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**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**

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**O B 4030**

**4 Element Yagi 40 / 30 m**

**!!! Quality made in Germany !!!**

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## 1. Introduction

The OB4030 is a high performing 4el duoband Yagi for the 7 and the 10 MHZ amateur radio bands.

OptiBeam shortwave antennas are designed and optimised by support of modern techniques such as computerised antenna simulation and are finally adjusted by extensive tests in practice.

The core of the antenna consists of a direct coupled 2-element-drivercell, where the drivers are connected with a phase line of square tubes. In addition there is a separate reflector for both of the bands.

A speciality are the high Q coils (no traps), carefully fabricated by OptiBeam, used on both frequency ranges. Hereby achieved is an almost loss free shortening of the element lengths.

By this new concept of feeding in combination with a special element order and the use of the high Q coils highest efficiency, optimum bandwidth concerning high gain, clear pattern and low SWR together with almost unlimited power handling are achieved.

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

<b>Bands</b>	40 / 30
<b>Gain (dBd)*</b>	3,6 / 3,9
<b>Gain (dBi)**</b>	10,8 / 11,3
<b>F/B (db)</b>	15 / 22
<b>SWR</b>	
40m CW/Europe Setting:	1,6 - 1,1 - 1,5
7,00 - 7,05 - 7,10	
40m USA phone Setting:	1,6 - 1,1 - 2,0
7,15 - 7,20 - 7,30	
10,100 - 10,125 - 10,150	1,3 - 1,1 - 1,2
<b>Impedance (Ohm)</b>	50
<b>Elements</b>	4
<b>Active elements</b>	2 / 2
<b>Max. element length (m)</b>	14,58
<b>Boom length (m)</b>	5,60
<b>Turning radius</b>	7,80
<b>Weight (kg)</b>	40
<b>Windload at 130 km/h</b>	600 N / 0,74 m <sup>2</sup> / 8,12 feet <sup>2</sup>

- \* = 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) 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 (millimeters).



When assembling the following **order** is recommended:

- 1) coupling of the boom sections, simultaneously mounting of the boom to mast plate (see fig. 2.2 and 2.10)
- 2) installation of the element middle sections, which are mounted on the element platforms, at the marked positions on the boom (see fig. 2.3)
- 3) connection of the two driven elements by means of the phase line and installation of the balun (see fig. 2.4)
- 4) adjustment of all mounted middle sections on the boom and final fastening
- 5) mounting of this „skeleton“ to the mast or temporarily to a separate pipe
- 6) complete installation of the 40m elements (see fig. 2.6, 2.8 and 2.9)
- 7) completing the elements for the 30m band (see fig. 2.7)

## 2.1 Sorting the parts

The antenna to a high amount 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 the boom

The square boom consists of three parts which have to be assembled each by two coupling pieces that are already installed at one side of the boom parts.

For each coupling piece 4 screws are needed. The screws have to be tightened finally not before the parts of the boom really **fit** to each other perfectly.

It is recommended to slide the boom to mast plate (totally pre assembled finished part, see fig. 2.10 and 2<sup>nd</sup> picture page) over the middle section and slightly pre fix it before the boom sections are put together. Hereby avoided are unnecessary working steps later on.

## 2.3 Element-Platforms / Element-Centre-Sections

For the element-to-boom brackets 4-cornered angle profiles in a length of 500 mm are used. The insulation and solid fixing of the elements is realised by 4 special UV stabilised tube holders, mounted on each of the platforms.

The driver and reflector middle sections (d = 40mm) are already inserted into the platforms (see picture on 3<sup>rd</sup> picture page).

The elements fixed on the plates have to be mounted at the **underside** of the boom in a way that the outer edge of the platform is located 1 cm in front of the tip of the boom.

The plates are attached to the boom by 2 square brackets (already inserted into the platform by us) which embrace the boom from the top and 4 self securing nuts (see 3<sup>rd</sup> picture page). When finally tightening the square brackets pay attention that the elements are **parallel** to each other.

The square boom makes a straightening of the elements in the vertical plane unnecessary.

For the tightening procedure use the included special tool (nut driver M10/13).

In case the antenna cannot be reached easily while assembling naturally the elements can be assembled completely and then be mounted below the boom in one piece.

## 2.4 Installation of the phase line and the balun

The driven elements (S30, S40) are connected with 2 parallel 20mm 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. Then insert the predrilled square tubes (move the elements slightly if needed) by means of the element screws.

Now mount the balun at S30. The balun has two right angle aluminium connection straps which have to be inserted on the driver screws in between the two big washers each. They have to be tightened to the element by means of the two driver screws.

