

Build a 12/17 Meter Trap Dipole Phil Salas – AD5X

Introduction

Why a 12/17 meter rotatable dipole? Well, many folks have verticals for the lower bands, and multi-band dipoles or beams for 20-, 15-, and 10 meters. But often you don't have an antenna for the 17- and 12-meter bands. In my case I have a Hy-Gain AV-6160 43-foot vertical for 160-20 meters, and a Hy-Gain TH-1 rotatable dipole for 20/15/10/6 meters, as this dipole normally outperforms my vertical on the higher bands. So I wanted a self-supporting rotatable dipole for best performance on 12/17 meter as well.

Trap Capacitors

Trap components should have a reactance of about 150-250 ohms (rule of thumb), which means a capacitance value of about 43-26pf at my trap design frequency of 24.5 MHz. Because of the cost and difficulty in finding high voltage door-knob capacitors, I decided to build my own trap capacitors. I used 1.5" wide aluminum duct tape attached to the inside and outside of a piece of 1-1/4" PVC tubing (aluminum duct tape, available at any hardware store, is used to seal air conditioning duct-work). I chose a PVC tubing length of 1.8", which is slightly longer than the width of the aluminum tape.

I attached a 4.2" length of aluminum tape to the inside of the PVC pipe, and a 5.5" piece of aluminum tape wrapped around the outside of the PVC pipe. Next I attached two #4 stainless steel screws, lockwashers, nuts and solder lugs to my homebrew capacitor. I cut away the aluminum tape such that one screw only contacted the upper piece of tape, and one screw contacted the lower piece of tape. When I measured the resulting capacitance with my antenna analyzer, I found it to be 35pf. This was perfect! Photo A shows the two capacitors I built for the 12/17 meter dipole.



Photo A: Home-built Trap Capacitors



Photo B: Home-made caps vs doorknobs

Next I coated the capacitors with liquid electrical tape, also available at your local home improvement store. The liquid electrical tape does two things: First, it seals the aluminum tape in place. And second it improves voltage isolation around the edges of the tubing. Photo B shows one trap made with my homebrew capacitor alongside an

earlier trap I built using a standard doorknob capacitor. The red coating on the homebrew capacitor is the red liquid electrical tape I used.

Traps

Now that we have the 35pf trap capacitors, it is time to build the traps. A 12/17-meter trap antenna consists of a pair of traps resonant at or about 12-meters placed within a 17 meter dipole. The 12-meter traps look like open circuits at 12 meters, so the outer sections of the antenna are effectively disconnected making a resonant 12 meter dipole when operating on this band. On 17 meters the traps look inductive, effectively shortening the overall length of the antenna.

To build the traps, we'll parallel the 35pf home-made capacitors with home-made inductors to parallel-resonate the traps on 12-meter (~24.9 MHz). From The ARRL Handbook:

$$L = 1/[C(2\pi f)^2] = 1/[35 \times 10^{-12} (6.28 \times 24.9 \times 10^6)^2] = 1.1 \mu\text{H}$$

The following equation can be used to calculate the inductance of an air core inductor:

$$L = (d^2 * n^2) / (18d + 40l)$$

Where: L is inductance in micro-henrys, d is coil diameter in inches, l is coil length in inches, and n is number of turns. Again, this info is in The ARRL Handbook. Table 1 lists all the parts necessary for the traps and resulting antenna.

Table 1 – Parts List for a 12/17 Meter Trap Dipole

<u>Description</u>	<u>Source/Part number</u>	<u>Price ea.</u>
U-Bolt/Clamp Set	Radio Shack 15-826	\$5.49
8' x 1"OD fiberglass tube	Max-Gain Systems RT-1-8	\$10.00
3/4"OD x 6' AL tube (4-pieces)	Texas Towers	\$1.50/ft
5/8"OD x 6' AL tube (1 piece)	Texas Towers	\$1.30/ft
#6 solder lugs (14)	Mouser 534-7326	\$0.14 ea
6-foot #14 Insulated house Wire	Home Improvement Store	
#6x1.5" SS machine screw (4)	Home Improvement Store	
6-32 SS nuts (4)	Home Improvement Store	
#6 SS split lock-washers (12)	Home Improvement Store	
#6x1/2" SS sheet metal screw (8)	Home Improvement Store	

Max-Gain Systems: www.mgs4u.com (Pay \$0.50 to have the 8' tube cut in half)

Texas Towers: www.texastowers.com

Mouser: www.mouser.com

If you choose to build a wire version of this antenna, you can eliminate the aluminum tubes. The 8-foot fiberglass tube length is oversize, so pay 50-cents to have Max-Gain Systems cut the fiberglass tube in half to keep your shipping charges reasonable. Using

the 1"OD fiberglass rod as the coil form, a 9-turn coil over 1.5" of length gives the required inductance. See Figure 1 and Photo C for the trap details.

