

OBJEKAT: „PEC“ - ABERDAREVA 1, BEOGRAD

NARUČILAC : RTS ,TAKOVSKA 10 BEOGRAD

IZMENA I DOPUNA PROJEKTA KONSTRUKCIJE NOSAČA ANTENE

PREČNIKA 3.7m NA KROVU

OBJEKTA PEC , ABERDAREVA 1, BEOGRAD

BEOGRAD , SEPTEMBAR 2026.G.

SADRŽAJ:

1. projektni zadatak
2. prilog uz projektni zadatak
3. tehnički opis konstrukcije
4. analiza opterećenja
5. proračun konstrukcije
6. dimenzionisanje konstrukcije
7. detalji čelične konstrukcije
8. specifikacija čelične konstrukcije
9. specifikacija vijčanog materijala
10. predmer radova

PROJEKTNI ZADATAK :

Za potrebe postavljanja parabolične „antene 2“ na krovu objekta PEC u ul. Aberdareva 1 Beograd ,potrebno je uraditi projekat konstrukcije.

Dobijeni podaci za projektovanje :

- Pozicija antene 2 na krovu je na mestu sadašnje parabolične antene prečnika 4.5m koja se demontira.
- Orijentacija po azimutu i nagibni ugao antene nisu precizno definisani ali za potrebe proračuna pretpostaviti identičan azimut i nagibni ugao kao za već posatvljenu antenu 1 koja ostaje u funkciji
- Nova antena je prečnika 3.7m . Ispuručuje se sa stubnim cevastim postoljem „KING POST“ i ostalom pratećom opremom .
- Težina svih elemenata koji se montiraju uključujući i antenu i postolje iznosi $P=11.50Kn$
- Visina težišta antene u odnosu na mesto veze postolja sa nosačem (uklještenje postolja antene) iznosi 2.40m
- Postolje antene ima montažnu vezu preko 8 ankera i zavrtnjeva indirektno preko horizontalne ležišne prirubnice. Podaci o debljini prirubnog lima na postolju, dimenziji prirubnice ,rasporedu i veličini rupa na prirubnici nisu poznati biće naknadno dostavljeni.
- Deformacioni uslovi u radnom opsegu antene -ne popstoje.
- Nosače postolja antene izvesti tako da nisu oslonjeni na krovnu ploču objekta.
- Predvideti oslanjanje nosača postolja antene na parapetne konturne a.b zidove na krovu objekta.
- Konstrukciju projektovati u skladu sa propisima. Veličinu elemenata prilagoditi veličini kada za toplocinkovanje ,mogućnostima transporta i podizanja na krov objekta .
- Antikorozivna zaštita je toplim cinkovanjem debljine 120 mikrona , bez završnog bojenja.

U prilogu materijal sa podacima o anteni i postolju antene koja se montira

Podaci prema dopuni projektnog zadatka od 02.09.2026 u prilogu projektnog tadataka, fajlovi „kit plate.pdf, GI-A100900-ADR.pdf i GI-A100901-ADR.pdf“.

U Beogradu 04.09.2026.g.

Za investitora :

3.7m Dual Reflector RxO & RxTx Antenna

Features

- ≡ Dual Reflector Design
- ≡ High Precision Aluminum Reflector
- ≡ 12 Panels
- ≡ C, Ku and Ka Band RxO & RxTx Feeds
- ≡ Fixed Az/El Mount with Manual adjustment
- ≡ Various motorized positioners for LEO/MEO and IO applications
- ≡ Optional Kingpost, Deicing and Lightning kit
- ≡ Optional Feed Blower & Dehydrator



Specifications

Electrical					
Frequency Band		C - Band		X - Band	
Operating Frequency, RxTx GHz	Std Ext	3.40 – 4.20	5.850 - 6.425 5.850 - 6.725	7.25 – 7.75	7.90 - 8.40
Polarization		Linear, Circular		Linear, Circular	
Antenna Gain, dBi	Rx / Tx	41.47	45.39	47.29	48.00
3d Beamwidth, °	Rx / Tx	1.33°	0.88°	0.68°	0.62°
VSWR	Rx / Tx	1.25 : 1	1.25 : 1	1.25 : 1	1.25 : 1
Antenna Noise Temperature, K					
	10° EL	36K		58K	
	20° EL	30K		52K	
	40° EL	25K		46K	
Typical G/T @ 20° EL, dB/K		22.88dB/K @ 3.8GHz, 25K LNA		26.79dB/K @ 7.5GHz, 43K LNA	
Power Handling Capability		5kW/Port		1kW/Port	
Feed Interface		CPR-229	CPR-137	WR-137	WR-112
Feed Interface Loss, dB		0.25dB	0.2dB	0.3dB	0.3dB
Rx to Tx Isolation		≥ 85 dB		≥ 85 dB	
Axial Ratio		1.5dB	1.0dB		
Cross Pol Isolation, dB (on axis)		≥35dB		≥35dB	
Sidelobes		CCIR.580-6		90% of sidelobe peak meet the below envelope, superscale less than 3dB, meet ITU_R.S580-5. 29-25log(θ) dBi (1°≤θ≤20°)	

3.7m Dual Reflector RxO & RxTx Antenna

Specifications

Electrical					
Frequency Band		Ku - Band		Ka - Band	
Operating Frequency, RxTx GHz	Std Ext	10.70 – 12.75	13.75 – 14.50	17.8 – 20.2	28.0 – 30.0 28.0 – 31.0
Polarization		Linear		Linear, Circular	
Antenna Gain, dBi	Rx / Tx	50.50	52.30	55.23	58.57
3d Beamwidth, °	Rx / Tx	0.42°	0.38°	0.26°	0.17°
VSWR	Rx / Tx	1.25 : 1	1.25 : 1	1.3 : 1	1.3 : 1
Antenna Noise Temperature, K					
	10° EL	42K		95K	
	20° EL	37K		85K	
	40° EL	33K		76K	
Typical G/T @ 20° EL, dB/K		30.20dB/K @ 11.7GHz, 59K LNA		31.22dB/K @ 19.0GHz, 120K LNA	
Power Handling Capability		1kW/Port		1kW/Port	
Feed Interface		WR-75	WR-75	WR-42	WR-28
Feed Interface Loss, dB		0.25dB	0.25dB	0.5dB	0.8dB
Rx to Tx Isolation		≥ 85 dB		≥ 85 dB	
Axial Ratio				≤1.5db (on Axis)	
Cross Pol Isolation, dB (on axis)		≥35dB		≥35dB	
Sidelobes		CCIR.580-6		CCIR.580-6	

Mechanical

Antenna Type & Material	Dual Reflector, precision formed aluminum
Reflector Segments	12
Surface Accuracy	C/X/Ku Ka 0.5mm(R.M.S) 0.3mm(R.M.S)
Movement	Manual or Motorized
Manual Travel Range (Az/El/Pol)	0° - 360° / 5° - 90° / ±90°
Wind Speed	72 km/h(operational) 200km/h(survival, fixed skyward)
Temperature	- 40°C to +60°C
Relative Humidity	100%, non-condensing
Rain	100mm/h
Ice load	25mm on all surfaces, 13mm on all surfaces with 130km/h wind gusts
Solar Radiation	360 BTU/h/ft ² (1000 Kcal/h/m ²)
Shock & Vibration	As encountered during shipment by commercial air, sea or truck
Seismic(survival)	0.3G's horizontal, 0.15G's vertical

1.8 – 3.7m 2-Axis Motorization

Features

- ≡ 2 axis Elevation over Azimuth Motorization
- ≡ Scalable Positioner design, for 1.8m to 3.7m Offset, Single and Dual Reflector Center Fed Antennas
- ≡ Designed for Global Invacom antennas, compatible with other brands
- ≡ For all C, Ku and Ka band antennas
- ≡ Speed: 0.75°/sec with up to 2.0°/sec on demand
- ≡ DC & BLDC Motors with built-in encoder
- ≡ Optional Polarization drive
- ≡ APS700 or APS910 Antenna Controller System

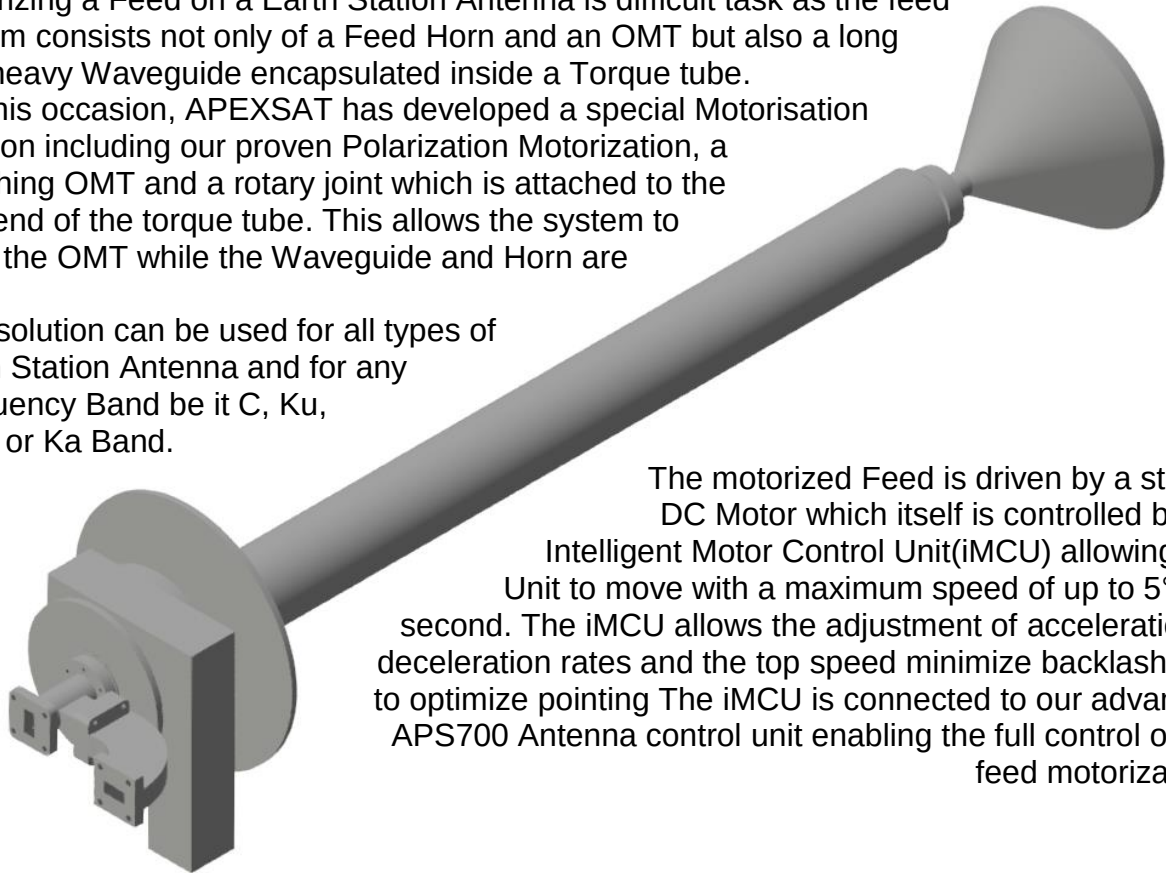


Specifications

Electrical		
Mount Type		Elevation over Azimuth, Two Single Worm Slewing Drives Mount
Material		Hot Dip Galvanized Steel
Antennas		1.8m to 3.7m Offset, Single and Dual Reflector Center Fed Antennas
Positioner Interface		Flange interface for NPRM or Pedestal, optional Canister
Travel Range	Azimuth	360°
	Elevation	75°
Polarization		optional
Axis Speed	Standard	0.75°/sec
	On request	Up to 2°/sec
Axis Precision		0.07°
Encoder Resolution		better than 0.01°
Motor		24V/48V DC/BLDC Motors w/integrated encoders
Drive Control		Intelligent Motor Control Unit(iMCU) with closed loop control
Antenna Controller		APS700 or APS910 Series
Power Consumption		230V AC, 50/60Hz, up to 1000W
Environmental		
Wind Speed		80 km/h(operational) 200km/h(survival)
Temperature		- 30°C to +50°C
Relative Humidity		100%, non-condensing
Rain		100mm/h
Solar Radiation		360 BTU/h/ft ² (1000 Kcal/h/m ²)
Shock & Vibration		As encountered during shipment by commercial air, sea or truck
Seismic(survival)		0.3G's horizontal, 0.15G's vertical

Motorizing a Feed on a Earth Station Antenna is difficult task as the feed system consists not only of a Feed Horn and an OMT but also a long and heavy Waveguide encapsulated inside a Torque tube. For this occasion, APEXSAT has developed a special Motorisation solution including our proven Polarization Motorization, a matching OMT and a rotary joint which is attached to the rear end of the torque tube. This allows the system to drive the OMT while the Waveguide and Horn are fixed.

This solution can be used for all types of Earth Station Antenna and for any Frequency Band be it C, Ku, C/Ku or Ka Band.



The motorized Feed is driven by a strong DC Motor which itself is controlled by an Intelligent Motor Control Unit(iMCU) allowing the Unit to move with a maximum speed of up to 5° per second. The iMCU allows the adjustment of acceleration & deceleration rates and the top speed minimize backlash and to optimize pointing The iMCU is connected to our advanced APS700 Antenna control unit enabling the full control of the feed motorization.

Specifications	
Motorization for	C, Ku, Ka & C/Ku Band RxTx & RxO Feeds
Antenna Types	Earth Station Antennas
Polarization	Linear, Circular using Rotary Joints
Movement Range	360°
Accuracy	0,01°
Speed	Up to 5°/ sec
Acceleration	Up to 10°/sec Selectable on APS700 ACU
Drive	24V DC Motor
Encoder	High Resolution Encoder on Motor
Current Consumption	Max 1,5 A @ 24V DC
Control Type	Intelligent Motor Control Unit(iMCU)
Antenna Controller	APS 700 ACU
Temperature Range	-30°C - +50°C
Humidity	0 – 100%

ø10.75" King Post

KP37 | 273mm

Read this instruction manual prior to assembly

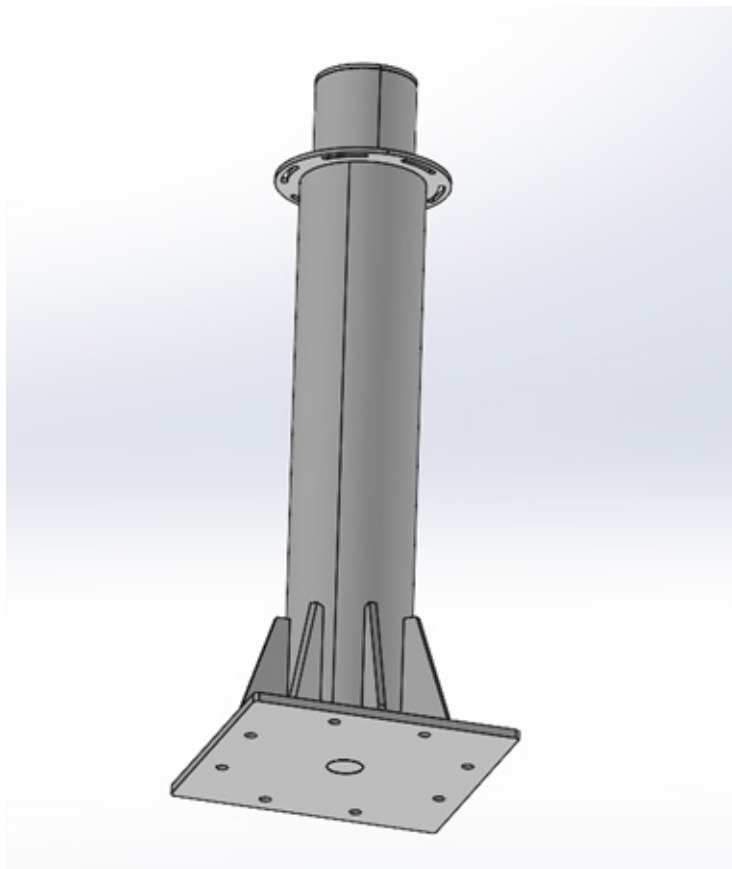
ASSEMBLY MANUAL

Ø10.75" KING POST

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1.0 ASSEMBLY AND INSTALLATION



The 3.7m King Post is supplied with a foundation kit to assist in the construction of the concrete pad, this pad must be designed in accordance with local building regulations. This will ensure the correct spacing of the fixings for assembly of the KingPost once the concrete has cured. The forces acting on a 3.7m antenna are shown below for reference at varying wind speeds which have been calculated based on ASCE 7-02 Exposure C.

Speed				
km/hr	mph	m/s	Velocity Pressure (Pa)	Wind Force (N)
56	35	15.6	135	1483
80	50	22.4	276	3026
161	100	44.7	1103	12103
217	135	60.4	2011	22057
241	150	67.1	2482	27231

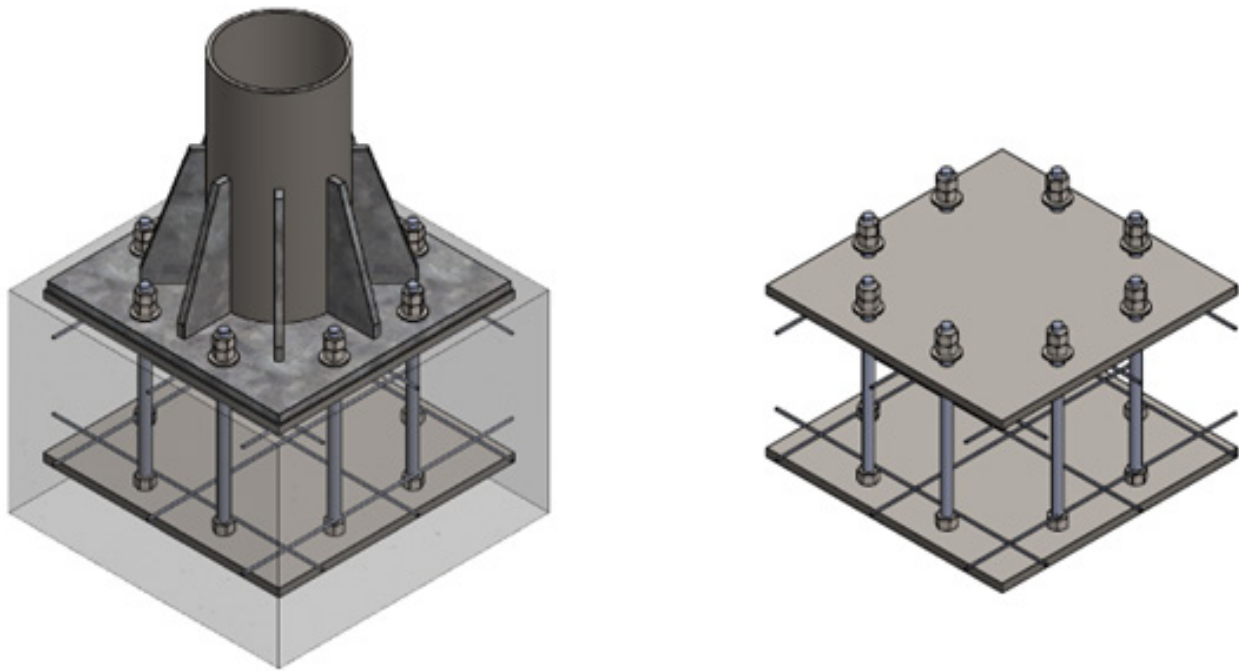
ADDITIONAL INSTALLATION MATERIALS (Not Included with NPRM/KP)

Grounding Rod, Clamp & Grounding Block - As required by National Electric Code or local codes.

