General

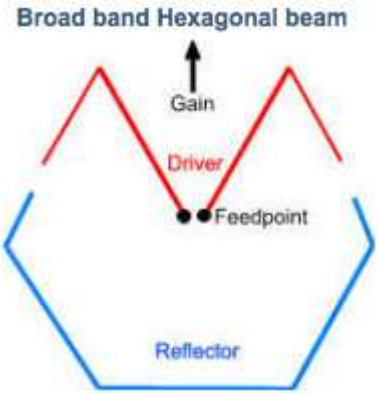
hex-beam.com/description/

 This site features the G3TXQ broad band hex beam R.F. antenna for the six amateur radio bands, 20, 17, 15, 12, 10 and 6 meters. It is featured in the March 2009 edition of QST magazine and is a significant improvement over the classic Hex-Beam design.

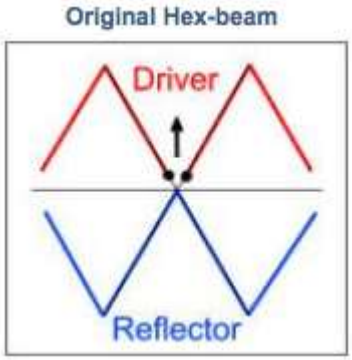
- The hex beam offers a number of features;
- Gain and front/back comparable to a two element full size Yagi beam
- Six bands with low SWR without a tuner
- Broadband characteristics
- Low weight and low wind load making possible an economical support structure
- Construction from general hardware components
- Ease of adjustment

A Bit of History

The original HEX-BEAM was developed by Mike Traffic, N1HXA, in the early nineties. Mike says his design was inspired by the snowflake. He spent much time in testing and analysis of the antenna and developed the nesting concept that uses an inverted umbrella frame to allow multi band operation. Mike invented many of the unique fixtures and components that became a byword among HEX-BEAM owners and after much experimentation introduced the antenna commercially under the trademark, HEX-BEAM. It was reviewed in both CQ and QST magazines and soon earned a reputation for being a pileup buster among its owners. For a number of years it was the only commercially available hexagonal beam. Eventually, home brewers began building the “hex beam” and for years, web sites maintained by W1GQL and DL7IO were the intellectual source for those who wanted a classic “hex beam” but preferred to build it themselves. The Traffie beam is no longer offered commercially but there are a lot of Hexbeam aficionados and the beam was quite well made so it will be heard on the air for some time. Many homebrew versions of the original Hexbeam are in service today.



The G3TXQ Broadband hexagonal beam is slightly larger but easier to build and actually performs better.



The original Hexbeam was built by Traffie Technologies

This original design is a good antenna and owners of the HEX-BEAM are quite vocal about its performance as were builders of the homebrew version. I used to be one of the homebrew builders and was so enthusiastic that I published a set of guidelines like these to help others build one. But, things have progressed a little and thanks to the exhaustive work of Steve Hunt, G3TXQ (sk)*, a slightly different configuration of the hex beam has been discovered. Viewed from above the wires for a single bander look like the sketch to the right.

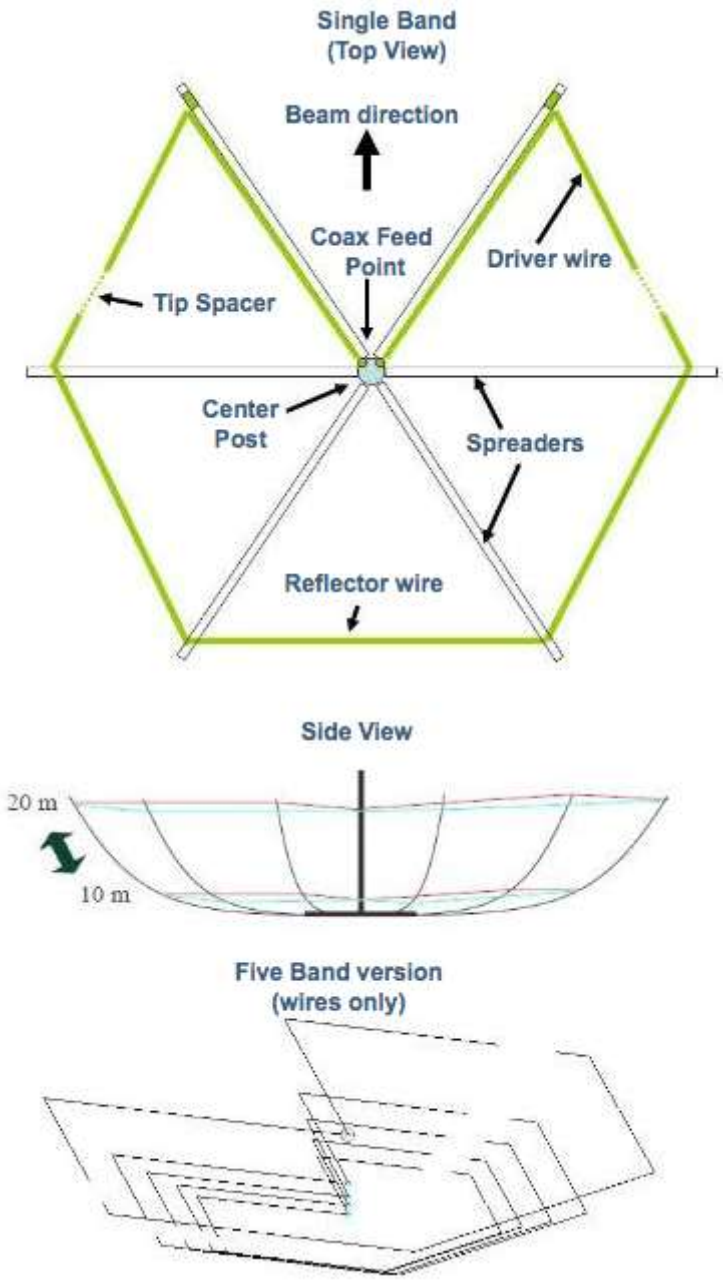
Which one is better? Well, owners of the original HEX-BEAM are very loyal. But now, all of the companies both here and abroad who are selling hex beams are selling only the new broad band hex beam and homebrewers are all building that version of the hex beam instead of the original classic version. The new version is much easier to build and adjust than the original classic version. And it has a broader frequency response than the original version. The only disadvantage is that the new broadband version is 22 ft in diameter vs 19 ft for the original Hex beam.

For a more full understanding of the technical parameters of the G3TXQ broad band hex beam, visit the web site of Steve Hunt, the inventor of the broadband beam. If you feel you would rather not get into building your own G3TXQ broad band hex beam, I can build one for you.See the details here.

*Steve Hunt fought a long battle with cancer but continued to provide support and advice to anyone interested in the hex beam, before expiring in December 2018. Steve's son, Jonathan, at the request of many hex beam fans, continues to maintain the site Steve established and it is frequently referenced in discussions about the hex beam. Steve was a true Christian.