Furthermore the balun has to be tightened to the phase line by means of the included ty wrap.



Finally the phase line square tubes have to be **tightened really solidly** together with the driven elements (=important electrical contact) and the driven elements have to be mounted below the boom by means of the element plates (see fig. 2.3).

The entire assembly can be seen on the picture pages and on the picture below.

## 2.5 Screw connections of the element sections

While assembling the element sections the following segments have to be inserted into the previous segments with their side which has two drill-holes **equal in size**. The tubes have to be put in until the drill-holes of both segments overlap perfectly. The enlarged drill hole of the previous segment has to point **upwards**.

Then the corresponding ss screws have to be pushed through **from the side of the enlarged drill-hole** of the previous segment.

There are **screws of two different diameters** (6mm and 4mm) and of different lengths.

The longer **6mm screws** are used for the 40/35mm and the 35/30mm transition, the shorter ones are used for the 30/25mm transition (please orientate by the included schematic diagram of the antenna).

The **4mm screws** have to be used as follows: 25/20mm transition = longest screw, 20/16mm transition = second longest screw, 16/12mm transition = shortest screw.

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, depending on the screw diameter use the thicker or thinner screw-driver, do it carefully, don't break the screws, 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 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 element plates are located at.



## 2.6 Assembly of the 40m element sections

We start with the already pre assembled middle section (d = 40mm) which is already fixed onto the element platform.

The following segment is the one with the coil (already pre assembled) with a diameter of 35mm (see picture on 3<sup>rd</sup> picture page).

The next one following has a diameter of 30mm (please orientate by the included schematic diagram of the antenna).

Before the following 25mm section is inserted into the 30mm segment (this counts for all four element halves) slide the **ring insulator** (see picture on 3<sup>rd</sup> picture page) -which represents the outer fastening of the centre element truss (see fig. 2.7)- over the 25mm tube. We have already fixed the centre truss rope to the two ring insulators by means of a special loop. Pay attention that the ring insulator is slid over the segment in a way that the truss rope which comes out of the smaller hole leads **towards the centre of the element**.

When the two ring insulators are slid over on the left and the right half of the driver and reflector the **centre element truss rope** will hang slack below the element for the moment.

Do not remove the centre insulator which is already inserted into the truss rope, but for the moment remove the truss mast from the centre insulator for this installation step!

You now have to insert the short 20mm segments into the 25mm sections. The 20mm segments have seven drill holes, one for the following 16mm element transition with an enlarged drill hole on top and six drill holes in the order of two **3-hole-rows**.

The hole rows are inscribed with 'CW/Europe' and 'USA phone'.

The outer hole row '**CW/Europe**' represents the setting which mainly covers the frequency spectrum from 7.000 to 7.100 KHZ, i.e. SWR, gain and f/b are optimised in this frequency range. This way the SWR in the frequency spectrum 7.150 to 7.300 KHZ is still manageable, but partly only by means of a tuner.

This setting mainly covers the "European 40m part" and at the same time serves the US ham who mainly wants to operate CW.

The inner hole row '**USA phone**' represents the US SSB setting. It mainly covers the frequency spectrum between 7.150 and 7.300 KHZ regarding an optimum SWR, gain and f/b. With this setting the SWR in the "European 40m part" is considerably higher and principally not suitable for transmitting. This setting especially serves the US ham who concentrates on SSB and who can work Europe split this way, of course.

The antenna is tuned by us in a way that with each setting the centre hole of the corresponding hole row has to be chosen (regarding tuning facilities, see fig. 4)

The 20mm segments are followed by the 16mm ones and they by the 12mm tips.

Concerning the 12mm tips of the driven element the **middle one** of the three drill-holes has to be chosen (regarding tuning facilities, see fig. 4).

## 2.7 Assembly of the 30m element sections

Like on the 40m elements we start with the already pre assembled middle section (d = 40mm) which is already fixed onto the element platform.

The following segment is the one with the coil (already pre assembled) with a diameter of 35mm (see picture on 3<sup>rd</sup> picture page).

The next one following has a diameter of 30mm etc. (please orientate by the included schematic diagram of the antenna).

When inserting the 12mm tips of the 30m driver again take the **middle** hole of the three drill holes. (regarding tuning facilities, see fig. 4).

## 2.8 Installation of the centre element truss on the 40m elements

Due to reasons regarding stability and optic the 40m driver and reflector are trussed in the centre by means of a little truss mast and a corresponding truss rope (see picture on 3<sup>rd</sup> picture page).

