

COBWEBB REVEALED

THE COBWEBB ANTENNA



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G3TPW CobWebb Antenna for the 14, 18, 21, 24 and 28 MHz Bands

The main advantages of the CobWebb over other 5 band 14 to 28 MHz antennas are that it is small, lightweight, strong (made from fibre glass), only requires a single support, needs no rotator, gives full size dipole performance on all 5 HF bands (without the end on nulls that straight dipoles suffer from), is fed by a single 50 ohm co-ax cable (via an in built air core choke balun), and most important of all, it produces a pure horizontally polarised signal with a confined electric field. This results in much reduced coupling to nearby conductors, so that losses and interference problems are reduced to the absolute minimum possible.

The CobWebb can be easily mounted on a single 20 foot aluminium scaffold pole, fixed to the wall of the house with a couple of stand off wall brackets. The pole can then be pushed upwards to put the CobWebb up at 30 to 35 feet, or lowered so that it is at roof ridge height, to overcome any possible planning problems!

All the other small multi-band commercial antennas that are available are less than optimum.

The "broad band" folded dipoles and verticals have lossy transformers or terminating networks in them.

These may provide a fairly low SWR over the full 2 to 30 MHz band, but so does a dummy load!

Some trap dipoles have lossy traps and baluns, so that a nice 50 ohm match is produced on all bands. Others have no balun at all, the feeder cable will then need to be a particular length to reduce feeder radiation and provide a match.

Doublet Antennas may have some gain on the higher frequencies, unfortunately every 3 dB peak has a 20 dB null in other directions! Other small "magic maths" antennas are available, but their performance is so poor that you can't even hear them on the bands, to measure how far down they are!

The many types of vertical antennas are best avoided, unless you have no neighbours, because of all the interference problems.

The inherent losses and poor radiation efficiency of the mini-beams negates any so-called gain. Remember that if a beam has a gain of 4 dB over a dipole in free space, it will be DOWN on a dipole! It will also only "work" over a very narrow frequency range.

A dipole or a CobWebb has a gain of about 5dB over a dipole in free space, (due to ground reflection) or 7dB over an isotropic radiator (7dBi) and will work equally well over the entire band.

The CobWebb has no lossy components in it, so there are no power limit problems for the QRO operators. The low loss and consequent high radiation efficiency also makes it ideal for QRP!

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The G3TPW CobWebb Specification

Covers all 5 Bands. Gives a low SWR resonance on the 14, 18, 21, 24 and 28 MHz bands. The SWR at the band edges is mainly reactive, i.e. the resistive component is still near 50 ohms, so auto and simple ATUs can match it with low loss. Over 95% radiation efficiency on all bands! Have you ever seen this spec mentioned by other manufacturers?

<u>Omni-directional.</u>	Talk to all the world, without the need for a rotation system.
<u>Minimum of EMC Problems.</u>	Vastly reduced interference on both transmit and receive due to pure horizontal polarisation and confined electric field.
<u>50 ohm Single Co-ax Feed.</u>	Built in co-axial choke balun to prevent feeder radiation. Standard PL259 plug on end of short lead. Feedbox and resonators all pre-assembled.
<u>No Compromise Performance.</u>	Full size half wave dipole on each band, without nulls!
<u>Fibre Glass Construction.</u>	Flexible so no metal fatigue problems in windy locations.
<u>Simple Assembly.</u>	Fix fibre glass sections together. All screw holes pre-drilled. All elements pre-tuned, just uncoil them and fix to spreaders. No adjustments needed.
<u>Small Size and Weight.</u>	Only 2.6 metre (8.5 feet) sides and 6 kg (14 lbs) weight when assembled. 1 metre maximum length parts for low cost world wide delivery.
<u>Easily Erected.</u>	“V” bolt fixing to mast of up to 58 mm (2.25 inch) diameter. Can be fixed to 20 foot scaffold pole, which can then be pulled up to the wall bracket with rope.
<u>100 mph Wind Survival.</u>	As long as the mast/support can take it!

The most important design point about the CobWebb is that it is a completely horizontally polarised, confined electric field antenna, which provides maximum radiation efficiency and the absolute minimum of interference problems. TVI fears have encouraged many people to shy away from the HF bands, in favour of VHF, UHF or 160 metres.

New stations often begin operating on HF using an end fed wire or a vertical antenna, a recipe for disaster, sometimes even on QRP. After starting in this way and getting involved with various EMC problems, it is often found that planning permission for a horizontal antenna is refused. You can't really blame your neighbour for being concerned. If that small inconspicuous vertical or simple wire antenna causes so much trouble, what would it be like with the proposed mast and special horizontal antenna? The fact that the use of horizontal polarisation, particularly if it is from a confined electric field antenna like the CobWebb, would probably cure the breakthrough problems is very difficult to explain.

During experimental work on a 5 band beam, using full size resonators on each band, it was noticed how well the driven element worked by itself. It also became obvious that a full sized dipole, up in the clear, worked far better than the multi-band minibeams!

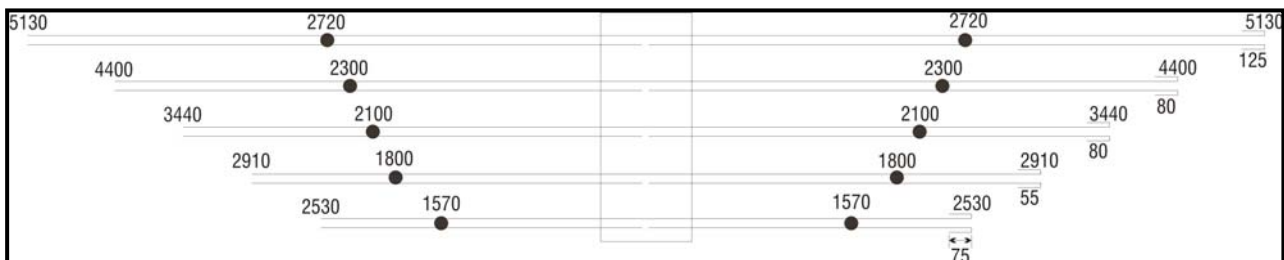
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The CobWebb Design

The CobWebb is a full size half wave dipole on each of the 5 amateur bands, 14, 18, 21, 24 and 28 MHz, for maximum performance. There are no lossy traps, stubs or loading coils, so there is no reduction of radiation efficiency on any band. Each dipole is bent round to form a horizontal square, to make the antenna omni-directional. Thus no expensive rotator is required. Each resonator looks like the "square halo" that is often used on VHF, for SSB mobile work using horizontal polarisation.

The parallel but anti-phase "sides" of the antenna cancel the radiation that would normally be wasted as high angle radiation from a straight dipole and fill in what would otherwise be the nulls off the straight dipole ends. The resulting omni-directional pattern has many advantages over antennas with directional effects. Unless an antenna with nulls in its response can be rotated, it will be found that certain parts of the world will be very difficult to contact.

The five "squares" are made from white PVC covered multi stranded copper twin cable which is supported by a horizontal cross, made from white fibre glass. Each element is folded and tapped for impedance matching, so that the antenna looks like 50 ohms on all 5 bands. The small size ensures minimum windage and the low weight means that TV type brackets and masts may be used for supports. There are no aluminium elements to corrode and cause high resistance joints, or snap off in the wind.



The drawing above shows the 5 dipoles. The length of each dipole is shown. The tapping point is also shown for each dipole. All sizes are in mm's. At each tapping point, the cores are bared back $\frac{1}{2}$ ", twisted together and soldered. Shrink sleeving is placed over each joint.

The junction box is shown in the centre of the drawing.

Technically the CobWebb is 5 separate full size dipole antennas, each bent into a square. This makes it very small (only about 8 feet square) ,but it is still full size!

It has 5 separate double gamma tee matches to match each element to a common 50 ohm co-axial feeder, and has a built in air cored co-axial choke balun, to prevent feeder radiation.

