



TZ-V-4 Quad-band Trapped Vertical - Installation Manual

The TZ-V-4 is a trapped vertical antenna for the 10, 15, 20 and 40m amateur bands. The antenna uses an aluminium radiating section and three traps to permit performance on four frequency bands. All hardware supplied is stainless steel to cope with aggressive environmental conditions except for the mounting U bolts which are optionally supplied at slightly extra cost as stainless steel.

The antenna uses high efficiency coaxial traps which are sealed against the ingress of moisture and surrounded with a PVC cover to protect the traps from rodent and bird attack, a common occurrence

in many locations. Heavy wall tubing is used to provide superior strength and durability.

The antenna has a large bandwidth capable of being tuned for a maximum VSWR of less than 2.0:1 across the whole of the 10m and 40m bands, with 250 kHz coverage of the 15m and 20m bands. The antenna may be ground mounted, mounted on a metallic surface, such as the roof of a house or garage or on a pole or tower with the addition of a radial kit. When mounted on a pole in the clear the antenna is extremely efficient and offers excellent low angle radiation for DX communications.

Supplied Equipment

The following equipment and/or facilities are supplied with the TZ-V-4 antenna:

Radiating element:	Radiating section – Various sleeved aluminium sections.
Traps	(3) Three traps – 10m, 15m and 20m resonant.
Adjustment hose clamps	(4) Four stainless steel hose clamps, 2 by 25mm and 2 by 15mm.
Mounting bracket	Aluminium mounting bracket attached to a support pipe or tube.
Element Screws	(3) Stainless Steel self tapping screws.
Mounting hardware	(2) 50mm galvanised steel U bolts.
Radial Kit Mounting	(2) Stainless Steel M6 phillips head screws, flat and spring washers.
Instruction Manual	This document.

Optional Equipment

Radial Kit	(4) Four wire radials supplied terminated with a 6mm eyelet with heatshrink mechanical strengthening at the eyelet. Cut to length for each operating frequency with terminating nylon thimble for attachment of wire/nylon rope. One nylon thimble to be used as an end termination per radial.
Stainless Steel U Bolts	(2) Stainless Steel 50mm U bolts are supplied instead of the two (2) 50mm galvanised U bolts for mounting the vertical on a pipe.

Guidance for all installation types

To assist with corrosion protection for the RF connectors, a layer of plastic insulation tape followed by a layer of self-amalgamating tape (bhtal rubber) tape may be used. The electrical tape assists in making removal of the self-

amalgamating tape easier when maintenance is required. Use drip loops to form a single coil of cable that assists with corrosion protection and provides stress relief for the RF coaxial feeder.

Tools Required for Assembly and Tuning.

The following tools are required to assemble the TZ-V-4 antenna:

- a. Flat blade screwdriver,
- b. No 3 Phillips Head Screwdriver,



- c. Tape Measure,
- d. 13mm open ended spanner, and
- e. VSWR Meter or antenna analyser.

Warning Electrocutation Hazard

When installing this antenna be sure not to come into contact with overhead electrical power lines which may not be insulated. Contact with uninsulated overhead powerlines whilst installing or operating this antenna may lead to *serious injury* or *death*. DO NOT INSTALL this antenna in a location where mechanical failure of the support or antenna may allow the antenna or support structure to fall onto or come into contact with overhead electrical power lines.