Ground Wire - #10 solid copper or #8 aluminum as required by National Electric Code or local codes (length as required).

1.1 ASSEMBLY AND INSTALLATION

Position the King Post in its selected location taking notice of the 'Site selection' and 'warnings' advise given in the antenna installation manual. Check the selected location to ensure there is clear line of sight with the selected satellite taking into consideration future tree growth. Ground preparation work will need to be carried out in line with local requirements and may need grounding installation.



The mast must be checked to ensure it is vertical in two orthogonal planes once bolted onto the concrete pad. This product has been galvanised and will self-heal however any damage during assembly should be repaired on-site with a zinc rich paint or equivalent product.

2.0 PERIODIC INSPECTION & MAINTENANCE

To ensure peak performance of the antenna system and to maintain validity of the warranty, the user should perform a periodic inspection every 6 months or following any severe weather event, As a minimum the following items should be inspected.

1. Installation Mount

Check for loose hardware - tighten if necessary.

Check integrity of anchor bolts or hardware securing mount to the building or foundations.

Check ballast of Non-Penetrating Roof Mounts - cracked or broken blocks must be replaced.

3.0 WARRANTY

Global Invacom

VERY SMALL APERTURE TERMINAL (VSAT) PRODUCTS TWELVE (12) MONTH LIMITED WARRANTY

Seller warrants that all Global Invacom manufactured VSAT products are transferred rightfully and with good title; that they are free from any lawful security interest or other lien or encumbrance unknown to Buyer. Seller also warrants that for a period of twelve (12) months from the date of shipment from Seller's factory, all its VSAT products shall be free from defects in material and workmanship which arise under proper and normal use and service. Buyer's exclusive remedy hereunder is limited to Seller's correction (either at its plant or at such other place as may be agreed upon between Seller and Buyer) of any such defects by repair or replacement at no cost to Buyer, except for the costs of any transportation in connection with the return of the defective VSAT products to be replaced or repaired, and the costs to remove and/or reinstall the products, which shall be borne by Buyer. The limited warranty period shall not be extended beyond its original term with respect to any part or parts repaired or replaced by seller hereunder.

This warranty shall not apply to VSAT products which (i) have been repaired or altered in any way so as to affect stability or durability, (ii) have been subject to misuse, negligence or accident, (iii) have been damaged by severe weather conditions such as excessive wind, ice, storms, lightning, or other natural occurrences beyond Seller's control; (iv) have presented damages, defects or nonconformances caused by improper shipping, handling or storage, and (v) have not been installed, operated or maintained in accordance with Seller's instructions.

Buyer shall present any claims along with the defective VSAT product(s) to Seller immediately upon failure. Non-compliance with any part of this warranty procedure may invalidate this warranty in whole or in part.

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, OTHER THAN AS SPECIFICALLY STATED ABOVE. EXPRESSLY EXCLUDED ARE ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE FOREGOING SHALL CONSTITUTE ALL OF SELLER'S LIABILITY (EXCEPT AS TO PATENT INFRINGEMENT) WITH RESPECT TO THE VSAT PRODUCTS. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY LOSS OF PROFITS OR REVENUE, LOSS OF USE, INTERRUPTION OF BUSINESS, OR INDIRECT, SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND AS A RESULT OF THE USE OF THE PRODUCTS MANUFACTURED BY SELLER, WHETHER USED IN ACCORDANCE WITH THE INSTRUCTIONS OR NOT. UNDER NO CIRCUMSTANCES SHALL SELLER'S LIABILITY TO BUYER EXCEED THE ACTUAL SALES PRICE OF THE VSAT PRODUCTS HEREUNDER.

In some jurisdictions, Buyer may have other rights under certain statutes that may imply non-excludable warranties. No representative is authorized to assume for Seller any other liability in connection with the VSAT products.



DO NOT DISCARD CONTENTS

The product in this packaging was placed in the market after August 13, 2005. Its components must not be discarded with normal municipal or household waste.

Contact your local waste disposal agency for recovery, recycling, or disposal instructions.

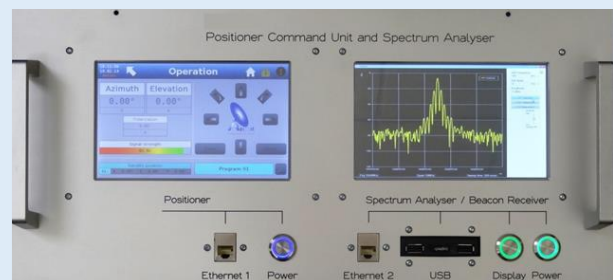
APS720 Antenna Control Unit with integrated Spectrum Analyzer

With over 25 years of experience in the development of satellite antenna positioners and antenna control systems, GlobalApexsat's expertise in this field has led to the development of the new APS720 Antenna Control Unit with integrated Spectrum Analyzer. This Controller represents a significant advancement in satellite communications technology, offering improved performance and versatility for a wide range of applications. Built as a two-unit design with a dedicated indoor unit with screen and a motorized ODU cabinet, the APS 700 can be used for a wide range of satcom applications.

System Features

- ≡ Available for all VSAT and ESA Antennas from 0,75m to 9,0m diameter
- ≡ Drives any Elevation over Azimuth Motorizations and X/Y Positioners
- ≡ 2 Axis Az/El and X/Y Control with optional 3rd Axis Polarization Drive
- ≡ Optional Multifeed Revolver Control
 - Control of up to 7 independent Motors (Az/El, 4 x Polarization Drives, Revolver Motor) on a single Positioner
- ≡ Satellite Monitoring & Tracking via Spectrum Analyzer

- ≡ 5RU Indoor Unit with Dual Screens
- ≡ CAN Bus Communication to ODU
 - Optional: Wi-Fi or Optical interface for Communication with ODU
- ≡ Analog and Digital (RS232 & Ethernet) Communication interfaces for external DVB-S/S2 Receivers and Beacon Receivers
- ≡ RF Interfaces with In & Out connector
 - Integrated Splitter and LNB power supply
- ≡ APS700 Controller with 7" Touchscreen
- ≡ Industrial grade PLC with 800 MHz ARM Cortex A9 CPU and 256 MB RAM + 256MB Flash



APS720 Antenna Control Unit with integrated Spectrum Analyzer

- ≡ Spectrum Analyzer with 7" Touchscreen
- ≡ Frequency Range: 1 Hz to 4,4 GHz
- ≡ Amplitude: -151 dBm to +10 dBm
- ≡ Accuracy: 0.25 dB relative accuracy
- ≡ Resolution Bandwidth: 0,1Hz to 250 kHz and 5 MHz
- ≡ Frequency Selection: min. 100 Hz Steps
- ≡ LNB Power: max 500mA via power injector



Optional Equipment:

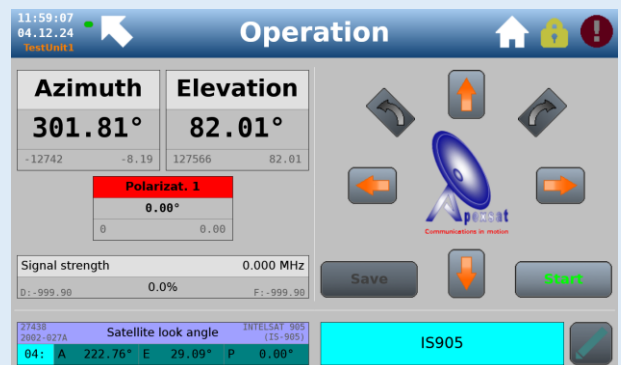
- ≡ TLE server: Find and track satellites based on TLE Data

- ≡ Outdoor Cabinet with integrated climatization and power supplies
- ≡ Control of DC/BLDC Motors (24-60V, 700W).
- ≡ Interfaces with high precision, high speed and/or high-power servo motors(400V) with up to 15 kW peak.
- ≡ Uses integrated Motor and On Axis Encoders
- ≡ Precise Satellite positioning and tracking via variable speed Motor Controller with Closed Loop Control System
- ≡ Manual Move Interface for local positioning at the antenna
- ≡ CAN Bus interface to Indoor unit



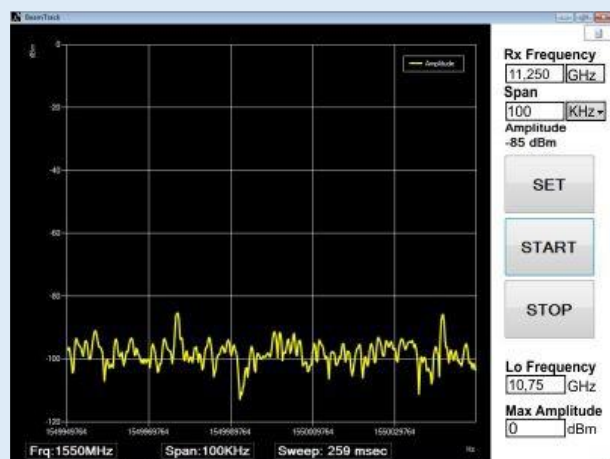
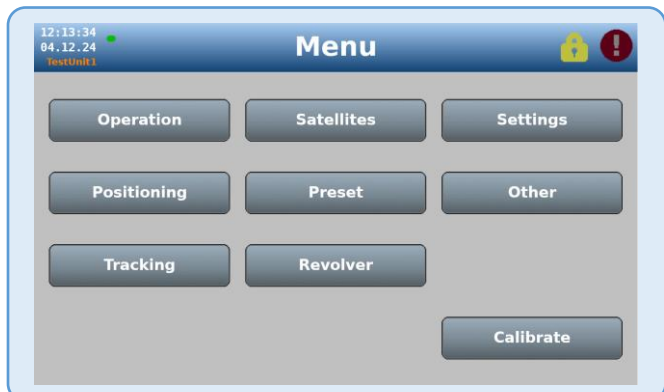
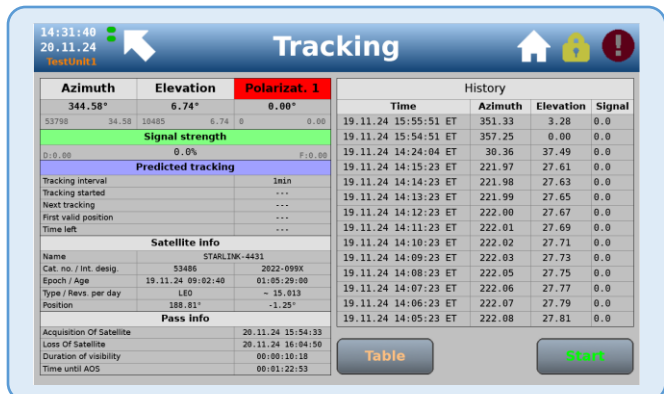
Features: APS700 Antenna Controller

- ≡ Antenna Control via 7" Touchscreen
- ≡ Remote control via HTML5 Web GUI
- ≡ Network management via MODBUS over TCP
- ≡ 99 Satellite memory
- ≡ Manual Satellite positioning
- ≡ GPS based Satellite positioning



APS720 Antenna Control Unit with integrated Spectrum Analyzer

- ≡ (Opt.) TLE based Satellite positioning
- ≡ (Opt.) Signal based tracking based on different variable (Time, Signal, table Optimization)
 - ⊙ Integrated Spectrum Analyzer
 - ⊙ External Beacon and DVB Receivers
 - ⊙ For GEO/IO Satellites
- ≡ (Opt.) TLE Satellite Path Prediction & Tracking
 - ⊙ Integrated TLE Server
 - ⊙ For GEO/IO and individual MEO/LEO satellites
- ≡ Available Options:
 - ⊙ Polarization Switching
 - ⊙ Multifeed revolver Control
 - ⊙ Remote Triggers

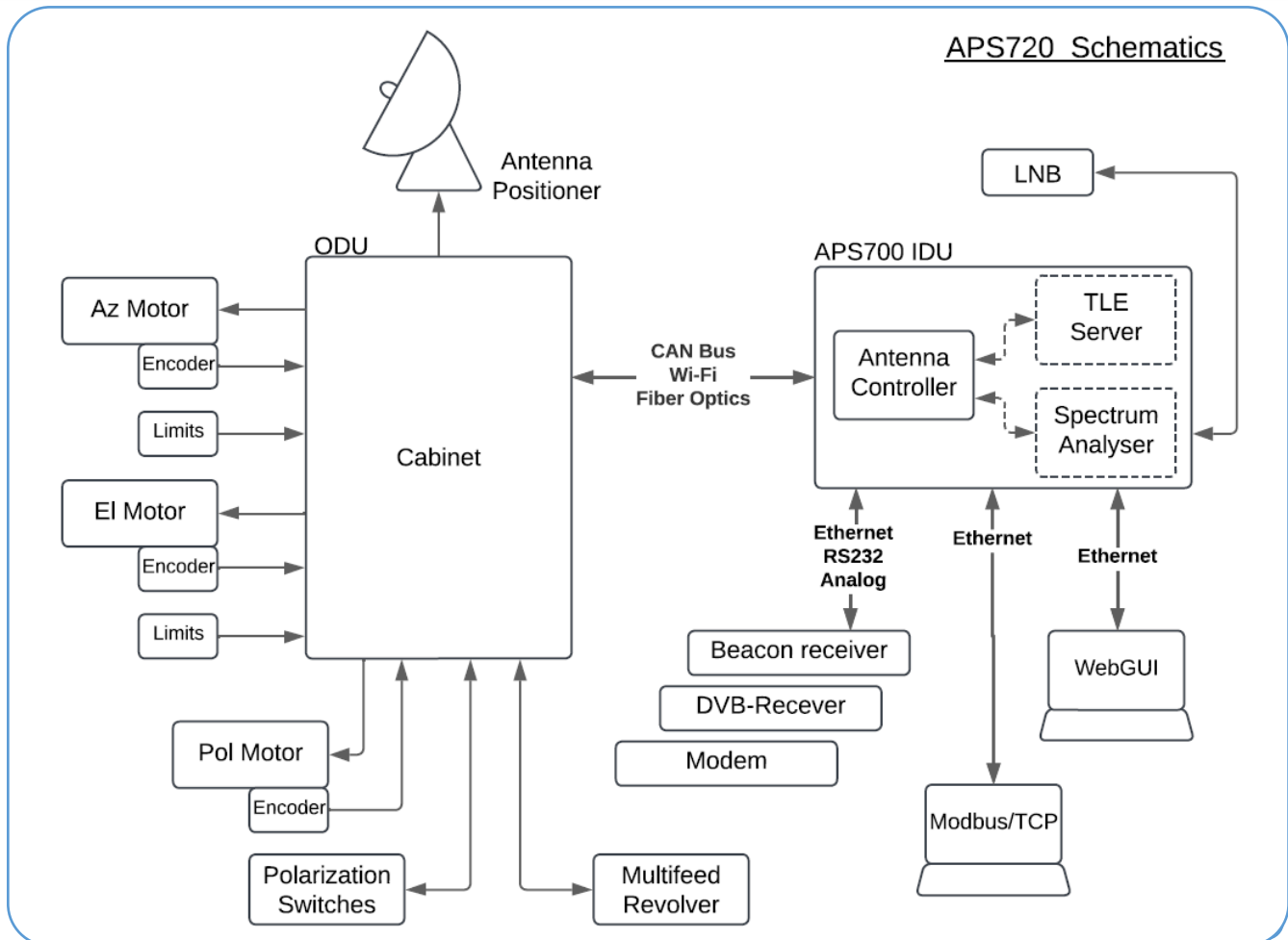


Features: Spectrum Analyzer

- ≡ Control via 7" Touchscreen
 - ⊙ Optional via Keyboard/Mouse
- ≡ Spectrum Analysis and Verification
- ≡ Frequency and Span, LO Frequency and Amplitude setting
- ≡ Peak signal used for satellite tracking
 - ⊙ Internal Signal peak transmission to APS700 Antenna Controller
- ≡ Remote control via Web GUI

APS720 Antenna Control Unit with integrated Spectrum Analyzer

APS720 Schematics



Dimensions

Unit	Size (L x H x D)	Weight	Power
APS720 Indoor Unit	480 x 222(4RU) x 275mm	8 kg	88 - 264V AC, 47 - 63Hz Opt. 3 x 320 - 575 VAC(3-Phase)
Outdoor Unit	600 x 400 x 210mm *	30 kg *	88 - 264V AC, 47 - 63Hz Opt. 3 x 320 - 575 VAC(3-Phase)

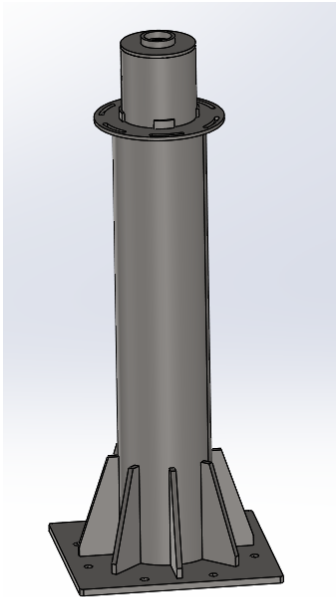
Environmental

	Temperature	Humidity
APS720 Indoor Unit	Operating: 0° to +55°C Storage: -20 to +70°C	85% (non-condensing)
Outdoor Unit	Operating: -20° to +60°C Storage: -30 to +70°C	100% (condensing)

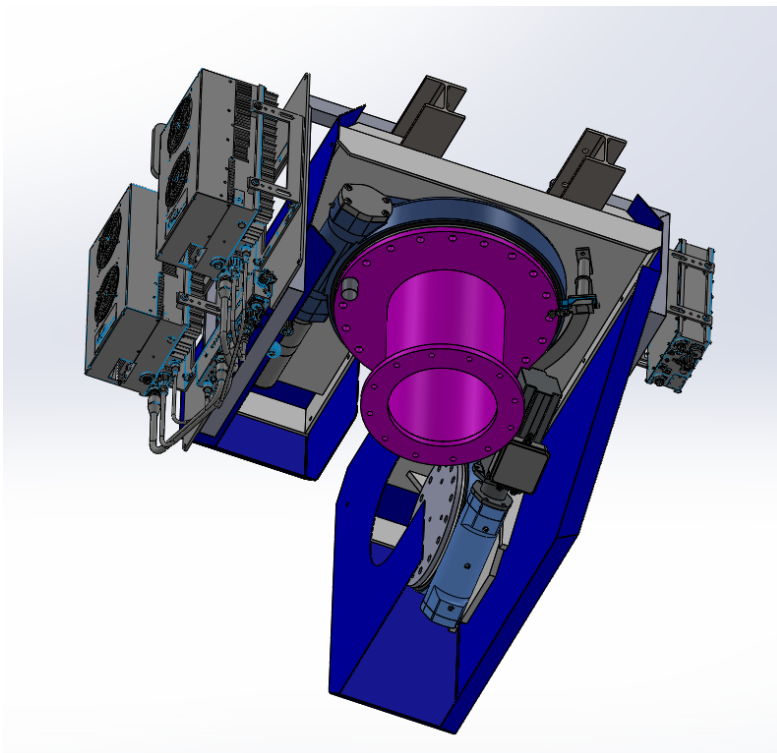
* Dimensions & Weights depending on application