Each dipole is made from Twin stranded Loudspeaker cable. (42 stands each core)

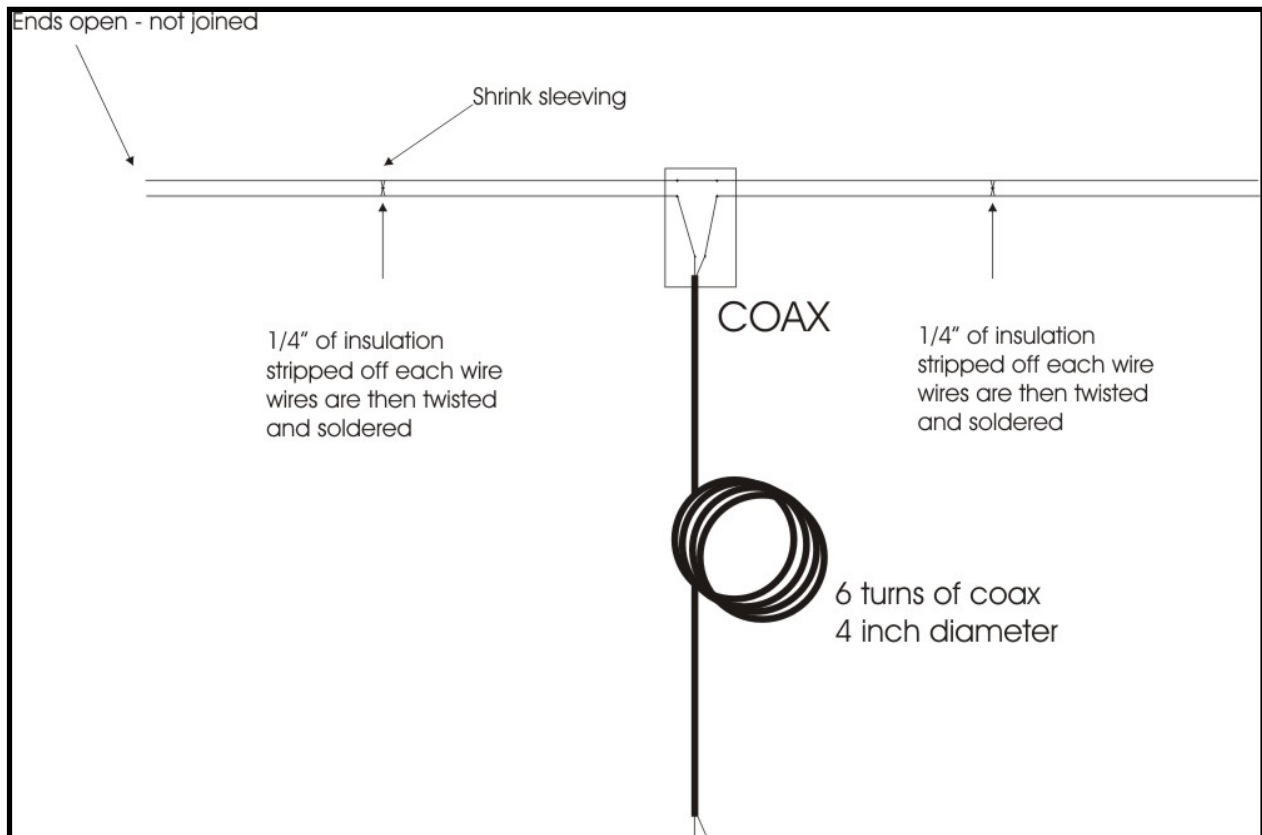


One core passes straight through the box. The other core is split, in the box and each end is stripped back and connects to the inner and outer cores of the coax. See Junction box description and photos.

The electric fields of the CobWebb are confined because the high impedance ends of each element are only a few inches apart. This reduces the coupling to nearby objects so the antenna does not need re-tuning for operation at different heights and locations.

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The drawing below, is a basic sketch of the Cobwebb design (Only 1 dipole shown)



What is a CobWebb antenna and what is its gain?

It is a very efficient horizontally polarised omni-directional antenna for the 14, 18, 21, 24 and 28 MHz bands, with a gain of 7 dB over an isotropic radiator (7dBi). Note that this is the same as a standard dipole, although a straight dipole will have sharp nulls off each end. A standard straight dipole has a gain of 5 dB over a dipole in free space! The specification of a standard large 3 element tribander says that it has a gain of 8.5 dB over a dipole in free space. This means that it has a gain of 3.5 dB over a dipole at the same height!

What is the secret ingredient. Why does the CobWebb work so much better than other antennas?

Simply because it radiates **all** the power fed into it, and it also radiates in an omni-directional manner so there are no nulls. There are no lossy ferrites, traps or loading coils to heat up, and each element is full size and made from :
Twin Lodspeaker cable. Each core is 42 strands of 0.2 mm diameter pure copper wire with a plastic covering.

The confined electric near field (caused by the high impedance ends of each dipole being close to each other) also ensures that the antenna does not couple to other electrical conductors i.e. telephone wires, power cables, television antennas or even the ground and lossy di-electrics such as trees and buildings. Thus the radiated power is not absorbed by nearby objects, it is all radiated into free space. Breakthrough and noise pick up are also reduced to an absolute minimum and the ground conductivity and height do not affect the antenna tuning.

What is the maximum power that can be fed into it?

Nearly all the power fed into the CobWebb will be radiated, so the antenna will not heat up and so limit the power rating. There are no ferrites used so no intermods are produced. It has been tested with 3 kilowatts of RF, above this level there could be a problem with corona discharge sparking at the ends of the elements as the air is ionised!

I've heard that different antennas suite different locations. Will the CobWebb work at my QTH?

YES! The ground conductivity for many wavelengths around an antenna will affect its performance. Vertical antennas that use a ground connection can be as much as 20 dB down on a dipole. Verticals that do not use a ground connection i.e. elevated feed vertical dipoles or ground planes etc. can still be as much as 8 dB down on a horizontal, due to reflection losses. The difference between sea water and very poor ground is up to 9 dB for a vertical antenna, but only 1 dB for a horizontal.

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The CobWebb is not affected as much as other antennas by trees, buildings, power lines, TV aerials feeders and telephone wires etc. The poorer or more cluttered that your QTH is, the better the CobWebb will perform, compared with other normal ants, including a straight dipole!

These are the reasons why CobWebb antennas so often out perform other antennas, they are not affected by the nearby environment so **THEY WORK AT ALL LOCATIONS.**

How do I mount it?

The CobWebb can be mounted on a vertical pole of up to 2.25 inches in diameter. It can be added to existing antenna installations such that the mast goes straight through the CobWebb. A 20 foot scaffold pole makes an ideal mast, this can be fixed to a wall with a couple of stand off brackets.

Do I need planning permission for it?

Most people don't bother to apply, if they are just mounting a CobWebb on a 20 foot pole. The pole can be slid down through the brackets so that the CobWebb is below the roof ridge height. This meets the standard "not above the roof ridge" planning restriction; it can then be gradually pushed up to the optimum height of 33 feet!

Will it stand the high winds at my QTH?

CobWebbs are in regular use in the Falklands and on Ascension Island. They have stood up to gales that have destroyed many other antennas. Most of the breakages that have occurred have happened when either the mast has come down, or the antenna has been dropped. Even then the antenna can be quickly and cheaply fixed because the short 1 inch diameter fibre glass joining tubes break, and the antenna simply folds up. These joining pieces can be easily changed in a just a few minutes. If the wires do get broken they can be repaired with choc block screw connectors or crimp connectors, or we can supply new wires.

How does the CobWebb minimise the chance of TVI and breakthrough problems?

The pure horizontal polarisation and use of a choke balun reduces the chance of breakthrough to the absolute minimum possible. The confined electric near field (caused by the high impedance ends of each dipole being close to each other due to being bent into squares) also ensures that the antenna does not couple to other electrical conductors i.e. telephone wires, power cables or television antennas.

Are there any complicated adjustments to be made during installation?

None at all! The CobWebb is not detuned by nearby objects, including the ground, because of the confined electric field. Thus the CobWebb can be pre-tuned and matched during production, so that it works at any QTH and any height!

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CONSTRUCTION

A single horizontal fibre glass cross, supports all 5 elements.

The feed-box is on the end of another solid fibre glass rod, such that the feed is in the centre of one of the sides of the squares.

Each rod is secured with “U” bolts onto a 0.25 inch thick aluminium plate.