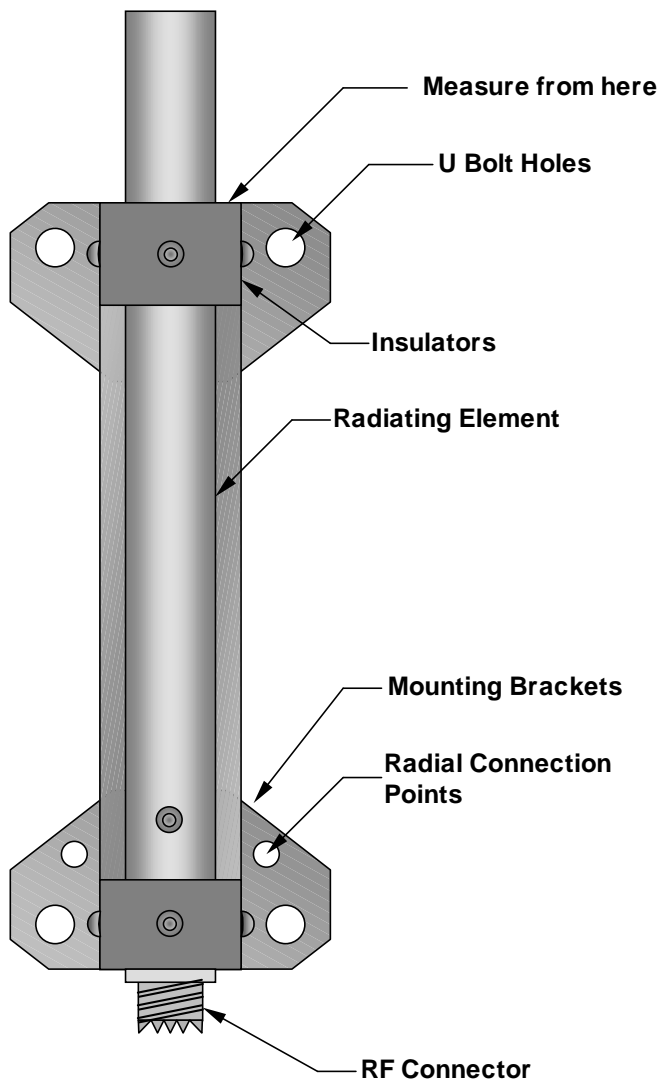


Figure 1 – Bottom Section Detail

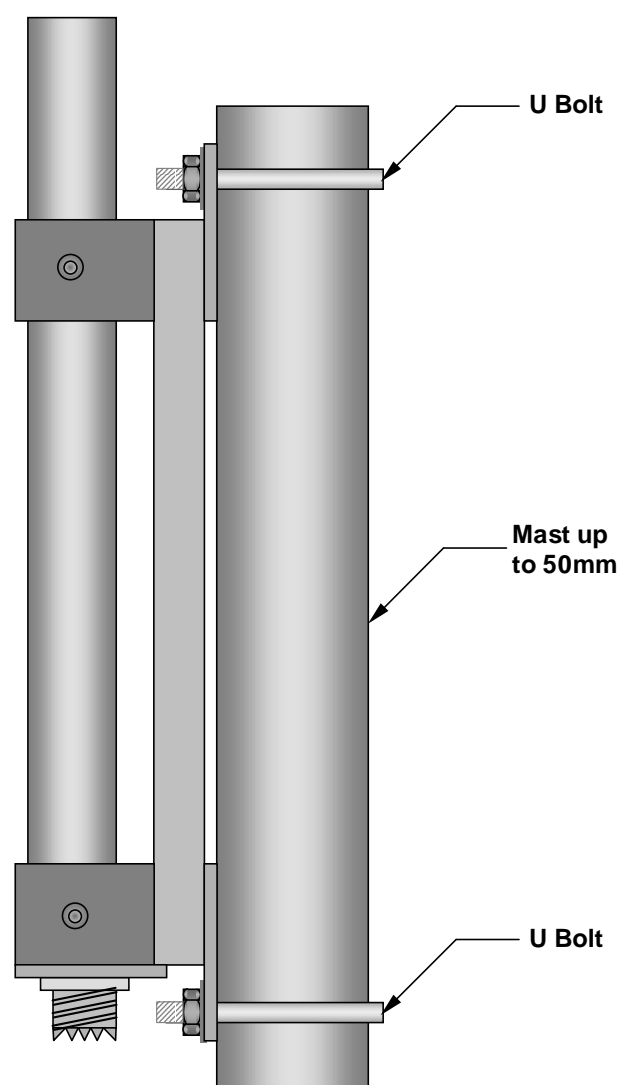


Figure 2 – Mounting Details



Assembling the antenna.

Locate all the components and check that all hardware has been supplied with your antenna. If any item is missing please contact RippleTech

Electronics for a replacement item, info@rippletech.com.au or contact your local agent or supplier.

