
optimale Kurzwellen-Antennen

computer-designed / computer-optimiert

entwickelt von Funkamateuren für Funkamateure

optimum short-wave antennas

computer-designed / computer-optimized

developed by hams for hams



O B 1 6 - 5

1 6 (24) Element Yagi / 20 / 17 / 15 / 12 / 10m

!!! Quality made in Germany !!!

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1. Introduction

The OB16-5 is a high performing and very special Fiveband Antenna for the 14, 18, 21, 24 and 28 MHz amateur radio bands.

OptiBeam shortwave antennas are designed and optimized by support of modern techniques such as computerized antenna simulation and are finally adjusted by extensive tests in praxis.

The core of the antenna consists of a direct coupled 3-element-drivercell, where the drivers are connected with a phase line of square tubes. There is a separate reflector for each of the three bands. Furthermore there is are two separate directors for each of the 20m and the 15m band and six separate directors for the 10m band.

The elements for the 17 and 12m band are coupled to the 20m elements by the special "hidden sleeve element technique". The 17 and 12m drivers are located close behind the 20m driver and are connected to the square tube phase line as well.

The reflectors and directors are organised vertically. The 12m reflector and director is located above, the 17m reflectors and directors below the corresponding 20m directors.

By this new concept of feeding in combination with a special order of all elements and the exclusive use of full size elements highest efficiency, optimum bandwidth concerning high gain, clear pattern and low SWR together with unlimited power handling are achieved.

In the following table the essential electrical and mechanical data can be seen:

Bands	20m / 17m / 15m / 12m / 10m
Gain (dbd)*	7,1 / 7,2 / 7,3 / 7,0 / 7,7
Gain (dbi)**	14,5 / 14,7 / 14,9 / 14,8 / 15,5
F/B (db)	18 / 20 / 22 / 24 / 20
SWR: 14,00- 14,20 14,35	1,3 - 1,1 - 1,2
18,07- 18,14- 18,17	1,3 - 1,1 - 1,2
21,00- 21,25- 21,45	1,5 - 1,1 - 1,5
24,89- 24,93- 24,99	1,3 - 1,1 - 1,3
28,00- 28,50- 29,00	1,5 - 1,1 - 1,5
Impedance (Ohm)	50
Elements	16 (+ 8 hidden sleeve for 12/17m)
Active elements 20/15/10	4 / 4 / 4 / 4 / 8
Max. element length (m)	10,98
Boom length (m)	10,10
Weight (kg)	65

* = average gain over a dipole in free space

gain of monobanders for comparison: 2-element Yagi: 4 dbd, 3-element Yagi: 5-6 dbd

** = average gain at 20m above ground

2. Assembly

The included schematic diagram is needed for the assembly and the following information is given:

- > type of element (R=Reflector, S=Driver, D = Director) and the position on the boom
- > measurements of the element sections (length and diameter)
- > lengths of the element halves
- > distances between the elements.

The lengths are given in m (meters) and the diameters are given in mm (millimetres).

2.1 Sorting the parts

The antenna partly consists of already pre assembled parts.

All parts of the antenna are marked.

For faster and easier assembly it is recommended to sort the parts per band.

2.2 Assembly of boom

The square boom consists of four parts which have to be connected by 12 coupling pieces in total.

For each coupling piece 4 screws are needed.

Pay attention that there will be 4 big M12 washers on each of the two top coupling pieces at the second screw of the outer boom segment (here the outer ends of the boom truss have to be fixed, see further down).

It is recommended to slide the boom to mast plate (totally pre assembled finished part, see fig. 2.7 and 2nd picture page) over the second section (seen from the rear) before connecting the boom sections and to prefix it **between D10b and D20a**. Hereby avoided are unnecessary working steps later on.

Furthermore the boom truss should be installed at this moment as well.

The **shorter** steel rope has to lead towards the **rear** (reflector side), the **longer** one to the **front** (director side). Each of the two unused 6mm loops have to be slid over the **second screw** of the upper coupler of the outer boom segment. Three of the four big 12mm washers have to be below the loop, one has to be above (see fig. 2.8 and the photo on the picture page).

The screws have to be tightened finally not before the parts of the boom really **fit** to each other perfectly. They have to be tightened very solidly.

2.3 Construction of the elements

2.3.1 ELEMENTS FOR 20, 15 AND 10M

For the element to boom brackets 4-cornered plates are used and the insulation of the elements is done by 2 (driver platform = 4, see below) special plastic tube holders.

According to the diameters of the elements there are 4 plates with 30mm (S20 / R20 / D20a,b), 3 plates with 20mm (S15 / R15 / D15a,b) and 8 plates with 16mm (S10 / R10 / D10a-e) tube holders.

The driver element platforms are a bit longer. On them you find a pair of tube holders left and right plus the bottom half of a tube holder in the middle to reinforce the centre of the driven element which is split with the insulator.

Furthermore the 10m driven element is lifted up a bit by means of additional half tube holder pieces. Hereby this element, later on at the phase line installation (see fig. 2.6), will be at one level with the other and much ticker centre tubes of the other driven elements.

The middle sections of the elements have to be fixed **exactly centred** on the plates (orientation = black middle line on parasites / insulator middle piece on driven elements which finally has to sit centred in the pre assembled bottom half of the support tube holder). For that the element middle sections have to be put in to the tube holders (only concerning the driven elements the tube holders at one side have to be opened for this process). Then the screws of the tube holders have to be **tightened solidly**. The screws of the driver middle sections divided with the insulators have to point **straight upwards**.

Next the other element sections have to be assembled. Insert the following sections in the previous sections with their side which has two drill-holes **equal in size**. The tubes have to be put in until the drill-holes of both sections overlap perfectly (concerning the outer 12mm tubes of the driven elements the **middle one** of the three drill-holes has to be chosen).