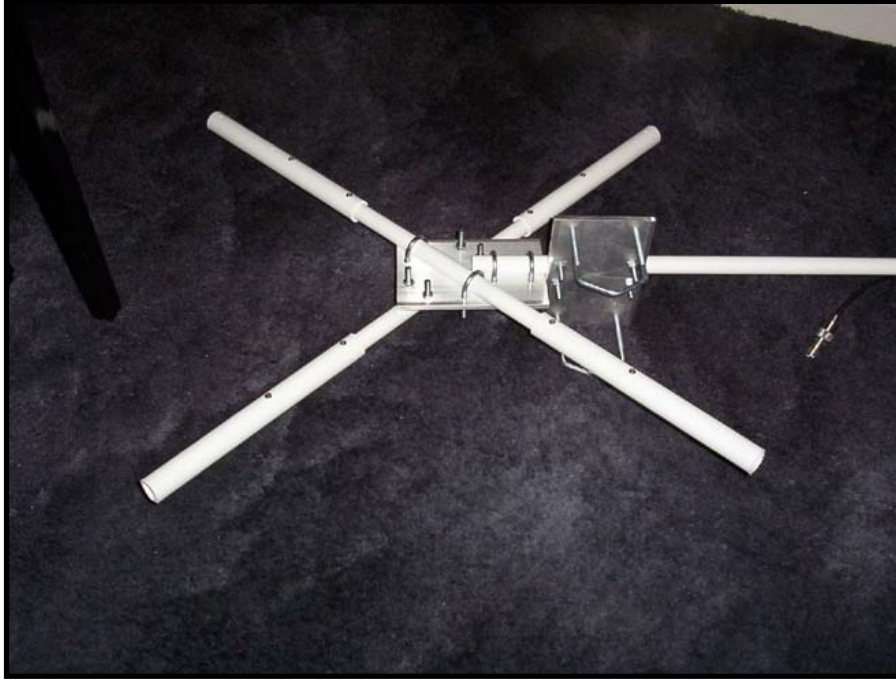
Another similar plate allows the antenna to be fixed to a vertical mast of up to 2.25 inches in diameter, with the “V” bolts provided.

Plastic covered “figure of 8” section 84 strand copper conductor is used for the elements, which are secured to the fibre cross by the unique G3TPW system to prevent pre-mature breakages!

A 33 foot dipole is a much bigger beast than a square with 8 foot 6 inch sides!

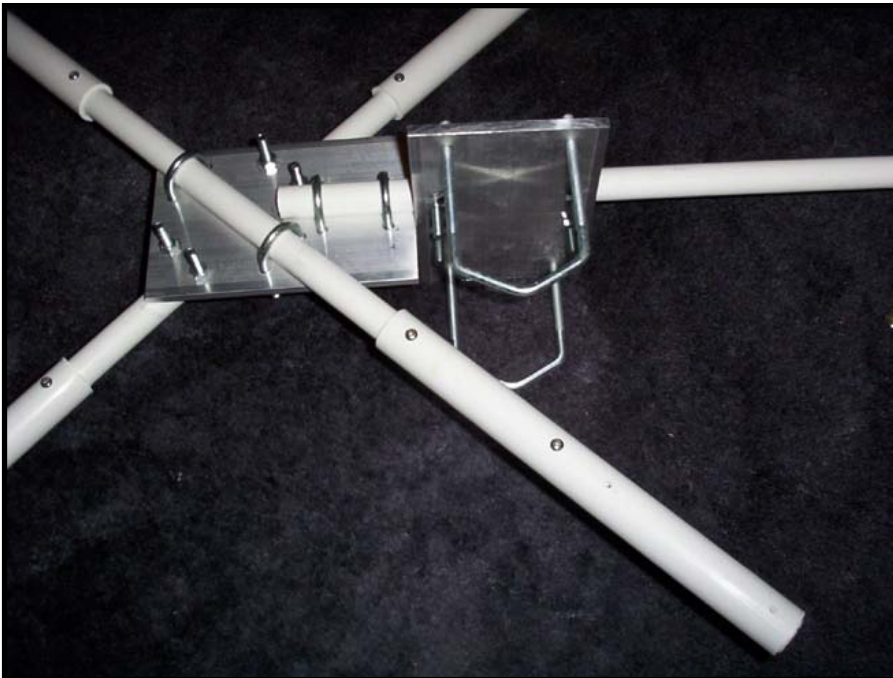


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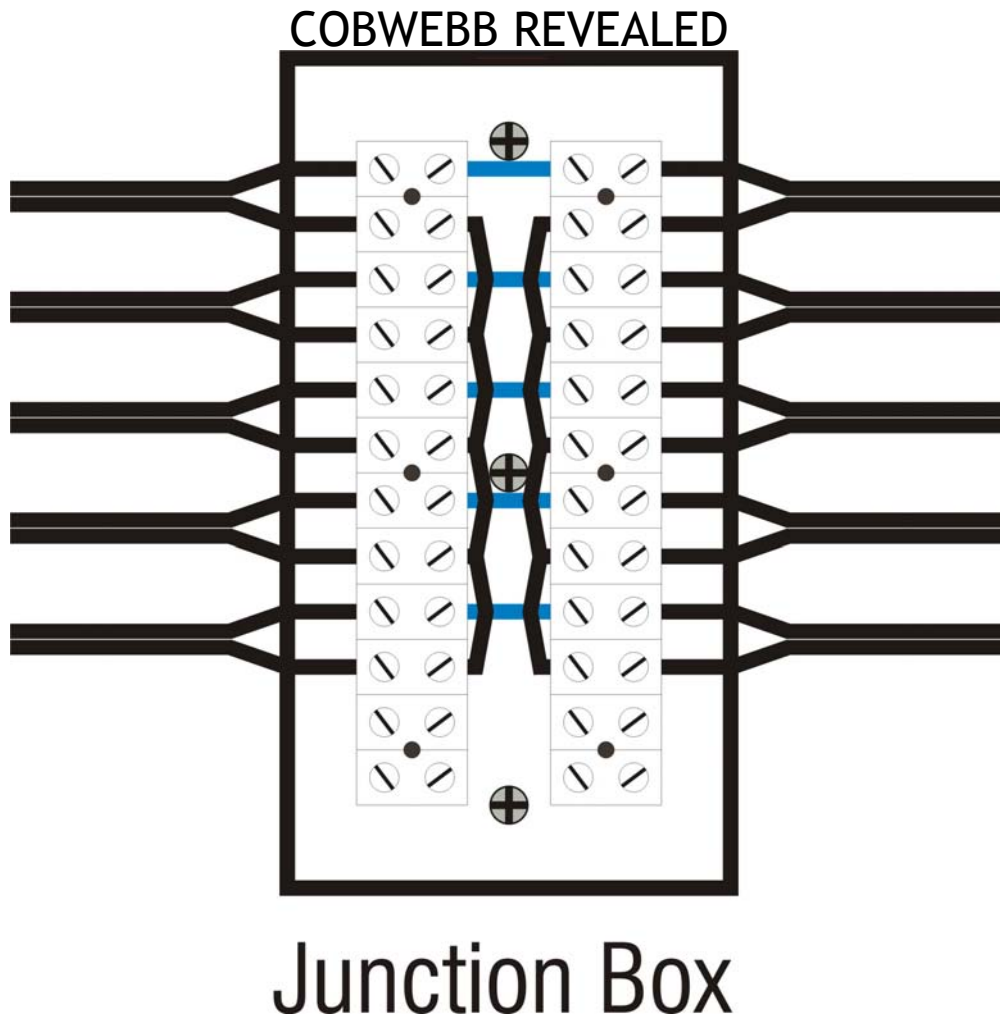


Above photo shows a Cobwebb in the initial stages of construction.
7 poles are shown.

In the centre are 2 - Pole 'D' 's connected top and bottom of plate in an 'X' shape.
Poles "C" are attached either end of Poles "D" (2 on each).
The pole on the right of the photo is pole "E", which the Junction Box is attached to.



This photo shows a close-up of the Mount plate configuration.
The bracket can attached to a scaffold pole up to 2 1/4" diameter.



The Junction Box dimensions are :-

Length: 150mm

Width: 80mm

Height: 50mm

The box is mounted upside down (i.e. lid on bottom). 4 holes are drilled into the lid for drainage.

Each terminal strip is held in place with 3 x self taper screws (No.6 x 0.5")

3 x hole 50mm apart for each terminal strip.

2 x 5amp – 12 way terminal strips are mounted into the box, 15mm apart.

Only 10 terminals are used on each strip.

On each terminal strip, terminals 2, 4, 6, 8 and 10 are connected together.

Pin 1 on left strip is joined to pin 1 on right strip and the same for terminals 3, 5, 7, and 9.

See photo on next page.