The pre assembled **truss mast** is mounted on a little right angle platform. A square bolt is already inserted into this little platform. This right angle platform has to be placed straight in front of the element (counts for driver and reflector) and fixed solidly onto the boom.



The centre element truss rope already hangs slack below the element since it was already fixed to the outer element parts by means of the two ring insulators in the moment of the element assembly (see fig. 2.6).

In the centre of the rope we have already fixed an insulator by means of a special double loop. This insulator now simply has to be inserted **on top** of the truss mast.

The ends of the truss rope are fixed to the ring insulators by means of a special loop (see picture on 3<sup>rd</sup> picture page). This loop means a continuous exact fastening and simultaneously delivers the possibility for an adjustment of the truss rope at any time.

The element now can be brought into the horizontal position (no sag) by tightening the rope on both sides at the ring insulators. For convenience we recommend to first remove the insulator from the truss mast so that the rope is slack again. Now the loop can easily be pushed through the hole of the ring insulator and the rope can be pulled as much as needed. Then the loop has to be fixed again and the insulator has to be reinserted into the top of the truss mast.

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

Important: Pay attention that the **hole in the ring insulator where the rope is fixed** points upwards when the rope is under tension.

In case the centre insulator might not be exactly in the middle the double loop can be loosened as well and a fine adjustment can be done.

## 2.9 Installation of the decoupling stubs on the 40m elements

OptiBeam has designed special decoupling stubs (software aided design) which efficiently eliminate negative interaction between the 40m elements of this Yagi and other antennas in the frequency range between 10 and 20m. Such a decoupling stub is used on each element half of the 40m driver and reflector (therefore all over all = four pieces).

The stubs consist of 2mm strong ss wire which runs in a short distance below the tubes of the outer element halves. The wire is held tight and stable in the correct distance by means of three insulators. These insulators are located at the element transitions 35/30mm, 30/25mm und 25/20mm (orientate by the schematic diagram of this antenna). The insulators have a thread on both sides. On one side there is already inserted a PVC screw which will be used to fix the wire later on. The free insulator side has to be turned onto the corresponding transition screw. Two insulators have a 6mm thread (transition 35/30mm and 30/25mm) and one insulator has a 4mm thread (transition 25/20mm).

Remove the three insulators from the wire first of all (they are slid over for transportation purposes).

The ss wire has a loop at one end. This loop has to be slid over the downpointing shaft of the screw at the 35/30mm transition.

First remove the selflocking nut and the washer at the transition screw. Now slide the loop over the screw shaft, put the washer on and turn the self locking nut on again and tighten it solidly.

Hereby the rope will be fixed as well. Pay attention that the rope will be fixed in a way that you will be able to realise a **half bow** of the rope towards the centre of the element.

One of the two insulators with the 6mm thread has to be turned onto the screw now until it **sits solidly** (= not turns any more) and the hole at the bottom part of the insulator points transverse (hole for wire lead).

Now making a little **half bow** towards the centre of the element lead the wire through the insulator transverse hole and fix it by means of the PVC screw at the bottom side of the insulator (see picture on 3<sup>rd</sup> picture page).

Then the two other insulators have to be turned onto the corresponding screws at the transitions 30/25 und 25/20mm until they sit solidly as well (not turning any more) and the hole for the wire in the bottom part of the insulator points **into the direction of the element**.

Now the ss wire can be pushed through these transverse holes, pulled tight and **fixed** by means of the PVC screw.

The remaining rest of the wire which shows out of the last insulator can now be cut off (the wire should finally show out of the transverse hole by about two to three cm).



## 2.10 Installation of the boom to mast plate

The boom to mast plate is a completely pre assembled part (see 2<sup>nd</sup> picture page) with four horizontal square-bolts 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 centre boom section in the moment of the boom assembly (see fig. 2.2). It should have been pre fixed and now has to be fixed solidly at the balance point of the antenna (about the centre of the boom).

## 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 which has to be screwed on to the balun housing. The connector should be sealed against water entry.

## 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 slightly.

By minimum changes of the driver lengths (=shortening or lengthening of the outer 12mm sections) the resonant frequency 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.