Then the corresponding screws (30mm tube = longest screw / 25mm tube = second longest screw / 20mm tube = third longest screw / 16mm tube = shortest screw) have to be pushed through **from the side of the enlarged drill-hole** of the previous segment. On the opposite side the washers have to be inserted and the self securing nuts have to be screwed on and **tightened solidly** (hold the screw heads with the included special screw-driver against turning, the screw heads dive into the enlarged drill-hole, see picture page). This method results in an extremely solid mechanical connection and rattle sounds inside the segment overlaps are totally avoided.

By this way of assembling the element sections the required lengths of the sections and the element halves are achieved automatically.

While mounting the elements pay attention that all screw heads show **upwards**. Keep in mind that the elements hang below the boom. Therefore the screw heads have to be on the same side of the elements where the plates are located at.

2.3.2 SLEEVE-ELEMENTS FOR 17 AND 12M

The sleeve-elements for the 17 and 12m band consist of single 12mm tube sections. The single sections are connected by 16mm tube **overlays**.

A 17m element always consists of **five** sections and therefore has to be connected four times by the use of the overlays (two times left and two times right each).

A 12m element consists of **three** sections with the requirement of two connections (one time left and one time right each).

The screwing has to be done in a way that the enlarged drill holes of the overlays are located on the **upside** of the element. 20mm long M4 screws have to be pushed through from the top, at the bottom a washer has to be slid over and an M4 self locking nut to be screwed on.

We recommend that you push through **both** screws first and then screw the nuts on as the tubes cannot be moved much inside the overlay.

The single elements are mechanically coupled to the 20m elements by **UV stabilised plastic spreaders** on which you find corresponding tube holders.

The plastic spreaders **type A, B and C** are used for the vertical installation of the 17 and 12m reflectors and directors to the 20m reflector and director.

The 12m elements have to be located **above**, the 17m elements **below** the corresponding 20m parasite.

The plastic spreaders **type D, E and F** are used for the installation of the 17 and 12m driven element to the 20m driver. They are located horizontally **behind** S20.

The final element order in this area has to be S12, S17, S20 (see schematic drawing).

The plastic spreaders should be mounted in a **distance of about two meters** in between each other (except the distance between the last two spreaders on the last 17m section).

The spreaders type A and D have their position on the **30mm** sections, the types B and E on the **20mm** sections and the types C and F on the **16mm** sections of the corresponding 20m element.

The entire structure of the sleeve elements and their mounting, i.e. the connection of the single 12mm sections by the overlays, the element installation to the 20m elements and the position of the plastic spreaders are to be seen on the schematic drawings and the special picture page of this manual.

2.3.3 INSTALLATION OF THE 20M PARASITES AND THE SLEEVE-PARASITES FOR 17/12M

The parasitic elements for 20m and the corresponding 17/12m parasitic sleeve-elements should be assembled **simultaneously**.

The 20m-element has to be put together section by section, beginning from the centre. The element platform with the installed centre section should already be fixed to the boom.

In the moment when you work on the 30mm, 20mm and 16mm sections you have to slide over the corresponding plastic spreaders (see above and watch the schematic drawing).

Hereby you avoid an extra de assembly and re assembly of the tube holders on the spreaders.

Starting from the centre now the 12mm sections of the sleeve parasites (R17/R12 and D17a,b/D12a,b) have to be installed piece by piece by pushing them through the 12mm tube holders which are mounted on the spreaders and by connecting the sections with the overlays (see above).

Pay attention that the parasitic middle sections are exactly centred (orientate by the **centre drill hole** in the centre section).

The 20m parasitic elements (R20 and D20a,b) have to be exactly in the horizontal position while mounting the sleeve parasites.

This can be achieved by the aid of a second person holding the element upwards or by laying it on an object.

When you have completed the 12 and 17m sleeve parasites on the corresponding 20m element check on each element complex that **all three tubes and the plastic spreaders are parallel to each other**.

Then all tube holders on the plastic spreaders can be screwed on solidly.

The straight mounting of the sleeve parasites to the corresponding 20m elements and their vertical arrangement sort of results in a little pre tension which will stabilize the entire element structure and which minimises the element droop.

2.3.4 ASSEMBLY OF THE 20M DRIVER AND THE SLEEVE-DRIVERS FOR 17/12M

Like on the parasites it is recommended to put together the 20m driver completely first of all.

Again an installation on the boom will be the most convenient way.

The 20m driver platform has to be fixed at the centre of the 20m driver middle section first to be installed onto the boom at the marked position afterwards.

In the same moment the **phase line tubes** should already be screwed together with the driver middle sections for 10, 20 and 15m (details see fig. 2.6).

Before you tighten the platform square bolts of driver 20m install the **element truss mast**.

The pre assembled truss mast is fixed onto a little right angle platform. This platform has to be slid **below the rear square bolt** of the 20m platform in a way that the mast will be located in the rear outside the square bolts of the platform (see picture page). When fixing the platform by screwing on the square bolts the truss masts will be fixed solidly as well.

Now the following segments have to be inserted into the 20m driver centre section.

Simultaneously the corresponding **plastic spreaders type D, E und F** have to be slid onto the corresponding segments (see above and watch the schematic drawing).

Note that the plastic spreaders will be in the **horizontal position** later on (in contrary to the spreaders of the vertically organized sleeve parasites).

In their later horizontal position all spreaders have to **point backwards** (=towards the rear) as the sleeve drivers are located behind the 20m driven element.

Watch that all black tube holders finally have to be located **below the spreaders**.

As soon as the 20m driven element is completed the 12 and 17m sleeve drivers can be mounted.

First the **four sleeve driver centre pieces** have to be screwed onto the **phase line** (details see fig. TZ 2.6).

Then the following sections have to be coupled onto the previous ones like described above. Stabilize them by fixing the corresponding plastic spreaders in the horizontal (position details see above fig. 2.3.2).

Continue this way until the 12 and 17m sleeve drivers will be completed.

