

ASSEMBLING MANUAL

LS 86

HF Log – Periodic Antenna

14 – 30 MHz

ACOM LS86
HF Log-periodic Antenna

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1. GENERAL INFORMATION

ACOM manufactures a range of antennas designed and produced to give top performance and reliable long-lasting service. They are completely manufactured of non-corrosive materials. The antennas come partly factory-assembled in order to facilitate and expedite your labor.

1.1. Introduction and Description

This manual explains the assembling of the ACOM LS86 HF Log-Periodic Antenna. The LS86 is a directional wideband antenna that covers the HF spectrum between 14 and 30 MHz continuously. It can be used with the full legal power of 1500W continuously or 3000W PEP.

1.2. Owner Assistance

If assistance or service is needed, your local dealer should be contacted first. In the unlikely event, you need further information you may get in touch with ACOM by facsimile, telephone, email, or standard mail. Fax: (+359 2) 920 9656; telephone: (+359 2) 920 9655; e-mail: acom@mail.orbitel.bg; standard mail: ACOM, Blvd. N. Mushanov 151, 1330 Sofia, Bulgaria.

1.3. Specifications

Number of elements	8
Frequency coverage	14-30 MHz continuously
Gain (average)	8.5 dBi
Front-to-Back Ratio	20 dB
Nominal Input Impedance	50 Ohm
SWR (max)	1.8 : 1
Maximum Input Power	1500 W continuously 3000 W PEP
Boom Length	6 m (19.7 ft)
Boom Diameter	50 mm (1.97")
Mast Diameter	50 mm (1.97")
Longest Element	11 m (36.1 ft)
Turning Radius	6.3 m (20.7 ft)
Wind-load Area	1.25 m² (13,45 sq.ft)
Wind Survival (no ice)	120 km/h (75 mph)
Weight	Operating 23 kg (51 lbs) Shipping 29 kg (64 lbs)
Connectors: antenna / coaxial feed line	SO239A / PL259

1.4. SAFETY FIRST!

Get acquainted with and observe strictly the requirements and instructions of your local legislation. Direct grounding of the antenna and the tower structure is essential as protection from lightning strikes and static electricity. The entire earth-connection system must meet your local standard requirements.

Do not install the antenna close to power lines and cables, as their proximity, arc-over or contact with them during assembly, installation, and exploitation is hazardous and can be lethal.

Do not work alone! You must have at least one assistant always when you work on the antenna. If you have any doubt concerning the safety, please consult your dealer or engage a professional company.

WARNING!
Expose to strong electromagnetic radiation can result in dangerous maladies or death. Do not allow people or animals around the antenna during operation and exploitation.

1mm=39.37mil 1cm=10mm=0.3937" 1m=100cm=3.281ft 1kg=2.205lbs 1m²=10.764sq.ft
1km/h=0.62137mph

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1.5. Location

The antenna should be mounted on a support tower structure at a height between 10 and 15 meters (33-50 ft) above the ground level. It must be located in the clear, away from trees, power installations, buildings, other antennas etc. Such objects can be dangerous and they can reduce the antenna efficiency or cause interference. If metal guy wires are used for the tower, they should be broken electrically with strain insulators, at 2 meters (6 ft) apart or less.

1.6. Your first steps

The first step to installation is to fully read this manual. Then, carefully inspect the shipping cartons for any physical damage. ACOM ships antennas in highly protected containers, but it cannot assure that mistreatment by shippers will not occur. If there is any such damage, notify your ACOM dealer immediately. Failure to do so may invalidate your warranty.

Select a large and clear area (8 x 11 m or 26 x 36 ft minimum) to assemble the antenna. Provide some supports for holding the boom at a suitable working height.

The ACOM production uses metric (European) system of measurement units. The antenna elements (two halves) and the phase-line straps are placed in separate polythene sleeves, marked respectively. The hardware is bagged by size (there are some spares). A set of required tools to do the job is enclosed, too.

2. ASSEMBLING

The antenna comprises the following main components: boom, mast, eight elements, balun transformer, and phase line (called also distribution feeder). The set includes also guys, installation elements, hardware, as well as required tools.

An overall view of the antenna is shown in **Fig. 1 LS86 - Appearance**. All the eight elements are isolated-mounted on the boom by eight supporting insulator blocks and each element is driven by the phase line.

2.1. Boom Assembly

The boom is composed of three pieces (sections), which are to be assembled together. The section ends to be joined together are marked by letters A-A and B-B directly on the tubes. Sections have the element-supporting insulators, mast bracket, balun transformer, and the boom guys readily installed in the factory.

You will find the required hardware situated along the boom sections.

Locate the three boom sections. Put them in order and orient letter markings so that "A" faces "A" and "B" faces "B" as shown in **Fig. 2 Boom Assembly**.

Join together the sections marked A-A. Align the mount-hole pairs. Insert 2 bolts M6x60 mm through the holes. Place a lock washer on each free bolt end. Screw in a nut on each bolt and tighten properly but without losing the tubes shape.

Fit the second boom joint (B-B) together similarly. This completes the boom assembly.

2.2. Element Assembly

Each antenna element has two symmetrical halves, called half-elements hereafter. They consist of sections, which are partly assembled in the factory to the longest suitable transportation length. The customer should do the final assembly as described below.

For transportation, the element sections are bundled up in pairs and packed each element in a separate polythene sleeve. The polythene sleeves are marked as follows: ELEMENT 1, ELEMENT 2, etc to ELEMENT 8.

Note: The shortest half-elements (number 8) are fully assembled in the factory.

Locate all polythene sleeves and identify them before to start assembling. Do not take out sections of more than one sleeve at a time to avoid mixing up of sizes and lengths.

Begin with ELEMENT 1. Put all sections in the size order. Insert the smallest-size section into the next one at a distance of about 100 mm (4") - see **Fig. 3 Element Riveting**.

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Align the three riveting holes and insert a rivet in each hole, without riveting. Arrange the whole half-element in this manner for a test only, without riveting for now. Check the total half-element length per **Table 1 - Half-Element Lengths**. If you find any discrepancy, correct the mistake prior to continuing. This check will ensure possible mistakes are avoided that could necessitate un-riveting multiple sections at any later stage.

Table 1 - Half-Element Lengths.