Subject: 3.7m APG version - total mass
Date: Tuesday, 24 March 2026 at 15:17:55 Central European Standard Time
From: Branislav Radivojevic [Amisys]
Attachments: image001.png, image008.png, image009.png, image010.png, image011.png, Screenshot 2026-03-24 at 15.11.21.png

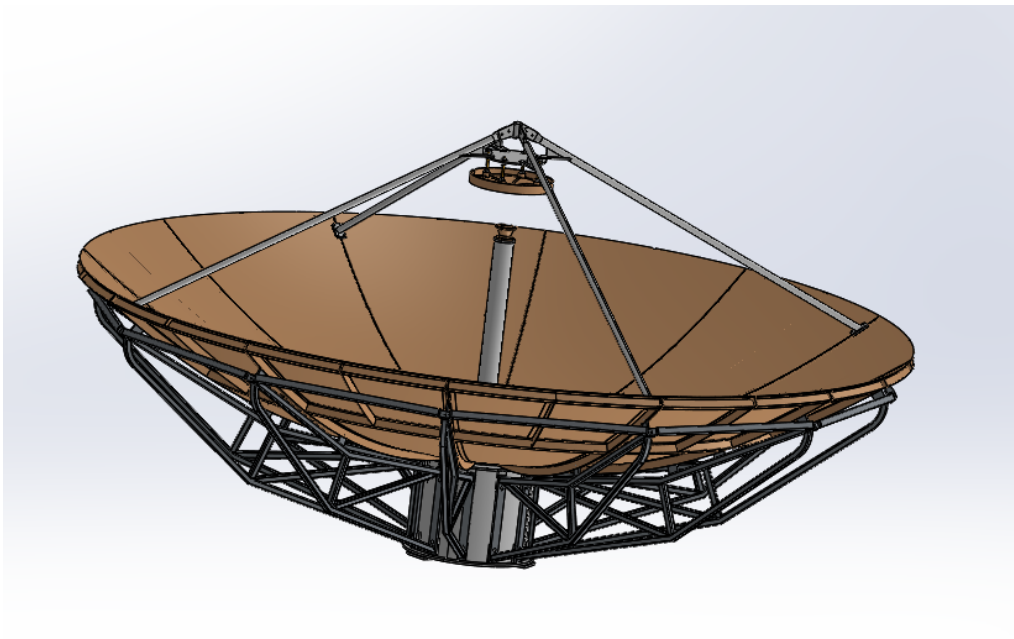
King Post – 130 kg



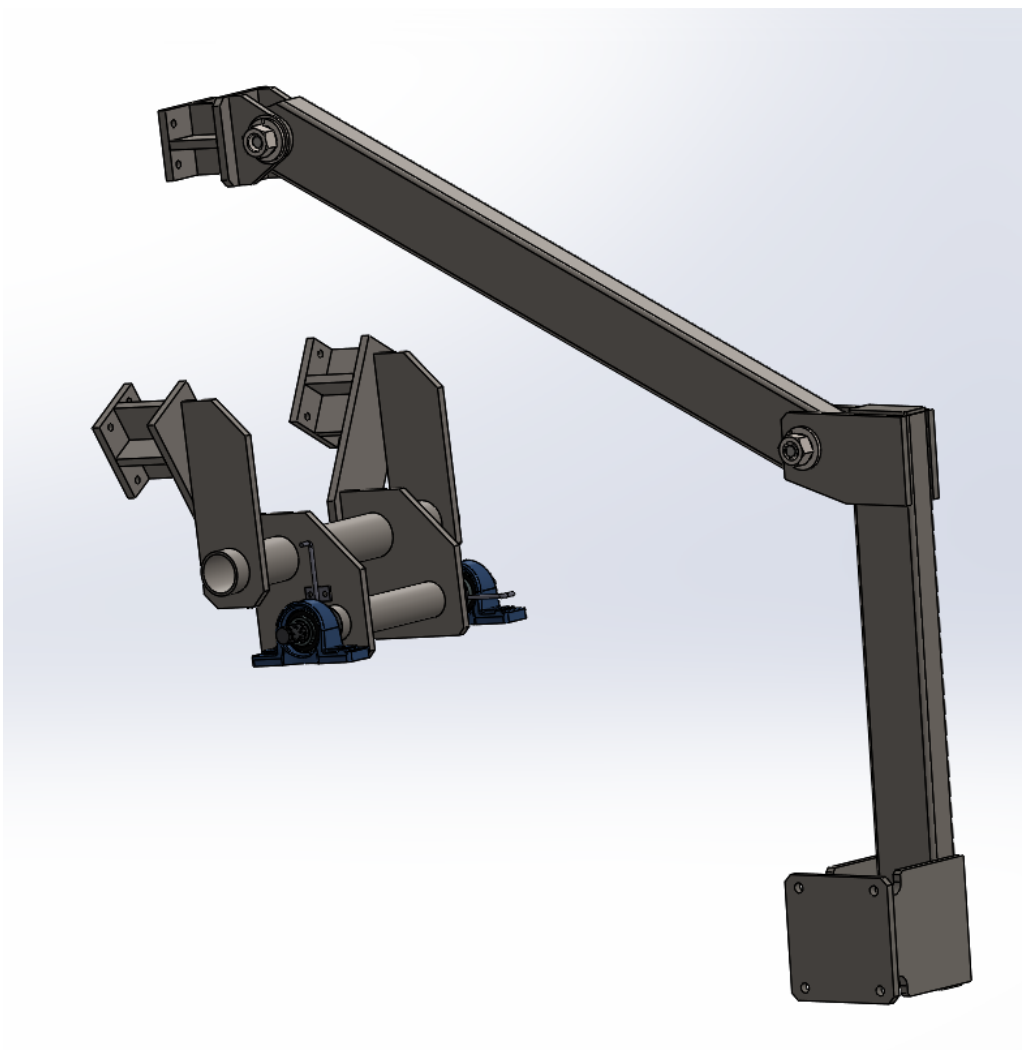
Motors, BUCS & Frame work 620 kg



Reflector, support structure and hub – 305 kg



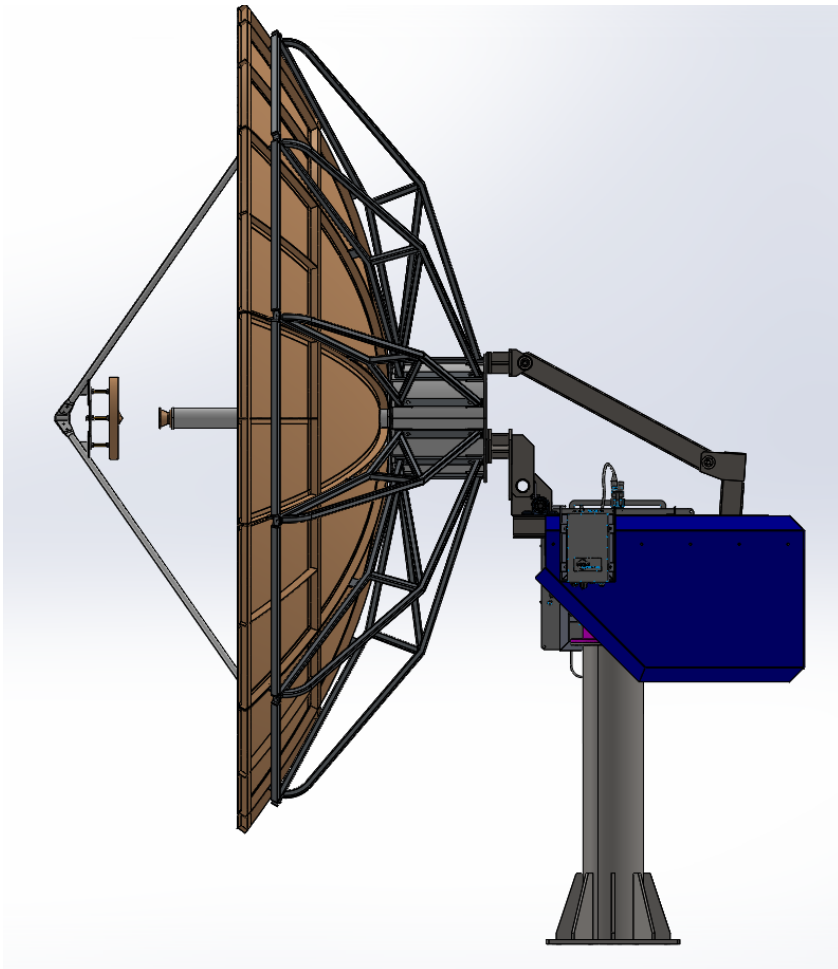
Pivot arms – 65 kg



Antenna controller outdoor unit (ODU) - 30 kg

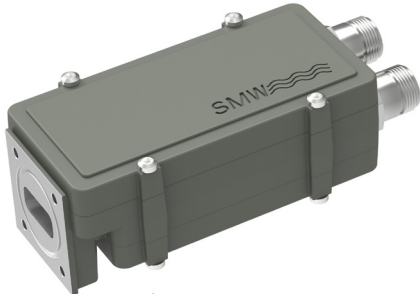


Total mass – 1150 kg



Ku LNB 10.70-12.75 GHz WDL ULP Dual & Quattro

Key features



Dual WDL LNB



QUATTRO WDL LNB with weather case

- Simultaneous reception Low and High band
- Full Ku-Band 10.70-12.75 GHz
- Ultra Low Phase Noise (ULP) as standard
- Models with Ext. 10 MHz ref. or Internal ± 1 ppm
- High P1dB and IP3
- Wide operating temperature range
- Dual output Low band and High band
- Available as Dual LNB or Quattro LNB for both polarisations V/H

Description

With simultaneous reception of Low & High Ku-Band 10.70-12.75 GHz (model E) or 10.95-12.75 GHz (model B) you are ready for all demands.

It comes with Ultra Low Phase Noise is standard to meet the requirements for reception of DVB-S2X (professional profiles), N3 and N4 signals.

Can be ordered as a Single polarisation LNB or as a Quattro LNB for both Horizontal and Vertical polarisation including OMT and weather protection case.

Ultra Low Phase Noise (ULP) is recommended* for:

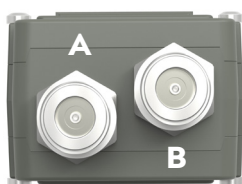
DVB-S2: - Narrowband 8PSK 8/9 and 9/10 FEC
- 16 APSK or higher modulation type (any bandwidth)
- All applications with "Pilot Off"

DVB-S2X: All "MODCODS" and symbol rates

NS3/NS4: All "MODCODS" and symbol rates

* Please note that these are general recommendations and that all other system components also will influence system performance.

LNB rear connectors



Connector A

Type: Female F, N or SMA
Function: Low band RF Output

Connector B

Type: Female F, N or SMA
Function: DC input, 10 MHz input, High band RF Output



Explore our full product range in this category



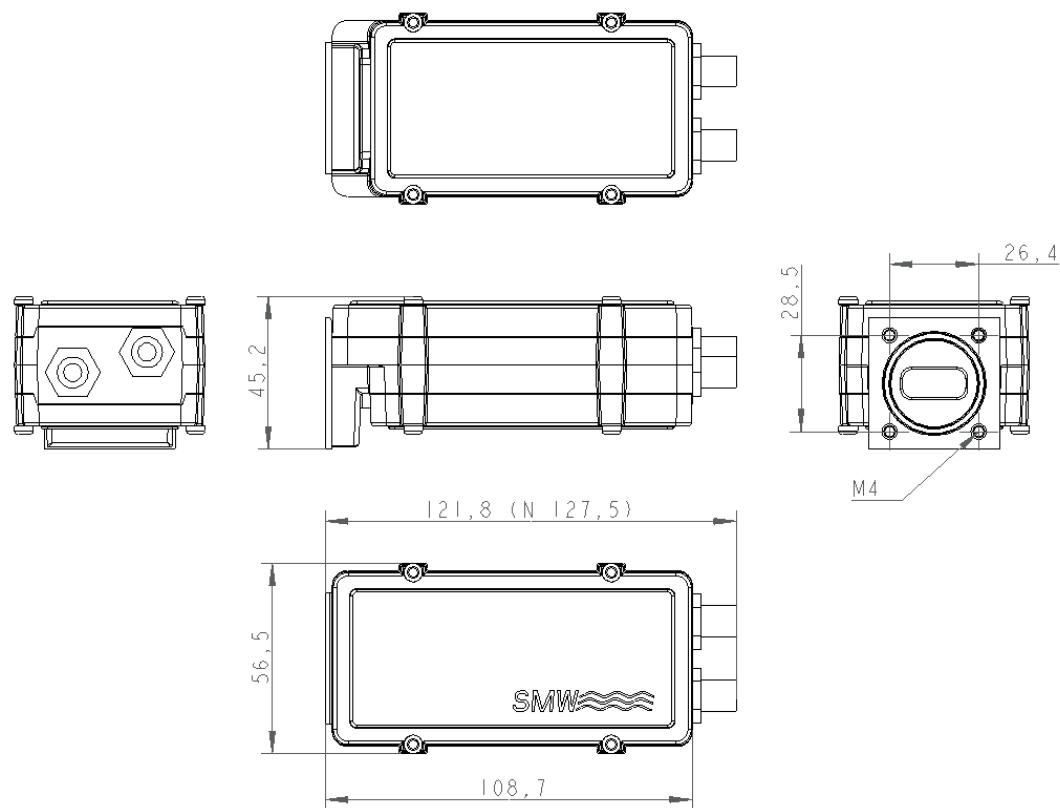
Ku LNB 10.70-12.75 GHz WDL ULP Dual & Quattro

Technical specifications

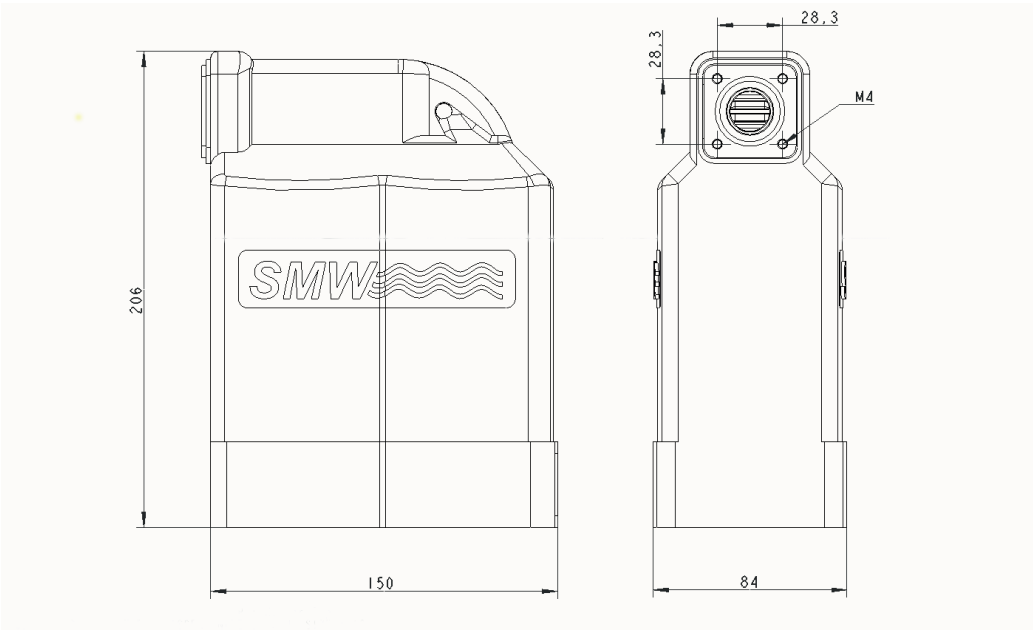
	Model	E	B						
INPUT	Input frequency	10.70-12.75 GHz				10.95-12.75 GHz			
	LO	9.75 and 10.60 GHz				10.00 and 10.75 GHz			
	Low/High band	10.70-11.70 / 11.70-12.75 GHz				10.95-11.70 / 11.70-12.75 GHz			
	Input WG	WR75 / R120							
	Input flange	PBR120 with M4 thread							
	Input VSWR	2.3:1 max.							
	Input max power	0 dBm instantaneous (not continuous)							
	DC input	+15 to 24 V (15 V min., 26 V max.) via High band connector on Ext. 10 MHz. Ref models and one or both connectors on Internal ref. models. Power consumption 5W typ.							
INTERNAL	Gain	60 dB typ., 55 dB min.				60 dB typ., 55 dB min.			
	Gain flatness	± 0.25 dB max. within 30 MHz, ±2 dB max. over band				± 0.25 dB max. within 30 MHz, ±2 dB max. over band			
	MODEL with Internal LO ref.	±1 ppm max. -40 to +80°C							
	MODEL with External 10 MHz ref.	Sine Wave, Level -10 dBm to +10 dBm. Supplied through High band output connector. With no ext. 10 MHz ref. present LO shifts -20 ppm.							
	Spurioses Low/High band	-60dBm @ 1700 MHz / -70dBm @ 1700 MHz typ.				-60dBm @ 1500 MHz / -70dBm @ 1500 MHz typ.			
	Out of band rejection	20 dB min.							
	Group Delay	±1 ns max.							
	Image rejection	40 dB typ.							
	Phase Noise	-35 dBc @ 10 Hz -65 dBc @ 100 Hz -82 dBc @ 1 kHz -94 dBc @ 10 kHz -98 dBc @ 100 kHz -120 dBc @ ≥1MHz, typ.							
	Noise figure @ 23°C	0.8 dB / 59 K typ.							
OUTPUT	Output frequency	Low band 950-1950MHz, High band 1100-2150 MHz				Low band 950-1700MHz, High band 950-2000 MHz			
	Output P1dB	+15 dBm min.							
	Output IP3	+25 dBm min.							
	Output VSWR	1.7:1 typ.							
	Output Connectors	F female 75Ω , N female 50Ω or SMA female 50Ω							
GENERAL	Dimensions	122 x 57 x 46 mm (F and SMA), 128 x 57 x 46 mm (N)							
	Weight	335 g (F and SMA), 371 g (N)							
	Temperature range	Storage and operating: -40 to +80°C, -40 to +176° F							
	MTBF	MTBF as per MIL-HDBK-217F Notice 2: Environmental Condition GF (Ground Fixed): >245000 hours, Environmental Condition AIC (Airborne, Inhabited, Cargo): >122000 hours, Quality level: Commercial, Temp used for MTBF calculation: +35 C Ambient							
	Miscellaneous	Enclosed conductive O-ring, mounting screws, M4x10,4 pcs							
OPTIONS	Low gain option (48 to 54 dB for larger antennas)								
	Quattro LNB including OMT and weather protection								
	DC and 10 MHz input at Low band output connector								
QUATTRO	Cross polarisation	31.5 dB min.							
	Input Waveguide	C-120 (circular 18 mm)							
	Dimensions	205 x 152 x 83 mm							
	Weight	1162 g (F-connectors), 1231 g (N-connectors)							