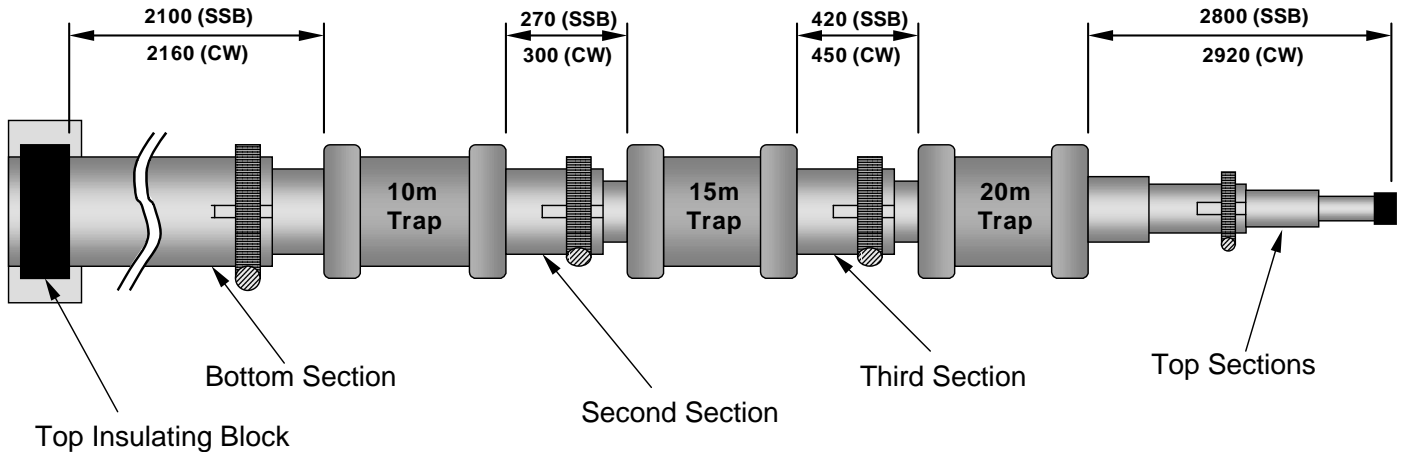


Figure 3 – Assembly and Adjustment

Locate the bottom section of the antenna. This is identified by the mounting hardware/bracket at the base. Insert the 28.8mm diameter by 1000mm section and insert into the base section. Use one of the self tapping stainless steel screws to secure in place using the pre-drilled holes. Locate a 25mm hose clamp (this is the largest one supplied). Place the hose clamp over the end of the bottom section and tighten so that the clamp doesn't move.

Locate the second radiating section which contains the 10m trap and insert it into the base sections. Place another 25mm hose clamp over the top end of the 10m trap section. Locate the third radiating section that contains the 15m Trap, insert into the top of the 10m trap section. Adjust to the length specified in Figure 3 – Assembly and Adjustment. Locate the top radiating section that contains the 20m Trap, insert into the top of the 15m trap section. Place the hose clamp over the top end of the 20m trap tubing (end with a slit) and tighten as per the bottom section instructions.

Locate the top radiating sections which include a 12mm diameter and 10mm diameter by 1000mm sections. Insert the 10mm section into the 12mm section and secure in place using the supplied self tapping stainless steel screw. Insert this combined section into the 20m trap radiating. Adjust the length of the entire 40m section so that the length of the element from the top edge of the trap to the top

of the antenna is in accordance with Figure 3 – Assembly and Adjustment. Use the length described for optimised VSWR for either Phone or CW portions of the 40m band.

Finally re-check and adjust the length of the sections between all traps and the 40m lengths in accordance with Figure 3 – Assembly and Adjustment. Use the length described for optimised VSWR for either Phone or CW portions. Tighten the hose clamps fully.

Insert the top and middle sections of the antenna into bottom section. Adjust the length of the aluminium tubing between the top of the mounting insulator and the base of the 10m trap in accordance with Figure 3 – Assembly and Adjustment. Use the length described for optimised VSWR for either Phone or CW portions of the 10m band. Tighten the hose clamp fully.

Locate the mounting U Bolts and insert them into the mounting bracket.

If you have ordered the optional radial kit, locate the radials and associated M6 screws. Place the eyelets of two of the radials over one of the tapped radial mount holes. Insert and tighten the M6 screw. Repeat for the remaining radial on the other side of the mounting bracket. The order or selection of radials for each side is not critical.

Assembly of your antenna is now complete.



Pre-tuning of your TZ-V-4

Prior to erection of the antenna at full height it is advisable to check that the antenna is correctly tuned. Use a VSWR or antenna analyser to check the VSWR of the antenna on each band. For ground mounted installations this step will configure the antenna for final installation. For pole or tower mounting locate the antenna at height of approximately 2m, and extend the radials downward so that they touch the ground at their ends. Support with a brick or other heavy object.