Element No.	1	2	3	4	5	6	7	8
Half-length, m:	5,55	4,82	4,18	3,63	3,15	2,73	2,41	2,05
(ft):	18,2	15,8	13,7	11,9	10,3	9,0	7,9	6,7

After passing the arrangement test, disassemble the half-element. Lightly smear the contact surface of the smaller-size section with conductive paste (supplied with antenna). This will ensure corrosion-free electrical contact between the element sections. Insert the smaller-size section into the next one at a distance of about 100 mm (4") and align the three riveting holes again. Insert a rivet (4 x 8 mm) in each hole. Begin riveting them one-by-one, without removing the others out of their places. Support the free rivets in order to keep them in place during riveting. This is important since the tubes could come out of position otherwise.

Use the "Hand Blind Riveter" tool, which is supplied with antenna, together with the needed number of rivets (there is a reasonable reserve). Operation instructions about this tool appear on its original packaging.

Proceed similarly to assemble the remaining six half-element pairs.

2.3. Mounting the Elements to Boom

All element-supporting insulator blocks are factory mounted on the boom sections. They isolate between half-elements as well as from each half-element to the boom.

The large ends of the completed half-elements are to be mounted on the supporting insulators at the same time. All the required hardware and mounting tools are bagged in polythene envelopes.

Please look at **Fig. 4 Elements mounting**. Start with the longest element (ELEMENT 1). The left half-element is marked with "1L" and the right one - with "1R". The insulator has two channels for element installation. They have the same marking "1L" and "1R". Lay the two half-elements in the corresponding channels.

Select two bolts M5x60 mm and place a plain (flat) washer on each bolt. Align the mount holes of the half-elements and the insulator. Push the two bolts upside-down through insulator and half-elements. Use the holes located next to the boom. Please note that the bolts heads are underside of insulator as shown in **Fig. 4 Elements mounting**. Smear a small amount of conductive paste on the tubes as pointed in the figure. Push an M5x45 mm bolt with a plain washer through the next holes that are more distanced from boom. Secure with lock washers and nuts on top of the tubes. Tighten the joint well but without deforming the tubes.

Mount the next two elements – ELEMENT 2 and ELEMENT 3 on their insulators in the same way. The rest antenna elements (ELEMENT 4 to ELEMENT 8) should be installed in the same way but you should use shorter bolts in the holes next to the boom - M5x55 mm. Refer to **Fig. 4 Elements mounting**.

2.4. Attachment of Phase-line Straps

The distribution (phase) line feeds each antenna element in the center. It comprises seven pairs of straps (called phase-line straps hereafter) that cross-connect in pairs between adjacent elements. Each phase-line strap has a mount hole drilled at each end.

Locate phase-line straps and arrange them in pairs according to length. Now look at **Fig. 5 Phase-line straps mounting**. Start mounting the longest strap pair between the longest antenna elements (ELEMENT 1 and ELEMENT 2). Place four plain washers on the four bolts of ELEMENT 1 and ELEMENT 2 that are closer to the boom. Smear these bolts and the strap ends (on the two surfaces) with conductive paste. Attach one end of the straps on the smeared bolts of ELEMENT 1. Cross the straps above the boom so that their free ends reach the smeared bolts of the opposite ELEMENT 2. Place a plain washer, lock washer, and a nut on ELEMENT 1 bolts only. Do not fully tighten at this time.

The second-length straps should be installed between the inner bolts of ELEMENT 2 and ELEMENT 3 in a similar way. Remember to smear the straps with conductive paste on the two surfaces. Now place a plain washer, lock washer, and a nut on the bolts of ELEMENT 2. Do not tighten the nuts yet.

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Continue in the same manner until you install all the seven strap pairs crossing between the antenna elements (straps actually zigzag). At the last element (number 8), place a plain washer on the bolts closest to the boom. Smear some conductive paste on the two surfaces of the cable ring terminals (lugs) of the balun-transformer. Connect the terminals to the bolts using M5 lock washers and nuts but do not tighten for now - see **Fig. 6 Balun Connection**.

At this stage of the installation check, whether all the nuts holding the phase line are screwed in but still loose.

CAUTION!

The nuts, holding the phase line should be tightened when you have reinforced the boom against the sag (refer to section **2.7 Boom Support Assembly**).

Now insert a strap-insulating spacer at each crossing point of the straps as shown in **Fig. 5 Phase-line Straps Mounting**. Orient the strap spacer between the two straps as shown in the figure. Slide it along the arrow shown in the figure until the straps engage the top and middle spacer slots.

2.5. Attachment of Coaxial Feed Line

Use coaxial cable with 50-Ohm characteristic impedance. Check whether your cable will withstand the power you intend to use at the highest frequency (30 MHz). To make use of the maximum permissible power of LS86, cable type RG213 or better is required.

Strip one end of the cable and install a type PL259 plug connector (male UHF) according to the connector-producer instructions for the appropriate cable type. Couple it to the balun-transformer SO239A jack connector - see **Fig. 6 Balun Connection**.

Protect the coaxial connection against moisture leak in the connectors as well as in the cable.

Leave some cable drip-loop (see **Fig. 1 LS86 - Appearance**) to eliminate any undue mechanical strain on balun transformer. Fasten the cable along underside of boom using ties delivered with antenna. First lay two ties at the nearest strap-insulating spacer (located between ELEMENT 8 and ELEMENT 7). Together with the cable, fasten also the legs (skirts) on the two strap-spacer sides (see **Fig. 5 Phase-line straps mounting**). Continue fastening the cable with two ties at each spacer until you reach the mast.

Now fasten also the strap-insulating spacers in the other part of the boom (although there is no cable there).

2.6. Boom to Mast Assembly

The mast bracket (boom to mast holding assembly) consists of a pair of metal brackets and four U-shaped bolts. It is factory mounted on the boom. Project the way you will mount the mast on the tower structure so that the antenna is installed at a distance of no more than 30cm (1 ft) above the support. The mast must protrude at least 80 cm (2.6 ft) above the antenna. Mark the draft position for the bracket on the mast.

Install firmly the mast in a vertical position so that it can bear the weight of the whole antenna.