Ku LNB 10.70-12.75 GHz WDL ULP Dual & Quattro

Technical Drawing



QUATTRO weather case

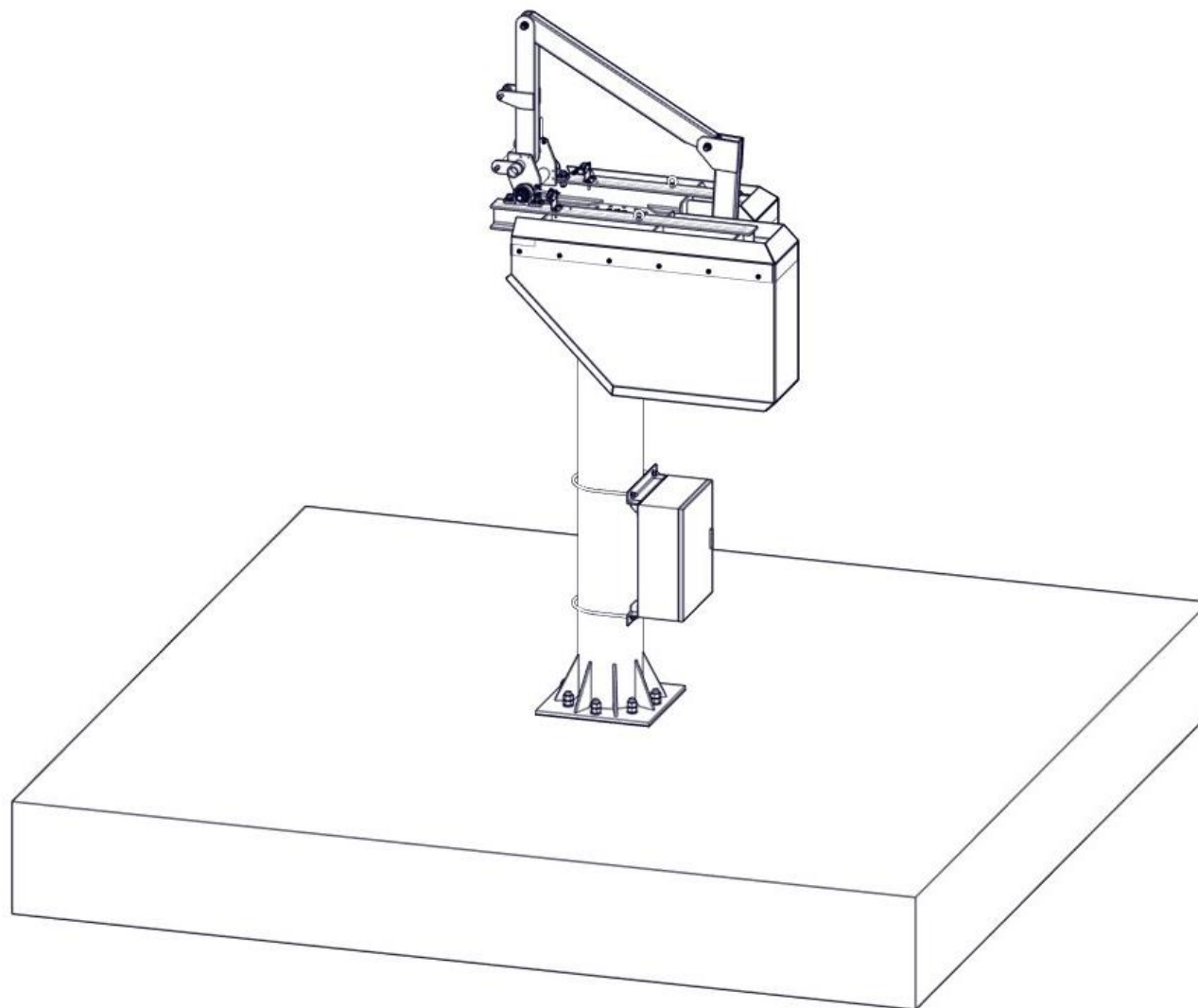


Professional Satcom Frequency Converters & Components. All products are fully CE and RoHS compliant and every unit includes full documentation of performance tests and quality control. Please contact sales@smw.se to configure or customize the unit to your needs. Visit smw.se or scan QR code to see our full product range and request a quote.



Installation Manual Motorization

Antenna 3.7m

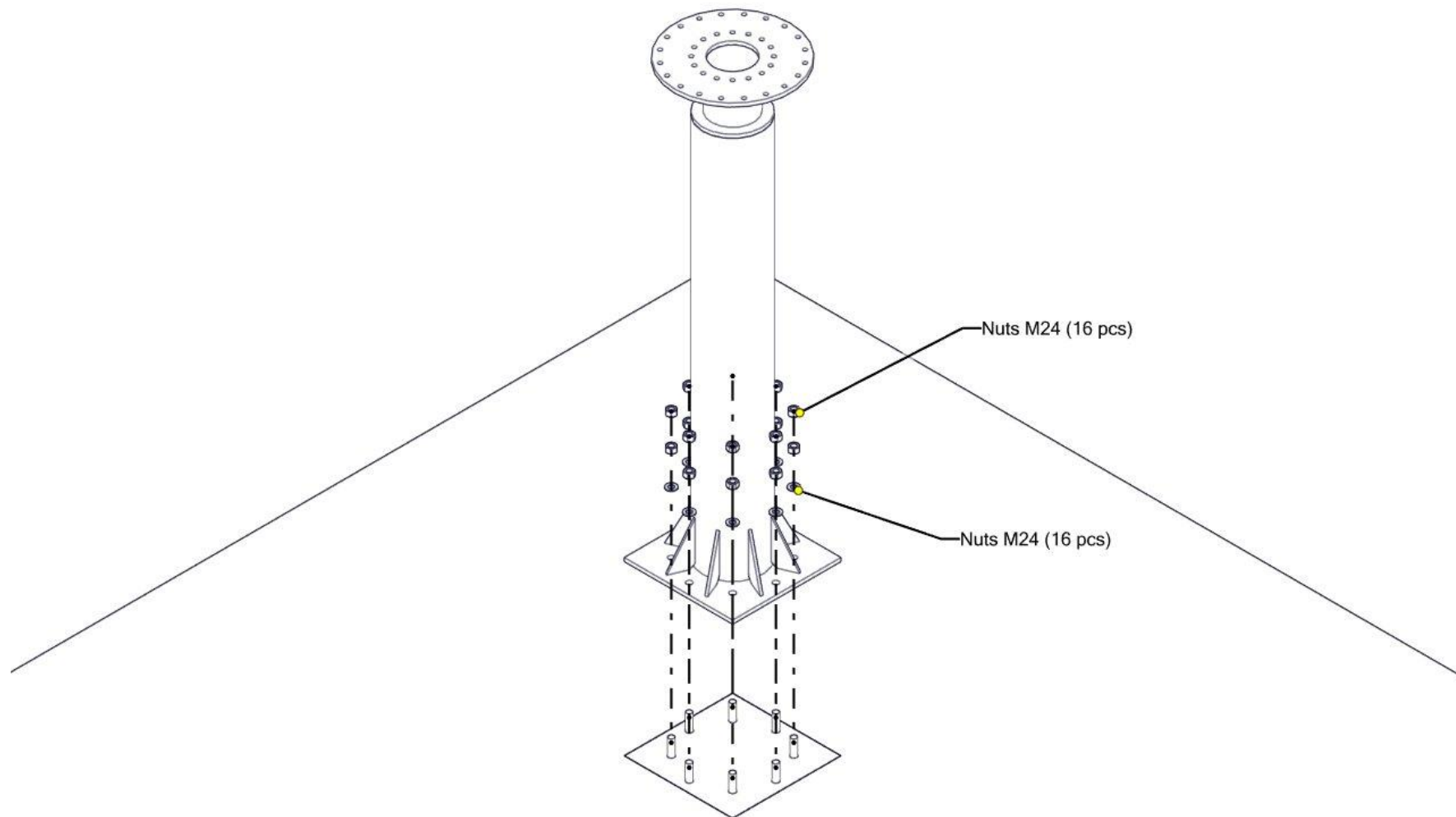


✓ Step 1

Install the king post and make sure the hole of the bottom King Post is aligned with the bolt thread on the foundation.

Note : Use Crane for making the King Post Stand Up

Tools : Spanner or Torque Wrench for M24 Size

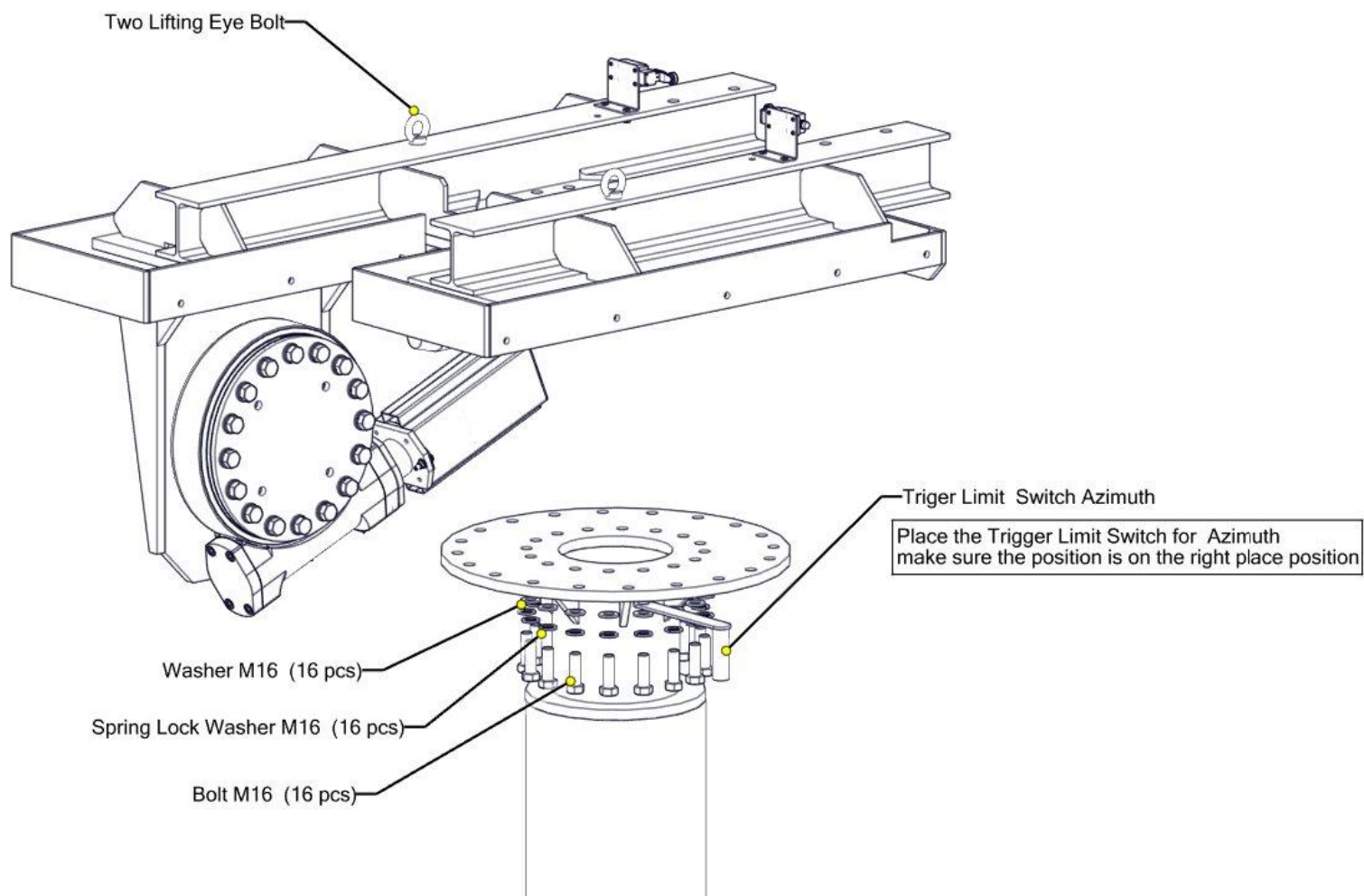


✓ Step 2

Take the Main Frame from the Box Shipping with Crane and Place it on the Top of the King Post, make sure the hole Drive PE9 is Aligned and put the Bolt M16 x50

Note : Take out the Bracket Limit Switch Azimuth before lifting, Use Crane to place it, by lifting on two lifting eye bolt

Tools : Ratchet Wrench or Spanner for M16 Size

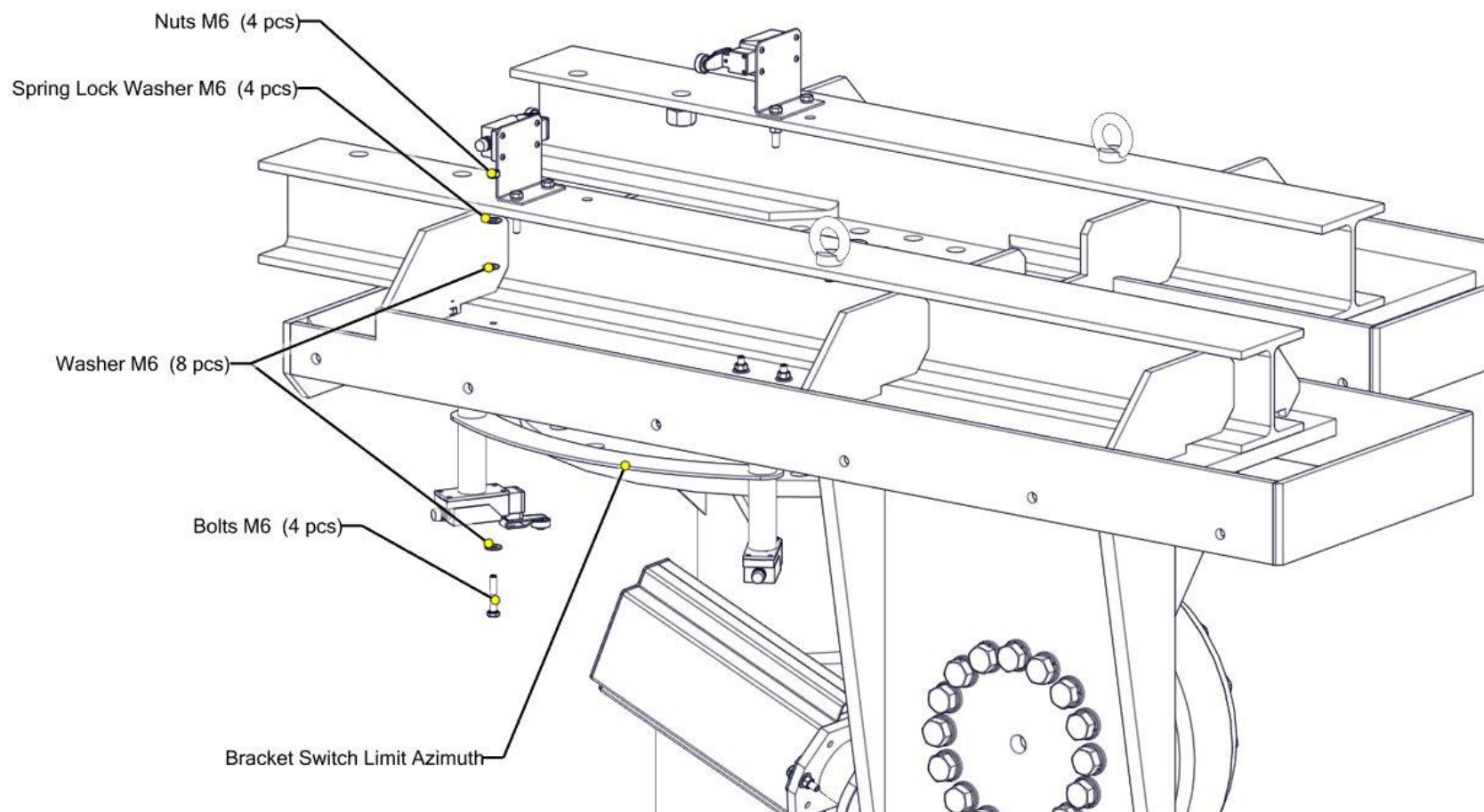


✓ Step 3

Install Bracket Limit Switch to the bottom Main Frame after installing on the top King post