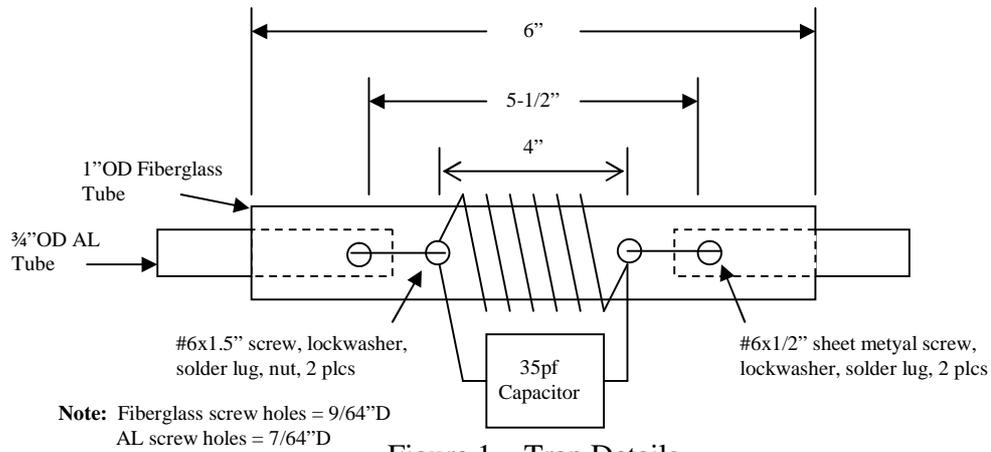


Figure 1 – Trap Details

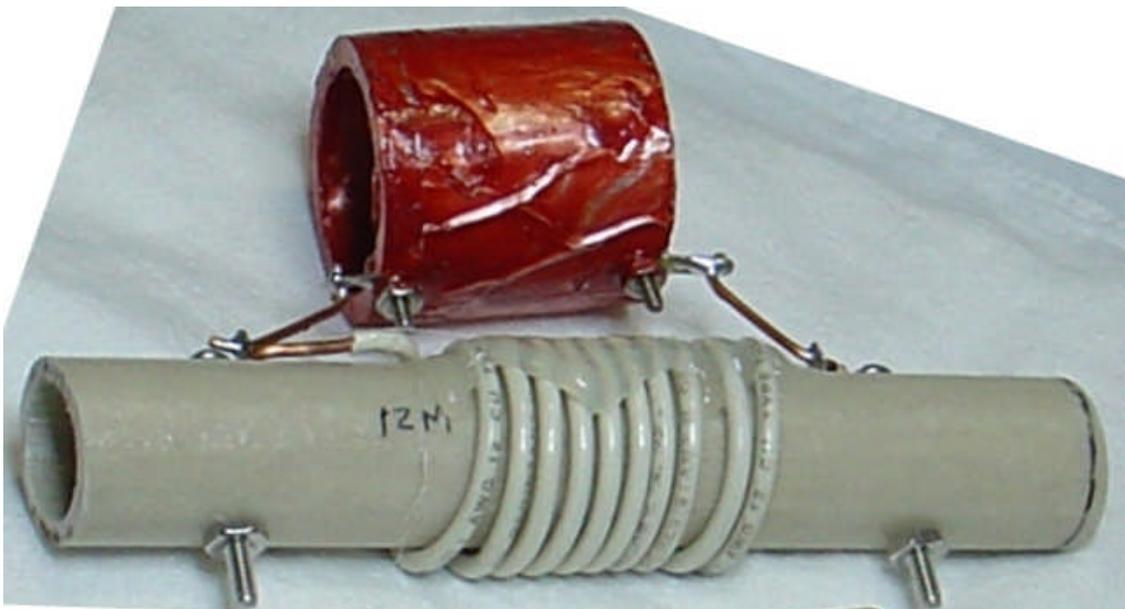


Photo C: The home-brew 12-meter trap

Next we must resonate the traps where we want them to be. For minimum trap loss, W8JI (www.w8ji.com) and others have shown that you should resonate the traps slightly out-of-band so I picked 24.5 MHz for my resonant trap frequency. The resonant frequency is not that important – more important is that both traps are resonant close to the same frequency. Trap resonance is measured with no aluminum tubing connected.

I used a grid dip oscillator (GDO) to check and adjust trap frequency. This involves holding the GDO coil close to the trap and tuning the GDO for a “dip” in the meter

reading. The GDO analog frequency read-out is probably inaccurate, so check the GDO frequency by listening to the GDO on a receiver and note any frequency offset.

When I was a kid back in the 60's it seemed that everyone made GDOs – Heathkit, Knightkit, Lafayette Radio, Eico, and probably a dozen other manufacturers. Today, the only new GDO I could find was the MFJ-201 (see Photo D). For older GDOs, a good source would probably be through an on-line auction site. However, you can also use an antenna analyzer to find resonant frequency by opening one end of the tuned circuit (turning it into a series-resonant circuit) and connecting the open ends across your antenna analyzer. Tune the analyzer until you see a very low impedance, which indicates series resonance. Not as convenient as using a GDO, but just as effective.



Photo D: The MFJ-201 Grid-Dip Oscillator

To adjust the resonant frequency, compress or expand the inductor windings until the resonant frequency of both traps are relatively close to each other (preferably within 200kHz). Once this is done use hot glue, epoxy or liquid electrical tape to hold the coil turns in place.