Please look at **Fig. 7 Boom to Mast Assembly**. Unscrew the nuts from the two unengaged U-shaped bolts and remove the bolts. Bring the boom near the mast at the height marked for the bracket. Re-install the two U-shaped bolts so that they embrace the mast as shown in the figure. Place the removed four lock washers and nuts and fully tighten all 16 nuts of the holding bracket.

Fasten the coaxial feed line to the mast using two ties.

If you will use a rotator, leave a large enough loop of cable around the mast in order to allow at least 360 degrees free rotation of the antenna.

2.7. Boom Support Assembly

To reinforce the boom against sag, it is tied up to the mast top via guys. They consist of two legs of stainless-steel cable with a turnbuckle each as shown in **Fig. 8 Boom Support Assembly**. On the mast top is installed a drawing bracket which serves for guys support.

After the boom has been assembled to the mast, uncoil the two guys (factory mounted to the boom). Adjust the two turnbuckles so they extend to their maximum length. Loosen the two U-shaped bolts and slide the

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bracket downwards along the mast in order to hook the guys. Unlock the shackle-locking pin. Align the drawing bracket, shackle holes, and re-insert the locking pin. Tighten properly.

Now move the drawing bracket upwards again and stretch the guys until the boom is essentially straightened. Tighten the two U-shaped bolts securely. When the guys are properly installed, the bracket-to-boom distance should be at least 70 cm (2.3 ft).

With guys attached to the drawing bracket, adjust the two turnbuckles in order to get the boom accurately horizontal. If needed, either guy length could be adjusted via loosening its wire-rope clip - see **Fig. 8 Boom Support Assembly**.

Check up whether all antenna elements are horizontal. If alignment is needed, loosen the two U-shaped bolts of the respective element-holding insulator and get the element horizontal.

Now tighten properly all the nuts that hold the phase line (remember the caution note in **S.2.4 Attachment of Phase-line Straps**). Do not over tight!

Check all antenna dimensions per **Table 1 - Half-Element Lengths** and **Fig. 9 LS86 Dimensional Drawing** before to start lifting the antenna on your permanent tower structure.

Check the quality of all mechanical and electrical joints.

Do not miss checking the hermetic seal of the coaxial connection at the balun transformer once again! Moisture irrecoverably increases coaxial cable loss when persisting for prolonged periods and it could result in electric breakdown in both coaxial cable and either coaxial connector.

This completes the antenna assembly. You must get acquainted with and observe the producers, safety requirements and installation instructions about your rotator and permanent tower structure before to continue with lifting the antenna.