Note : Take out the cover for easy installation

Tools : Ratchet Wrench or Spanner for M6 Size

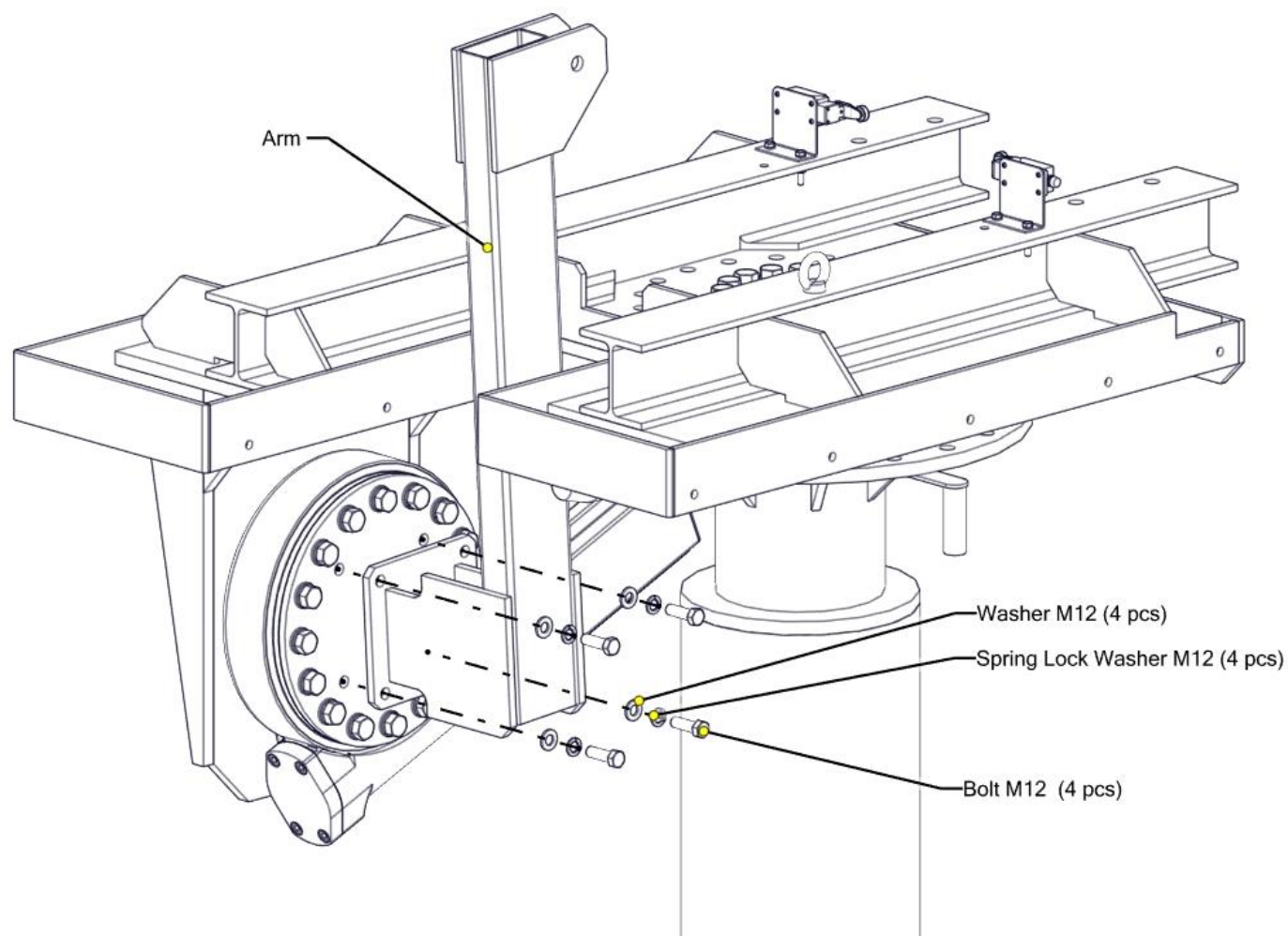


✓ Step 4

Assembly the Arm to the Elevation Drive PE9 with 4 bolts

Note : Assembly the arm in vertical Position

Tools : Spanner or Ratchet Wrench for M12 Size

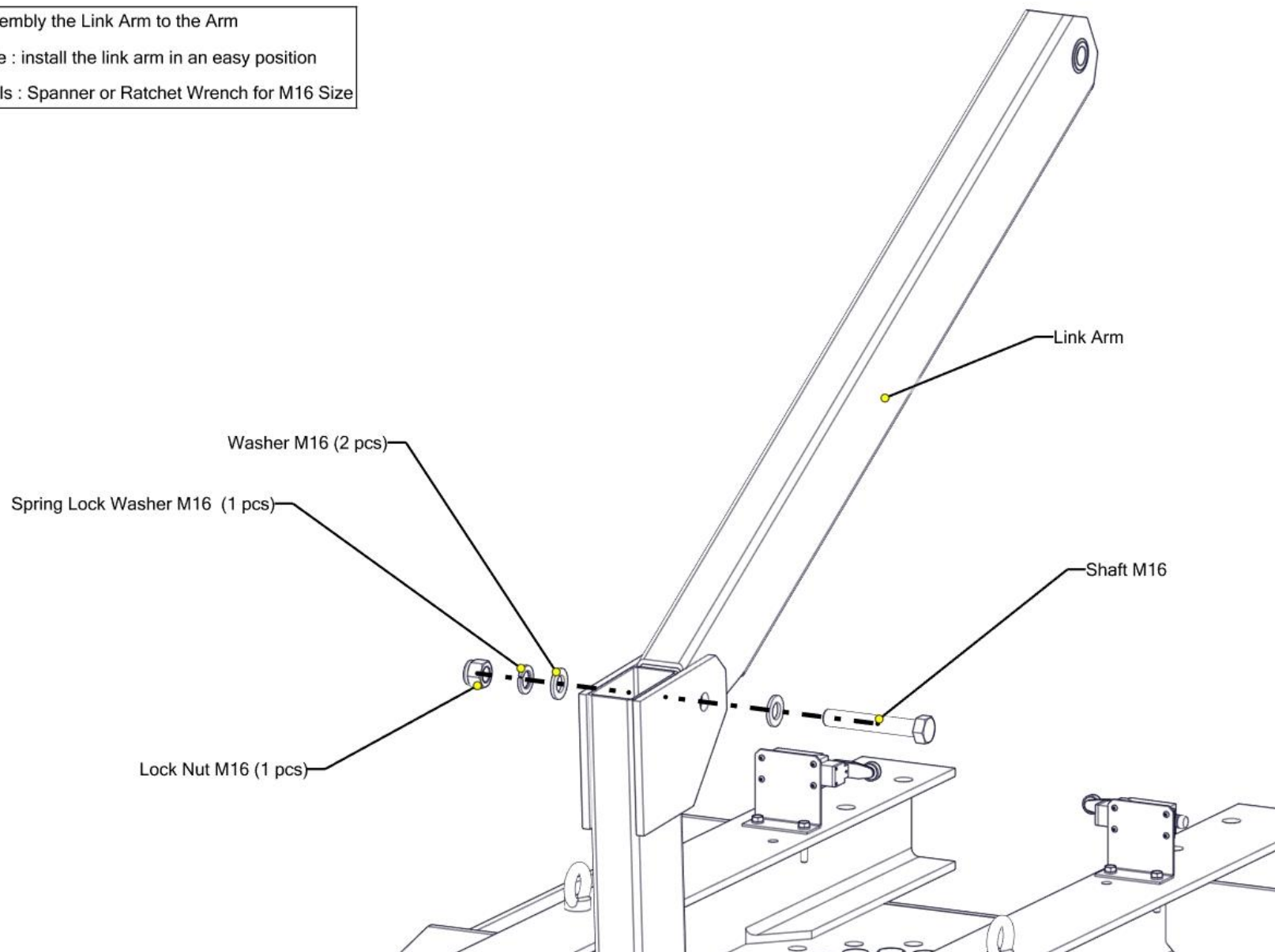


✓ Step 5

Assembly the Link Arm to the Arm

Note : install the link arm in an easy position

Tools : Spanner or Ratchet Wrench for M16 Size

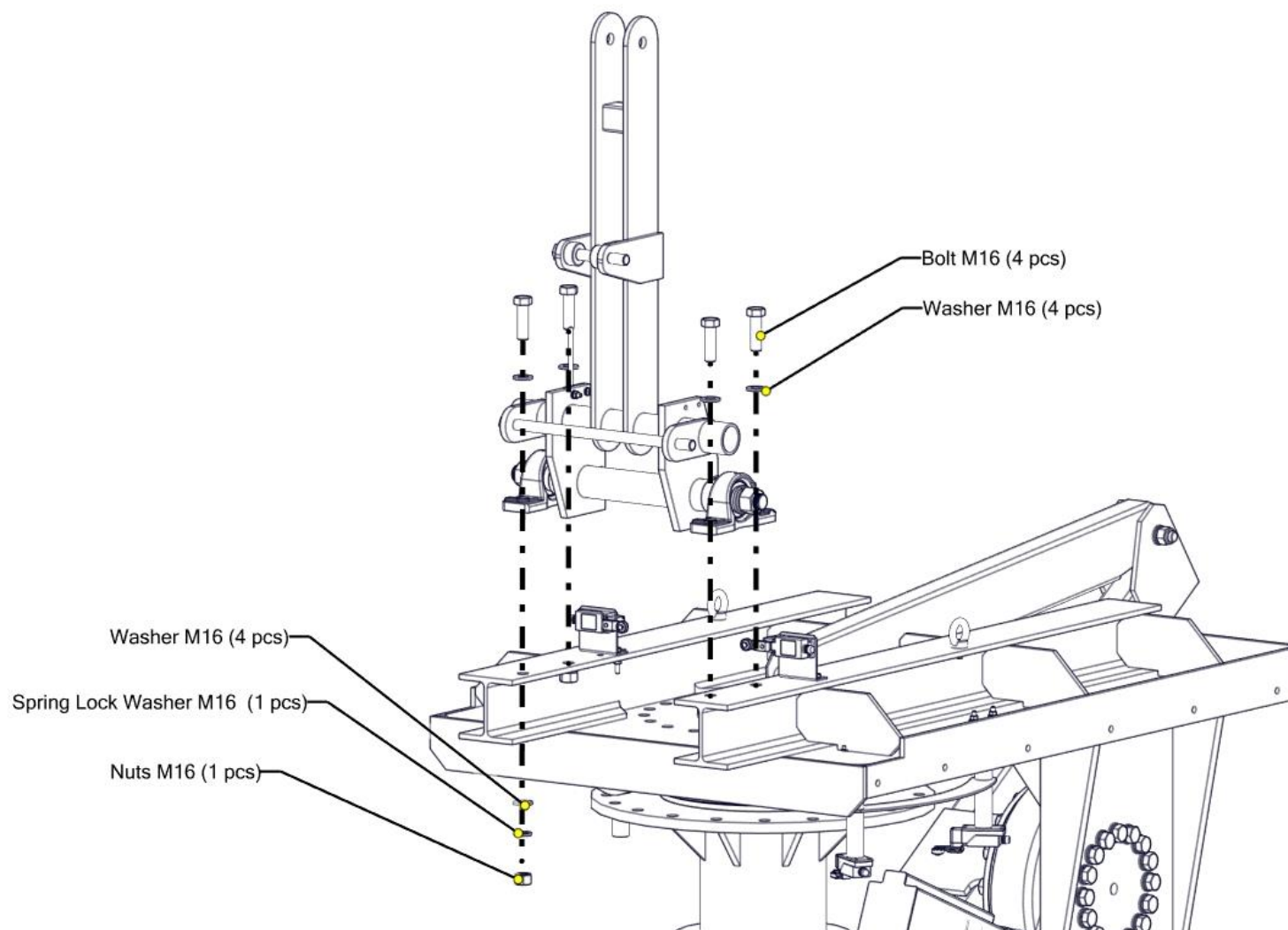


✓ Step 6

Assembly the Bracket Hub to the main Frame

Note : install first the Bearing and shaft to the Bracket Hub by Nuts, Spring Lock Washer, Washer M24 Size

Tools : Spanner or Ratchet Wrench for M16 Size

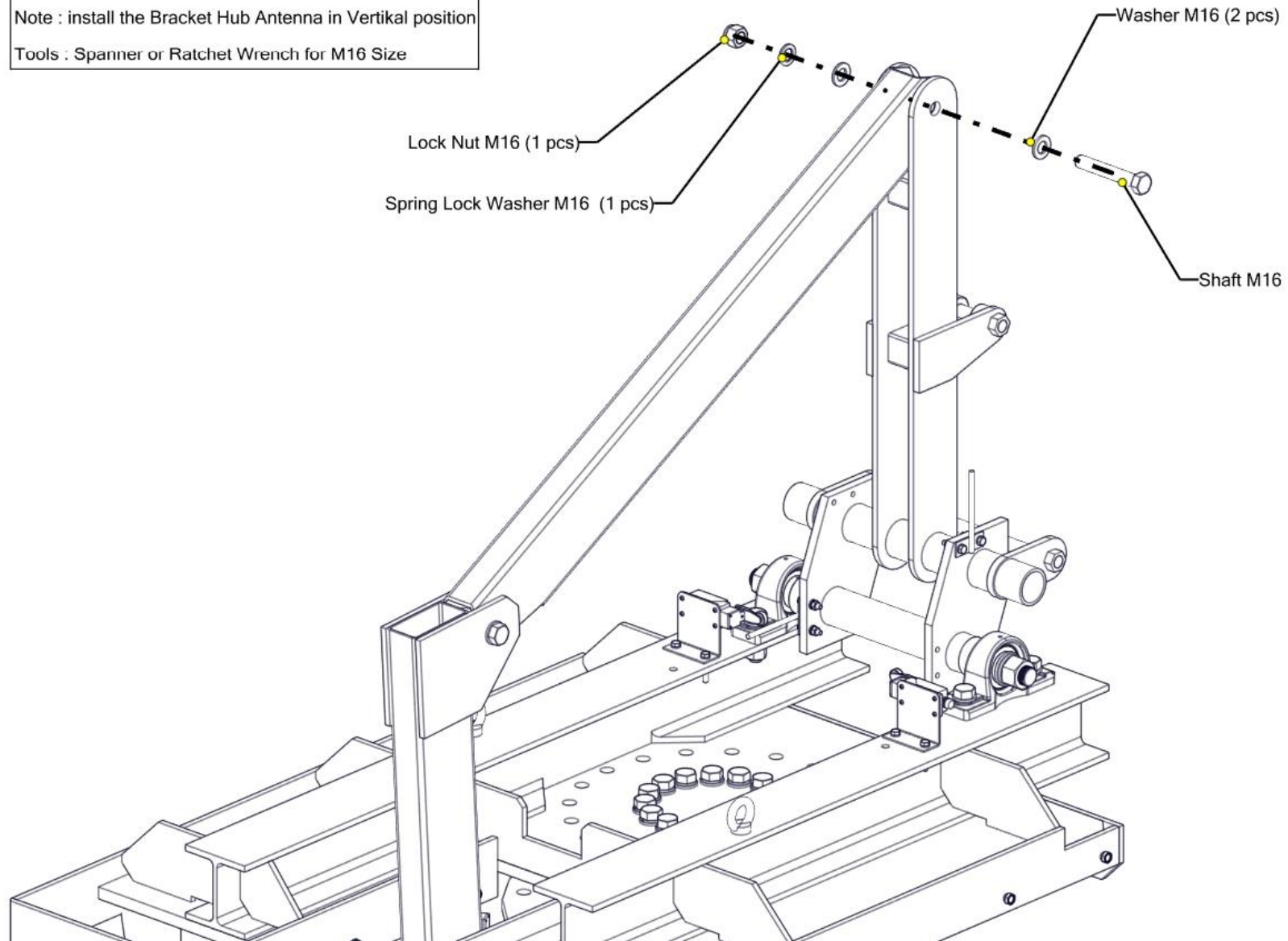


✓ Step 7

Assembly the Link Arm to the Bracket Hub Antenna

Note : install the Bracket Hub Antenna in Vertical position

Tools : Spanner or Ratchet Wrench for M16 Size

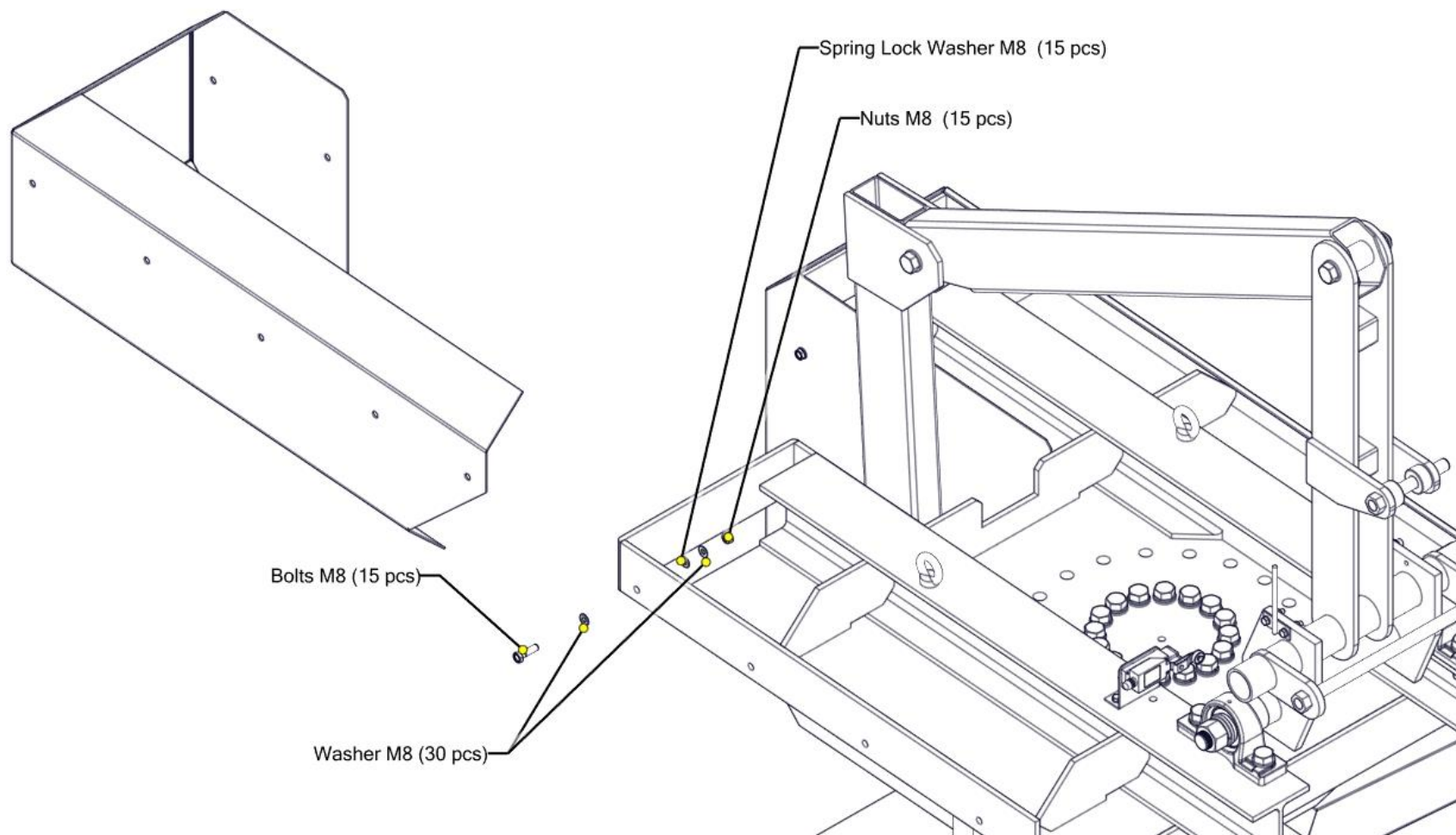


✓ Step 8

Assemble the Cover Main Frame Right and Left

Note : Put the cover from the back to the front by sliding it

Tools : Spanner or Ratchet Wrench for M8 Size

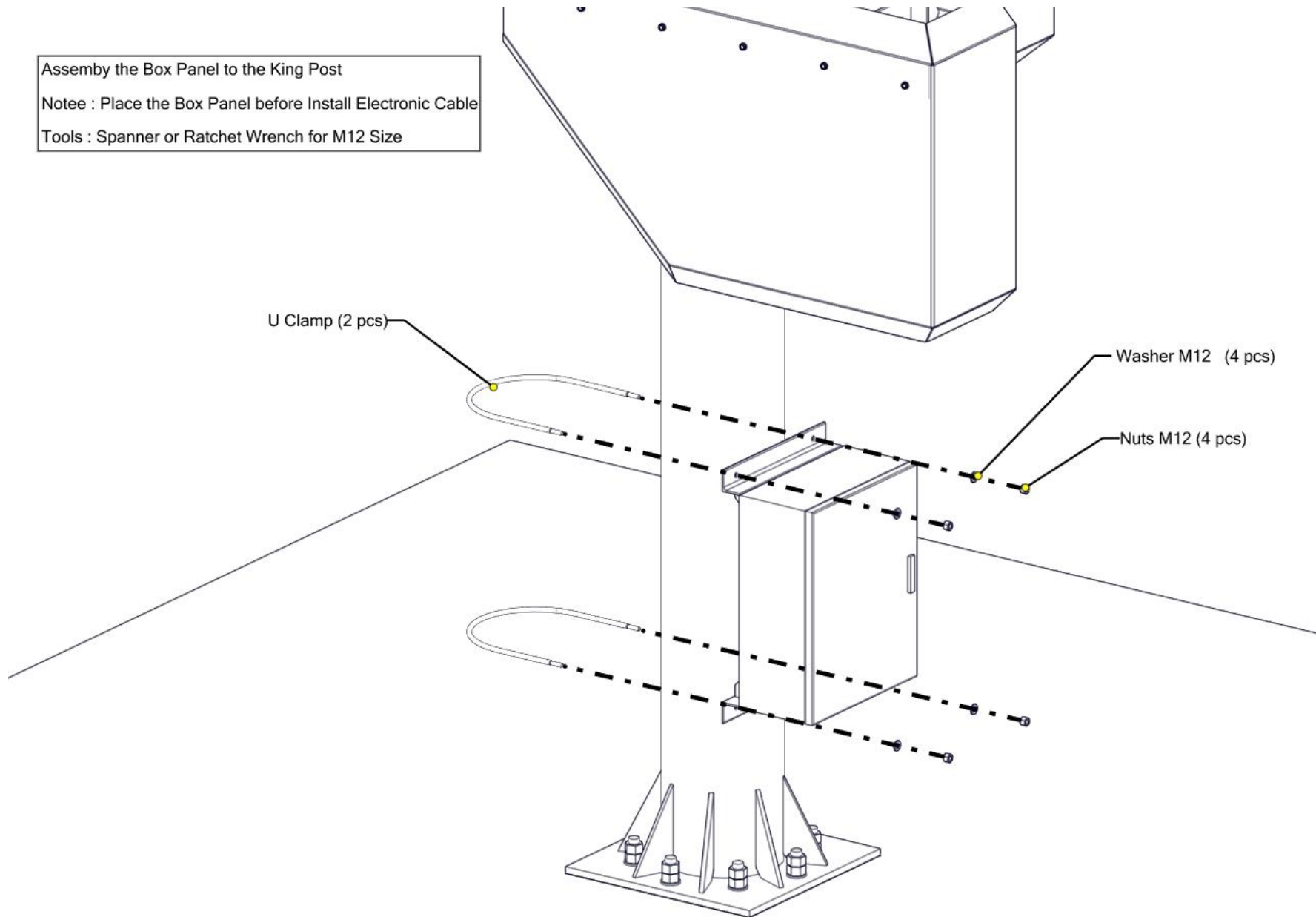


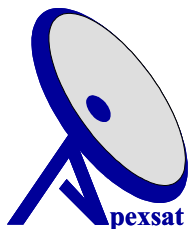
✓ Step 9

Assembly the Box Panel to the King Post

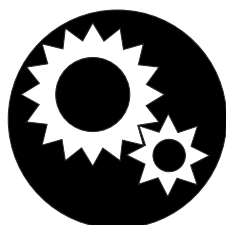
Note : Place the Box Panel before Install Electronic Cable