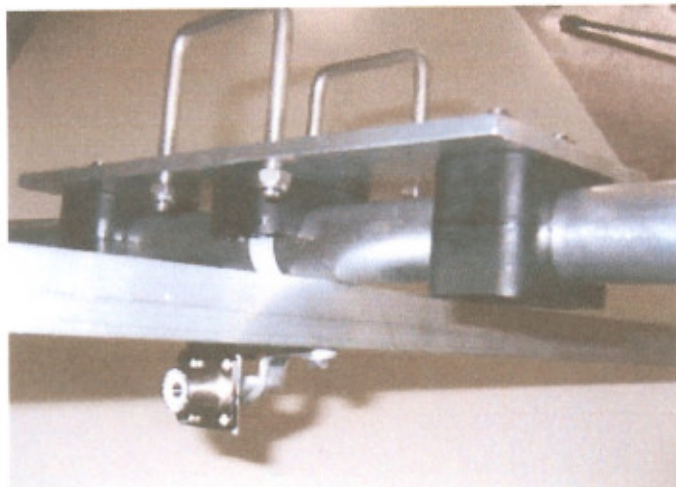
In case of unexpected big discrepancies to the desired resonance frequency or thinking in terms of changes in the official band plans on the 40m elements in addition there is the possibility of realising even bigger changes by adjustments through the 3-hole rows of the 20mm segments.

It counts as well: By pushing the 20mm segment in to the last drill-hole of the corresponding 3-hole row the resonant frequency will be shifted upwards, by pulling the 20m segment out to the first drill-hole of the corresponding 3-hole-row it will be shifted downwards.

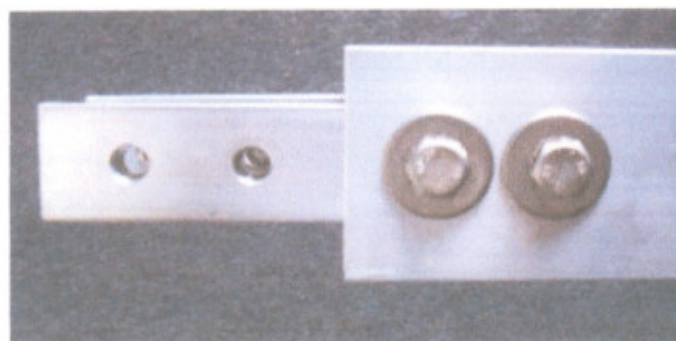
## 5. Position of the antenna at strong winds

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 elements is avoided and their duration is enlarged.

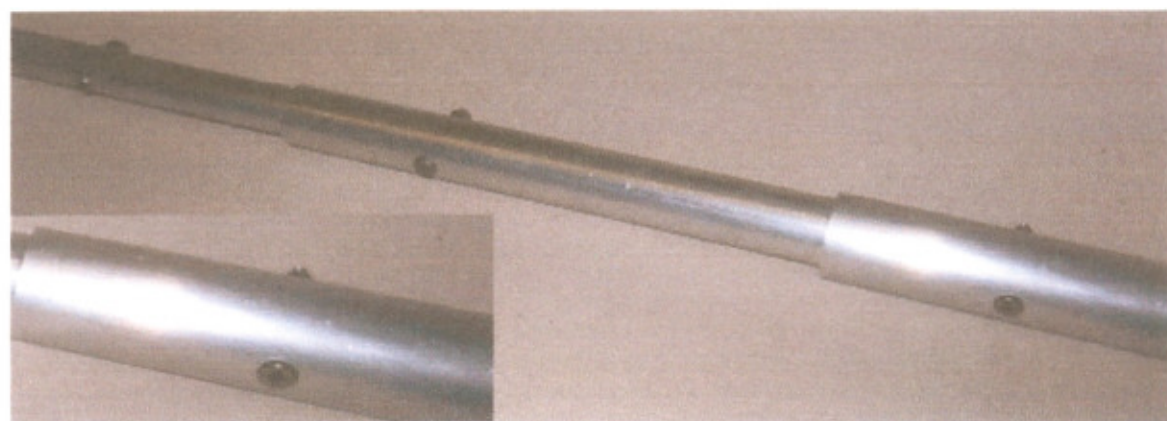


Ansicht Element-Plattform Strahlerelement  
 mit Phasenleitung und Mittenunterstützung /  
 view element platform driven element with  
 phaseline and centre support



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

Ansicht Boomkopplung bei Vierkantboom /  
 view boom coupler at square boom



Detailansicht Elementübergänge / close up view element transitions





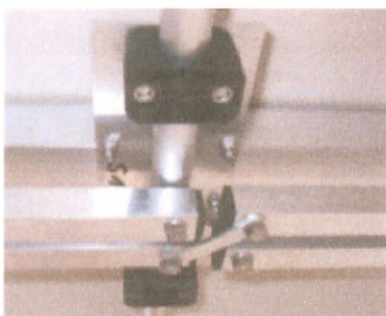
Boom-Masthalterung für kleinere Modelle /  
 boom to mast mounting for smaller models