END

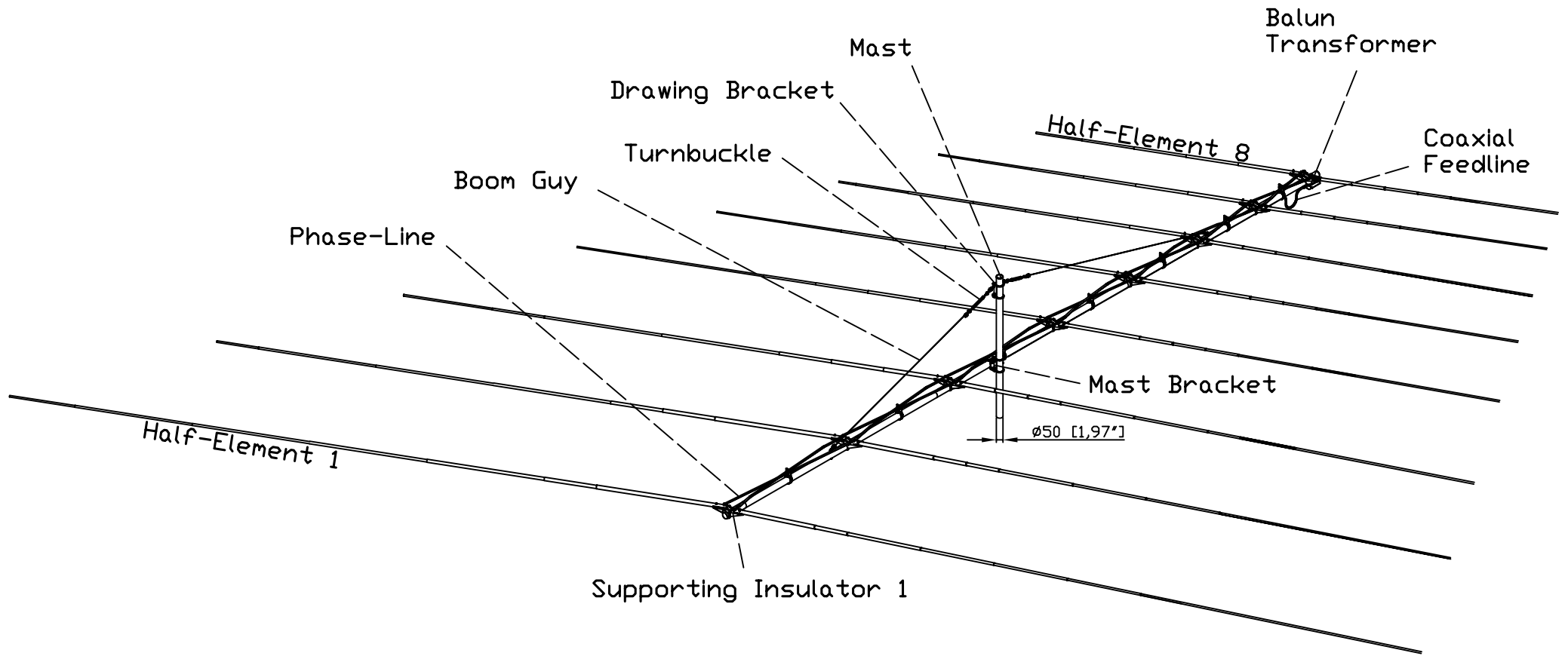


Fig. 1 LS 86 Appearance

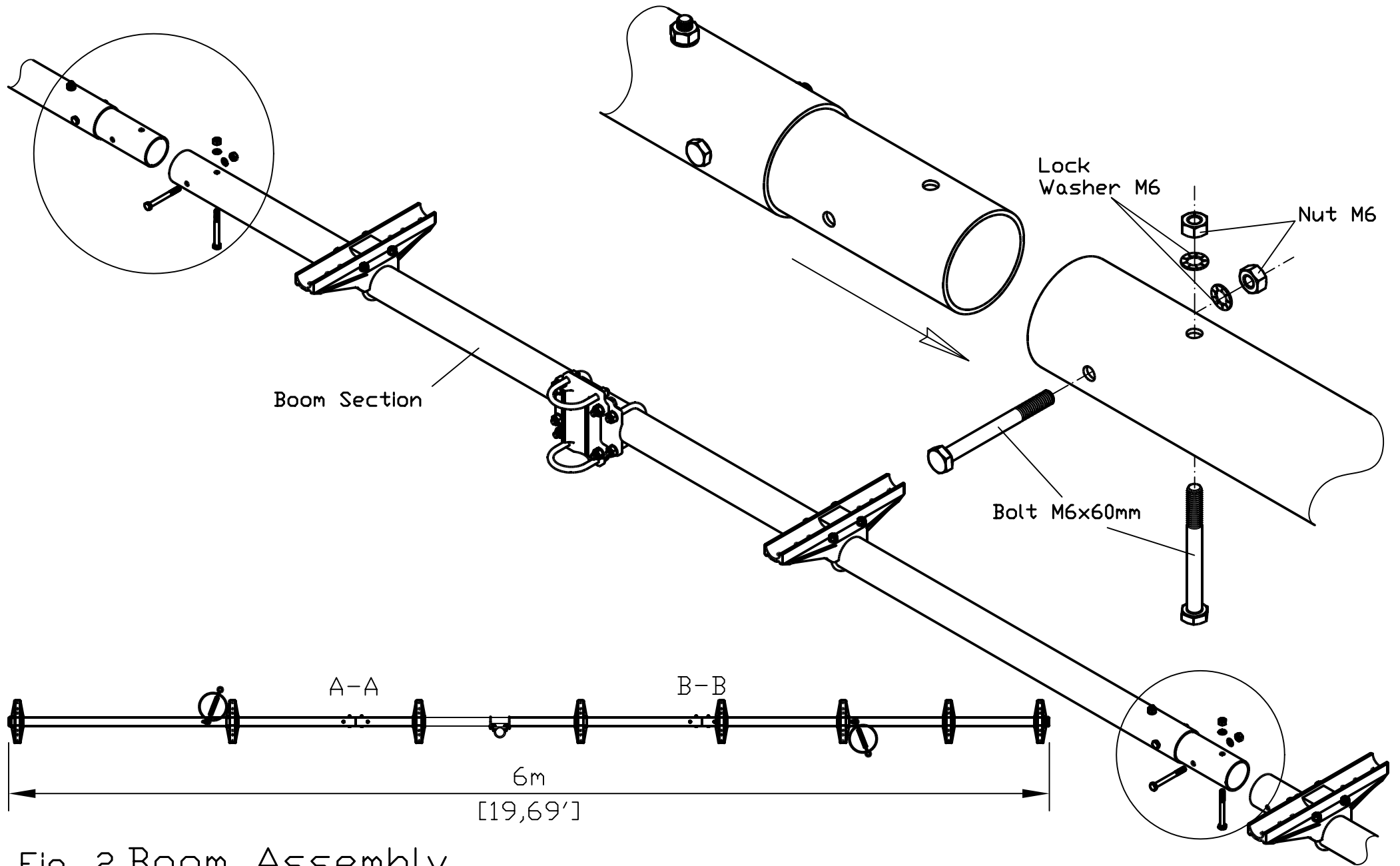


Fig. 2 Boom Assembly