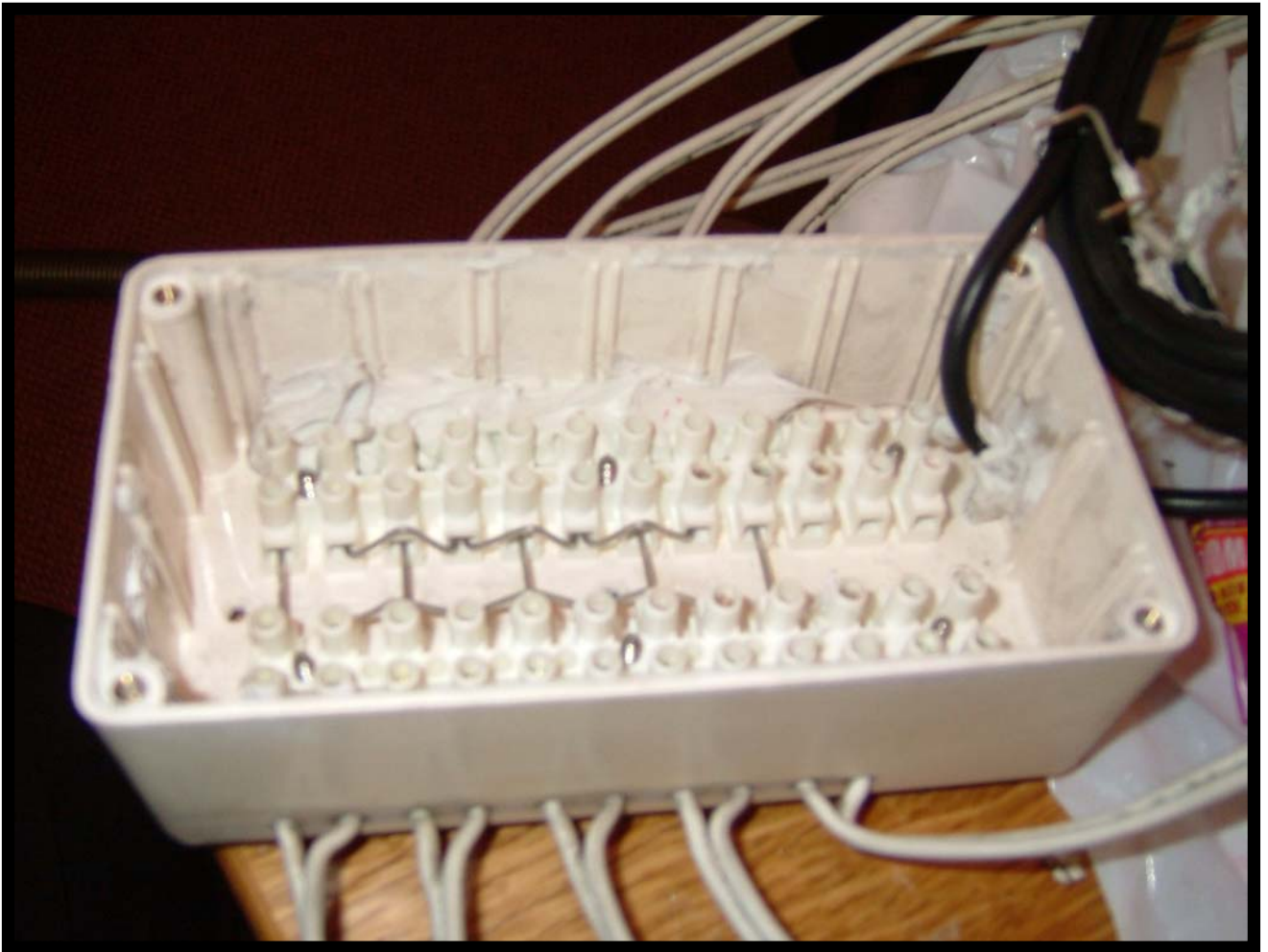
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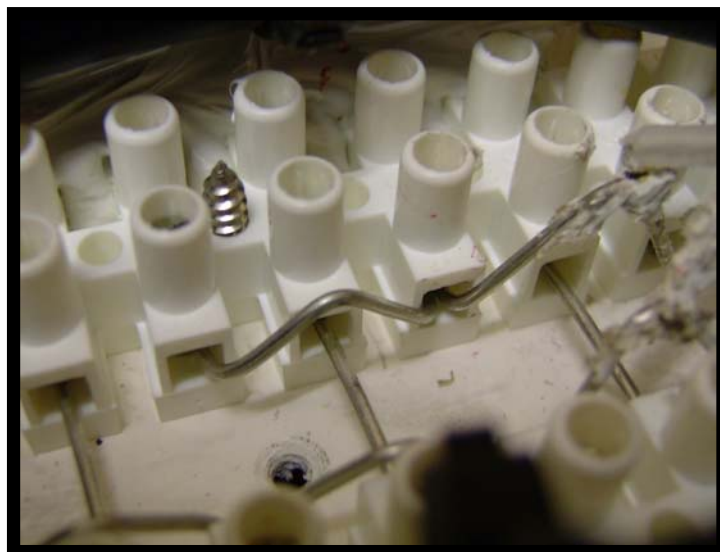
Terminals 2, 4, 6, 8 & 10 are interlinked using wires bent to shape as photo on left.

Wire is 1.2mm dia.

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**The RG58 Coax cable enters the box, is looped 6 turns around a 3 inch diameter and tie wrapped.
The coax end is stripped back exposing 1 inch of inner and screen and these 2 wires are soldered in place.
Inner core to left hand links and outer screen to right hand links.**

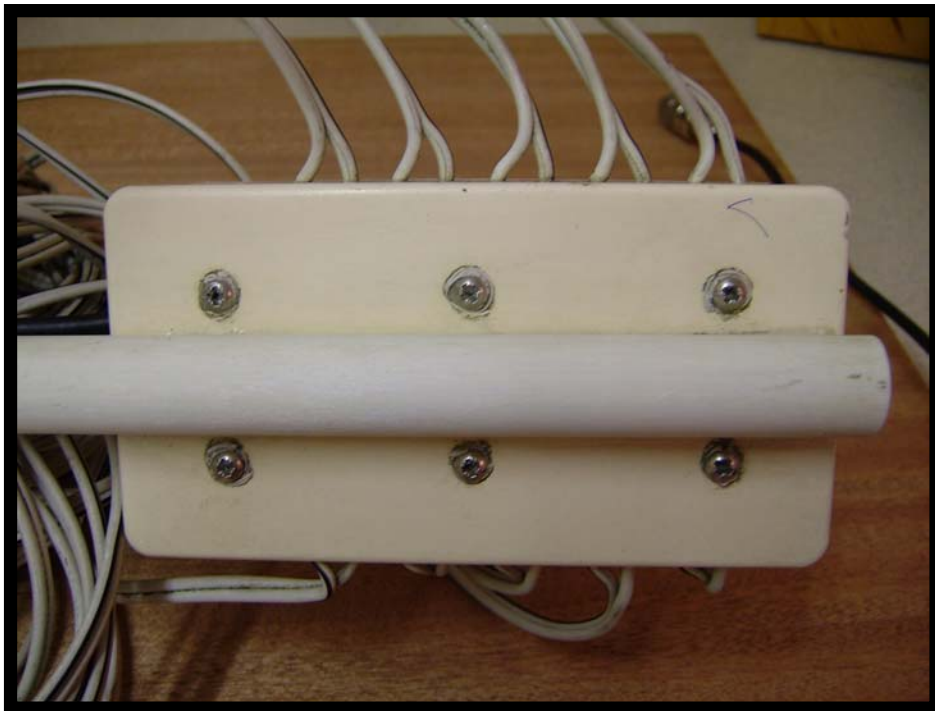


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The coax loop is squashed and placed into the box (See photo below).

This loop acts as a co-axial choke balun at the common feed point, to prevent any current from flowing down the outside of the co-axial cable feeder. This balun is absolutely vital, to prevent any radiation or pick up of signals by the feeder. EMC problems can be just as bad as with verticals if this balun is not exactly right.

NOTE: Sealant is used on All entry points and on lid to weatherproof the box.