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



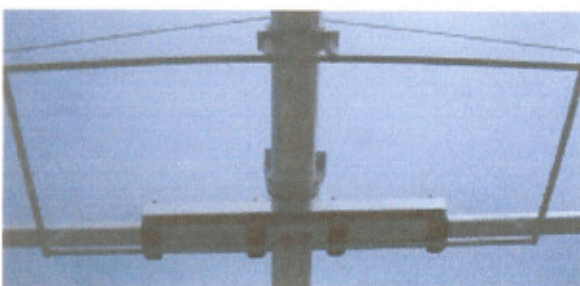
Seitenansicht Überkreuzung  
 Phasenleitung bei Modell 9-5  
 u. 4-40 /  
 side view crossing of phase  
 line at model 9-5  
 and 4-40



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

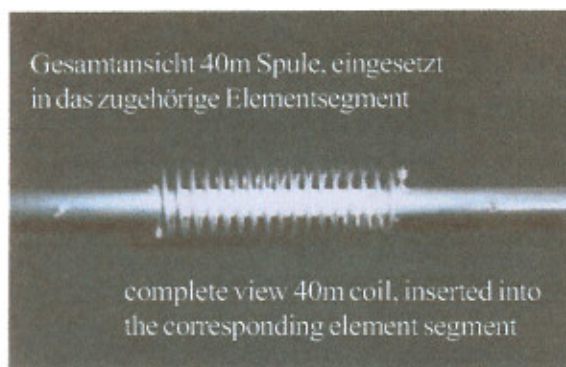


Zentrale Seilabspannung für Modelle über 6 Meter Boomlänge /  
 centre boom truss for models over 6 meter boom length





Gesamtansicht 40m Spule, eingesetzt  
 in das zugehörige Elementsegment



complete view 40m coil, inserted into  
 the corresponding element segment

Detailansicht 40m Elementplattform  
 mit vier Rohrhalterungen



detail view of 40m element platform  
 with four tube holders

Zentralabspannung  
 des 40m Elementes,  
 Spannturm montiert  
 auf Winkelplatte



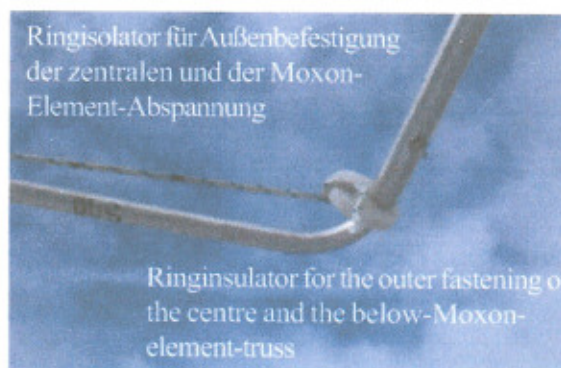
centre element truss  
 of the 40m element,  
 truss tower  
 mounted on right  
 angle platform

mechanische isolierte Verbindung des  
 Moxon-Elementteiles mit Moxon-  
 Element-Travers-Abspannung



mechanical insulated connection of the  
 Moxon element part with the below-  
 Moxon-element-truss

Ringisolator für Außenbefestigung  
 der zentralen und der Moxon-  
 Element-Abspannung



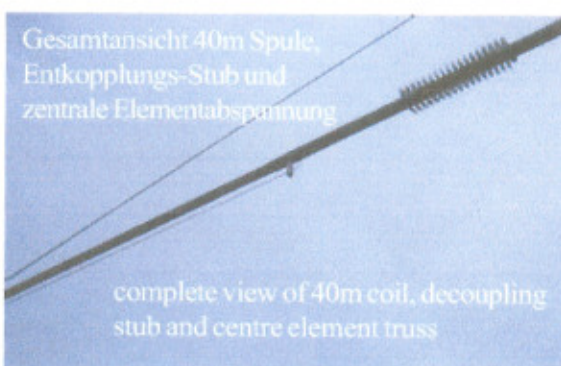
Ringinsulator for the outer fastening of  
 the centre and the below-Moxon-  
 element-truss

Detailansicht Anschluß Entkopplungs-Stub



close up view connection of decoupling stub

Gesamtansicht 40m Spule,  
 Entkopplungs-Stub und  
 zentrale Elementabspannung



complete view of 40m coil, decoupling  
 stub and centre element truss