There is no need to earth the radials at the ends. For a roof mounted installation simply earth the antenna as best as possible, use a number of radials lying on the ground or other simulation of the final installation location.

Measure the VSWR of the antenna across each band and note the values at 50 kHz intervals on 15 and 20m and 100 kHz intervals on 10m. Locate the minimum VSWR point and determine if this is acceptable for your type of operating. If necessary alter the lengths of the various sections to achieve the VSWR dip at your preferred frequency. Adjust the bottom section first (10m), second section next (15m), then the 20m section and finally the top section (40m). There is some interaction between these adjustments. Shorten the lengths to raise the VSWR dip frequencies or lengthen the distances to lower the VSWR dip frequencies.

As a guide the following applies

10m A 10mm change in length will adjust the antenna resonant frequency by approx 100 kHz

15m A 10mm change in length will adjust the antenna resonant frequency by approx 50 kHz

20m A 10mm change in length will adjust the antenna resonant frequency by approx 40 kHz

40m A 10mm change in length will adjust the antenna resonant frequency by approx 20 kHz

For instance, if you wish to alter the 10m frequency up by 250 kHz decrease length A by $250/100 \times 10\text{mm} = 25\text{ mm}$. Once the 10m section is tuned, measure the 15m VSWR performance, and repeat for length B. Lastly, measure the 20m VSWR performance and repeat for length C.

Note, if you are using your own radials, the length of the radials and/or deployed angles will effect the VSWR and resonance points of your the TZ-V-4. Changing the length or down tilt angle of the radials can affect the VSWR and can be used to obtain a better impedance match. For optimum VSWR the radials should tilt downwards at close to 45°.

The radial lengths should be approximately $\frac{1}{4}$ wavelength long. Note that the velocity factor of the wire used is significant. For bare copper or stainless steel wire an approximate formulae is:

$$\text{Radial length} = (300/\text{freq}) \times 0.25 \times 0.96$$

For PVC insulated wire use:

$$\text{Radial length} = (300/\text{freq}) \times 0.25 \times 0.92$$

Attention: The copper radials should not be used as guys, since their strength is insufficient for this purpose.