Pay attention, like on the installation of the sleeve parasites, that the 20m driven element is straight (held by second person or laid on object) while mounting the 12 and 17m sleeve drivers.

In contrary to the vertically organized parasites here the weight of the plastic spreaders results in an increase of the droop of the main element.

This will be compensated by trussing this entire horizontal element arrangement.

Use the included **blue plastic rope**. In the centre of it you will find a plastic insulator which we have fixed to the rope by means of a special double loop.

Insert this insulator into the **top** of the truss mast which is clamped below the 20m driver platform.

Now the rope ends have to be pushed through the hole which you find on the plastic spreaders type E to the left and to the right. Secure the rope ends against sliding out of the hole by making a knot.

The element now can be brought into the horizontal by adjusting the position of the knot.

For convenience we recommend to first remove the insulator from the truss mast so that the rope is slack again.

This way the position of the knot can be changed easily, then reinsert the insulator into the top of the truss mast again.

Alternatively the position of the spreaders type E can be changed to increase or to reduce the tension of the truss rope.

Long remaining rests of the ropes can either be cut off or somehow fixed at the main ropes.

The entire installation can be seen on the picture pages.

2.4 Attaching the elements to the boom

The elements fixed on the plates have to be mounted on the **underside** of the boom at the marked positions while the connecting screws of the boom should remain horizontal. The square boom makes a straightening of the elements unnecessary.

The plates are attached to the boom by 2 square brackets which embrace the boom from the top and 4 self securing nuts (see picture page). When tightening the square brackets pay attention that all elements are **parallel** to each other.

The standard driven elements (from the rear S10, S20, S15) should not be tightened before the installation of the phase line is done (see fig. 2.6) as they might have to be moved slightly on the boom.

2.5 Installation of the grounding for the sleeve parasites

The sleeve parasites (R17, D17a,b and R12, D12a,b) are vertically located in a rather close distance to the corresponding 20m parasites (R20 and D20a,b). The result is a strong electrical mutual coupling with high currents flowing between each of the 20m parasites and the corresponding sleeve parasites mechanically installed at them (this counts especially for the director elements).

To electrically stabilize this configuration, especially under very wet conditions, the sleeve parasites have to be grounded from their centres to the boom.

This is done by means of right angle aluminium straps which have to be installed at the sleeve parasites.

The **longer bent part** of the right angle aluminium strap has to be screwed onto the centre of the sleeve parasite using an M4x25mm inbus screw, an M4 washer and an M4 self locking nut.

The strap has to be fixed in a way that it is located on top of the corresponding 12m tube or at the bottom of the corresponding 17m tube.

Attention: there are two types of right angle aluminium straps. The slightly **shorter** ones have to be used on the 12m sleeve parasites located above, the slightly **longer** ones have to be used on the 17m sleeve parasites located below the boom.

On their opposite side the **shorter bent part** of the right angle aluminium straps have to be clamped to the boom (the little drill hole is just due to the manufacturing process and has no specific meaning).

This is done by a square bolt (identical with the ones being used on the element platforms) and an aluminium flat piece. The square bolt has to be slid over the boom from the top and the aluminium flat piece has to be inserted over the shanks of the square bolt from the bottom. It has to be pre secured by two self locking nuts and now can be pushed up to the edge of the element platform.

The right angle aluminium straps have to be clamped below the square bolt on top of the boom and below the aluminium flat piece at the underside of the boom.

Then the square bolt with the flat piece and the clamped aluminium grounding straps has to be fixed by screwing on the nuts on the shanks of the bolt at the bottom.

Hereby achieved is a solid grounding for each parasitic sleeve configuration which finally results in electrical stability.

The entire installation can be seen on the photo on the picture pages.

2.6 Installation of the phase line

The five driven elements (from the rear S10, S12, S17, S20, S15) are connected with 2 parallel 40x20mm square tubes (=phase line).

The square tubes have to be in **direct contact** to the elements (put the washers only below the screw heads). First remove the element **screws and washers of the three standard drivers**. Then insert the predrilled square tubes (move the elements slightly if needed) by means of the element screws.

Likewise insert the coax connector or the balun at the bottom of the phase line (=elements below boom) directly with the screws of S20 (see picture page). In case the coax connector is used be sure that the screw at the backside of the connector which holds the strap is **tightened solidly**.

Finally the phase line square tubes have to be **tightened really solidly** together with the standard driven elements (=important electrical contact) and the driven elements have to be mounted below the boom by means of the element plates (see fig. 2.4).

The **sleeve drivers for 12 and 17m** have to be screwed onto the phase line by means of the added M4x60mm screws.

The screw has to be pushed through from the bottom upwards (slide a washer over the screw shaft first) through the phase line, the element tube and the inserted inlay. Then you can screw on the self locking M4 nut and fix the sleeve driver element half to the phase line solidly.

2.7 Installation of the boom to mast plate

The boom to mast plate is a completely pre assembled part (see 2nd picture page) with four horizontal square-brackets which embrace the boom and four vertical U-bolts which embrace the mast.

The boom to mast plate should have already been slid onto the second boom section (counted from the rear) in the moment of the boom assembly (see fig. 2.2). It should have been pre fixed **between D10b and D20a**.

It now should be fixed solidly.

2.8 Installation of the boom truss

The boom of the antenna mounted to the mast has to be trussed by two included stainless steel ropes of 4mm in diameter. The **shorter** rope leads to the **rear** (reflector side), the **longer** one to the **front** (director side).

A turn buckle is inserted into each steel rope at one side and a steel loop for the fixation to the boom at the other side.

Each of these loops should have already been fixed to the **second screw** of the top coupler piece of the outer boom segment, with **three** big washers below and one above (see picture page).

The two turn buckles, turned out by about 2/3 of their lengths, are already connected by us to the centre piece of the boom truss. Fasten this centre piece by means of the corresponding U-bolt to the mast and push it up to about one meter until the truss ropes are pre tensioned and then fix it solidly.