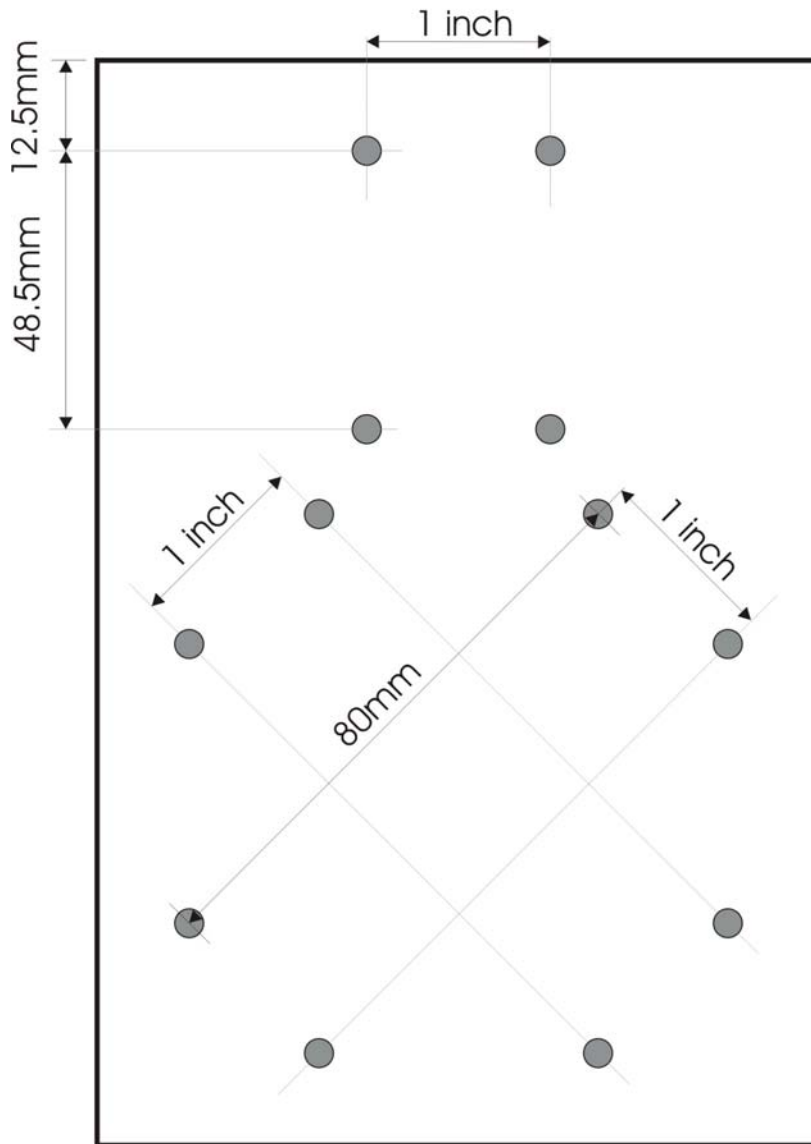


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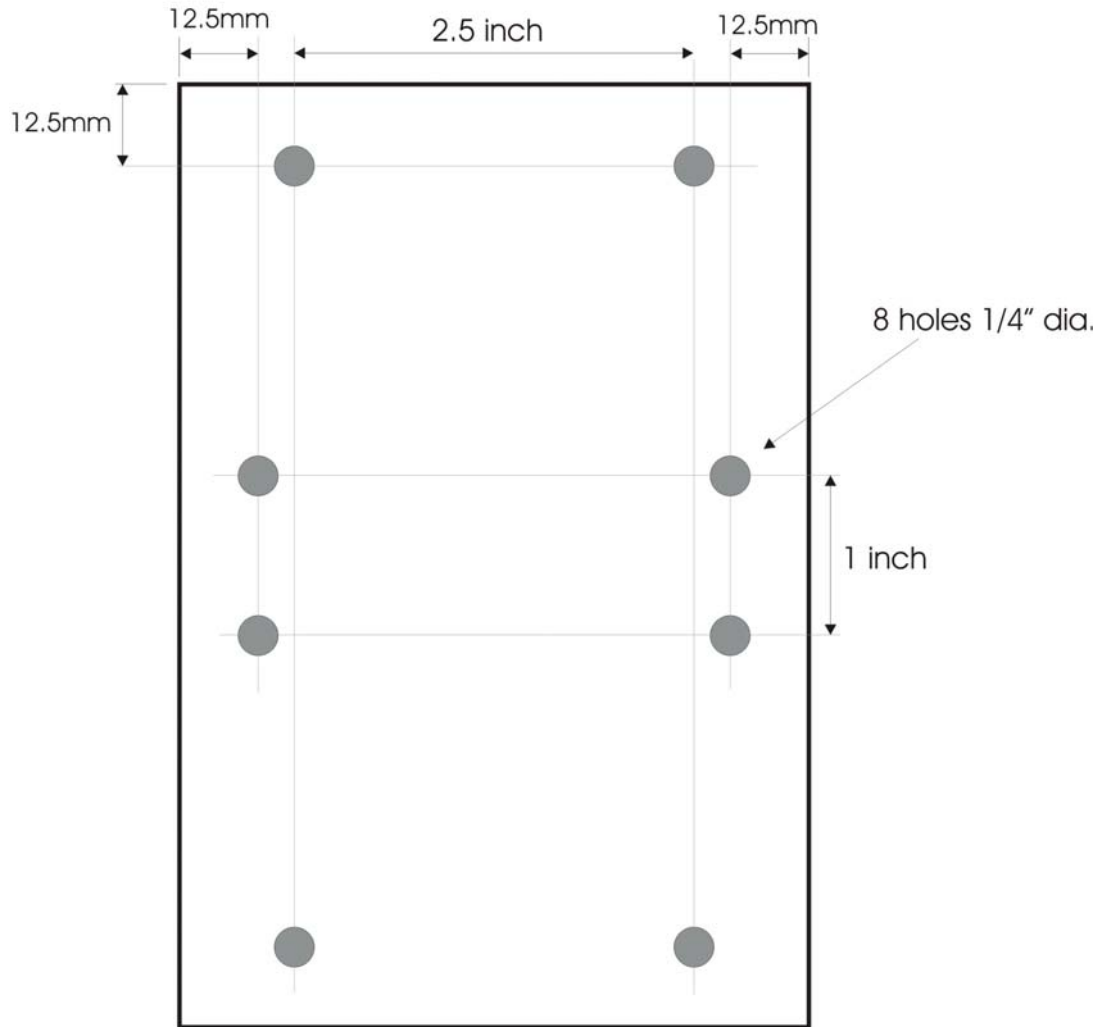
Plate No. 1



