the join to the top cap.

Drill the side holes for the eye bolts that will hold the thimbles, through the cap and pipe. Fit the outer washers and nuts to the bolts, right up to the end of the thread towards the eye. Temporarily insert into the housing and measure where to cut off, leaving about 3 turns of thread on the inside beyond the inner washer and nut. This is important to minimise the projection into the housing, to help prevent a short or spark-over. Fit the bolts securely. The inside flat washers may bend slightly to the curve of the housing. The eyes can be arranged either horizontal or vertical.

Fit the thimbles over the side eye bolts. They will need to be expanded slightly to do this, then squeezed back with pliers. Then take each dipole wire in turn, pass it through the swage around the thimble, back through the swage, around in a loop and into the side hole. Make the loop big enough to allow a slight excess on the inside.

With a swaging tool, clamp the swages onto the wires, as in the next photo.

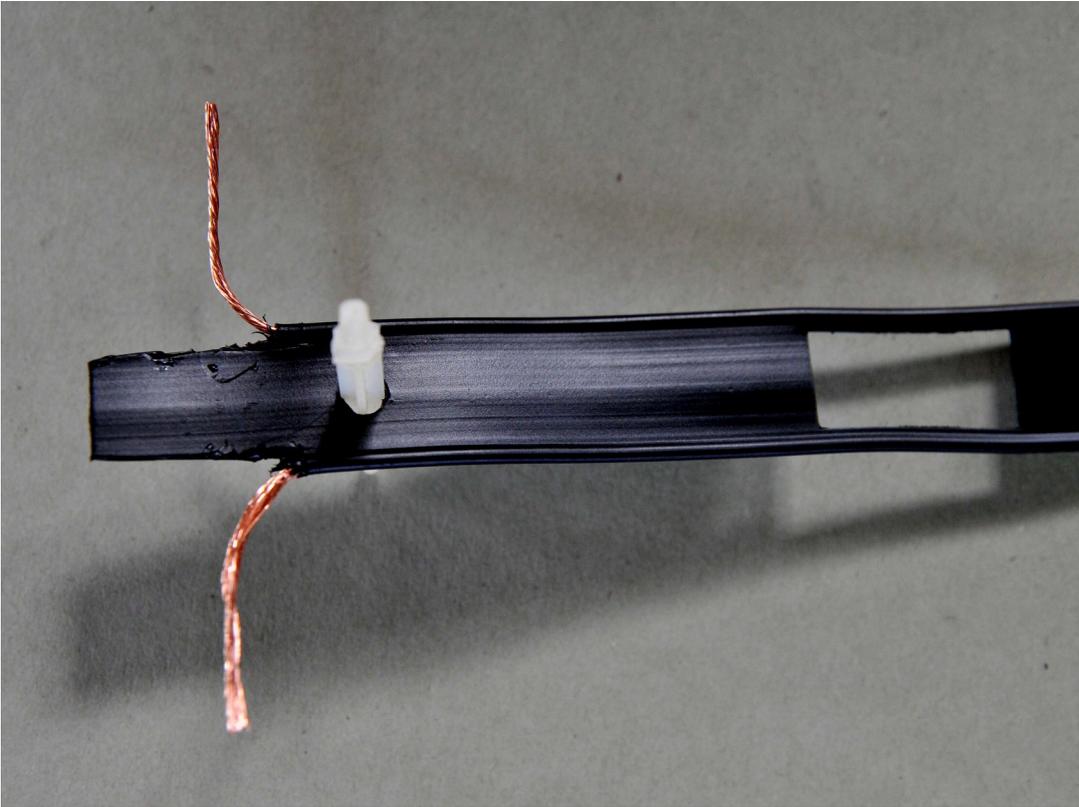


In the antenna shown above, I used 14 AWG insulated hi-flex wire from Davis RF.