Finally the steel ropes have to be tightened by means of the turn buckles until the boom is stable in the horizontal **without any sag**.

The entire installation can be seen on the picture pages.

3. Connection of coax cable

The feeding of the antenna is done by 50 Ohm coax cable.

For connection a PL-259 connector is required. The connector should be sealed against water entry.

Close to the feed point the cable should be winded to a choke coil with 5 to 6 turns of about 20 cm of diameter. Hereby the antenna is electrically balanced and unwanted radiation of the cable itself is prevented.

Instead of the choke coil a 1:1 balun can be used as well (recommended).

4. Adjustment of the antenna

An adjustment of the antenna is not necessary if the given dimensions are exactly observed.

By some influences of the direct surroundings it may happen that the resonance of the antenna (=point of best SWR) shifts on one or several bands.

By minimum changes of the according driver lengths of the **drivers for 20, 15 and 10m** (=shortening or lengthening of the outer 12mm sections) the resonant frequency of the according band can be shifted to the desired point.

By a slight decrease of the lengths of both element halves (put outer section in to the last drill-hole) the resonant frequency will be shifted upwards, by an increase (pull final section out to the first drill-hole) it will be shifted downwards.

Normally these adjustments don't have to be done as the antenna does not react very sensitive against influences of the surroundings and the SWR curve is flat anyway.

The sleeve element drivers (driver 12 and 17m) are not adjustable on purpose as they are perfectly tuned in combination with their parasites within their 100 KHZ band range.

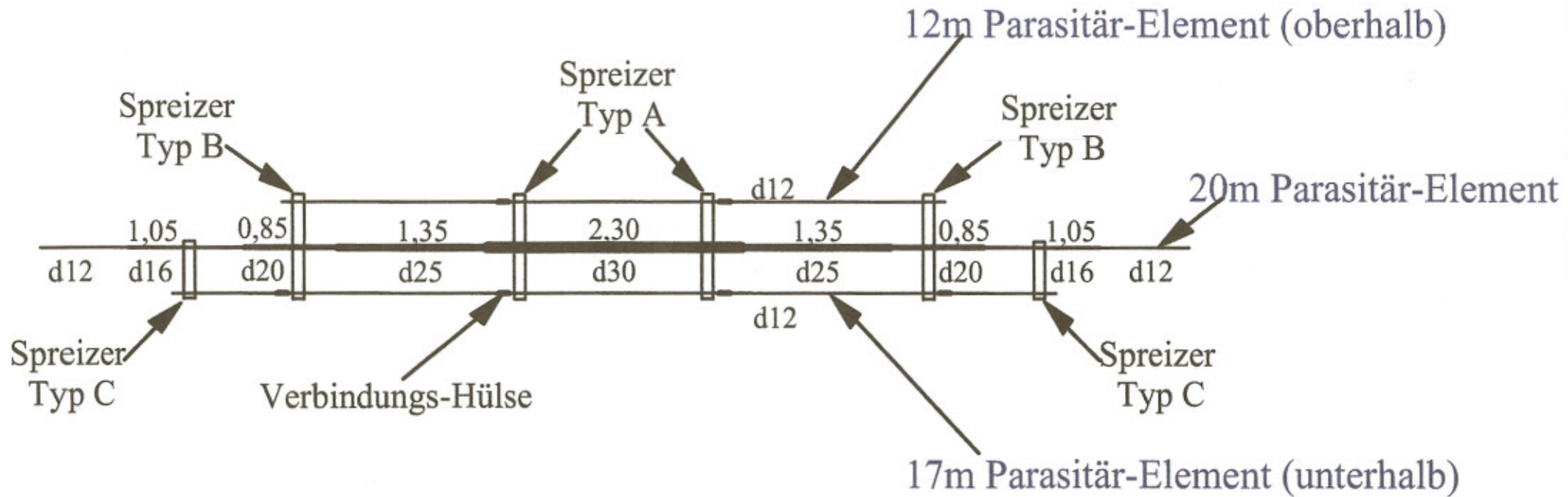
5. Position of the antenna at strong winds

At strong winds the antenna should be placed in a way that the tips of the elements **show straight into the wind** which means that the boom stands broadside to it.

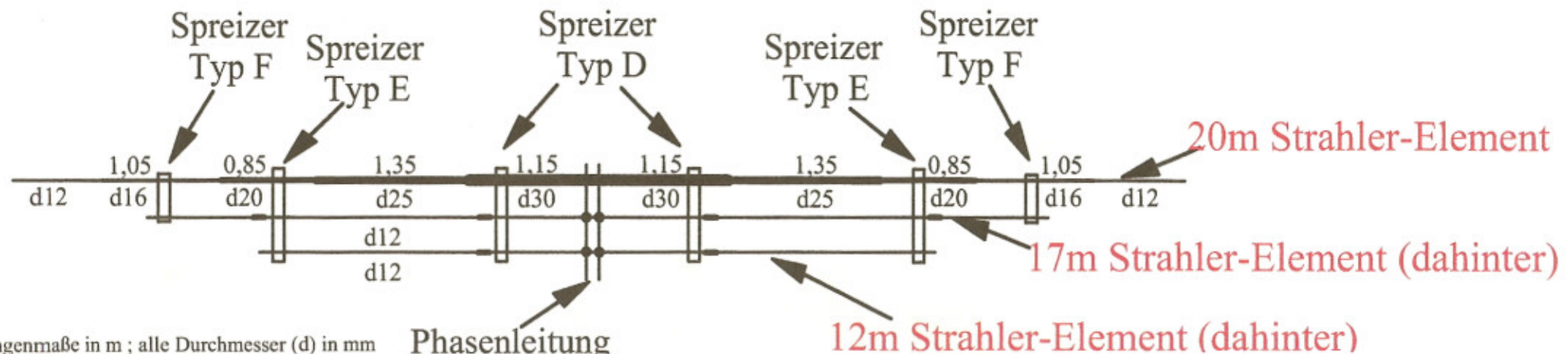
Hereby physical stress to the full size elements is avoided and their duration is enlarged.