Building the 12/17 Meter Trap Dipole

Now that we have a pair of 12-meter traps using the home-built capacitors and a pair of home-built coils, we'll complete the project by incorporating everything into a 12/17 meter trap dipole.

Caution: When working with the fiberglass tubes, use gloves and goggles to protect your skin and eyes from the little fiberglass glass shards.

The first task is to build the dipole fiberglass center insulator which is detailed in Figure 2. I used #6 sheet metal screws to firmly attach the aluminum elements and the coax feed to the center insulator. Figure 3 shows the individual element construction. My inner 12-meter element came in almost 2-feet shorter than the calculated length ($234/\text{Freq}$) do to the trap loading, and the overall length is 6.6-feet shorter than calculated, again due to the inductive loading of the traps on this band. Photo E shows the dipole up and ready for operation, and Photo F is a close-up of the trap. At this point, you should use an SWR analyzer (preferably) or SWR meter to make any element length adjustments to center up the SWR in each band. Adjust both sides of the antenna by the same amounts. The inner 12-meter elements are easily adjusted with the hose clamps. For the outer element, I placed the 5/8"OD tubing in the 3/4"OD tubing and slid it for best SWR on 17 meters. Then I marked the tubing with a black marker pen, took the antenna down, and drilled #6 holes as shown to attach this element in place. Finally, a balun should be used at the feedpoint as this is a balanced antenna. As you can see in Photo G, I used a 6-turn coax balun. The balun interfaces to the dipole via solder lugs on the ends of the stripped coax cable. Make sure you weatherproof this end of the coax. Liquid Electrical Tape™ from your local home improvement store works great.

How do these traps work? Perfectly! Now I don't know what the ultimate breakdown voltage rating of these capacitors is, but there are no problems when using my 600 watt ALS-600 amplifier with the 12/17 meter dipole. However, I can't guarantee that the capacitors won't break down under full legal limit.

Other ideas: As discussed earlier, you can build a wire trap dipole. Or if you wish a more robust antenna, use 1.125"OD/1.0"ID aluminum tubing for the inner element. Or use PVC tubing for the center insulator and trap forms. Experiment! Antennas are very forgiving, and you can become personally well known by the employees at your local home improvement store.

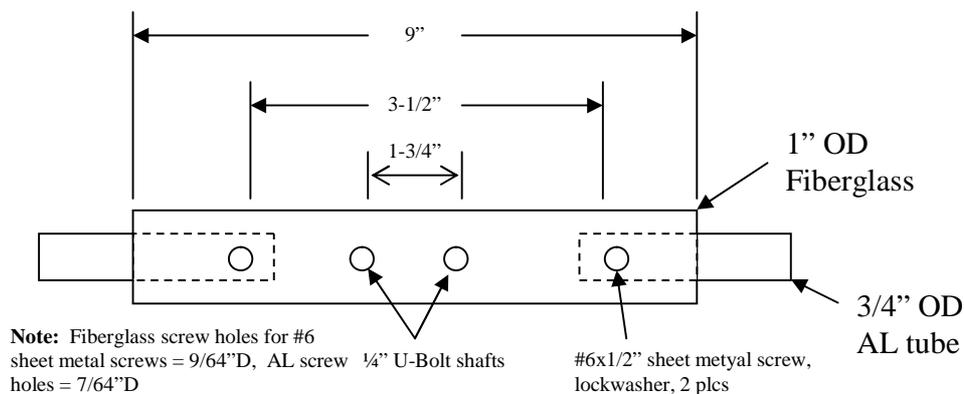
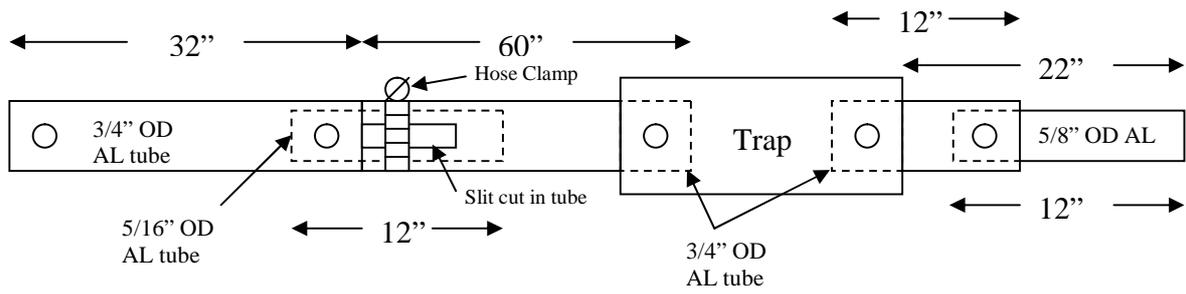


Figure 2 – Center Insulator Details



Note: All holes shown are for #6 sheet metal screws. Use 9/64"D clearance holes in fiberglass, 7/64"D clearance holes in AL tubing.

Figure 3 – Each Element



Photo E: Completed 17/12M trap dipole



Photo F: Close up of the home-made trap



Photo G: 6T, 5"D Balun