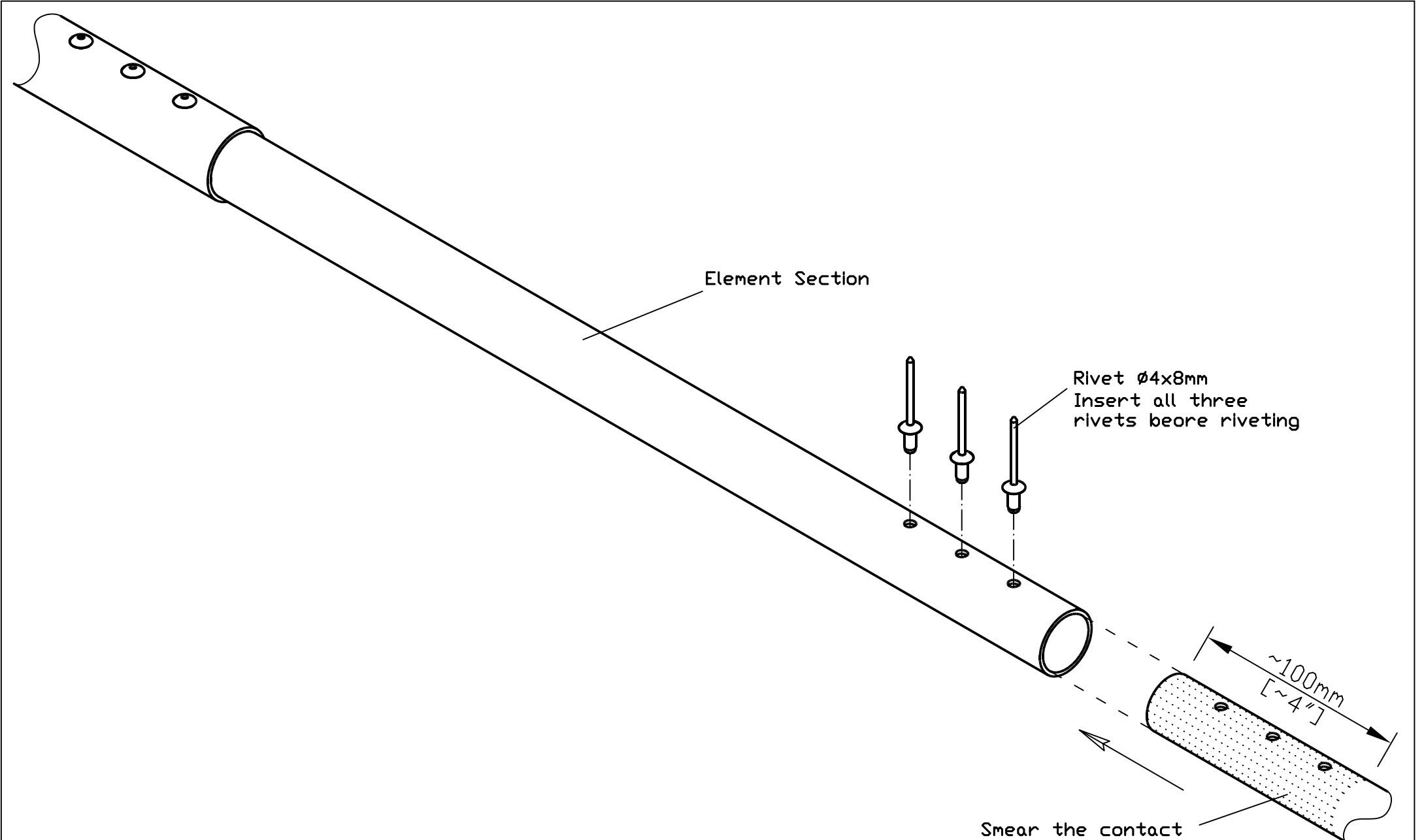


Fig. 3 Element riveting

Smear the contact surface with conductive paste.