Tools : Spanner or Ratchet Wrench for M12 Size





3,0m to 3,7m Prime Focus Antenna Motorization Manual



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1. Recommended Tools

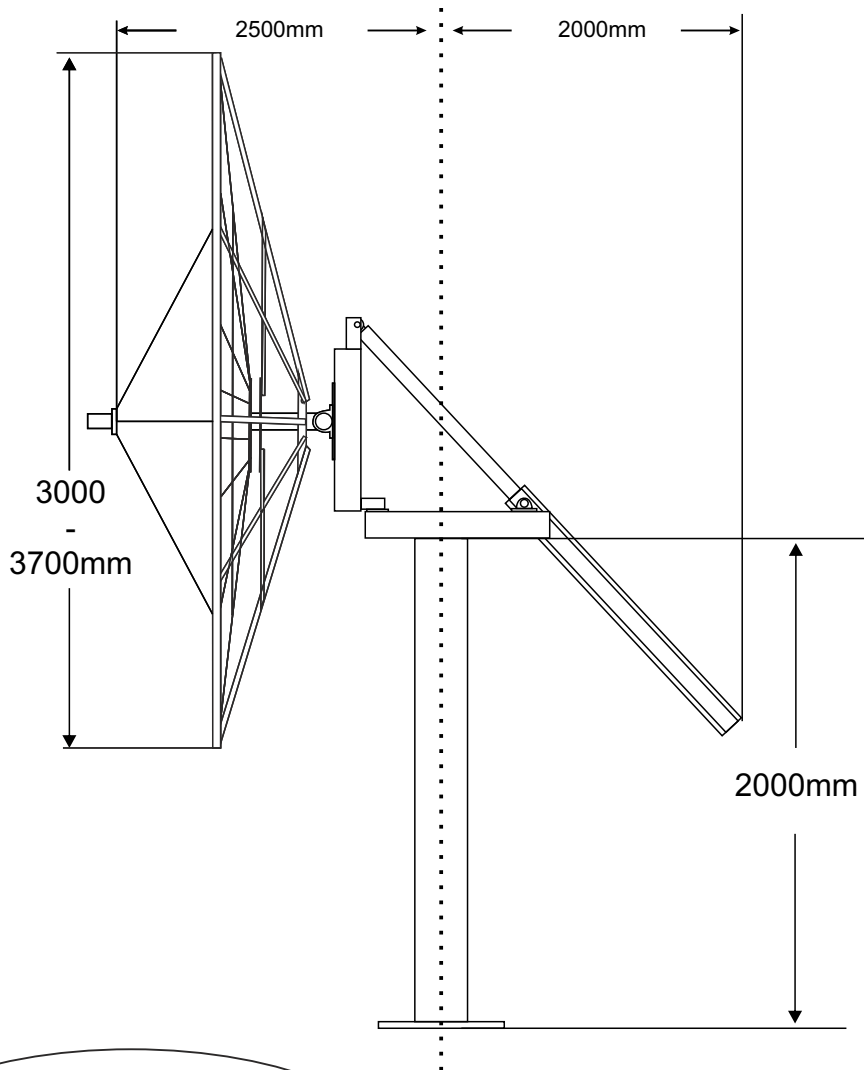
During the installation, you should have convenient access to the following hand and power tools however, site dependent materials and processes may require additional and different tools.

- a set of wrenches size 8 to 36mm
- a ratchet with a set of 8 to 24mm wrench sockets
- an adjustable crescent wrench
- a set of allen keys of sizes 1,5 to 10mm
- screwdrivers of different sizes - standard and cross-blade
- For lifting the antenna motorization parts a crane or forklift is needed
- For assembly a ladder and a scaffold or a heightened working platform is needed.
- For antenna alignment a compass and inclinometer
- For an easier installation we suggest to have a 24V/7A power supply to have the axes moved before all cables are wired and the controller is proper configured.

Also we recommend having cable ties, cable conducts, isolation tape and silicone at site.

As a further requirement it shall be assumed that the pipe of a Kingpost or NPRM matching to the Motorization to be installed is on site already buildup

2. Antenna Site Requirements



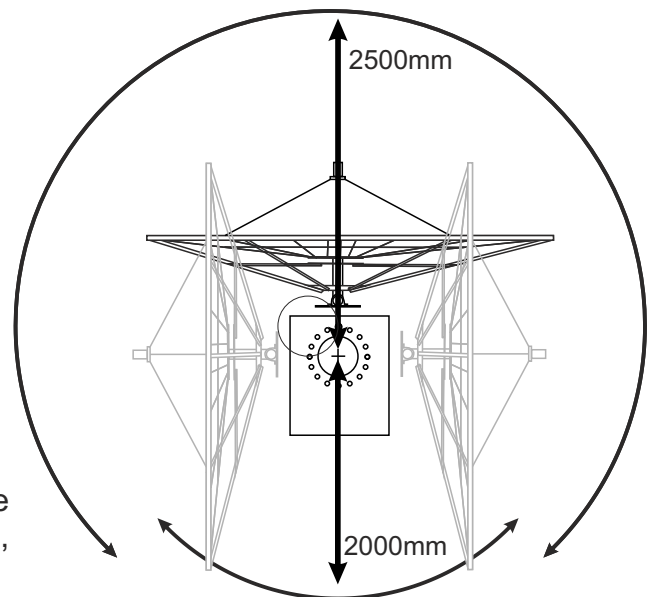
Estimated Dimensions for
Site survey and site
preparation

Necessary Space in the Front

For 3,0m to 3,7m Antennas @ an Azimuth movement of 180 degrees:

Front: Estimated necessary space of 2500mm in a 270° Radius around the motorization pipe center must be free of any obstacles. Medium and Long Range Space without any obstruction in the antennas receiving path.

Back: estimated necessary space 2000mm in a 90° Radius around the motorization pipe. The back side must be free of obstacles like stones, walls or outdoor cabinets.



Necessary Space in the Back

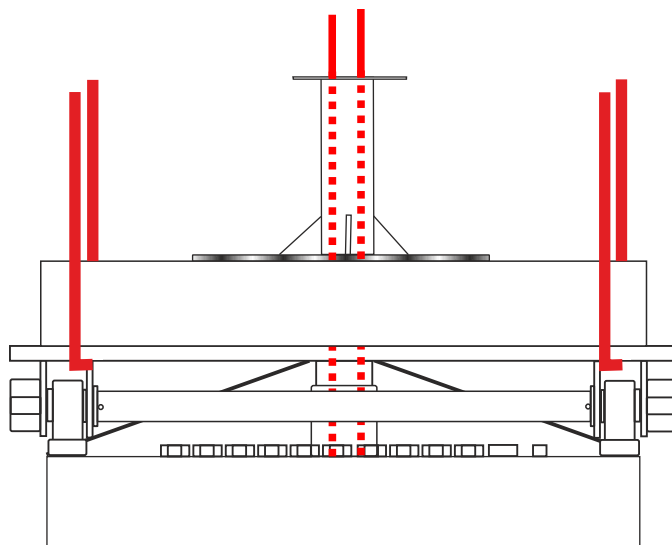
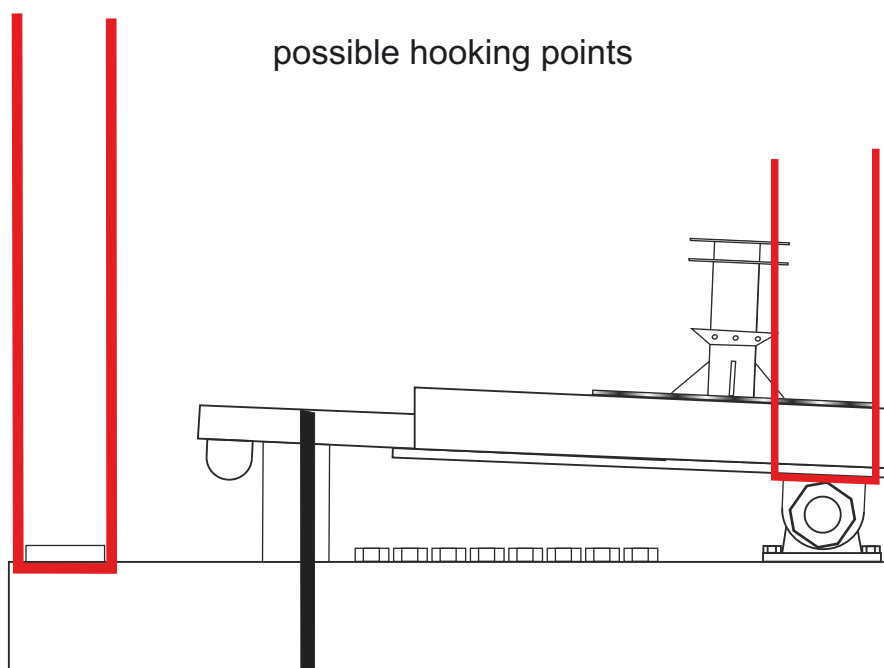
3. Unpacking

The Unpacking of the Antenna has to be done careful and without any damages.

The Motorization is delivered in a wooden crate. Open the crate and take out all other things like Controller unit, cabling, screws and any other packing material.

To lift the Motorization out of the wooden box please notice the hooking points from which the antenna can be safely towed. All other hooking points may result in a possible damage of the antenna motorization. For a safe lift at least 2 ropes are needed to have the antenna during the whole procedure stabilized. Both ropes shall be attached as far as possible to have the motorization in balance and prevent tilting or slipping off the hook.

!!! DO NOT USE ONLY ONE ROPE TO LIFT THE MOTORIZATION



4. Mechanical Assembly and Installation

4.1. Motorization installation

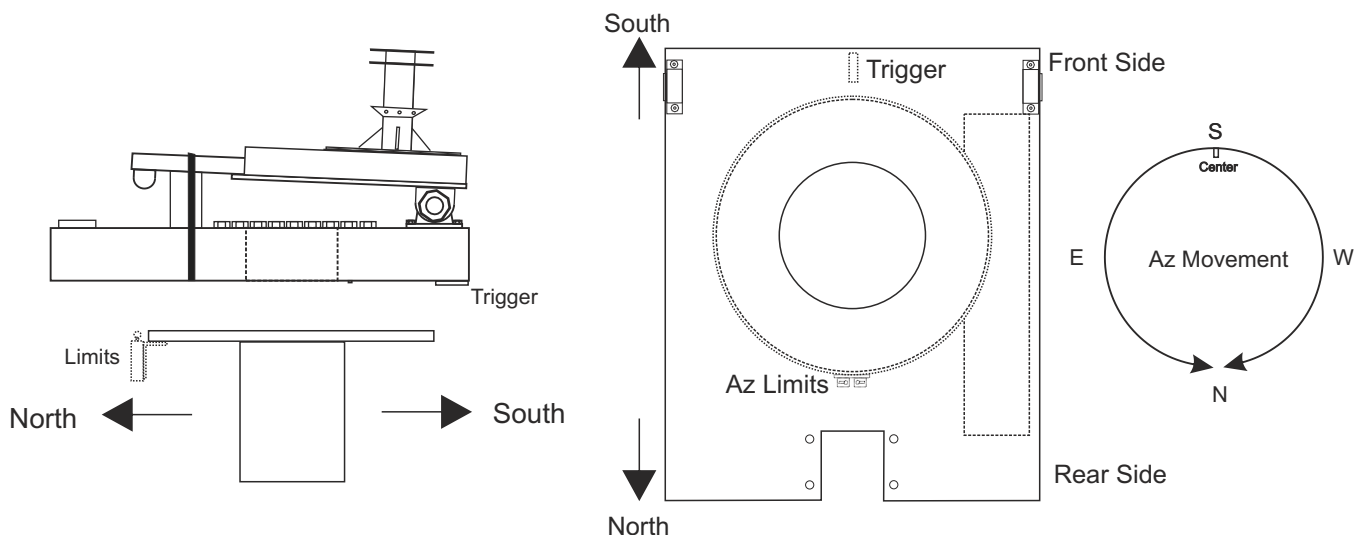
With the antenna motorization on the hook lifted out of its box you have to put it on top of the pre-installed pipe which is delivered with a flange on top - to fit the motorizations bottom.

Before attaching the antenna motorization to the pipe 2 issues have to be considered:

a.) **ALIGNMENT:** Each antenna has on the front side in the middle of the turntable 2 limit switches(circuit breakers) one next to each other allowing the azimuth motor to travel around 360 degrees (+/- 180 degrees) but not more. In order to have the full travel range the motorization has to be aligned to the south (see picture) if you are in the Northern Hemisphere and your satellite arc(orbital position of all accessible satellites) is southwards. For the Southern Hemisphere you have to align the motorization towards the North.

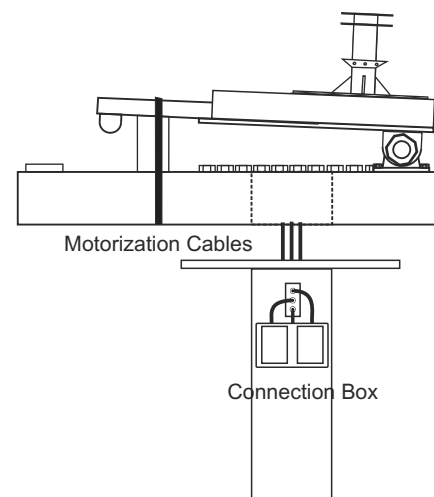
To determine this position use the compass.

As the limits might be dismantled for transportation you have attach them back to their place so they can reduce the travel range and prevent cable breaks. The trigger to interrupt the current when the limits go over it has to be aligned to be on the rear side 180 degrees apart from the 2 Limits looking northwards. Physically it has to be attached to the pipe to be a fix point while the motorization with the limits are driven left and right of their position towards this trigger to make +/-180 degrees.

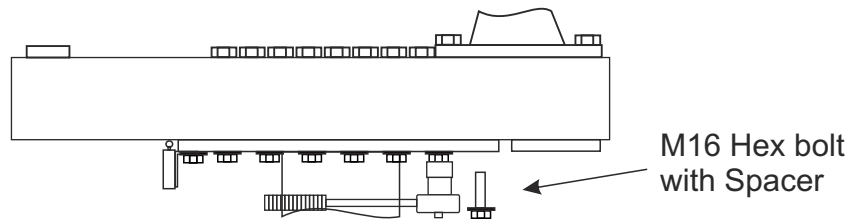


b.) **CABLING.** This antenna motorization has all cabling running internally through the azimuth motor so the cables must be also looped through the pipe and have to be retrieved through the prepared hole which was drilled into the pipe. The cables will be then attached to the provided Main Connection Box.

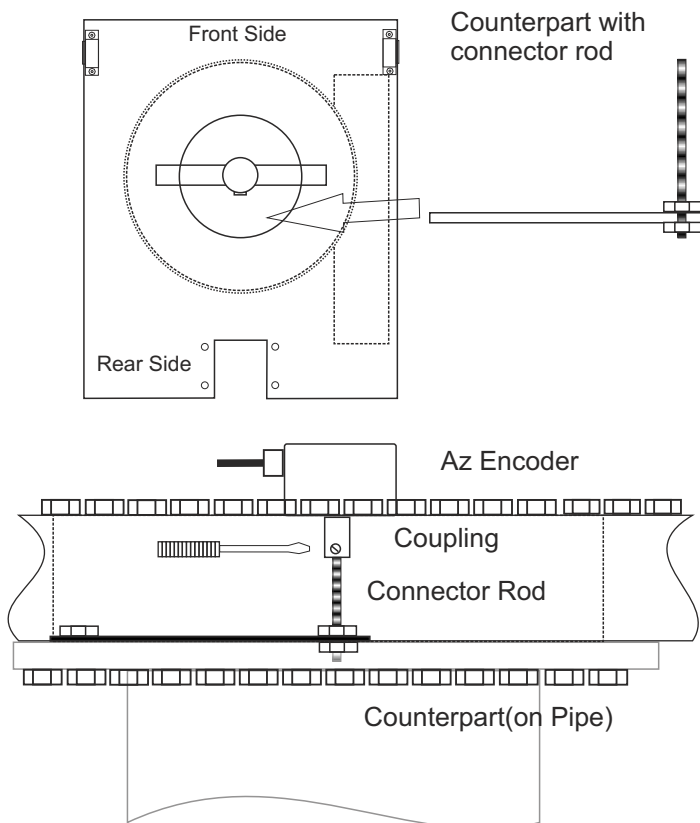
After doing both steps the motorization has to be lowered on the pipe while paying attention on the pipes flange holes to cover the antenna motorization holes. Now the M16 Hexagon bolts can be screwed with spacers in every hole.