ALUMINIUM PLATE

150mm x 100mm x 6.25mm

Plate No. 2

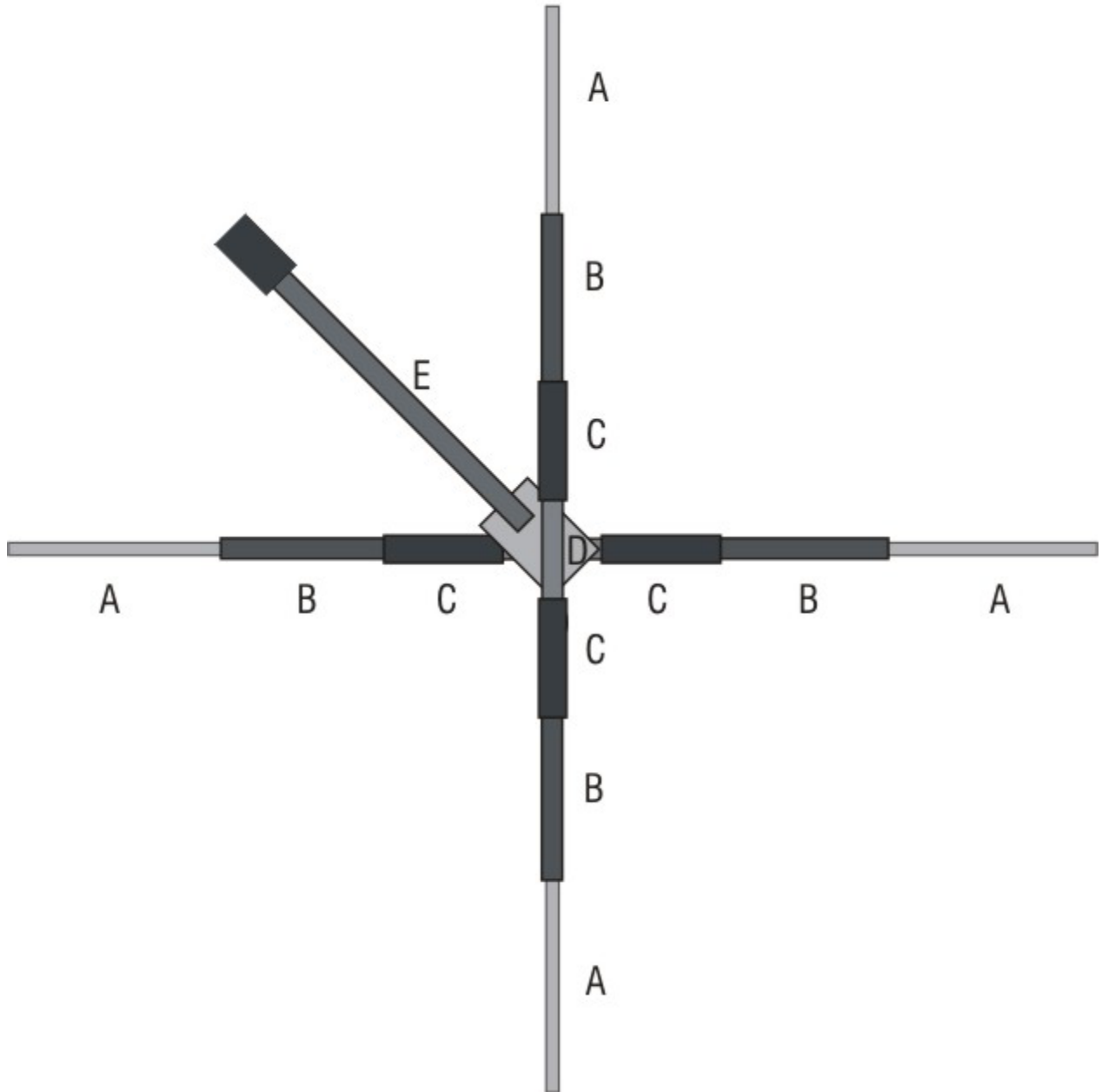


ALUMINIUM PLATE

150mm x 100mm x 6.25mm

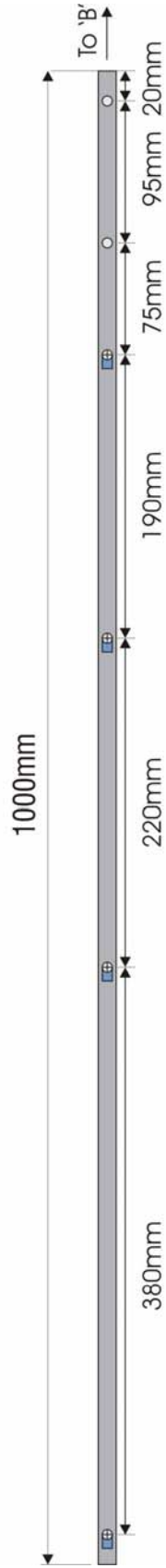
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POLE CONFIGURATION



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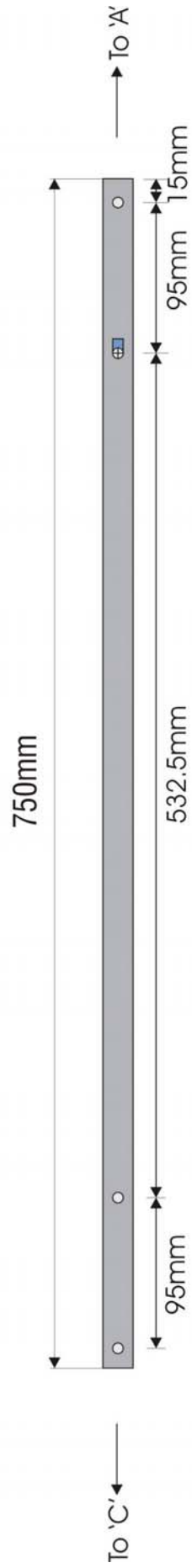
POLE - 'A'



Material: Solid Round Bar : 12mm dia.

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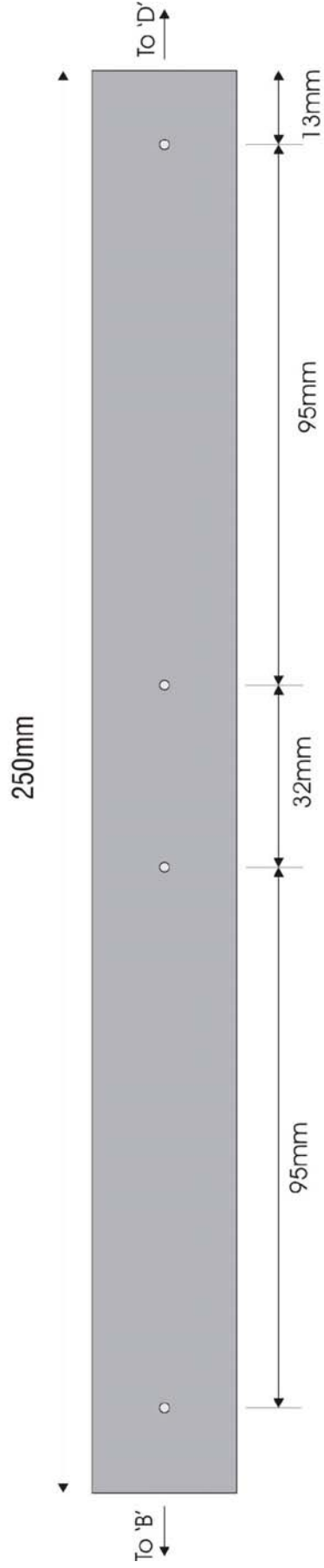
POLE - 'B'



Material: Round Tube : 19mm O.D, : 12.5mm I.D.

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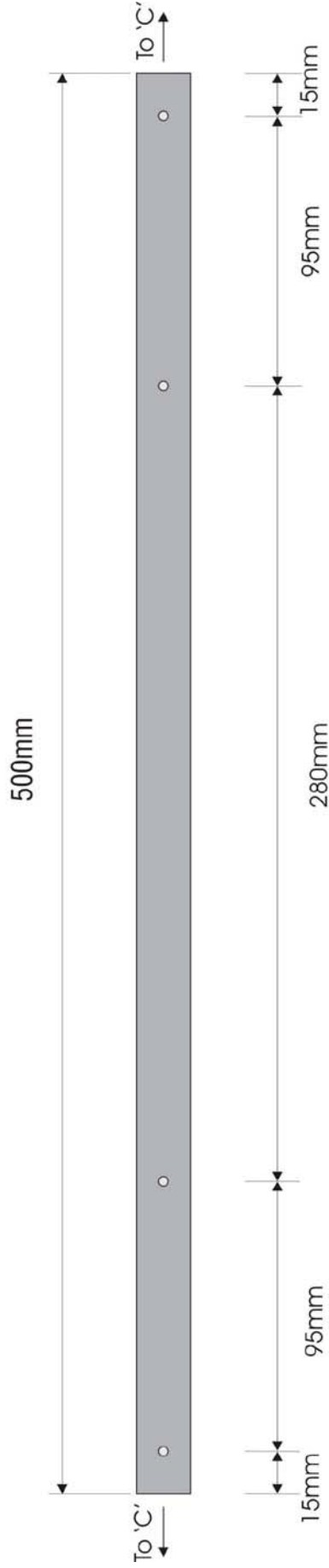
POLE - 'C'



Material: Round Tube : 25.4mm O.D. : 19.5mm I.D.

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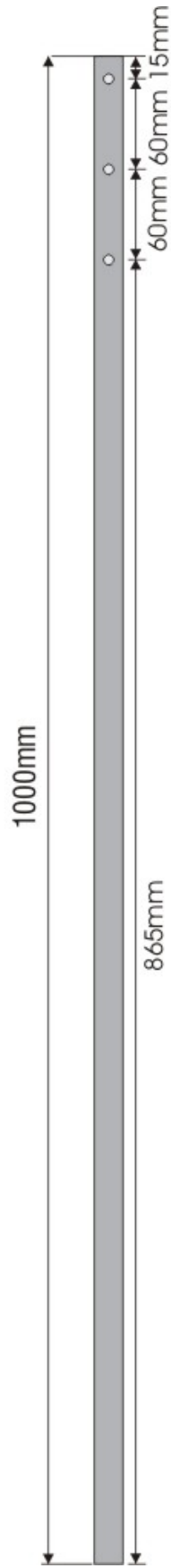
POLE - 'D'



Material: Solid Round Bar : 19.0mm dia.