Description

hex-beam.com/overall/



G3TXQ Broadband Hexagonal Beam Sketches

The G3TXQ broad band hex beam for 6 – 20 meters is constructed of six fiberglass arms and 14 or 16 gauge stranded copper wire. The center post is made of PVC water pipe. The beam is fed at the top of the center post with 50 ohm coax and weighs about 25 pounds. The hex beam consists of two elements for each band. The driven element is in the shape of an “M” and the reflector element is wrapped around the four spreaders to the rear of the driver wires. The elements are made of wire instead of tubes used by most yagi antennas. Therefore there is a need for a supporting structure. The supporting structure consists of six flexible fiberglass arms attached to a base. The arms are as shown and thus the name hex beam.

The antenna elements are held in place by the base/tube structure, the wires and kevlar/dacron cords. All bands of the antenna are fed by a single coax cable.

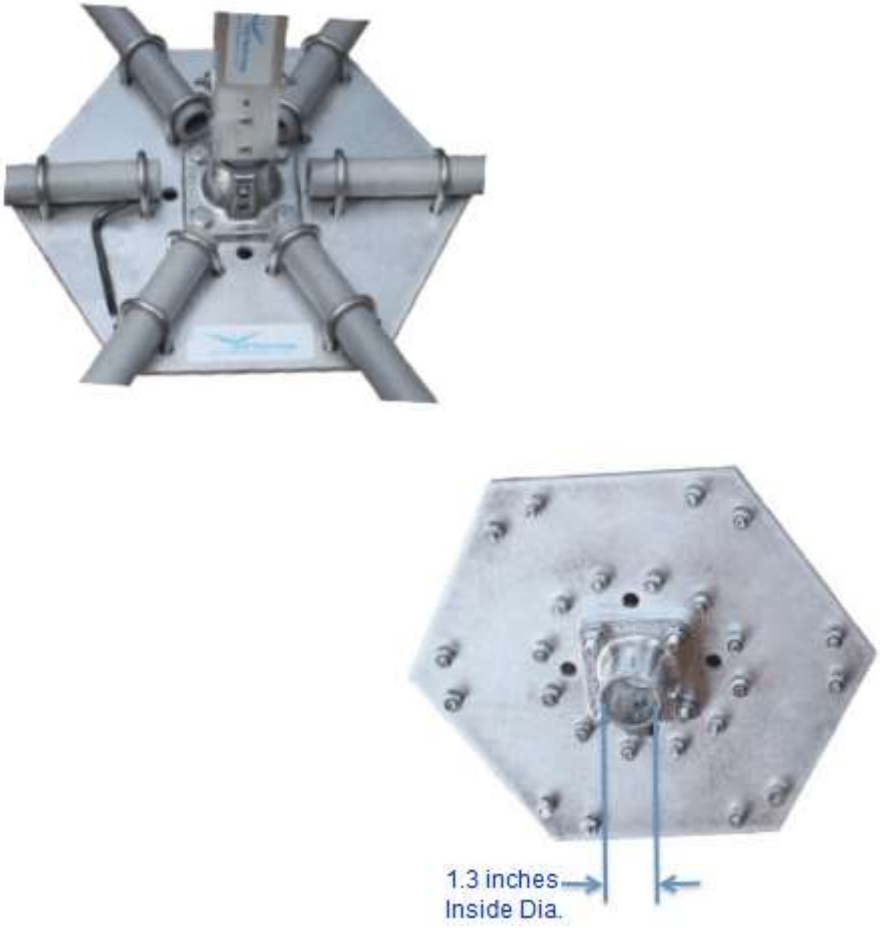
To the right are sketches of how the G3TXQ broad band hex beam is configured for a single band. A sketch of the wires of a five band hexagonal beam is also shown to the right.

In late 2007 Steve Hunt, G3TXQ, conducted extensive testing and modeling of many variations of the classic hex beam seeking to overcome its narrow banded deficiency without sacrificing the simplicity and small size. The design featured in this G3TXQ broad band hex beam is the result of his efforts in this regard. It has a turn radius of 11 ft but has a significantly broader frequency response than the original hex beam, is easier to build and easier to adjust and tune. A full explanation of the design is available on Steve’s web site. An overall comparison of the new broad band design and the classic design is also available there.

The guidelines presented here are based on my own construction of the G3TXQ broad band hex beam in several iterations beginning with the version documented in my QST article of March 2009. We began offering the hex beam for sale in 2009 and it has been improved substantially over the QST version. These guidelines reflect some of those improvements.

Base plate

hex-beam.com/base-plate/



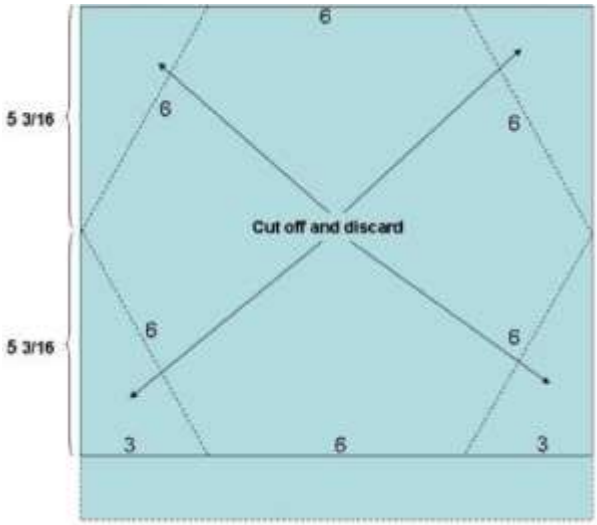
Base plate bottom with flange that slips onto the mast.

General

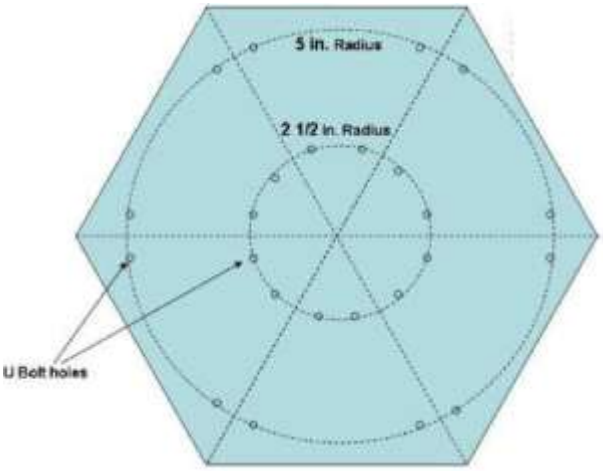
The base plate is the foundation of the hex beam serving as the mounting point for spreader arms, center post and attachment of the beam to the mast. As such, strength and stability are of the utmost importance.

This base plate is cut from a 12 inch square piece of T6-6061 aluminum plate 3/16 inch thick. This type aluminum is quite tough and unlikely to bend. Two U bolts are installed for each of the six spreader arms. Two square base floor flanges are mated on the top and bottom of the base plate; the top for mounting the center post and the bottom for attaching the beam to a mast. The inside diameter of each of the flanges is 1.31 inches, a standard size for one inch pipe. This is close enough for most push up masts also on the bottom and for one inch pvc used to build the center post. Unused holes shown in the photo at left are for mounting a larger flange on the bottom for use with a mast greater in size than the push up mast.