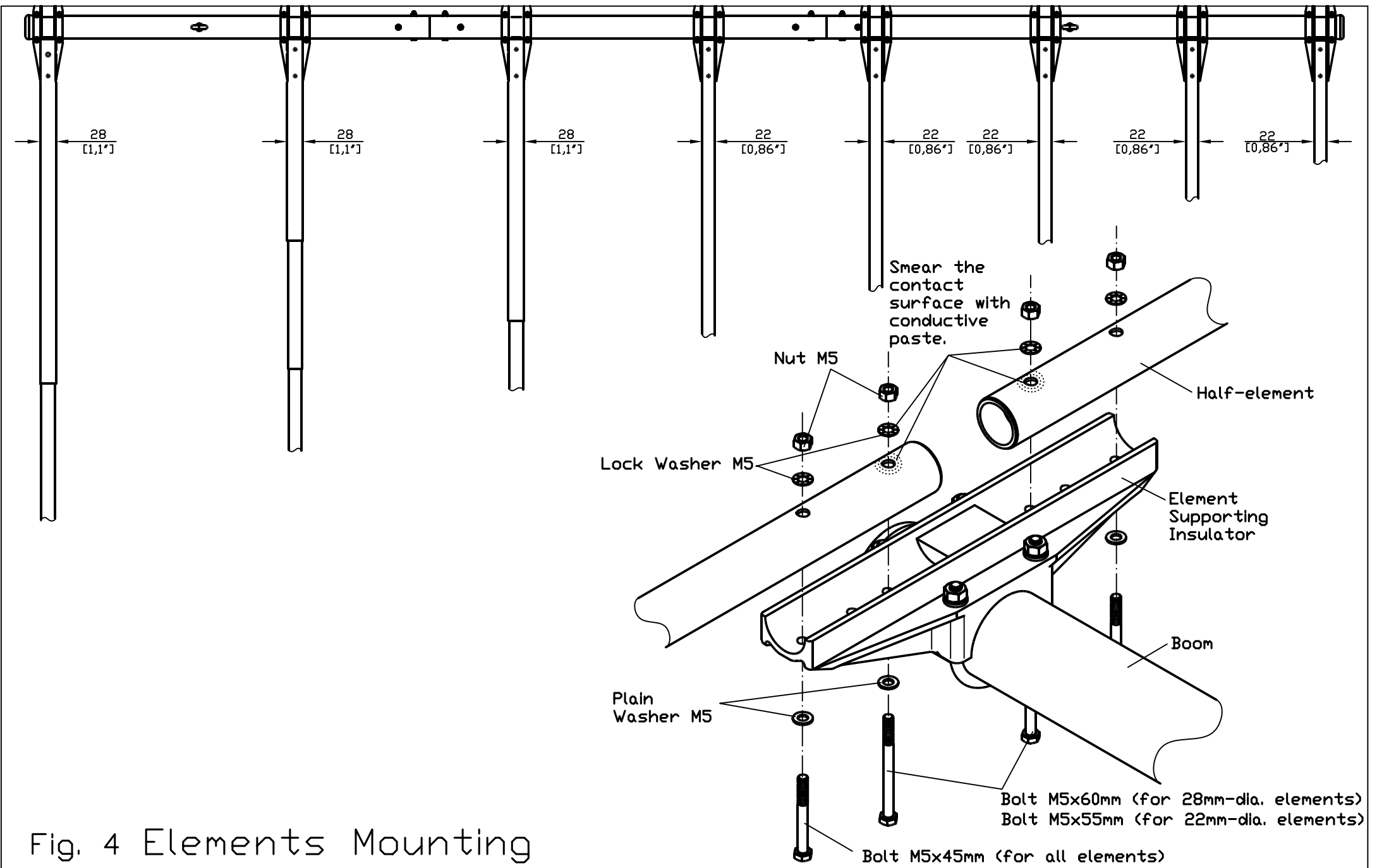


Fig. 4 Elements Mounting

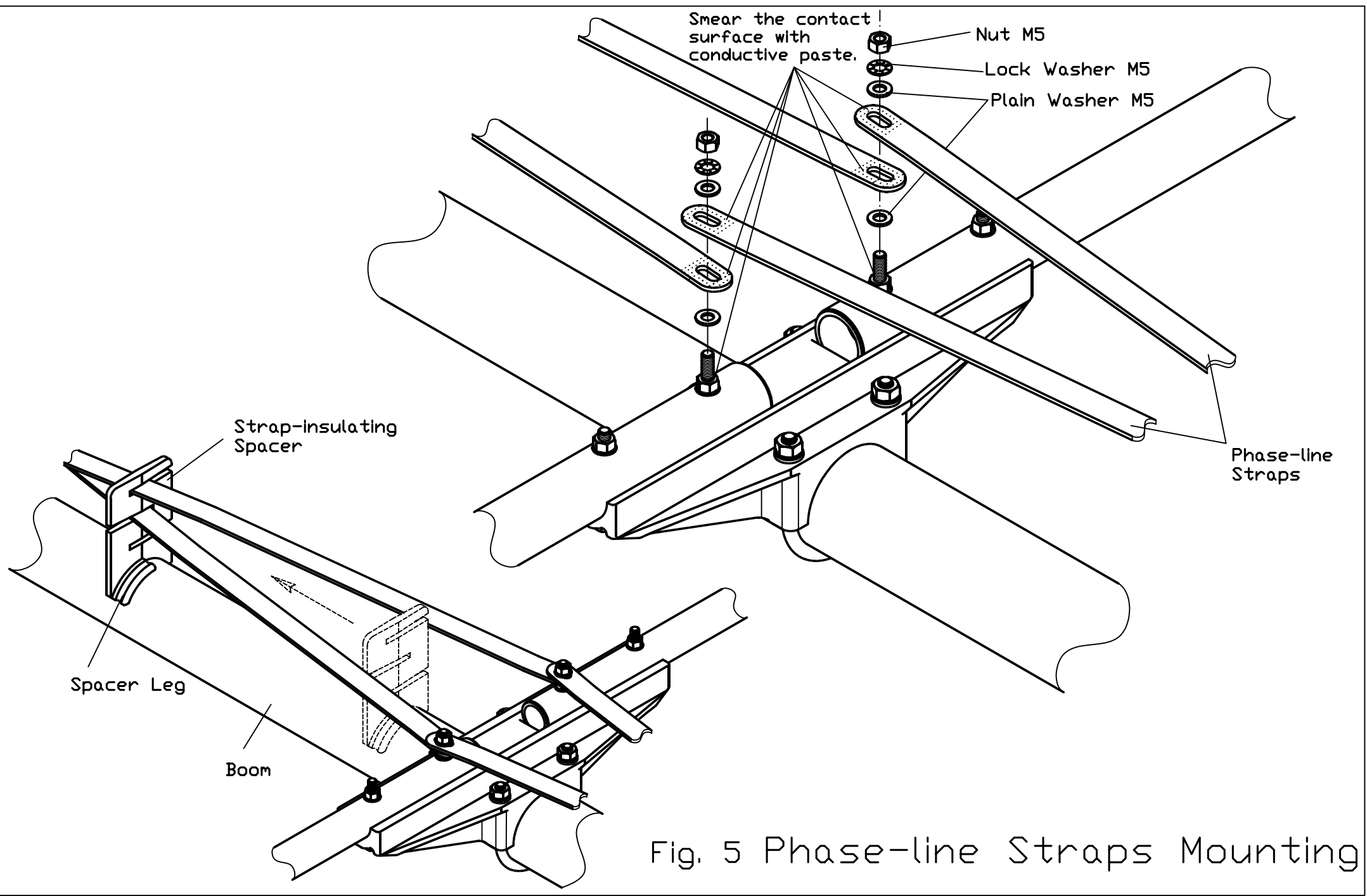


Fig. 5 Phase-line Straps Mounting

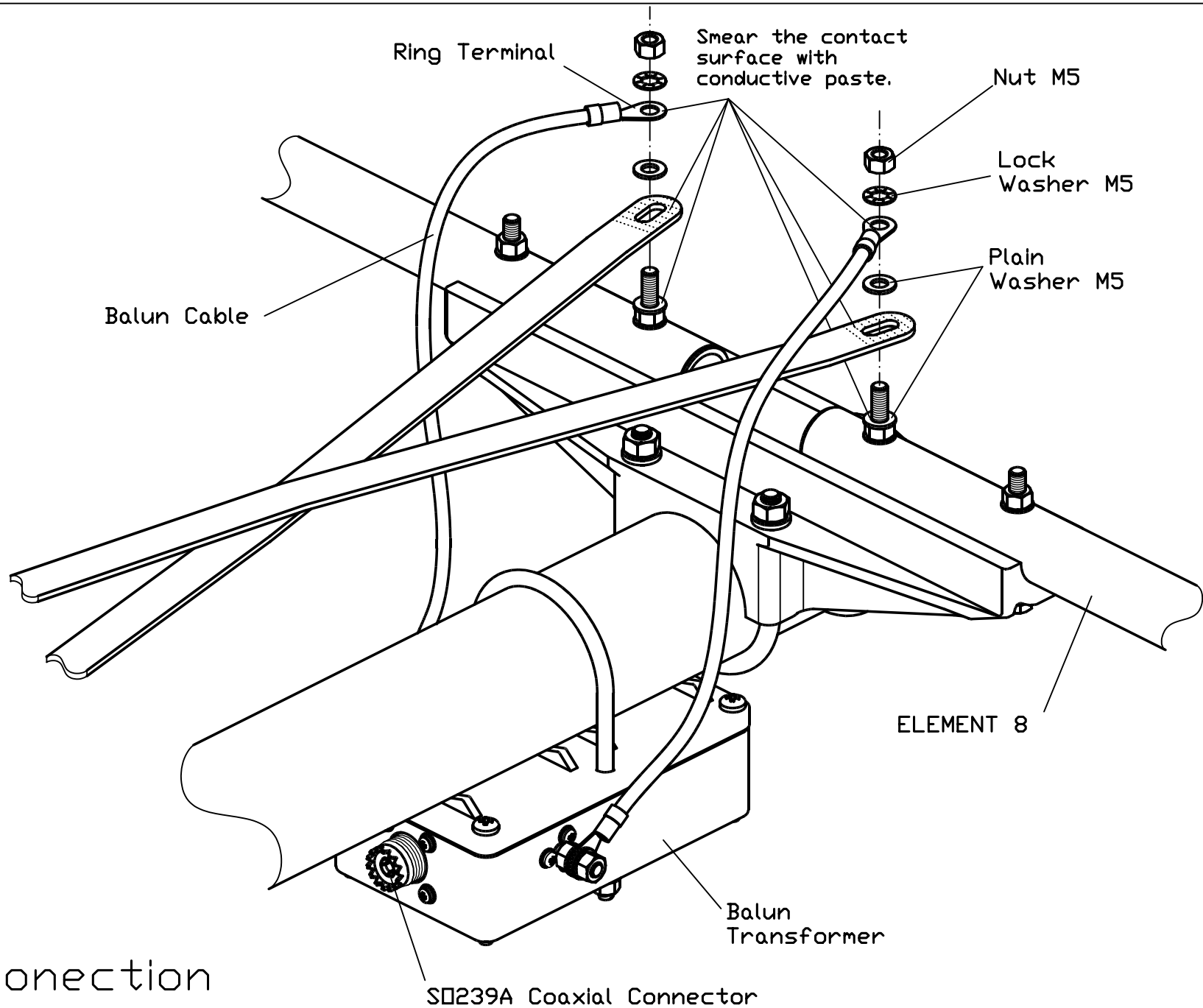