Darstellung Sleeve Elemente

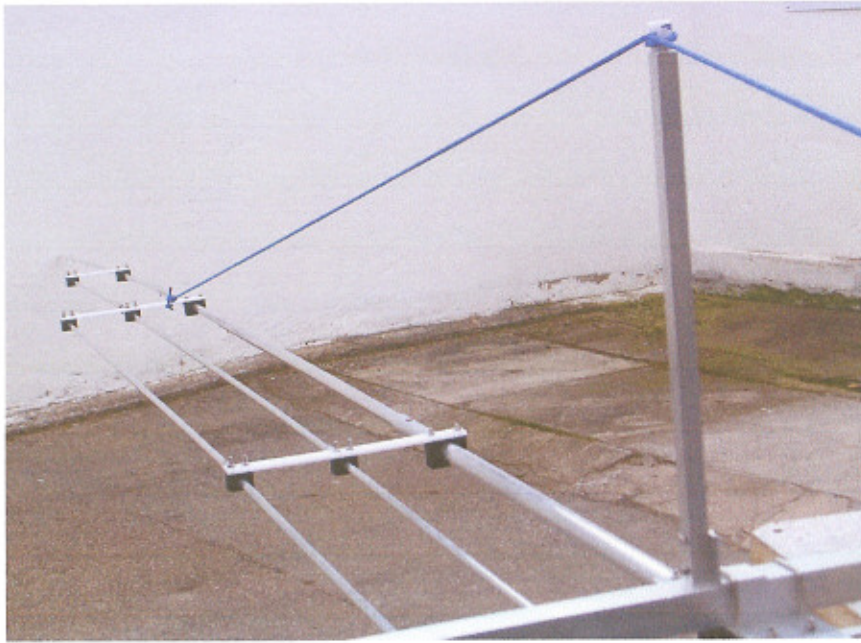
Parasitärordnung (vertikal)



Strahleranordnung (horizontal)



alle Längenmaße in m ; alle Durchmesser (d) in mm

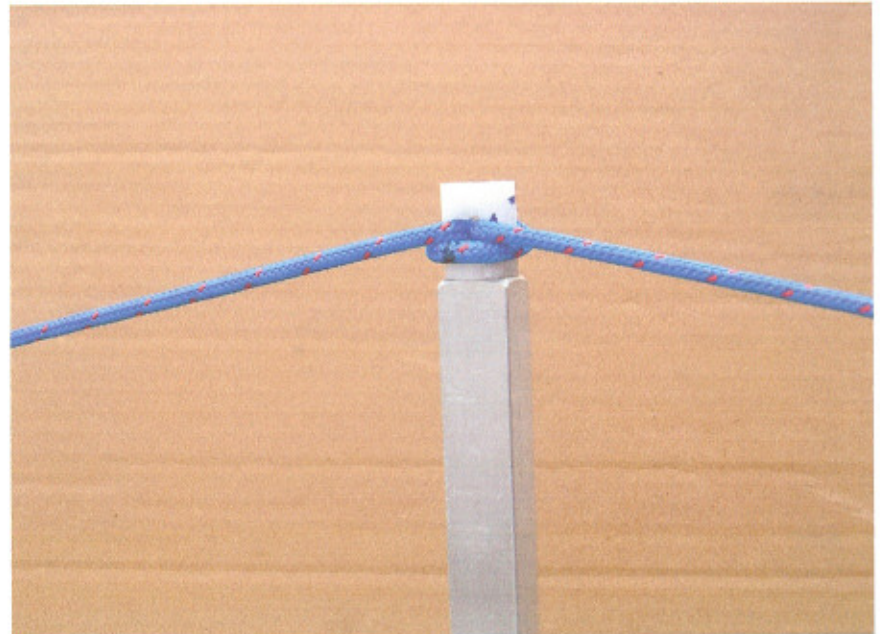


Abgespannte 20/17/12m Strahlerzelle mit eingeklemmtem Spannturm (Bsp. OB11-5)

trussed 20/17/12m driver cell with clamped truss mast (sample OB11-5)

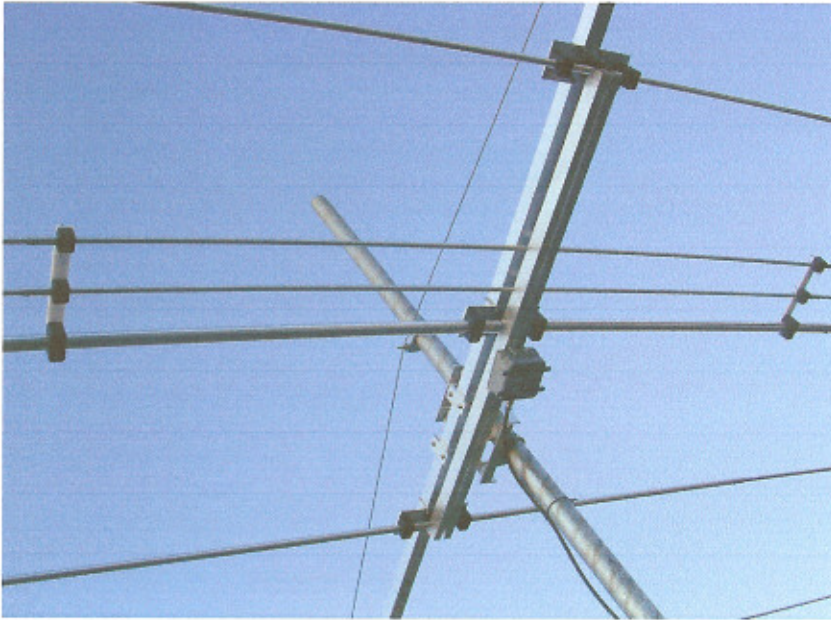
Detailansicht der Spannseil-Doppelschlaufe im Spannturm-Isolator