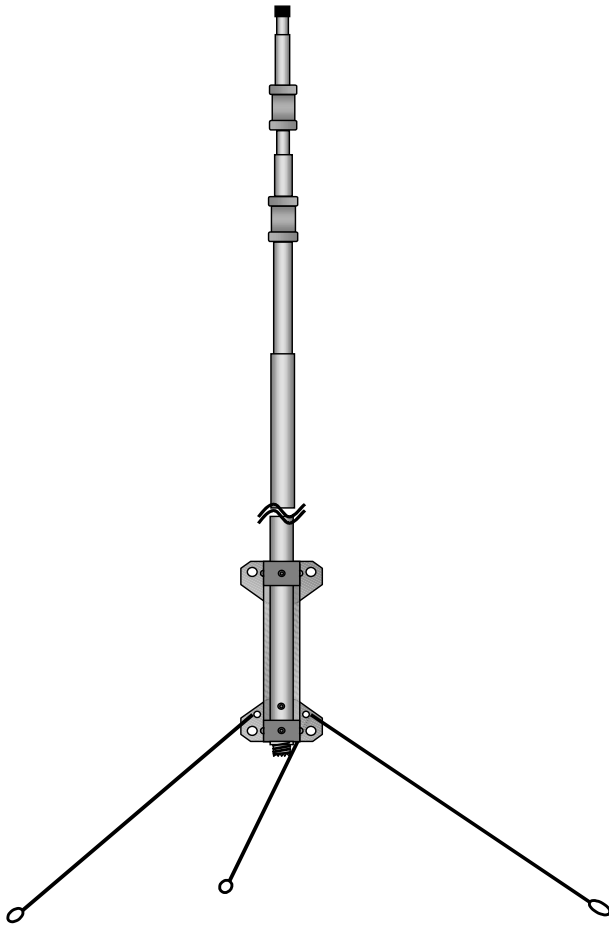


Figure 4 – Final Configuration

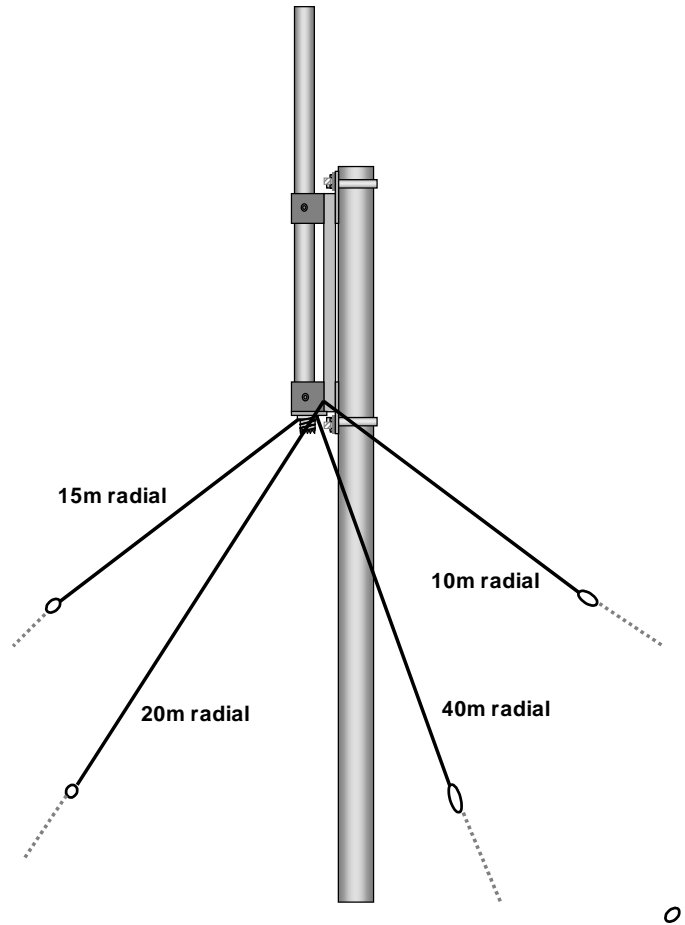


Figure 5 – Radial Installation Detail

Mounting the TZ-V-4 on the ground

When mounting the TZ-V-4 on the ground a short stub mast is required. It is advisable to ensure that the stub mast is earthed and is conductive. The stub mast should be inserted at least 500mm deep, preferably 750mm or greater. The coax socket at the base of the antenna should be no more than 100mm above the ground. To ensure good efficiency, at least 8 radials of at least 10m in length should be connected to the stub mast or mounting bracket. Use the pre-tapped M6 holes. For optimum ground mounted efficiency 32 radials of 10m length or greater should be installed. Note that the input

Mounting the TZ-V-4 on a roof

When mounting the TZ-V-4 on a metal structure such as a roof a short stub mast is required, approximately 300mm in length. It is advisable to ensure that the stub mast is conductive and connected to the metal structure. The coax socket at the base of the antenna should be no more than

impedance of a quarter wave vertical is approximately 37.5 ohms when fed against a perfect conductor. If the antenna has a ground resistance of 15 ohms then the antenna input impedance will be very close to 50, i.e. a VSWR of 1:1. However, significant power will be dissipated in the ground. By adding radials to your antenna, the VSWR may be degraded but the operating efficiency of your antenna will be improved. With an effective ground radial system, the VSWR of the TZ-V-4 would be close to 1.5:1 at resonance.

100mm above the structure. No radials are required if the metal surface is at least 1m². Ensure that the method used to secure the stub mast to the metal structure is sufficient to withstand the bending moment applied by the antenna under strong wind conditions.



Mounting the TZ-V-4 on a pole

When installed on a pole or tower the TZ-V-4 requires a ground plane. This is best achieved using the optional radial kit supplied by RippleTech Electronics. If the antenna is mounted directly above a large yagi array this may be substituted for a ground plane as long as the mount point is less than 10cm from the boom of the beam.

When mounted on a pole the radials (kit or your own) should be connected as previously described.

The radial should be angled down from the antenna at angle of between 30° and 50°, preferably 45°. In plan view the radials should be separated from each other by approximately 90°, i.e. evenly spaced around the antenna, in order to provide an omni-directional radiation pattern. Slight departures from 90° separation will not drastically effect the antenna performance.