The U bolts and mounting hardware should be stainless steel for resistance to corrosion although less expensive zinc hardware can be used and will still last for years in most environments.



1. Measure and cut



The plate can be cut with a hack saw, a chop saw or even a skill saw with the appropriate metal cutting blade. The holes can be drilled with a drill press if available and with a hand drill if necessary. Use the measurements on the sketches here for this. After drilling the holes for the U bolts you can place the flange in the middle and mark the holes for mounting the flanges. The flanges are on opposite sides of the plate so the same four holes can be used for both. Since the flanges are a good fit for only a 1.3 inch O.D. pipe, you can consider use of the arrangements we now use on the commercial version. See it here and you can buy the parts here.

You can download a template of the plate (courtesy of KE8KMX) that can be printed on tabloid sized paper (10 X 17) at Fedex. This template can be used to mark the aluminum plate for cutting and drilling without having to do measurements.

2. Install U bolts and flanges

Use lock washers for all the hardware fittings as the wind will be doing all it can to disassemble your hex beam.

Comments

Some feel that a reinforcing collar should be slipped over the spreader arms where the U bolts clamp them to avoid damage to the tubes and provide greater strength. Actually, this is unnecessary; in a disaster the spreader arm breakage always occurs right at the edge of the base plate so the reinforcing collars add no additional protection. Moreover, the U bolts will crush the fiberglass tubes only if excessive tightening is applied.

If you would prefer to avoid all ordering of aluminum, flanges, hardware and U bolts, the measuring, cutting and drilling, you can buy a complete base plate already built with all stainless steel components at KIO Technology. The bottom fastening arrangement is a bracket and U bolts which fits the standard push up mast of 1.25 inches O.D. Optionally, a universal clamp arrangement is available which fits all sizes 1.25 – 2.25 inches O.D.

Spreader Arms

hex-beam.com/spreader-arms/

General

The six spreader arms are made of three telescoping tubes each, with each tube 48 inches long. The thinnest tube is 1/2 inch in diameter and slips into the next size which is 3/4 inches and it, in turn, slips into the largest size which is one inch. The largest size slips under the U bolts of the base plate where it is secured. The two telescoping sections have a hose clamp installed four inches from the telescoping end to prevent it from sliding all the way in. The assembled spreader arms are bent upward by the radial support cords that extend from the outer end to the top of the center post. This tension keeps the spreader arm assembled and tight without the use of pins, glue or other fasteners. By this means, the beam can be easily disassembled if necessary by simply unhooking the radial support cords.

1. Paint the spreader arms

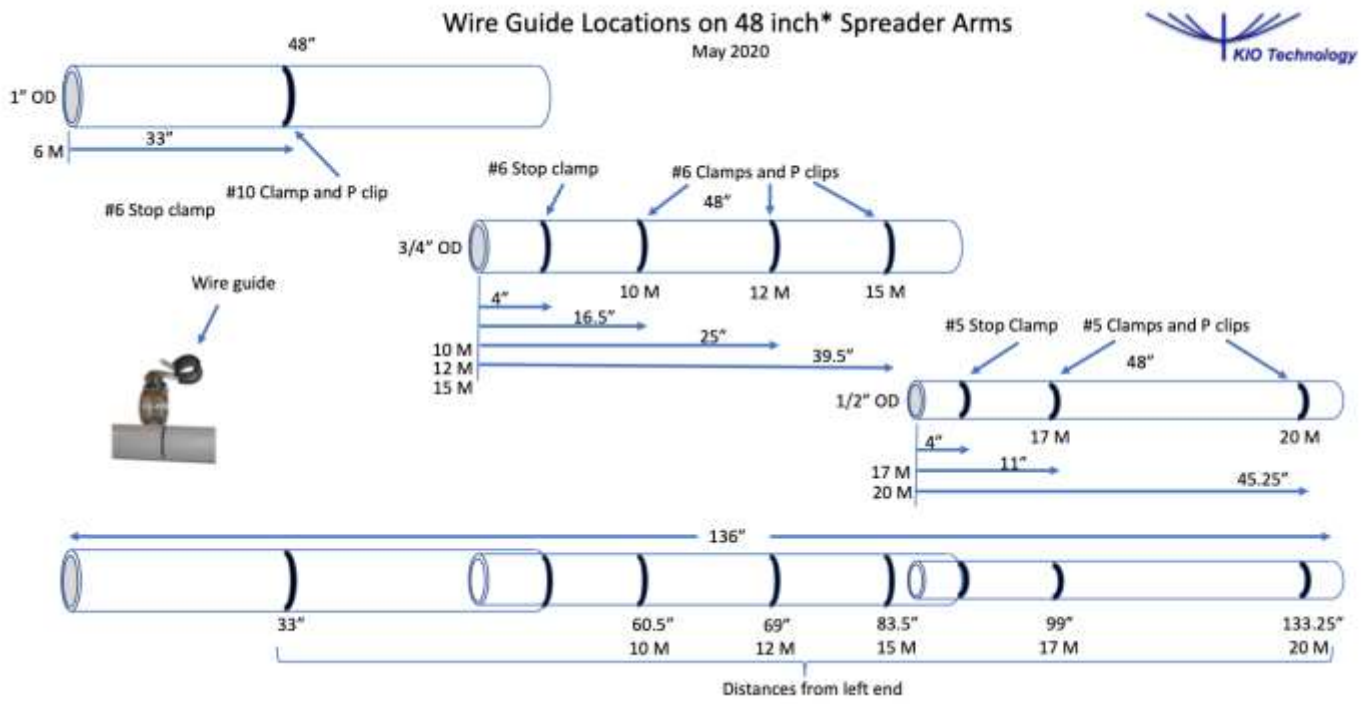
The fiberglass tubes should be painted to protect them from UV deterioration. Otherwise, in a few short years, you can expect flaking of the outer surface of the fiberglass tubes. Elaborate painting techniques are fine if you want to spend the time but a simple coat of exterior latex of your color choice will last years. This can also be helpful in reducing visibility of the beam. Spray it on or use a brush.

2. Mark the spreader arms for the clips and stop clamps

After they are dry, measure and mark the spreader arms using the lengths below. A good way to do this is to lay the six thickest size spreader sections side by side and measure them for the marks shown. Do the same for the six medium thickness spreader sections and the six thinnest sections as well. Use a felt tip marker for this; tape might pull the paint off.

3. Install the clips and clamps

Each wire attachment consist of a stainless steel hose clamp that holds a loom clamp in place. These and the stop clamps should be installed at the locations shown on the sketch below. On the thick sections, use #10 size hose clamps, on the medium spreader sections, use #6 hose clamps and on the smallest sections, use #5 hose clamps. These sizes might be found at Lowes or Home Depot but are not likely to be stainless steel.