close up view of the truss rope double loop in the truss mast insulator



Detailansicht des Fixierungsknotens mit Seilrest

close up view of blocking knot with rest of rope

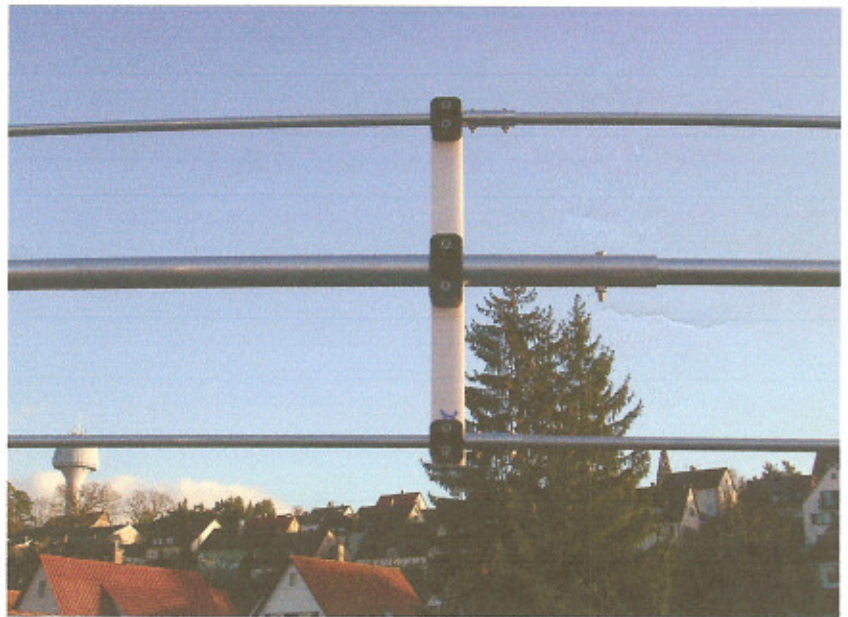


Strahlerzelle mit Sleeve Strahler für 12 und 17m (hier mit 1:1 Balun 5 KW, Bsp. OB11-5)

driver cell with sleeve drivers for 12 and 17m (here with 1:1 balun 5 KW, OB11-5)

20m Parasitärelement mit vertikal angekoppelten Sleeve Parasitärelementen 12 und 17m

20m parasitic element with vertically coupled sleeve parasitic elements 12 and 17m

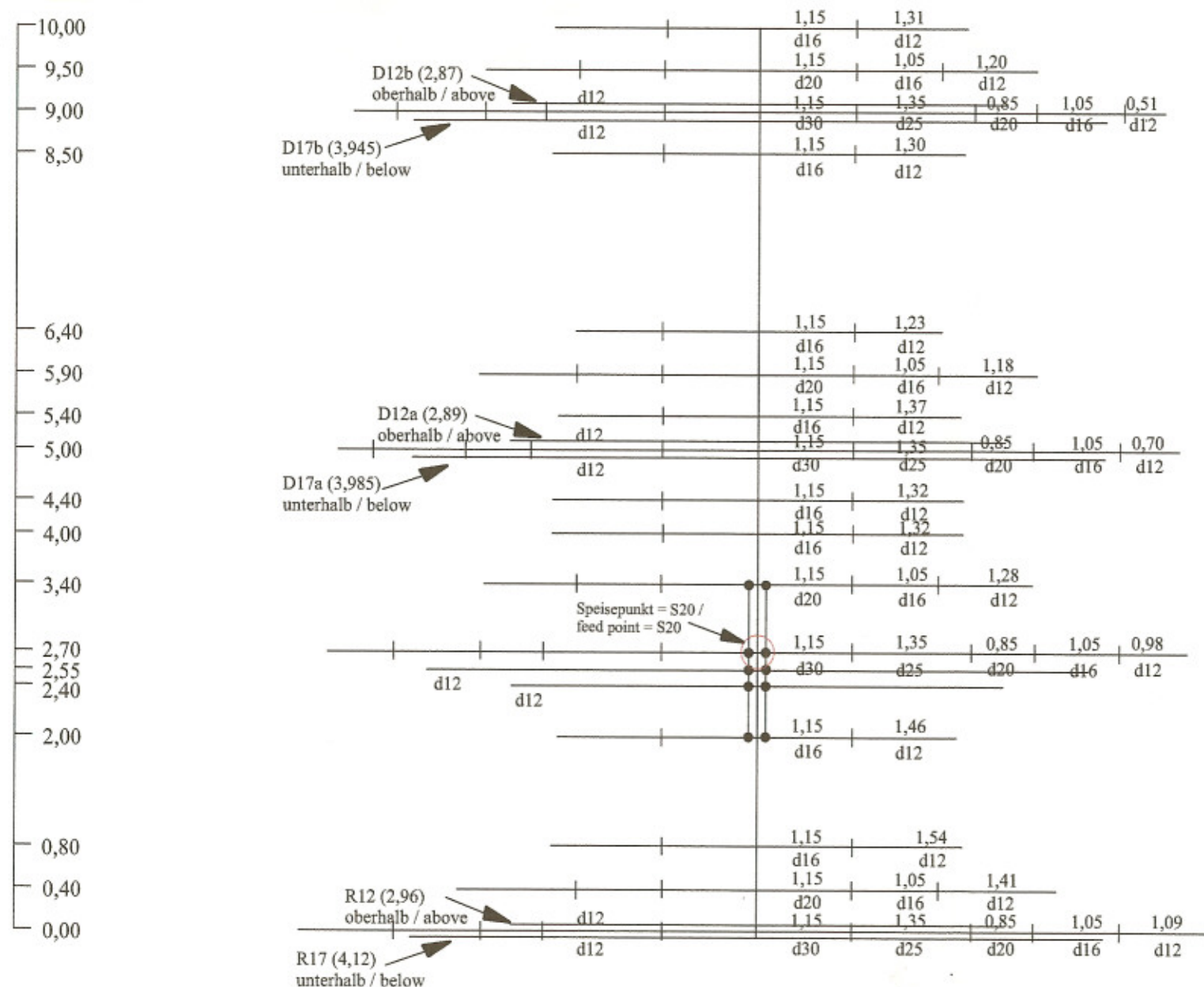


20m Parasitärelement mit über den Boom geerdeten Sleeve-Parasiten 12 und 17m

20m parasitic element with sleeve parasites 12 and 17m, grounded via the boom



OptiBeam OB16-5



D10f (2,46)
D15b (3,40)
D20b (4,91)
D10e (2,45)