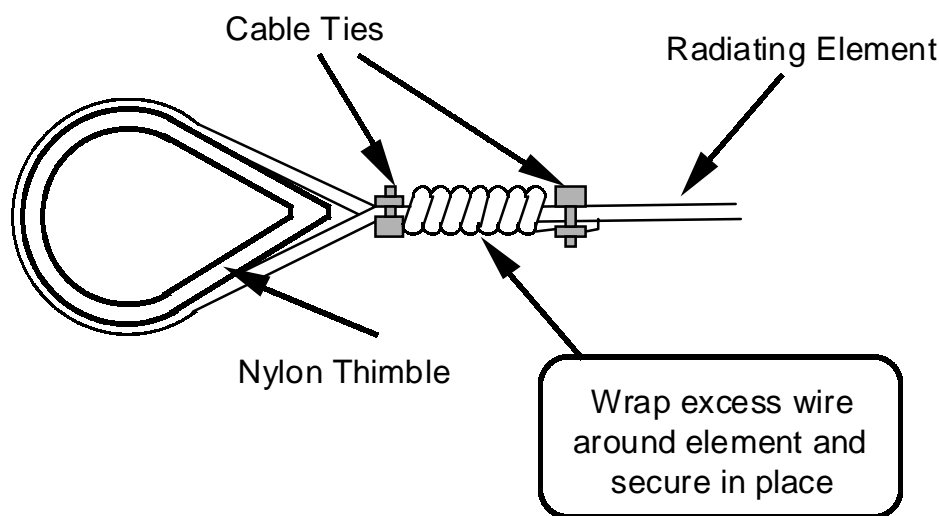


Figure 6 – Radial connection to support ropes

Change Required	Option One
To Lower Resonant Frequency	Lengthen dimension A, B or C
To Raise Resonant Frequency	Shorten dimension A, B or C
To Raise Impedance	Lower the radial ends lower
To Lower Impedance	Raise the radials more towards horizontal.

Table 1 - VSWR adjustment Options



Specifications

Type	Trapped Vertical (1/4 wavelength)			
Frequency Range	10m, 15m, 20m, and 40m.			
Bandwidth*	10/11m - 3500 kHz, 15m - 700 kHz, 20m - 400 kHz 40m - 350 kHz (2.0 : 1 VSWR limit).			
Input Impedance	Nominally 50 ohms.			
VSWR Minimum	Sloping Radials	Over flat G.P		
	10m 1.2:1	10m 1.5:1		
	15m 1.5:1	15m 1.7:1		
	20m 1.2:1	20m 1.4:1		
	40m 1.2:1	40m 1.3:1		
Radiation polarisation	Vertical			
Gain	10m - 2.4 dBi,	15m - 1.8 dBi,	20m - 1.2 dBi,	40m - 0.5 dBi
Directivity	Omni-directional			
Power Handling	1000 Watts PEP			
Total Weight	5 kg.			
Overall Length	6.600 m – 6.840m			
Wind Survival	100 km/h			

Bandwidths quoted for optimum installation with 15m of RG-58 cable when mounted over a large metal surface, approximately 8m by 8m or greater.

Special Notes – Ingress of water into the trap covers

The antenna traps are sealed both internally and externally. However, from time to time, or if the antenna is subject to a combination of high rainfall and winds causing vibration, one or more seals may fail. The external PVC cover for each trap is provided only as protection against bird attack. In the event a trap outer cover seal fails, water may become trapped inside the trap cover. This will produce a high VSWR or moderate change in VSWR for one or all of the frequency bands in use.

The ingress of moisture usually will not result in damage to the trap itself, however the water will electrically connect the top and bottom aluminium sections which will prevent the trap from operating correctly, unless the water is removed.

To repair a trap which has not been electrically damaged, disassemble the antenna and whilst gently shaking each trap, listen for “sloshing” water within the trap.

If the trap is filled with water, drill two (2) small holes approximately 2 - 3mm in diameter in the lower end cap of the trap. Use a battery powered drill to prevent any chance of electrical shock when the water is released from the trap. **Ensure that the drill penetrates only 3 or 4mm into the trap cavity to prevent damage to the internal circuitry of the trap.**

You may wish to re-seal the trap using a neutral cure clear silicon sealant, or leave the holes in place to allow water to drain from the base of the trap.

The coaxial cable traps are sealed internally, however if high power has been used with the trap full of water, arcing may have occurred. In such an instance, removing the water from the trap will not return the trap to a serviceable condition and the trap will require replacement with a new item.