Comments

The locations on the chart above apply to #14 ga pvc insulated wire. If bare wire is used instead, the wire sets will be longer and therefore the clip locations must be moved out further. The bare wire sets are 2% longer than the insulated wire sets so, for example, the clip for the 20 meter wire should be moved out 2% from 45 1/4 to 46 inches. Apply the same approach to the other wire P clips. Bear in mind that these are only preliminary clip locations and when the beam is installed, minor adjustments might be needed to get the wire tensioned right. This adjustment will be explained in Step 6.

Many have tried using pvc plumbing pipe for spreader arms but pvc is too heavy and not rigid enough to work well. Fiberglass is far superior.

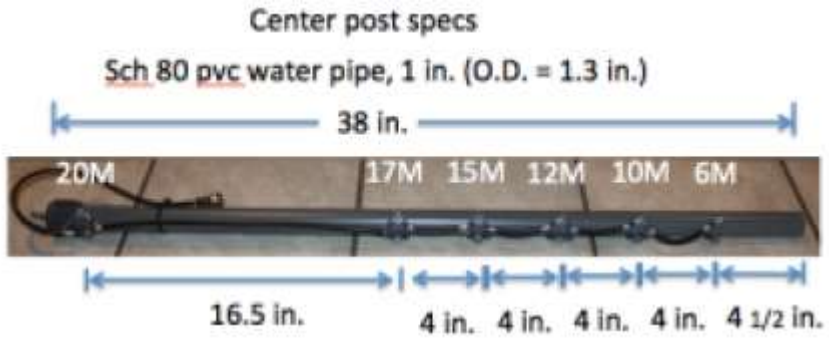
Center post

hex-beam.com/center-post-2/

General

The center post of the beam is seated in the baseplate flange and serves two functions. First, it serves as a terminal for all the driver wires to be fed by the coaxial cable and secondly, it provides an anchor point at the top for all the radial support cords that bow the spreader arms into the inverted umbrella shape. You can save yourself the trouble by buying an air coaxial, all aluminum/stainless steel center post here.

The center post should reflect a characteristic impedance as close to 50 ohms as possible as that is the impedance of the coaxial feed cable and it is close to the radiation resistance of the tuned wire sets. There are a number of devices used for the center post by commercial hex beam makers but most, though simple, are nevertheless a bit complicated to build. As a result, many home brewers use a pvc pipe with exterior coaxial sections connecting the wire terminals. This actually works quite as well as the commercial center posts but has the vulnerability of water contamination if not sealed. Coaxial cable, when contaminated with moisture, changes its characteristic impedance and no longer provides the good match that optimizes power transfer to and from the antenna wire sets.



1. Measure, mark and drill

Measure two longitudinal marks along the length of a 38 inch piece of 1 inch schedule 80 pvc pipe and then measure off marks for the wire terminals following the sketch above. Drill holes through the wall of the pipe for each of the two terminals for each of the six bands. Use a 7/32 inch drill bit for the holes.

2. Install terminal bolts

Using a piece of stiff wire, insert the bolts with external toothed washers from the inside of the pipe through the holes and install another toothed washer and a nut.

This  technique looks difficult but actually is quite easy. Tighten the nut after pushing the stiff wire forward to remove it from the bolt. Repeat for all the terminals.

3. Make terminal interconnections

Using RG8X coax cable, cut a piece to connect two adjacent terminals as shown. Solder ring terminals on each end of the piece. Install it on the center post. When you are sure it fits, remove it and apply a generous coat of liquid tape to seal up the braid and center connection to prevent ingress of rain water. This is very important as water

contamination of the coax braid will alter its electrical characteristics and degrade the beam SWR performance. Repeat this process for all the links between the terminals. When all links are dry, install them on the terminals using a toothed washer and nut on each. Make sure the braid is on the same side of all terminals.

4. Make center post pigtail

Cut a piece of RG8X coax cable about a foot long, solder ring terminals on one end and a PL259 connector on the other end. Apply the liquid tape on the exposed end of the pigtail

to seal it against ingress of rain water. When dry, Install the pigtail.

5. Make the cap

Drill a 7/32 inch hole in the top of the pvc cap and install a one inch eye bolt using toothed washers. Install the cap and drill a small hole through the side of the cap into the side of the post for installing a 3/4 inch metal screw to secure the cap against violent wind conditions.

Comments

Some have suggested use of parallel wire links between the terminals as an easier way to interconnect them and avoid the water contamination issue. This is not a good idea because it is nearly impossible to achieve a low impedance in these links without using 50 ohm coax. Others have tried to install the coax inside the center post for water protection. This is a nice idea but also nearly impossible to achieve. The commercial hexagonal beams all use different techniques than the one described here. But they require considerable manufacturing finesse and skill that can be avoided by the simple method here.

The RG8X coax recommended


here is much easier to work with than the larger 1/2 inch coax such as RG8 or RG213. This coax will handle 500 watts easily and unless you are going to use higher power there is no need for the heavier cable.

The liquid tape here should be liberally applied on your exposed coax cable links to seal the coax from moisture con

Wire sets

hex-beam.com/wire-sets/

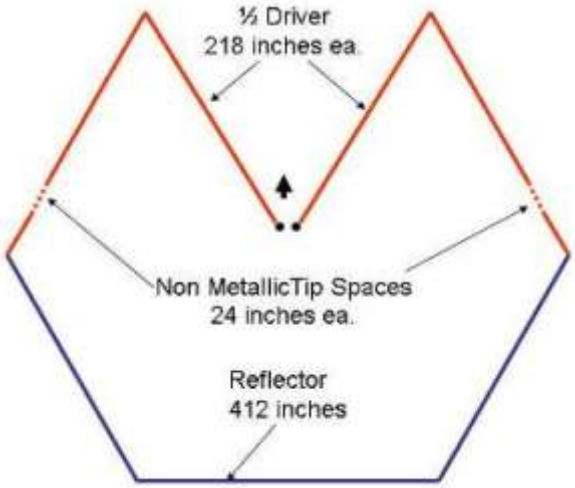
Assembled wire set with the reflector coiled in the middle and the two half driver wires coiled on the ends.

General

The wires of course, are the reason for the existence of all the other components. **The wires ARE the antenna.** On a hex beam, there are two wire elements for each band and these operate exactly like a two element beam for each band. The big difference is that the wires are scrunched up to take up less space and the frame of the hex beam is designed to achieve this odd configuration of the wires. You can buy already assembled and tuned wire sets for one or more bands here.

Each band of the hex beam requires two elements; a driver wire and a reflector wire. The wires are configured into the shape shown here for each band. The tips of the driver wire are connected to the tips of the reflector wire through fixed length insulator cords called tip spacers. The driver wire is cut into halves and where it is cut, the ends are connected to the center post terminals. This is the feed point for the band. So at the end of the day, when you assemble a wire set for a band, you wind up with a big loop with each end of the loop tied to the terminals of the center post. The loop looks like the shape shown below. Each band looks like this but the higher the frequency band, the smaller the loop, of course. And each wire set has a different feed point although all the feed points are connected by means of coaxial cable on the center post. The table on the Specifications page provides the lengths of wire sections and tip spacers for all the bands.