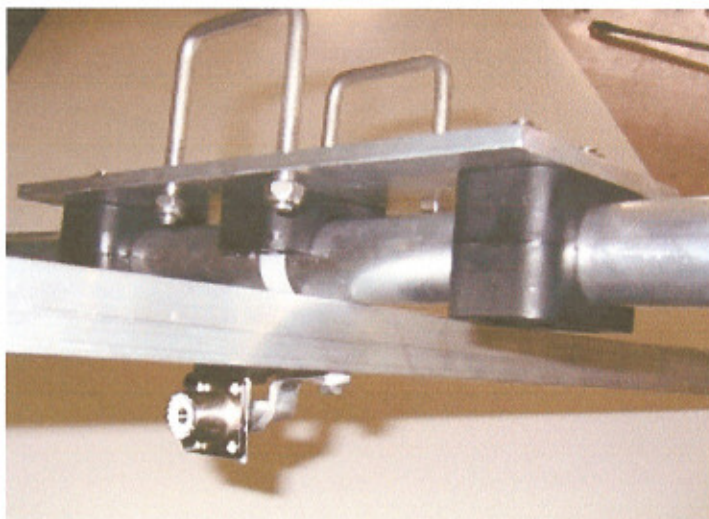
D10d (2,38)
D15a (3,38)
D10c (2,52)
D20a (5,10)
D10b (2,47)
D10a (2,47)

S15 (3,48)
S20 (5,38)
S17 (4,06)
S12 (2,925)

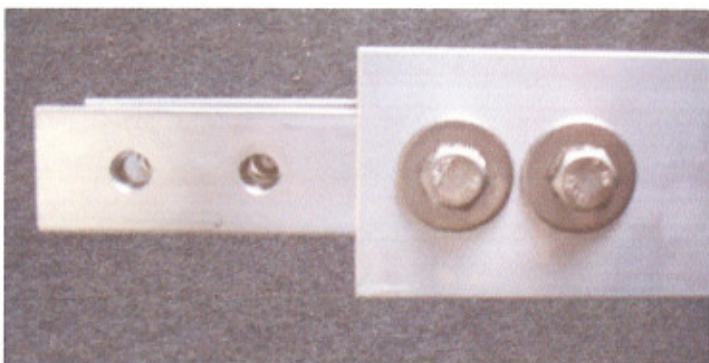
S10 (2,61)

R10 (2,69)
R15 (3,61)
R20 (5,49)

alle Längenmaße in m, alle Durchmesser in mm, Gesamtlängen = Elementhälften / all length dimensions in m, all diameters (d) in mm, total lengths = element halv



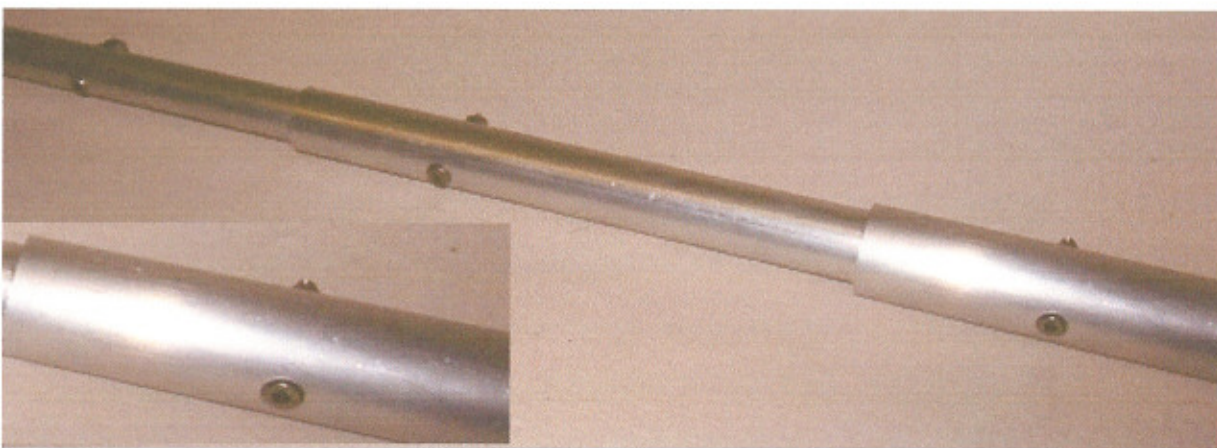
Ansicht Element-Plattform Strahlerelement
mit Phasenleitung und Mittenunterstützung /
view element platform driven element with
phaseline and centre support



Ansicht Boomkopplung bei Vierkantboom /
view boom coupler at square boom



Ansicht Koax-Anschlußbuchse SO239 mit Strahler-
element und Phasenleitung /
view coax connector SO239 with driven element
and phaseline



Detailansicht Elementübergänge / close up view element transitions



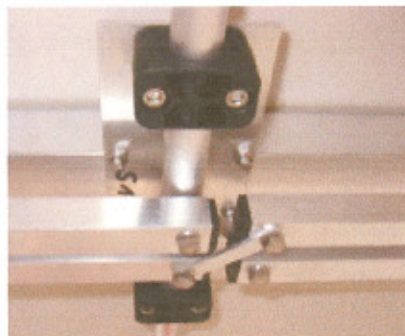
Boom-Masthalterung für kleinere Modelle /
 boom to mast mounting for smaller models