Fig. 6 Balun connection

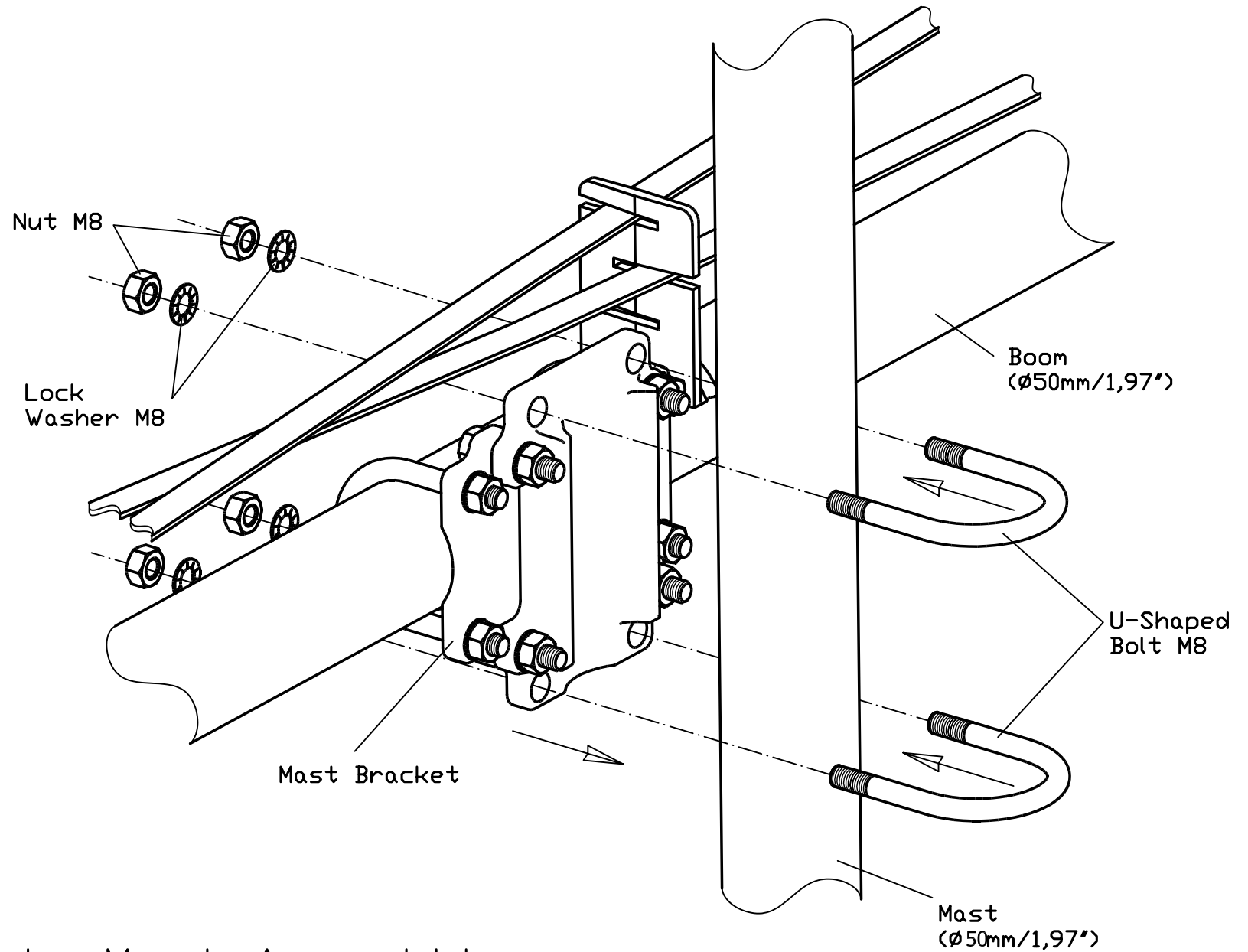


Fig. 7 Boom to Mast Assembly

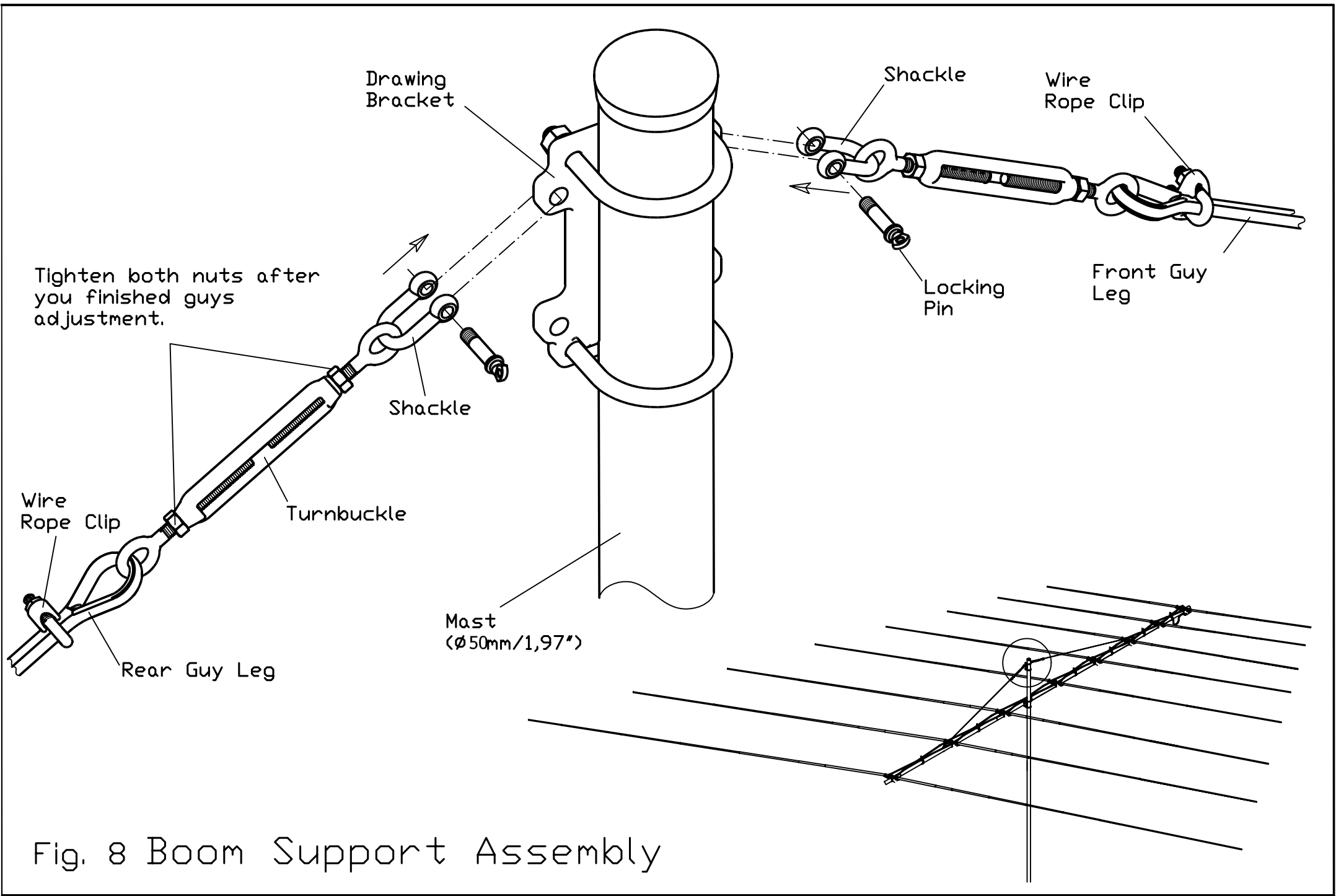


Fig. 8 Boom Support Assembly