Follow this procedure for each band starting with 6 meters.



The 20 meter wire set as viewed from overhead with no spreader frame shown for clarity.

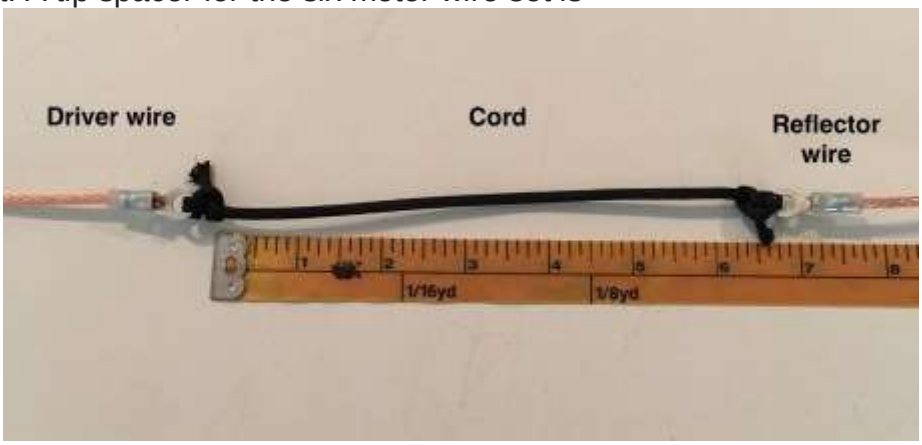
1. Measure wires

Lay the wires out on the driveway or floor and with a tape, measure the reflector and two half drivers to the table values. Allow 1/2 inch for each end so that the wire for each half driver and each reflector is cut one inch shorter than the table value. When ring terminals are installed on each end, the length will be very close to the table value. Be as precise as possible as an inch can make a difference in resonant frequency.

2. Attach terminals

Solder ring terminals on each end of each wire section. Six ring terminals are required for each band.

3. Tip Spacers

Measure the two tip spacers to the Wire Specifications Table value plus 4 inches for knots and cut. A tip spacer for the six meter wire set is shown 

4. Assemble wire set

Tie each tip spacer cord to one end of each half driver and thence to an end of the reflector. Check the length of the tip spacer when knotted to be sure the distance from the tip of the ring terminal on the end of the half driver to the tip of the ring terminal on the reflector matches the value in the Table. The tip spacer distance is important to the performance of the beam but If you are within 1/2 inch, that is close enough. Roll the wire set into loops about 6 inches in diameter, put it into a plastic bag and label it for the band.

5. Repeat steps 1 – 4 for each band's wire set.

Other comments

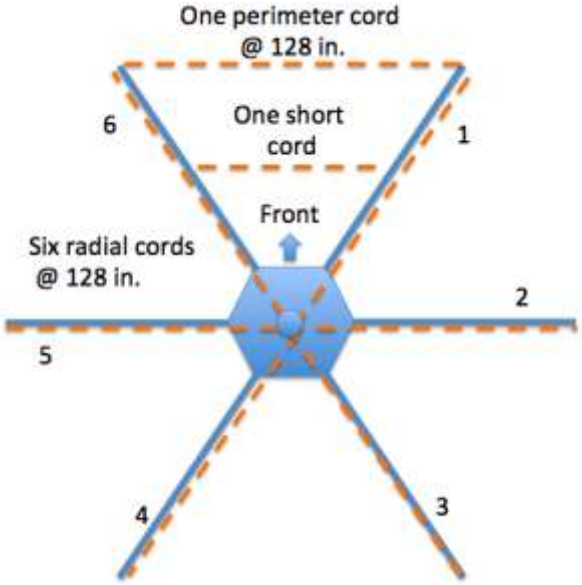
Separate tables are provided for wire that is insulated by pvc and wire that is bare. If you depart from the use of 14 or 16 gauge wire you will need to make adjustments of the lengths of the wires. If you use 12 gauge wire, the table lengths need to be multiplied by 1.004. If you use 18 gauge wire, the table lengths need to be multiplied by 0.998.

Each band is tuned for the middle range of the band except for 6 meters which is tuned for the bottom of the band. It really is not necessary to fine tune the wires for the CW part or the SSB part of the band as the broadband design makes the wires perform well across the entire band. However, if you want to do any fine tuning, the proper approach is to change both the driver wires as well as the reflector wires by the same amount. The amount to be increased is the same percentage as the percentage reduction in frequency that you want. There is an inverse relationship between the frequency and lengths. To increase the frequency by 1%, reduce the reflector wire by 1% and reduce each half driver by 1/2 %.

The tip spacers should be made of non-metallic cord that is resistant to UV so it will not degrade and come apart. Dacron is good for this although Kevlar with Dacron covering is better since it does not stretch. When installed, the wire sets should not be taut as there is no need and this just unnecessarily increases the likelihood of breakage. Therefore, the tip spacer cords need have only modest strength.

Support Cords

hex-beam.com/support-cords/



General

Support cords from the top of the center post to the ends of the spreader arms establish and hold the beam in an inverted umbrella shape. Two other cords between spreader arms 1 and 6 on the front of the beam also play a role in maintaining the hex beam shape. The cords, except for the short cord, are all exactly alike. They are each 128 inches long and have S hooks on the ends for attachment to the center post and the ends of the spreader arms.

1. Measure and cut

Measure and cut seven cords each 130 inches long.

2. Attach S hooks

Tie an S hook to the ends of each of the seven cords so that the total length when finished is 128 inches including the two hooks on the ends. The photos show use of aluminum sleeves but knots work just as well.

3. Make a small cord

Measure and cut a small cord 89 inches long and tie a #6 hose clamp to each end. The finished length is not critical.

Comments

The cords will supply all the tension needed to pull the spreader arms into shape so that it is not at all necessary or desirable to have the wires under any tension except for their own weight. The tension on the cords is well under ten pounds so the use of “no stretch” Kevlar cords covered with Dacron is completely adequate. Dacron cord is fine too but stretches more so when measuring for length, the cord should be pulled very firmly to a stretched state when measured.

You can buy already assembled Kevlar support cords here.

Assembly

hex-beam.com/assembly/

General

Congratulations, you have built the components for your hex beam; all that remains is to assemble them into a completed beam. If you have had the courage to take this construction project on, you probably don’t need the step by step assembly instructions. They are pretty much a mirror image of the assembly instructions we publish for buyers of the commercial version of the KIO beam. In fact, you can download them here and print them for convenience. And you probably also don’t need the precaution to avoid over tightening things. As you know, you can destroy mechanical things by over tightening. Now, here are the steps.

Spreaders

1. Set the base plate on a table, or a 10 gallon paint bucket filled with sand or rocks to serve as an assembly foundation. You can sink a one inch pipe in the ground and set the beam on it.

2. Insert the large spreader sections into the U bolts on the base plate. Tighten the U bolts evenly to keep the spreader straight and be careful not to over tighten. If you see the fiberglass spreader section flattening at all, you are over tightening it.