Boom-Masthalterung für mittlere Modelle /
 boom to mast mounting for medium size models



Boom-Masthalterung für große Modelle /
 boom to mast mounting for big models



Seitenansicht Überkreuzung Phasenleitung bei Modell 9-5 u. 4-40 /
 side view crossing of phase line at model 9-5 and 4-40



Ansicht zentrale und äußere Boomabspannung für OB11-3 /
 view centre and outer boom truss for OB11-3



Ansicht variable äußere Boomabspannung div. Modelle /
 view variable outer boom truss diverse models



Gesamtansicht Abschlußstub mit Isolatoraufhängung an Boom bei diversen Modellen /
 total view termination stub with insulated fixing to the boom at diverse models



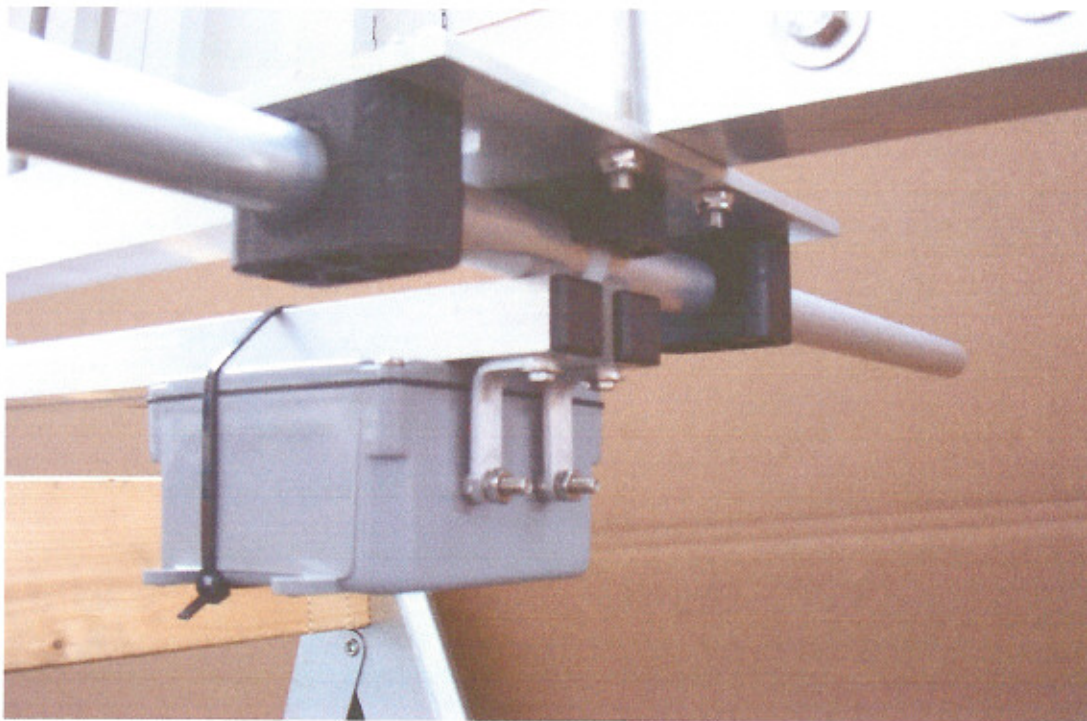
Äußere Seilabspannung für große Modelle, Rundboom dto. /
 outer boom truss for big models, round boom equivalent



Zentrale Seilabspannung für Modelle über 6 Meter Boomlänge /
 centre boom truss for models over 6 meter boom length



Installation des 5 KW Baluns / Installing the 5 KW balun



Durch die Verwendung des beigefügten 50 Ohm 1:1 5 KW Baluns (Design nach WX0B) am Speisepunkt wird die Antenne elektrisch symmetriert und Eigenstrahlung des Koaxkabels wird unterbunden.

Installation

1. Zuerst sind die zwei Schrauben des Strahlerelementes zu entfernen, an dem die Antenne gespeist wird und die auch die Phasenleitungsrohre halten.
2. Der Balun läßt sich aufgrund seiner Flachstruktur gut unter den beiden Phasenleitungsrohren befestigen. Er ist mit seinen beiden Aluminium-Anschlußbügeln und den vorher entfernten Strahlerschrauben am Strahler zu befestigen.
3. Das Einsmieren der Balun-Anschlüsse mit einer Konduktionspaste kann den einwandfreien Kontakt zwischen Balun und Element dauerhaft fördern.
4. Der Balun ist mittels des beiliegenden Kabelbinders an der Unterseite der Phasenleitungsrohre abschließend zu fixieren.
Die Details gehen aus obigem Photo hervor.
5. Das Koaxkabel ist am SO239 Anschluß des Baluns zu befestigen und sollte hier gegen Wassereindringen geschützt werden (z.B. mit selbstverschweißendem Klebeband oder Silikon).

The antenna is electrically balanced and unwanted radiation of the coax cable itself is prevented by the use of the attached high quality 50 Ohm 1:1 5 KW balun (design by WX0B) at the feed point.

Installation

1. Un-screw the two bolts of the driven element where the source is located at and which hold the two square tube transmission lines.
2. Due to the flat structure the balun can easily be mounted below the two square phase line tubes. It has to be connected to the driver by means of the two aluminium straps and the driver screws.
3. You may want to put some anti-oxidant paste such as No-Alox, or Penetrox on the terminal connection before you tighten the bolts.
4. Use the included plastic ty-wrap to finally secure the balun to the transmission line.
The entire installation can be seen on the above added picture.
5. Attach your feedline jumper to the balun's SO239 connector and weather proof this connection to protect it from water.