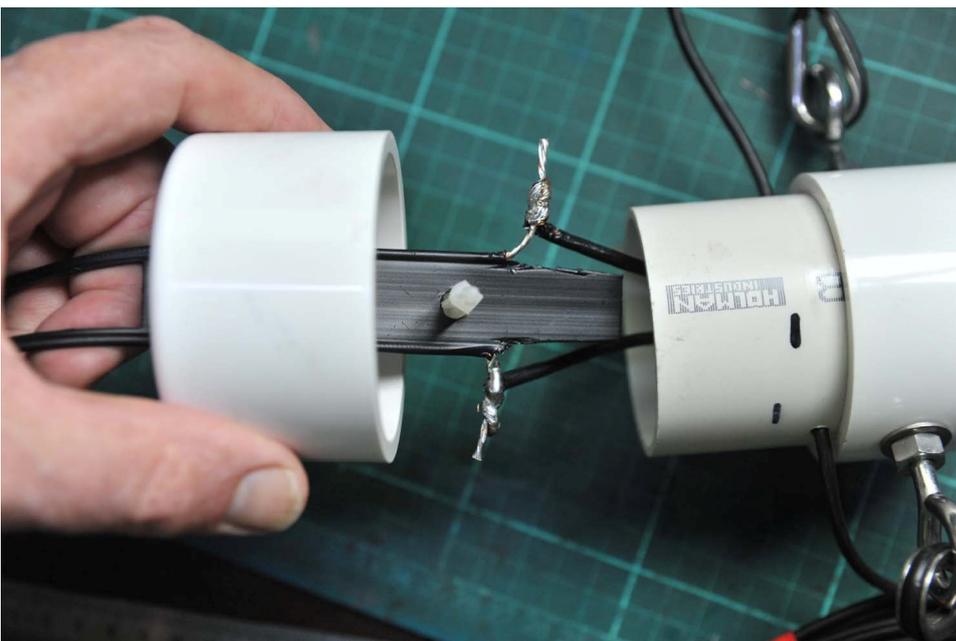
This meant that each loop and dipole wire could be all one length.

If however you use a fairly rigid wire for the dipole, you will need to make the loops separately using flexible wire, and solder them on to the dipole wires. It may also be feasible to feed them into the swage, but solder should still be used to ensure a reliable electrical connection.

Prepare the window line as shown in the next photo. It is important to cut and remove insulation such that there is a solid section where the line exits the housing, since the line is much stiffer here. The plastic shaft is inserted as a precaution, to prevent the line being pulled out of the housing under strain. For this I used a trimmed nylon pcb standoff.



Now push the loop wires into the housing, so that they come out of the pipe. Remove some insulation (if any), wrap the wires and the feeder together and solder them, as in the next photo.



Now fold the joined wires (to the left in the photo) and push them into the housing, while drawing the loop back out of the side holes. Ensure that there is good clearance between the wires and the internal metal parts. The assembly is now ready to be 'potted'.

If you have a two-pack epoxy, you can just fill up the housing to about 10mm short of the open end. Don't put the cap on yet. If using a tube of sealant, it will need to be done in stages, allowing each layer of sealant to cure before putting in more.

Now pull back the cap and wrap 2 layers of self-amalgamating tape around the part of the feeded that will pass through the slot in the cap. As in the next photo. Then add more filling and push on the cap, ensuring there is enough filling so that some squeezes out of the slot as you fit the cap. Clean off any excess.



The next step is to fit the balun at the other end.



This photo shows how it is constructed. Again, HP pipe and caps (25mm) are used. You might be able to get away with 20mm diameter, however you are limited by the width of the window line. The ferrite beads are prevented from moving by small cable ties at each end. The left (output) end is

wrapped in self-amalgamating tape to provide strain relief at the coax exit. The ends are potted with sealant, but not the ferrites.

The next picture shows the soldered coax to window line in more detail. Note the red wall plug inserted to prevent the window line from being pulled out of the balun. This could be any strong non-conductive material such as nylon or polypropylene. I coated the soldered wires with some 'liquid electrical tape' from [Jaycar](#) etc



The last photo shows my completed second antenna. Note how I have cable-tied the coax to the side of the balun to prevent strain on the point where it exits the balun.



That's about it. If it all seems like too much trouble, or you can't get the right materials, you can buy one ready made. See websites of [W8AMZ](#) and [Amateur Radio Supplies](#) (selling [Tango Golf](#) brand). There are some also on ebay, however the design does not look as the ones I have mentioned here.

Any advice needed? Feel free to email me [vk2acd@wia.org.au](mailto:vk2acd@wia.org.au)