(*Tip: Look across the beam to see if a spreader arm is lined up with its opposite. If not, then re-adjust the nuts on the U bolts to make them straight.)*

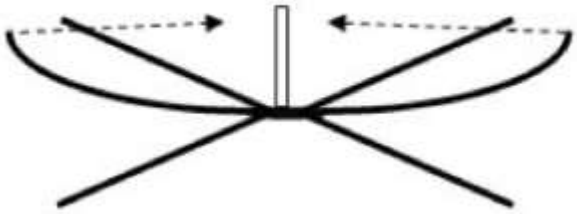
3. Insert the medium spreader sections into the larger ones and push up to the stop clamp.

4. Repeat for the small spreader sections. Twist all sections so the P clips are on the upper side.

Center post

Insert the center post into the top flange on the base plate. Twist it so that the terminals are facing out from the middle between any two spreader arms. This will be the front of the beam and the two spreader arms will be designated #1 and #6 counting clockwise. Tighten the set screws on the flange to secure the center post. Again, there is no need to over tighten it.

Support Cords

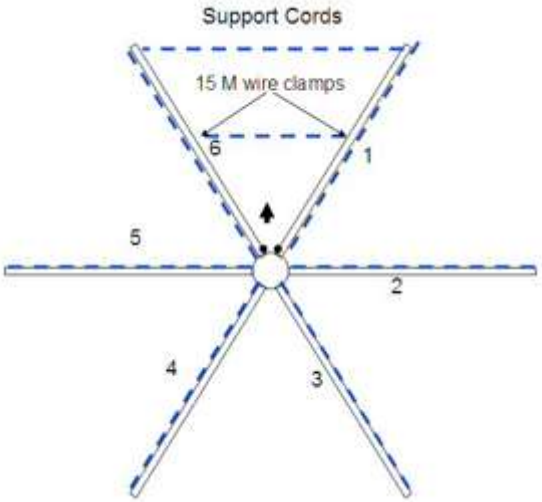


1. Hook a support cord into the end of any spreader arm and pull it toward the center post and let it lie on the ground.

2. On the opposite spreader arm, hook another support cord into the spreader arm end, pull it toward the center post and let it lie on the ground.

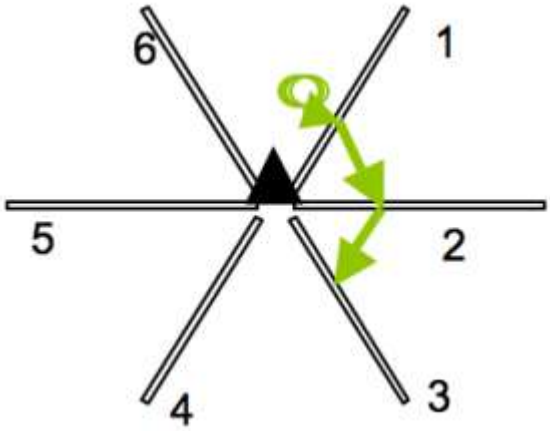
3. Now, grip the loose ends of the two support cords and pull them together until you can hook them simultaneously onto the center post eye bolt. The idea of pulling the two cords together is to prevent stress on the center post.

4. Repeat this process for another pair of spreaders and support cords and then again until all six spreader arms and support cords are installed.



5. There are two remaining support cords. Hook the larger one between the ends of Spreaders #1 and #6. It will be loose but that's ok, leave it for the time being. Also, the remaining short cord will be installed later.

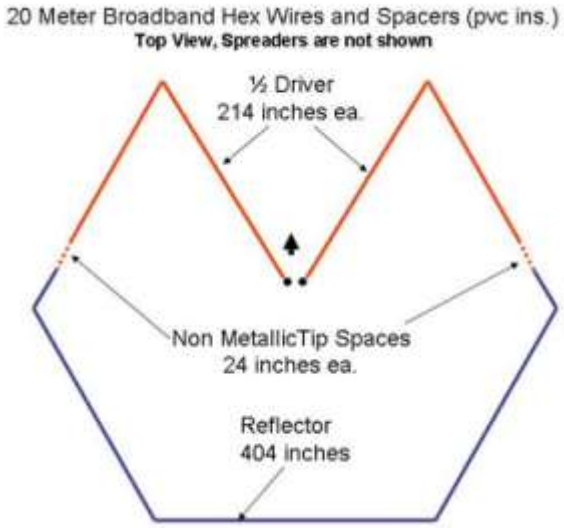
6. Fasten the cords onto the spreader arm ends using the hose clamps as shown. With pliers, squeeze all the hooks closed on the post top. You now have the basic hexagonal beam shape established.



Wire sets

1. Beginning with the highest frequency band (the shortest wire set), at spreader #1, thread the wire set through the P clips for that band all the way around the frame until the last P clip on spreader #6 is threaded. Now take the two ends of the wire set and attach them to the band's terminals on the center post. If they will not reach, just loosen the P clips on Spreaders 1 and 6 and let them slip in to provide enough slack to be able to attach the wire set to the terminals. When tightening the nuts on the terminals, use a second wrench or pliers to hold the nut beneath from twisting while you tighten the top nut.

2. Repeat this process for each of the wire sets continuing until all wire sets have been installed.



3. Adjust the wire sets until most of the slack is out of each of them but do not make them taut. The beam does not require taut wire sets and they just put unnecessary tension on the beam. On the other hand, do not let any wire droop down to the wire below as this will adversely affect performance. Adjustments can be done entirely on Spreaders 1 and 6 or if there is so much slack that this seems too much, all the spreader P clips for a band can be adjusted a smaller amount each to get the tension right. Remember, let the support cords do the work of holding the spreader arms in position, not the wires.

Final adjustment and tests

1. Install the last, smaller support cord with the hose clamps on it to pull the spreaders #1 and #6 back in line. Usually the weight of the wires will pull these spreaders apart and that is the purpose of both of the cords connecting these two spreaders. The initial location of the smaller cord is at approximately the 15 meter wire clip position. Adjust the location of the smaller cord to achieve the alignment of the two front spreaders. The shape and appearance is of little importance in performance of the beam so do not waste a lot of time fiddling with it unless you have a fanatical drive for perfect appearance.

2. Check DC continuity across the top two terminals of the center post. You should have infinite resistance. If you have a short, it is likely that a strand of coax somewhere has gotten across the cable.

3. Hook up a SWR analyzer such as the MFJ 259B with a short piece of coax to the pigtail and run a sweep on each band. You should be able to see a clear dip of SWR on each band. It might be a little lower in frequency than you prefer and it might not be as low a value as you would like, but the main thing is that you do see a dip. This tells you that the wire sets are cut right and that the beam is performing correctly. It's a good idea to record this information on a piece of paper for future reference. Later when you raise the beam on the mast you should generally see a slight upward shift in frequency and improvement of SWR.