After doing both steps the motorization has to be lowered on the pipe while paying attention on the pipes flange holes to cover the antenna motorization holes. Now the M16 Hexagon bolts can be screwed with spacers in every hole.



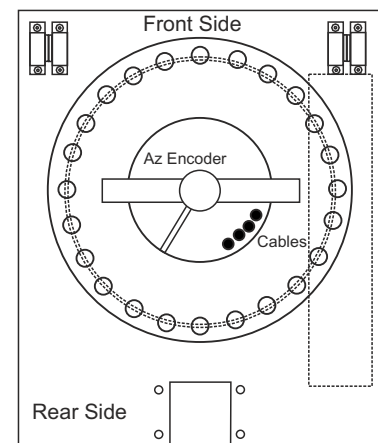
b.) RESOLVERS. For a higher accuracy and direct angular movement some controllers require a digital signal. This means on every axis there has to be placed a encoder showing the exact angle. Elevation and Polarization encoders are already fixed, installed and wired - only Azimuth has to be finished. The Azimuth encoder sits on the center of the moving turntable and its counterpart must be fixed on the pipe below the Motorization.



Insert the Counterpart in the Turntables Center shift the connector rod inside the coupling which connects to the encoder and fix it ON THE PIPE with the provided 2 screws.

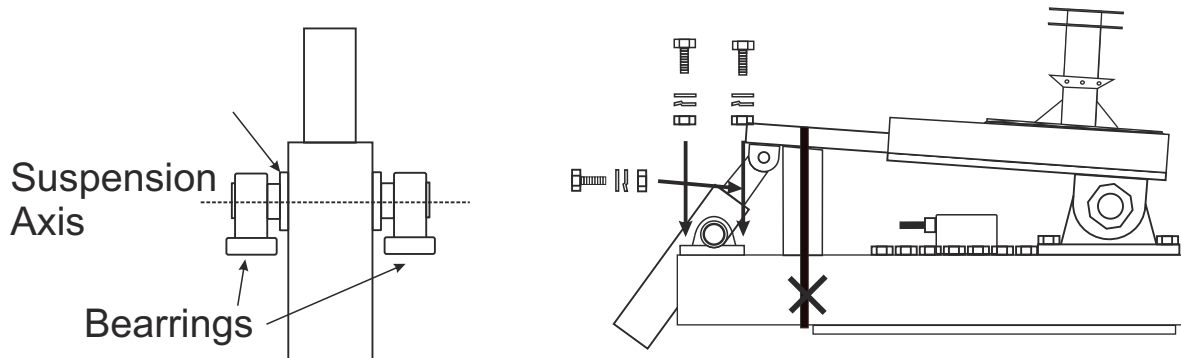
Due to the big hole it should be enough space to do this.

Tighten the rod inside the encoder coupling with a straight screwdriver



Now it is time to fix the elevation Actuator. The actuator itself has a suspension point on each side of the fix part and 2 bearings are delivered with it to make out of the suspension a moving axis. Before attaching the actuator you have to remove the bar on the back side of the motorization which was earlier used to lift it on the pipe.

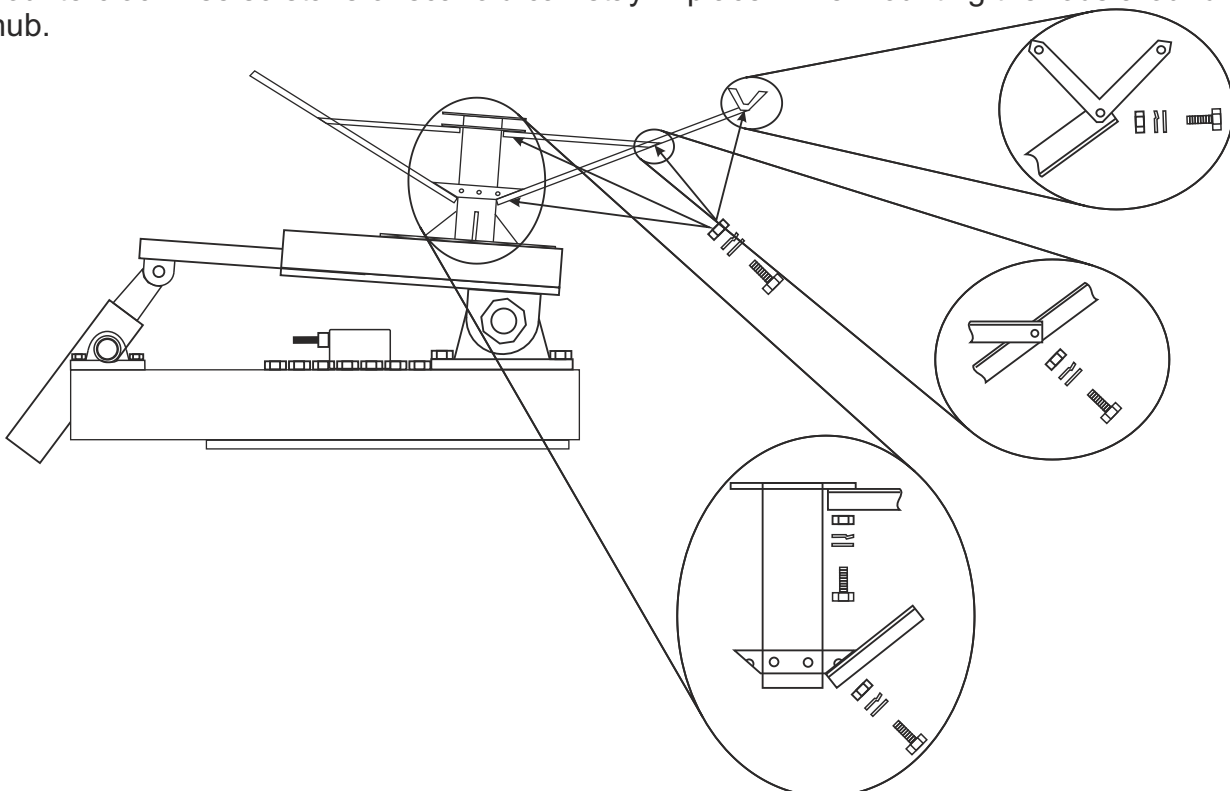
Attach the 2 bearings on the suspension pints of the actuator lift all 3 together on the back side of the motorization inside the carved plate and fix the bearings on the provided holes with the necessary screws



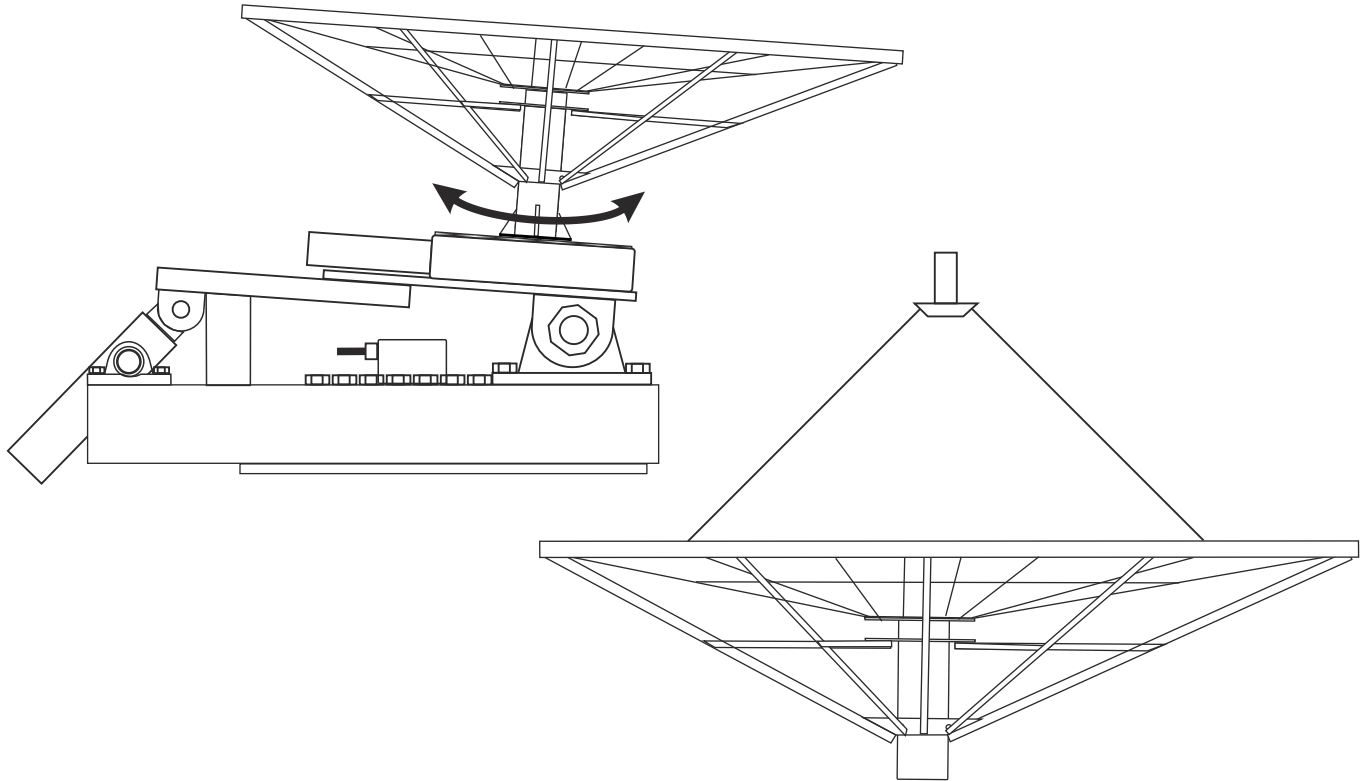
Connect the extendable end of the actuator to the Hub extension part and tighten it with the provided hex screw. Now you can release all ropes and cut the transport fixation to move the motorization electrically. you can also remove all hanging points around the hub.

4.2. Antenna Installation

For the furthergoing activities you will need the ladder and/or scaffold for a work on a certain height. As the antennas central hub is already mounted first thing we recommend to mount the antenna backstructure. This is made of eight (8) long L type galvanized steel rods and eight(8) short L type rods of the same design. These Rods have to be attached together with one screw before fixing them on the central hub. Afterwards a triangle flat bar has to be fixed with a screw on the extendable part of the long rod. Follow this procedure for every of the eight reflector backstructure around the hub. In order to make installation easy the polarization motor can be attached to a 24V power supply or the controller unit and turned clockwise or counterclockwise so stairs or scaffold can stay in place while mounting the rods around the hub.



When all eight(8) straight and cross blades are joined together with the stabilization triangles and attached to the central hub it is time to mount the reflector panels. This can be done the same way by turning the polarization motors while mounting the reflector segments. After finishing the reflector installation the 4 Feed legs have to be attached to the dish together with the Feed and the LNB(s).

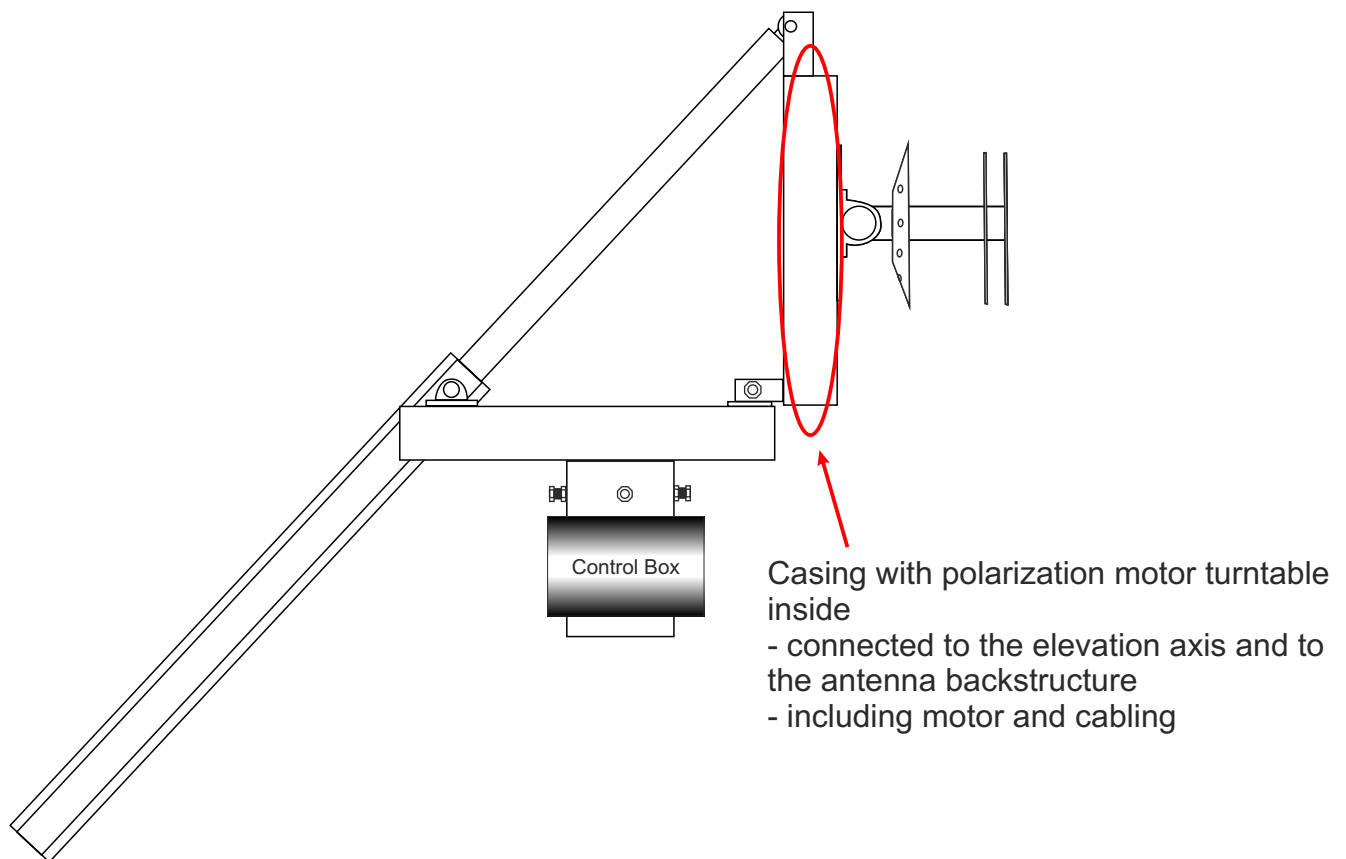


For a detailed installation description of the complete antenna please refer to the antenna installation manual.

4.3. Polarization Motorization Installation

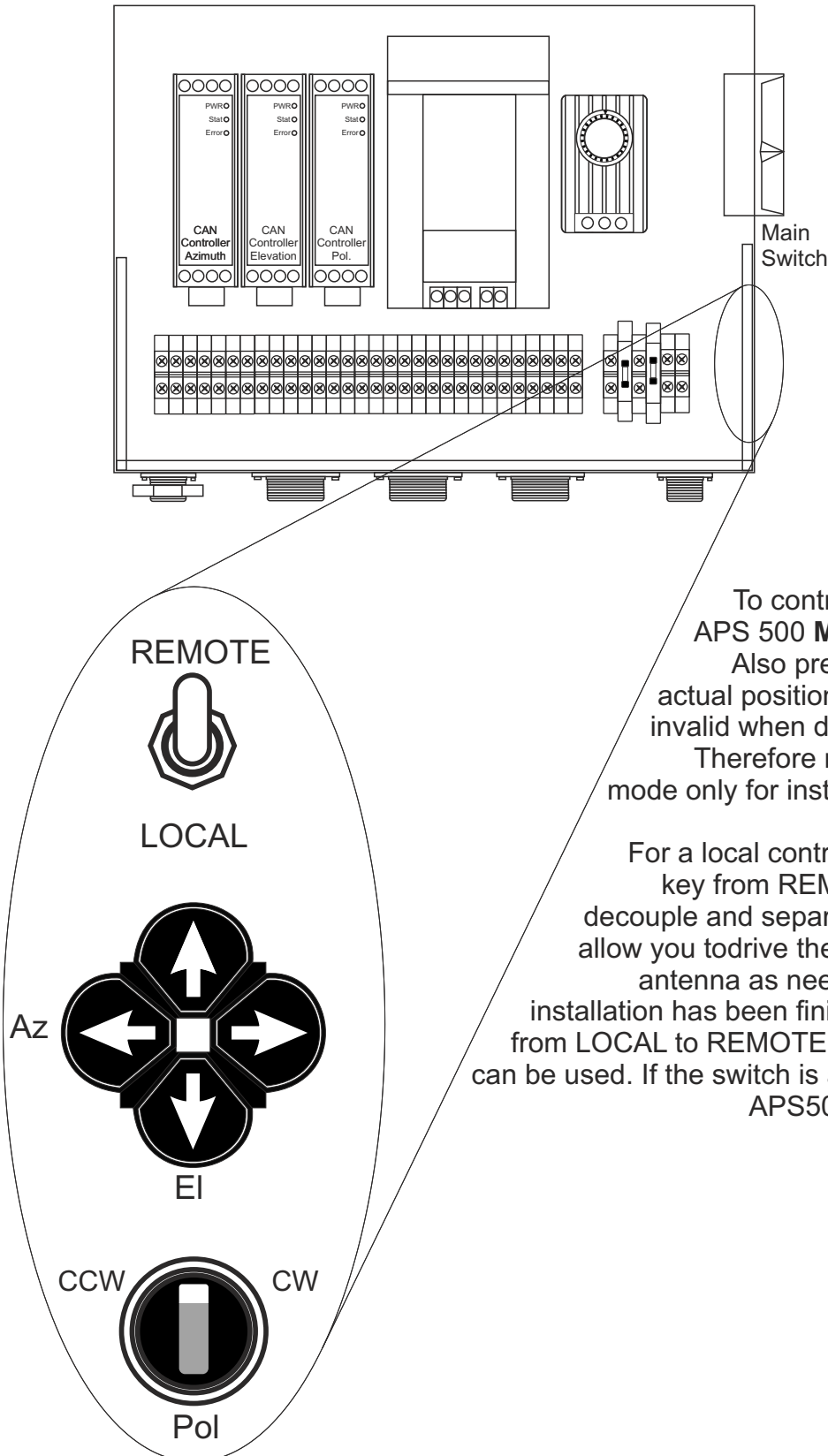
Prime Focus antennas are a central feed design meaning the antenna reflector is perfectly round and the feed is placed at the antennas focal point directly in the center of the dish. Due to this design APEXSAT is turning the complete dish in polarization clockwise and counter-clockwise keeping the radiation pattern measured for one polarization angle the same for all other polarization angles.

If a three axis prime focus system is delivered the motorization already includes the polarization motorization with a part of the antennas backstructure already installed. Also the motor wiring for the polarization drive is already done. The only to do is to install the antenna reflector and the feed legs/feed system.



4.4. Local Control:

Each ODU provides the possibility to control the antenna locally during installation and setup. For this purpose the antenna control keys have been placed on the right side of the Outdoor Unit



To control the antenna locally the APS 500 **MUST NOT** be connected.