mm	inch
28	= 1,102
25	= 0,984
22	= 0,866
19	= 0,748
16	= 0,630
14	= 0,551
12	= 0,472

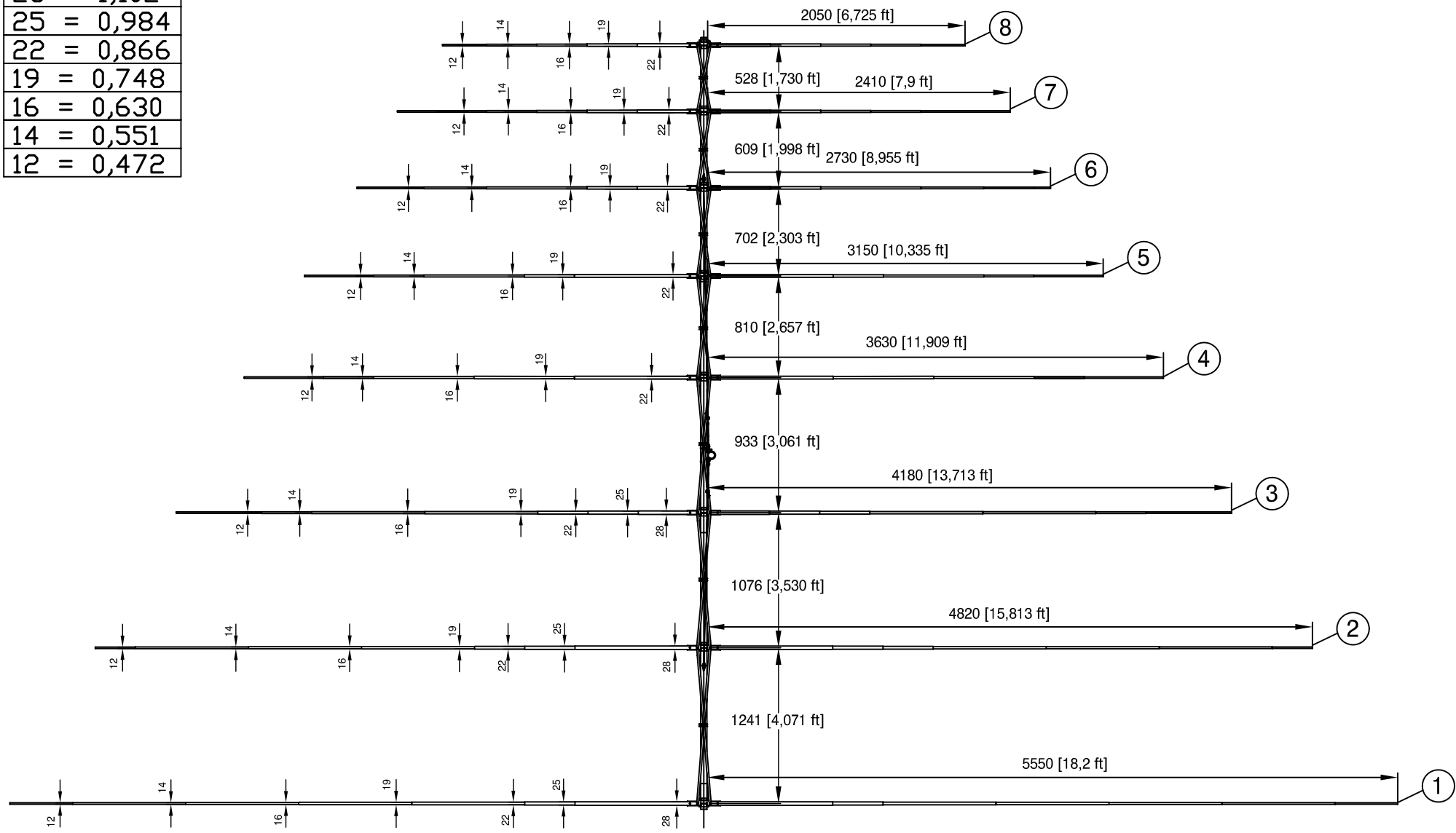


Fig. 9 LS86-Dimensional Drawing