You need a Balun

It is a good idea to use a balun with your new hex beam. Place the balun near the feed point at the top of the center post or below the base plate. The balun reduces the flow of RF current on the exterior of the coax. This unwanted RF if unchecked, will distort the radiation pattern of the hex. A bead balun works fine and you can see more about this for a hex beam here. Or any other 1:1 current balun will do fine. If you use your own ferrite beads, type 31 is ideal and type 77 works fine too. You can fashion your own balun by simply coiling the feed line itself into about six turns of six inches neatly coiled as if wrapped around a Quaker oat box. Make it neat; a random coil won't work well. Balun Designs and MFJ and DX Engineering all make baluns or you can buy one from us, of course.

Comments

You are done with the construction of your hexagonal beam. What'dya think? Now, on to erecting it on a mast. We don't give you much guidance here; there are just too many possibilities. You can see a lot of actual installations here for inspiration and ideas of your own. A few points that we will make. When raising the beam handle it by holding it by the center post at about a foot above the bottom. Remove that small cord so you can stand there by the post inside the beam without getting tangled up. When carrying it up a ladder, go slow. The beam wants to grab every shrub and tree branch within a mile. Do not drop the beam on its side; it will definitely break a spreader arm, usually right at the base plate.

If you have to leave the beam on the ground overnight, expect that a deer will accidentally find it and get tangled up in the wires and cords.

Oh! Safety. You should have already researched the rules for safety with antennas and towers in the ARRL handbook. If you haven't and are still alive, it is not too late to do this and pay attention especially to the stuff on power lines.

Specs

hex-beam.com/specs/

Length of wire elements and spacing

Note that driver consists of two half driver wires

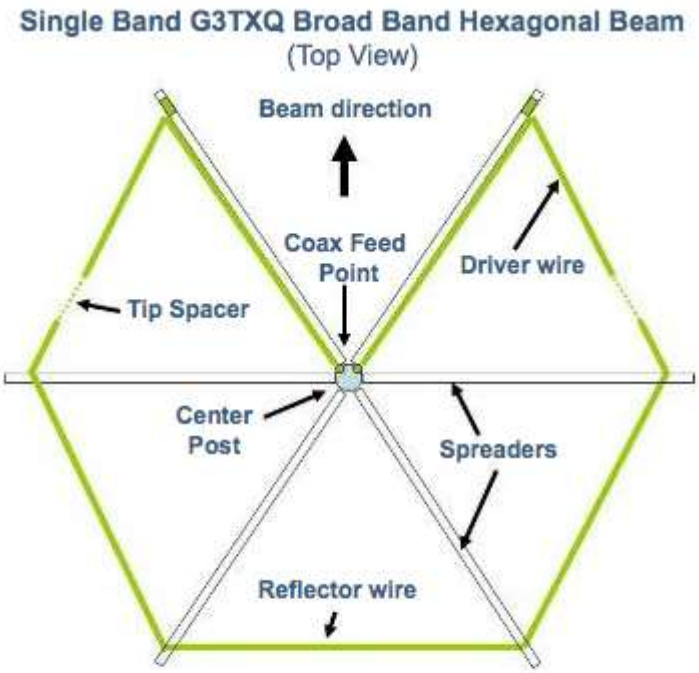
One inch = 2.54 cm

PVC Insulated wire lengths (inches) for #14 or #16 ga.

Band	Half Driver (2)	Reflector	Tip Spacer
20	213.5	403.0	24.0
17	165.5	313.5	18.5
15	141.0	268.0	16.0
12	118.75	226.25	13.5
10	104.0	199.25	12.0
6	57.3	110.25	6.5

Bare wire lengths (inches) for #14 or #16 ga.

Band	Half Driver (2)	Reflector	Tip Spacer
20	218.0	412.0	24.0
17	169.5	321.0	18.5
15	144.5	274.4	16.0
12	121.7	232.0	13.5
10	106.8	204.4	12.0
6	58.5	112.5	6.5



Overall data on the G3TXQ Broad Band Hexagonal beam by K4KIO

Freq. bands (M)	6, 10, 12,15,17,20
Weight	25 lbs
Diameter	22 ft
Wind Surface Area	5 Sq Ft

Performance

SWR <2:1 except for high end of 10 and 6 meters

Gain 5.5 dBi, free space, peak

F/B >20 dB, peak

Turning Radius 11 ft

The Mast

hex-beam.com/the-mast/

 One of the biggest advantages of a hex beam over a conventional multi-element HF beam is that you can get by with a very economical support structure with the hex. In fact, you can buy a hex beam and the materials for a decent support structure, all for a fraction of the cost of a typical tower needed for a SteppIR or a Force 12 beam. This is why the hex beam has become so wildly popular. You can actually have a directional antenna that works well and not have to spend your retirement to get it.

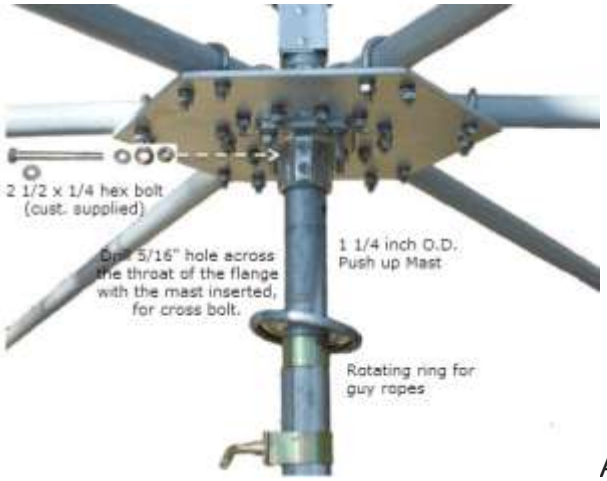
The typical support structure for a hex beam is a push up mast, a roof mast, a chimney mast or numerous other creative arrangements. You can see a wide variety of these here and with a little thought, come up with a support structure that fits your situation. Despite neighborhood covenants and restrictions, you can frequently find a way to erect a hex beam that is discrete and doable without hiring a professional tower crew.

 We feature here, the push up mast arrangement of the author. Are we bragging? No, in fact the reason for featuring this arrangement is to show that a primitive, obviously home-brew structure can actually work. It is one that you can build.

My mast is a 30 foot Channel Master push up telescoping mast that cost about $90. I sank a twelve foot 4X4 treated post in concrete to serve as a rigid support and mounted the push up mast to the post. With the post sunk in concrete, you can lean a ladder against it to get up high enough to push the mast to its maximal position. You can climb the ladder with the hex beam and then mount the hex beam into place on the mast before extending the mast sections. Some neighborly help would be nice for this although I was able to do mine completely alone.

The guys are every ten vertical feet and Dacron rope is fine for this. It is a good idea to completely extend the mast without the beam and then adjust all the guy ropes. After this, lower the mast and install the beam on the top as shown.

Shown in the photos are the rotator mounted at the bottom on a home-brew bracket made from angle stock from Lowes. At the top of the post is another bracket for mounting a thrust bearing. A thrust bearing is a device that supports all the weight of the mast and beam and allows the mast to rotate freely so the work and weight on the rotator is minimal. These brackets are easy to make. All you need is a hack saw and a hand drill to fashion them for your situation. Or you can buy shelf brackets that will do the job too. Check out these brackets.