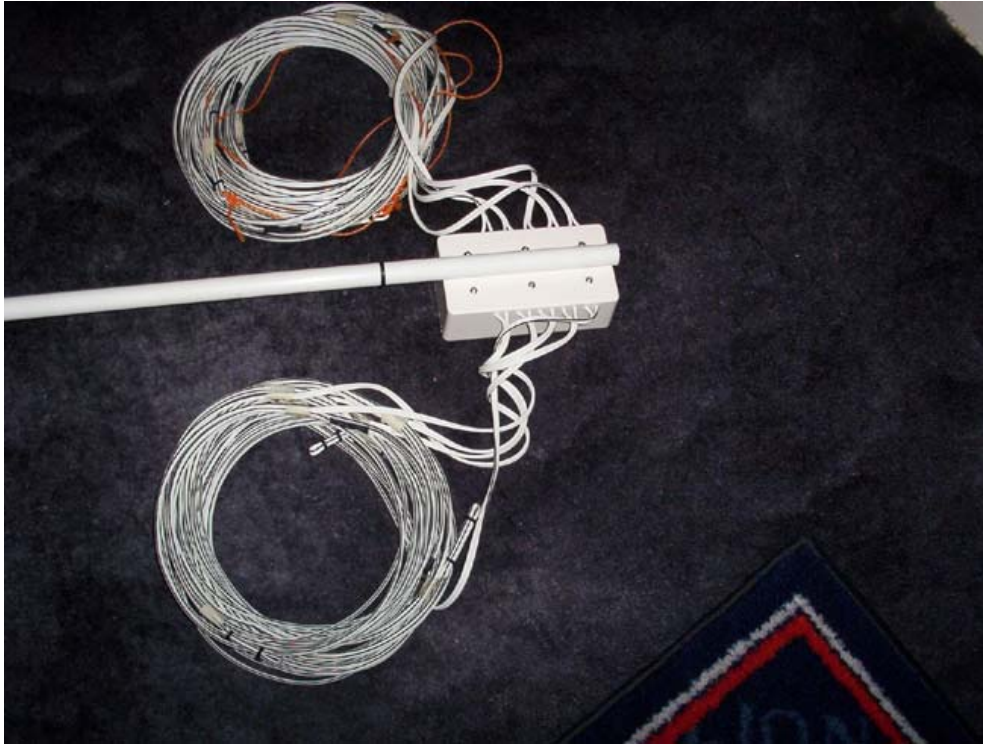
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POLE - 'E'



Material: Solid Round Bar : 19mm dia.

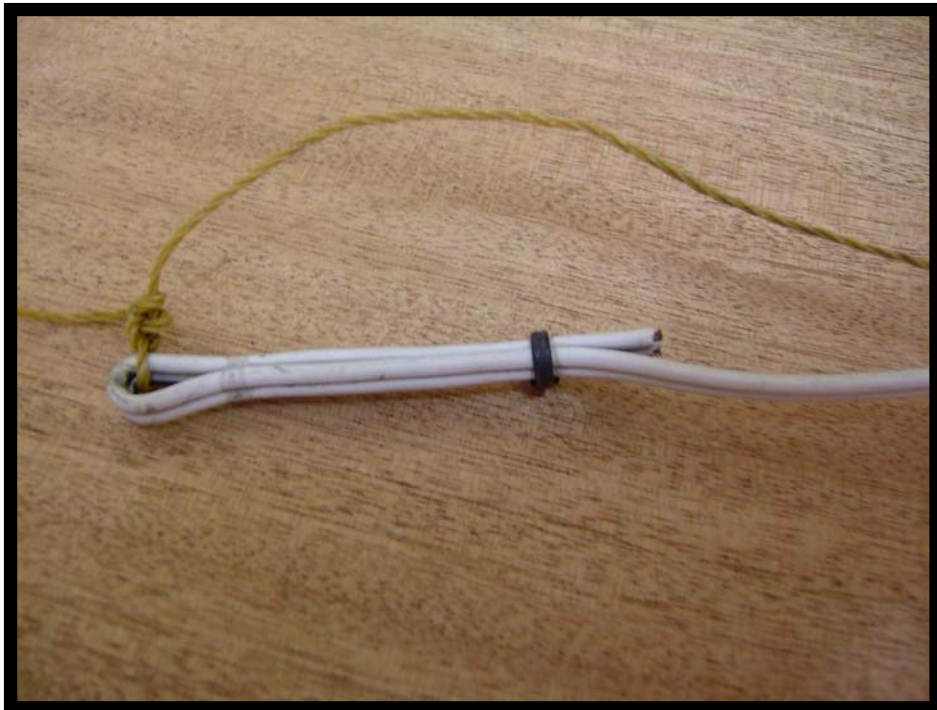
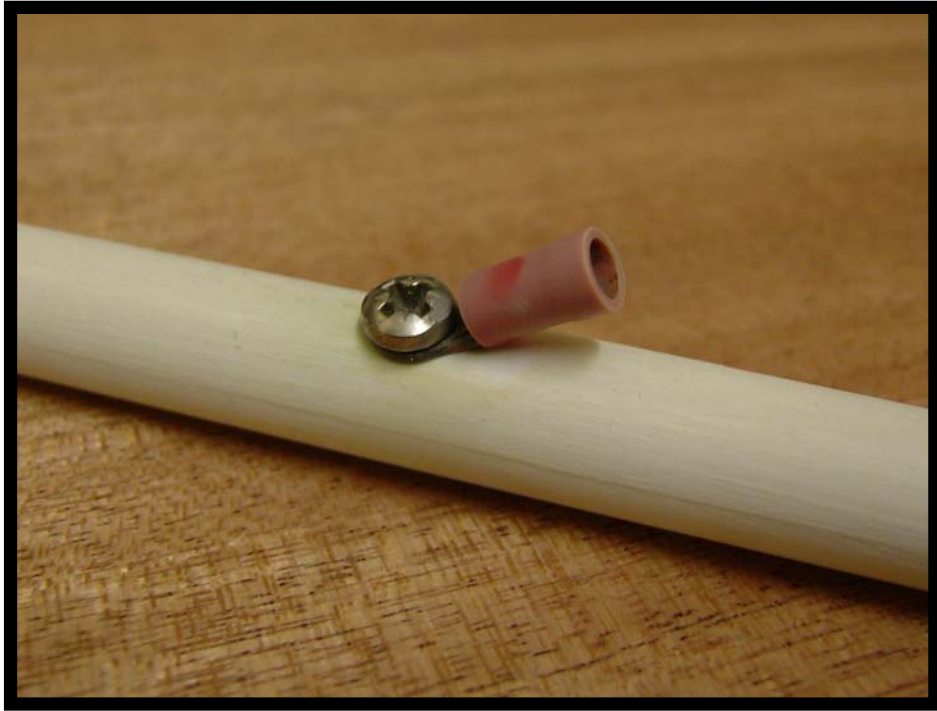
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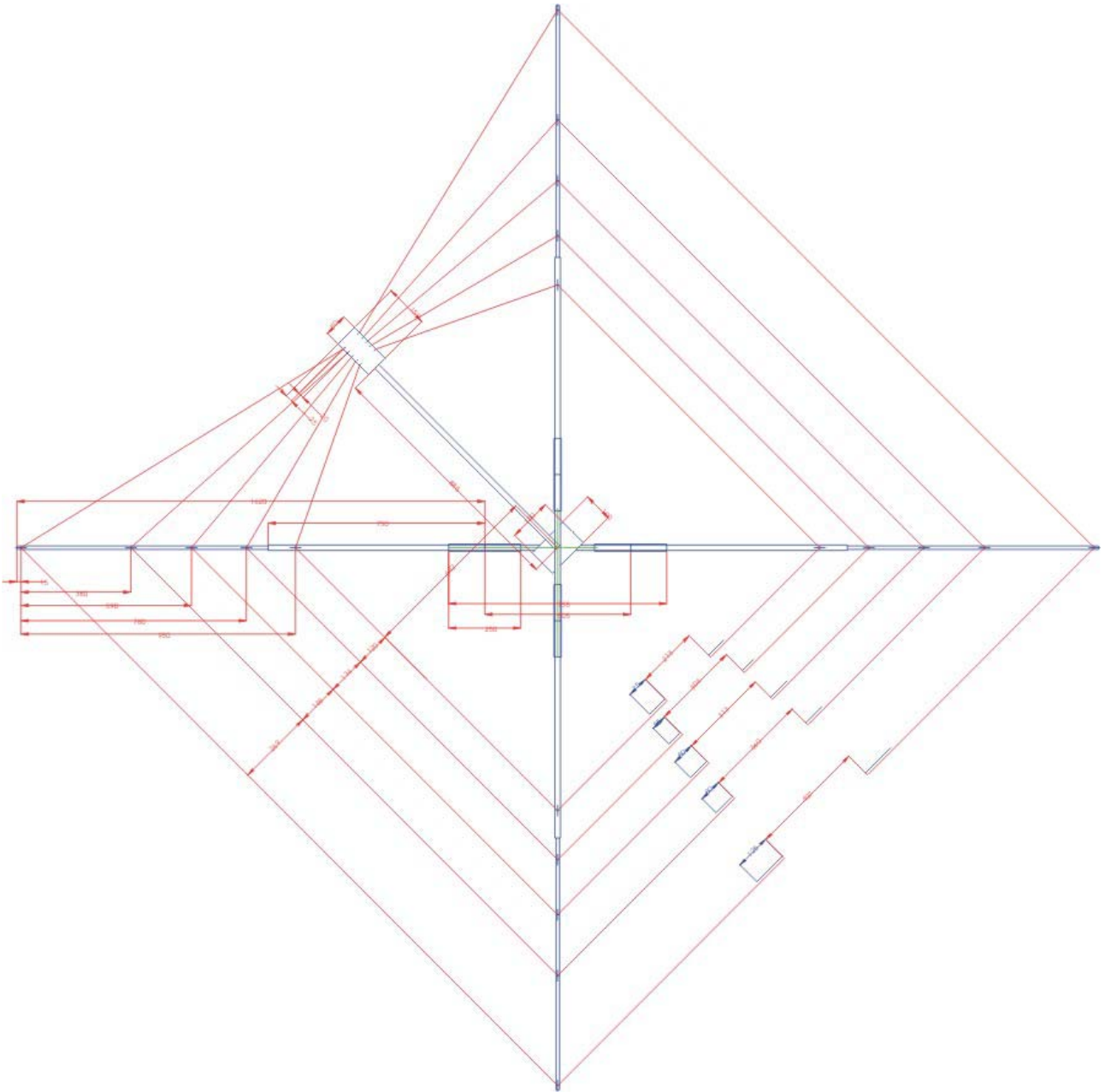
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Item No.	Qty	Description	Length mm	Width mm	Height mm	Type	Tube O.D.	Tube I.D.
A	4	White Round Bar	1000			Round Bar	12	-
B	4	White Round Tube	750			Round Tube	19	12.5
C	1	White Round Bar	1000			Round Bar	19	-
D	4	White Round Tube	250			Round Tube	25.4	20
E	2	White Round Bar	500			Round Bar	19	-
Plate BOX	2	Aluminium Plate	150 (6")	100 (4")	6.35 (1/4")		-	-
	1	White ABS Box	150	80	50	-	-	-
						-	-	-
Wires						-	-	-