Also shown is the bottom of the hex beam as it rests on the mast. Note that the bottom flange has a cross bolt in it. This cross bolt is essential as the set screws in the flange are not adequate to resist the constant torque and moment of the rotating beam. In a short while, the beam will be free wheeling if not for the cross bolt. The push up mast is a pretty good fit for the bottom flange but some shimming with a thin piece of sheet metal might be a good idea to eliminate any wobble.

You can download a copy of our Push_up_mast_guidelines here.

Parts

hex-beam.com/parts/

General

All parts that are needed to build the hex beam are provided below. Stainless steel is recommended although it is considerably more expensive. For example, stainless steel U bolts cost more than twice the cost of zinc U bolts. The sources for steel parts here offer stainless steel or zinc so you must be careful in your selections. Of course, the information on parts and sources is current when this web page is published in August 2014 but might not be later.

Baseplate parts

Item	Description	Source	Quantity
Plate	6061-T6 alum plate, 12 " X 12",	Metals Depot.com	1

Item	Description	Source	Quantity
	3/16 inch thick		
U bolt & nut	1X1 3/4, 1/4 X20 incl nut Part 12520	Boltdepot.com	12
U bolt Lock washer	1/4 Part 2956	Boltdepot.com	24
Flange	#45-6 Sq base floor flange	nurail.com	2
Mounting bolt	5/16 X 1 1/4 hex bolt, 5/16"-18, Part 146	Boltdepot.com	4
Mounting nut	5/16"-18 Part 2564	Boltdepot.com	4
Mounting washer	5/16 Part 2948	Boltdepot.com	4

Spreader arm parts

Item	Description	Source	Quantity
Large fiberglass tube	1 X 48 fiberglass tube	mgs4u.com	6
Medium fiberglass tube	3/4 X 48 fiberglass tube	mgs4u.com	6
Small fiberglass tube	1/2 X 48 fiberglass tube	mgs4u.com	6

Item	Description	Source	Quantity
Large hose clamp	#10 hose clamp 54195K22	McMaster Carr	6
Medium hose clamp	#6 hose clamp 54195K17	McMaster Carr	24
Small hose clamp	#5 hose clamp 54195K14	McMaster Carr	18
P clip	Cushioned P clamps 3177T11	McMaster Carr	36

Center post parts

Item	Description	Source	Quantity
Pipe	Sch 80 or Sch 40 one inch pvc pipe	Lowes	5 ft
Cap	Sch 80 or Sch 40 one inch cap	Lowes	1
Coax cable	RG8X coax cable	Radioworks	10 ft
Ring terminal	16-14 Ga Vinyl ins, #10 Stud, Part 552105	delcity.com	22
Male UHF connector	PL259 coaxial connector	Radioworks	1
Eye bolt	#10-24, 1-5/16 inch	boltdepot.com	1

Item	Description	Source	Quantity
	eye bolt, part 12243		
Machine screw	#10-24, 3/4 in. Phillips pan head mach screws, Part 1358	boltdepot.com	12
Mach screw nut	#10-24, Part 2560	boltdepot.com	25
Ext tooth washer	#10, Part 4078	boltdepot.com	50

Wire set parts

Item	Description	Source	Quantity
Antenna wire	#14 pvc ins Flexweave FW14BK	The Wireman	275 Ft
Cord	1/8" Dacron (DA18)	The Wireman	20 Ft
Terminal	16-14 Ga Vinyl ins, #10 Stud, Part 852105	Delcity.com	36

Support cord parts

Item	Description	Source	Quantity
Cord	1/8 " Dacron (814)	The Wireman	85
S	1" open S hooks, SS	McMaster	14

Item	Description	Source	Quantity
hooks	Part 9378TZ2	Carr	
Hose clamp	#6 hose clamp 54195K17	McMaster Carr	6

FAQ's

hex-beam.com/faqs/

1. Why should I be considering a hex beam?
Because it is a hot performer that works with little fiddling and is a great way to get a directional antenna that won't cost your retirement.

2. Are the wire lengths critical?
A. Well, if you change the wire length for the reflector on 10M by one inch, it changes the design frequency by about 130 kHz. Two inches would be about 260 kHz, and so on. You can do a simple ratio of frequencies to figure the change in wire lengths for adjusting the tuning different from the table values on this web site.

*Percent **Increase** in wire length = Percent **Decrease** in frequency*

If you change the reflector lengths be sure and do the same for the driver wires. (e.g., increasing Reflector 3 inches requires increasing each half driver 1 1/2 inch.)

3. How important are the tip spacers?
A. They affect the front/back performance and the SWR and are designed for the optimal balance of these two performance criteria. But if you are off an inch it isn't going to make a lot of difference.

4. What if I want to use a different gauge of wire than 14 or 16 gauge?
A. That is fine. To use 12 ga. wire, just multiply the table wire lengths by 1.004. To use 18

ga. wire, multiply the table wire lengths by 0.998. Leave the tip spacers as they are shown in the tables.

5. How high should the hex beam be?
A. Higher is better for DX generally as it reduces the takeoff angle of the main RF lobe. However, the hex beam can be quite effective even at modest heights. Some say 40 feet is optimal and that spending bucks on more height just isn't worth it. That's probably a pretty good rule of thumb.

6. What about use of steel wire or aluminum instead of copper?
A. Your main concern will be the physical properties as there is not much difference in the performance among different wire materials.

7. What about stranded wire or solid wire?
A. Either is fine. Solid wire is harder to work with, of course. Use the same wire length table for both.

8. What about insulated wire?
A. It can be used and if it is the specific wire in the table here you already have the specs. But you can't depend on these specifications for all other insulated wire.

9. How important is spacing on the center post?
A. Post spacing can become a problem if the terminals are closer than 4 inches from each other. The RF current is highest right at the terminals so if they are too close together, RF interaction can be significant.

10. Should I feed the hex beam at the top or the bottom?
A. Top feeding will provide better results overall.

11. Should I connect the bands with wire or coax?
A. Coax will provide better results. Use 50 ohm coax.

12. Do I need a balun?
A. It is a good idea because it prevents surface currents flowing on the exterior of the coax and thereby distorting the radiation pattern.

13. Can I substitute materials if those on the parts list aren't available?
A. Well, sure. Your substitutions might be better than mine. Just be sure you know the physical factors that are important and make judicious choices. There are only a few things truly critical about the details of a hex beam such as wire length, general shape, etc.

14. Where can I learn more about the hex beam theory?
A. Visit the web site of Steve, G3TXQ.

15. Can I buy a broad band hex beam?
A. Thought you'd never ask. Seriously, we sell a multi-band hex beam on another web site that is already built. You just assemble five modules when you get it and it works with no tuning. Other companies such as DX Engineering and MFJ enterprises sell kits of parts

with illustrated instructions to build a broadband hexagonal beam. Are they as good as mine? Well, I’m sure they are good products but be prepared to do more work than you would do with one purchased from us. You get over 200 parts to build a hex beam from them.