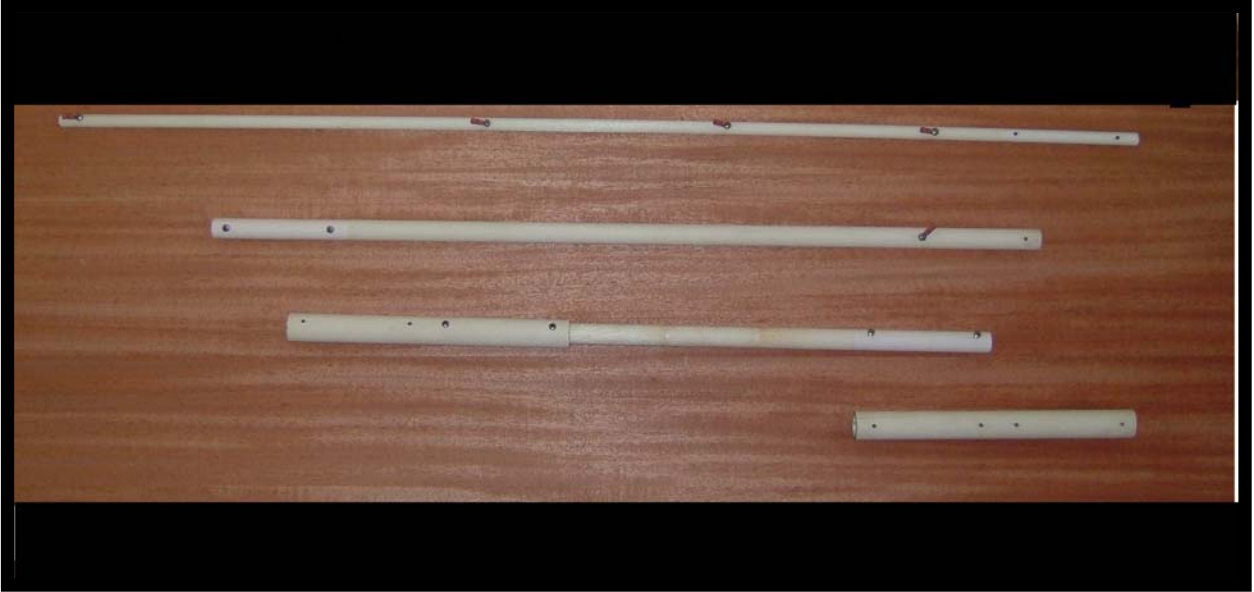
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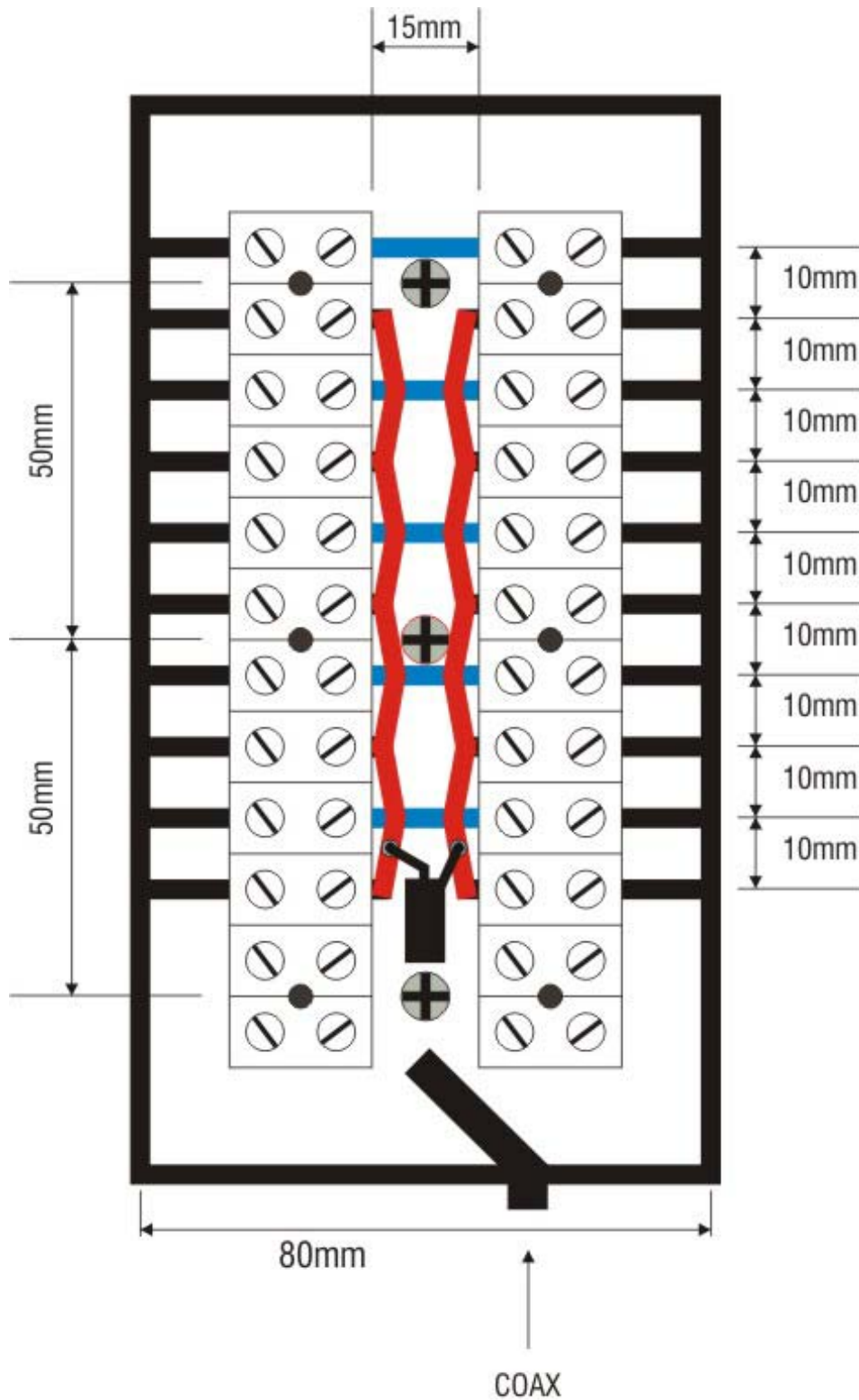
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Junction Box