Also presaved settings like limits, actual position and satellite data will be invalid when driving the antenna locally.

Therefore move the antenna in local mode only for installation and setup **before** lining up the controller.

For a local controll you have to switch the key from REMOTE to LOCAL. This will decouple and separate the motor drivers and allow you to drive the motors locally. Move the antenna as needed and after the outside installation has been finished switch back the key from LOCAL to REMOTE so the APS500 controller can be used. If the switch is at LOCAL driving with the APS500 controller will not work.

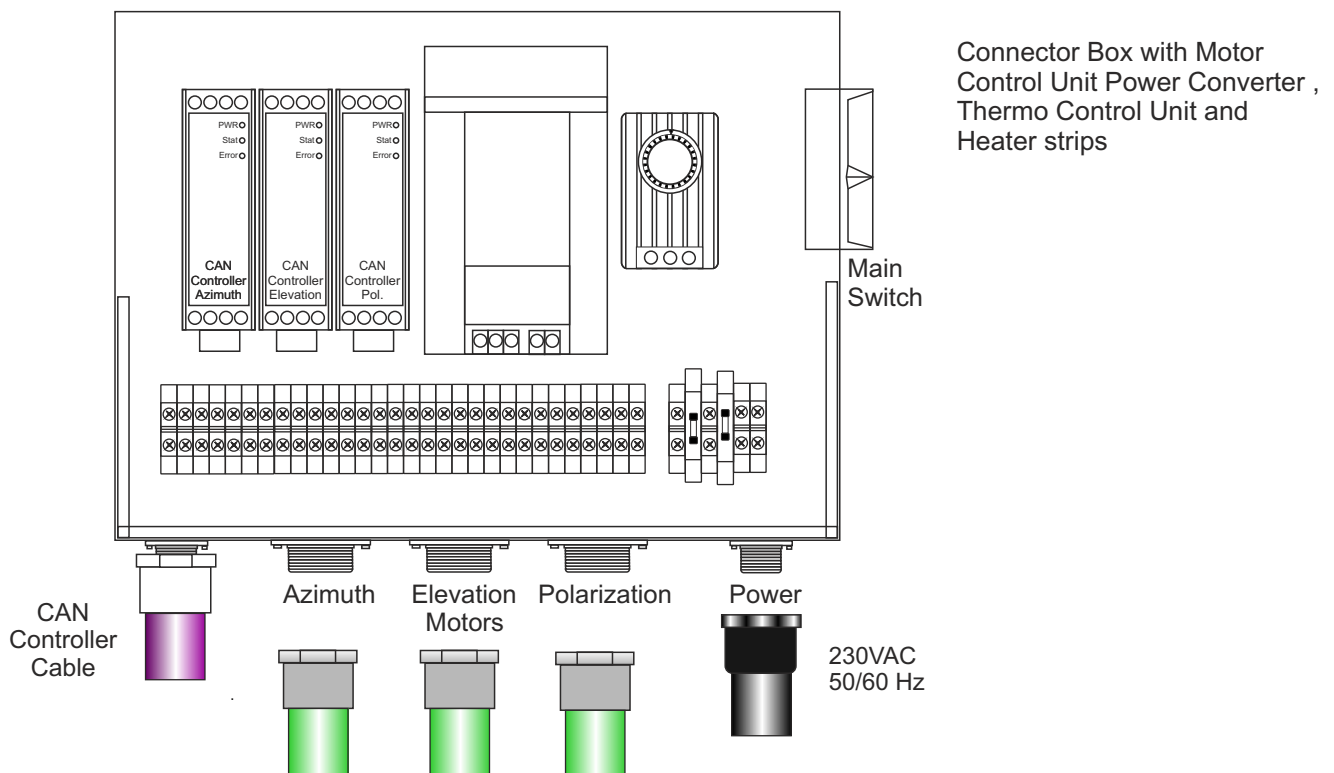
5. Electrical Installation

This Antenna motorization can be operated with 3 different controller units:

- a APEXSAT APS500 CAN Bus Controller with Touchscreen and remote control Webinterface.
- a RC2000 Series Contoller

5.1 The APEXSAT APS500 CAN Bus Controller

The cable looped through through the pipe ang going into the upper part of the Connector Box are 3 x 8 wires cables. One Cable for one Axis/Motor each shielded. 2 Wires run to the Motor 4 for the Hall sensors. and 2 for the limit switches feedback.

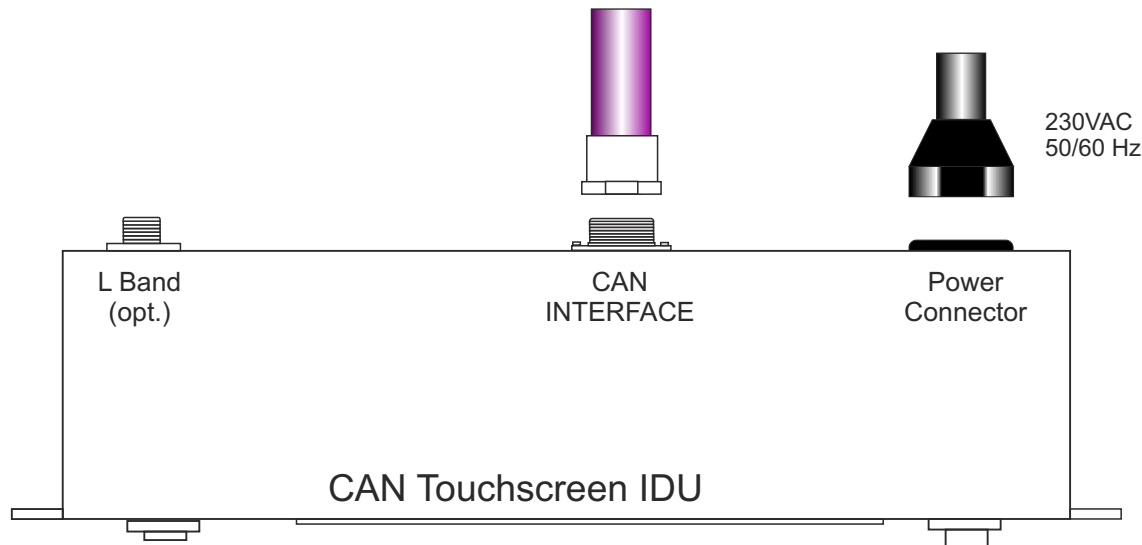


All antenna motorization cables are delivered with connectors attached so that when mounting the Motor Control Unit only the Azimuth Elevation and Polarization Axis Cables have to be attached and for Command & Control the violet CAN BUS Cable and the Power Cable.

The power requirement is 230V AC 5 Amps max. This power can be supplied locally at the antenna or it can be attached to the power grid inside a near the Touchscreen Indoor Unit. The CAN controller cable is a two(2) pair twisted pair cable with 0,34mm or 0,5mm² square section(depending on cable length) a copper shielding and a violet UV resistant outer jacket e.g. UNITRONIC BUS CAN FD P Cable from Lappkabel.

Due to the nature of the CAN Protocol the cable length can be up to 6,7 km which means the antenna can be up to 6,7km away from the control room.

Indoors on the controller site also 2 cables have to be attached to make the motorization working: the power cable and the CAN Cable which is connected to the connector box outside.

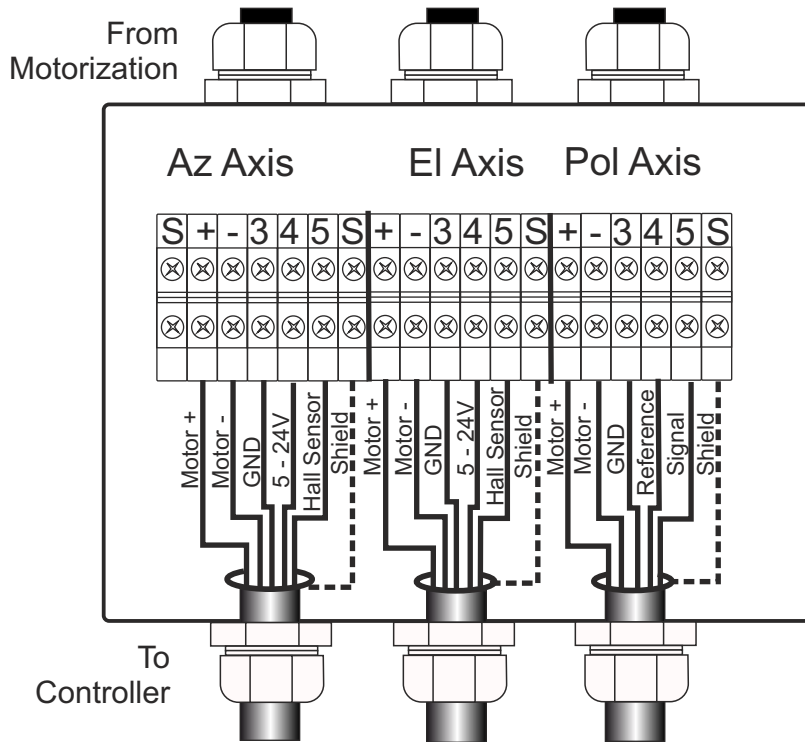


For configuration and driving of the antenna controller please refer to the [CAN Touchscreen Indoor Unit Manual](#).

5.2.The RC2000 Series Controller

The cables which are looped though the pipe are moved into the Connector Box in which all cables are combined. Three Cables are needed. Each cable is for one axis (Azimuth, Elevation, Polarization) carrying the Motor cables(2 wires) and the sensor cables(3 Wires). The cables are shielded and carry a black UV-resistant PVC/PU jacket

Connector Box Wiring Diagram



Cable Configuration

Cable No. Function

AZIMUTH

1	Motor +
2	Motor -
3	Sensor GND
4	Sensor 5-24V Input
5/GY*	Sensor Output

ELEVATION

1	Motor +
2	Motor -
3	Sensor GND
4	Sensor 5-24V Input
5/GY*	Sensor Output

POLARIZATION

1	Motor +
2	Motor -
3	Sensor GND
4	Sensor Reference Input
5/GY*	Sensor Signal Output

5/GY* = Cable no.5 or cable color green/yellow

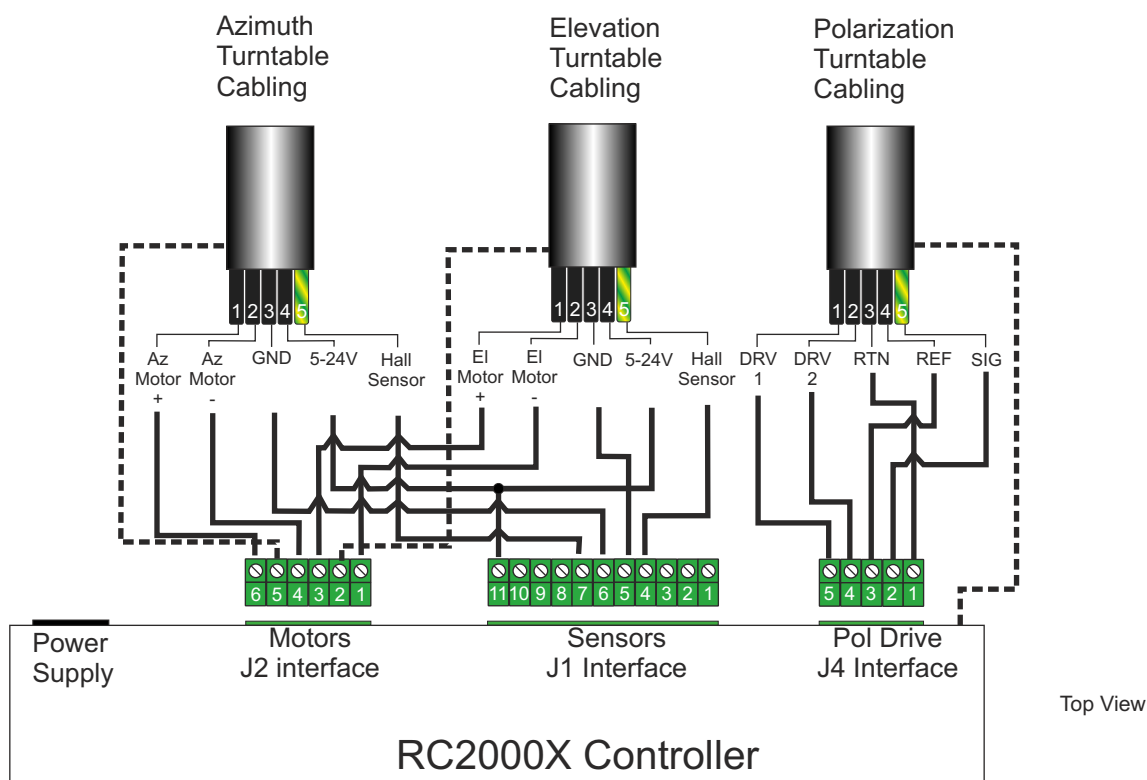
After wiring the connector box it is time to look for a cable (if none is provided). The recommended cable specs are : Black UV-resistant PVC/PU jacket, all wires shielded, 5 or more wires, numbered or differently colored. The cable Cross Section is determined by the needed cable length inbetween antenna site and controller room and and the antenna size resulting Motor power consumption (see below table).

Recommended Cable Cross Section in relation to antenna size and cable length

Antenna Size/ Cable Length	30m	50m	70m	100m /+100m
1,2m	0,75mm ²	0,75mm ²	0,75mm ²	1,5mm ²
1,8m	0,75mm ²	0,75mm ²	0,75mm ²	1,5mm ²
2,4m	0,75mm ²	0,75mm ²	0,75mm ²	1,5mm ²
3,0m	0,75mm ²	0,75mm ²	1,5mm ²	2,5mm ²
3,4m	0,75mm ²	0,75mm ²	1,5mm ²	2,5mm ²
3,7m	0,75mm ²	0,75mm ²	1,5mm ²	2,5mm ²
3,8m	1,5mm ²	1,5mm ²	2,5mm ²	4,0mm ²
4,5m	1,5mm ²	1,5mm ²	2,5mm ²	4,0mm ²
5,3m	2,5mm ²	2,5mm ²	2,5mm ²	4,0mm ²
6,2m	2,5mm ²	2,5mm ²	4,0mm ²	4,0mm ²

Controller Wiring

The standar Keypad Controller incorporates on the back side a series of different ports. To determine the correct wiring please refer to the below drawing.



For configuration and driving of the antenna controller please refer to the RC2000X [Antenna Controller Manual](#).

Maintenance:

A periodic inspection and maintenance is to be performed at least every three(3) months.

Lubricating grease has to be injected in the turntables and worm gears in order to prevent rotating parts to go dry and get damaged. The grease should be a high temperature stability grease on a Lithium basis with a high pressure additive(EP), water-repellant and working in temperatures from -30 to 130° C.

All mechanical parts have to be examined thoroughly on structural weaknesses especially connecting parts like, screws, bolts etc.

All electronical parts have to be re-inspected, the connections if loosened should be pulled again tight. Damaged or broken cable ties replaced

NOTE: After severe weather conditions inspection of the antenna should be performed to determine if foreign objects have caused damage or if survival specifications have been exceeded

Other Installation References:

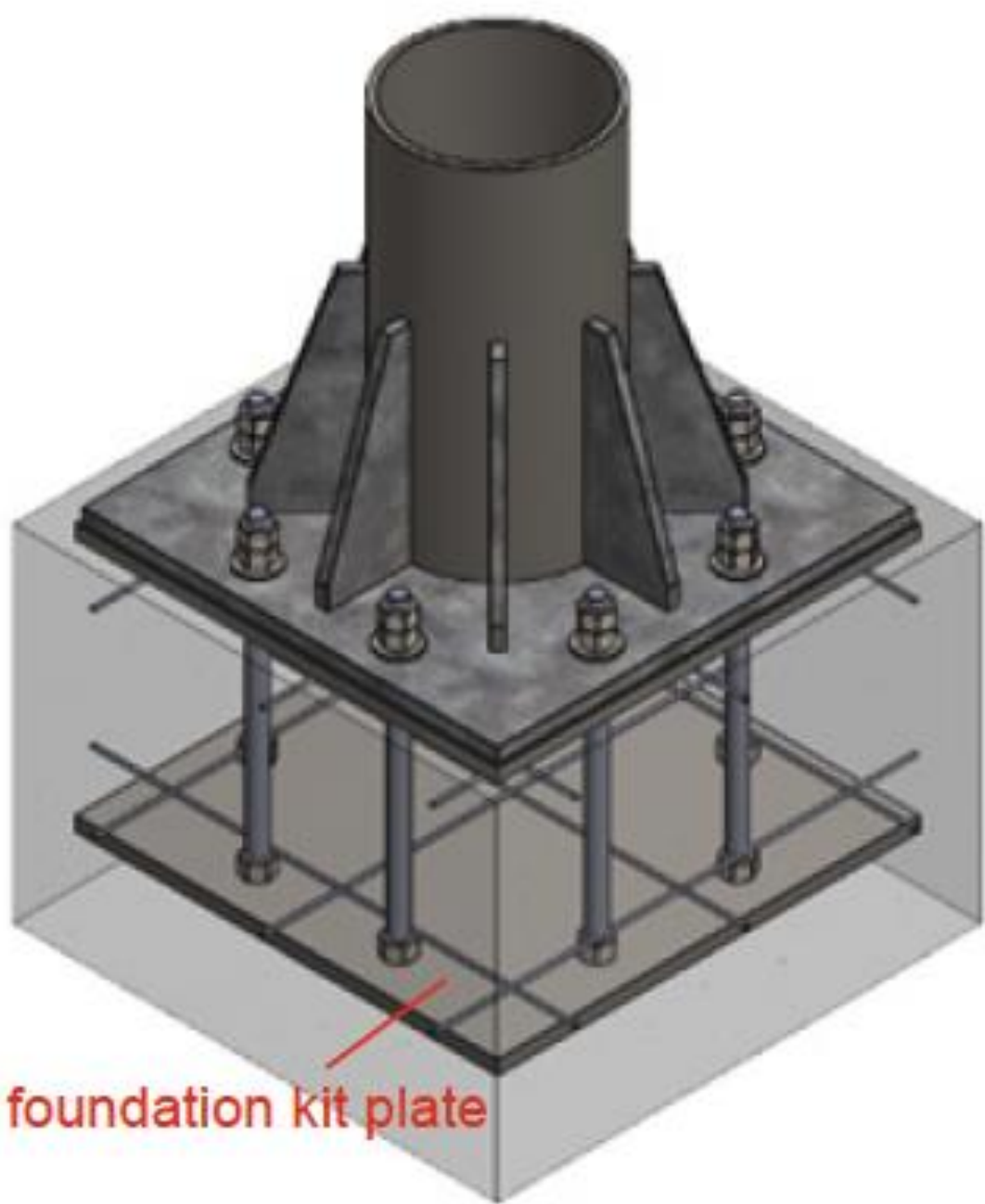
- Antenna Manual
- RC2000C or X Controller Manual
- Webinterface Controller Manual
- CAN Controller Manual

For further technical questions or service inquiries please address :

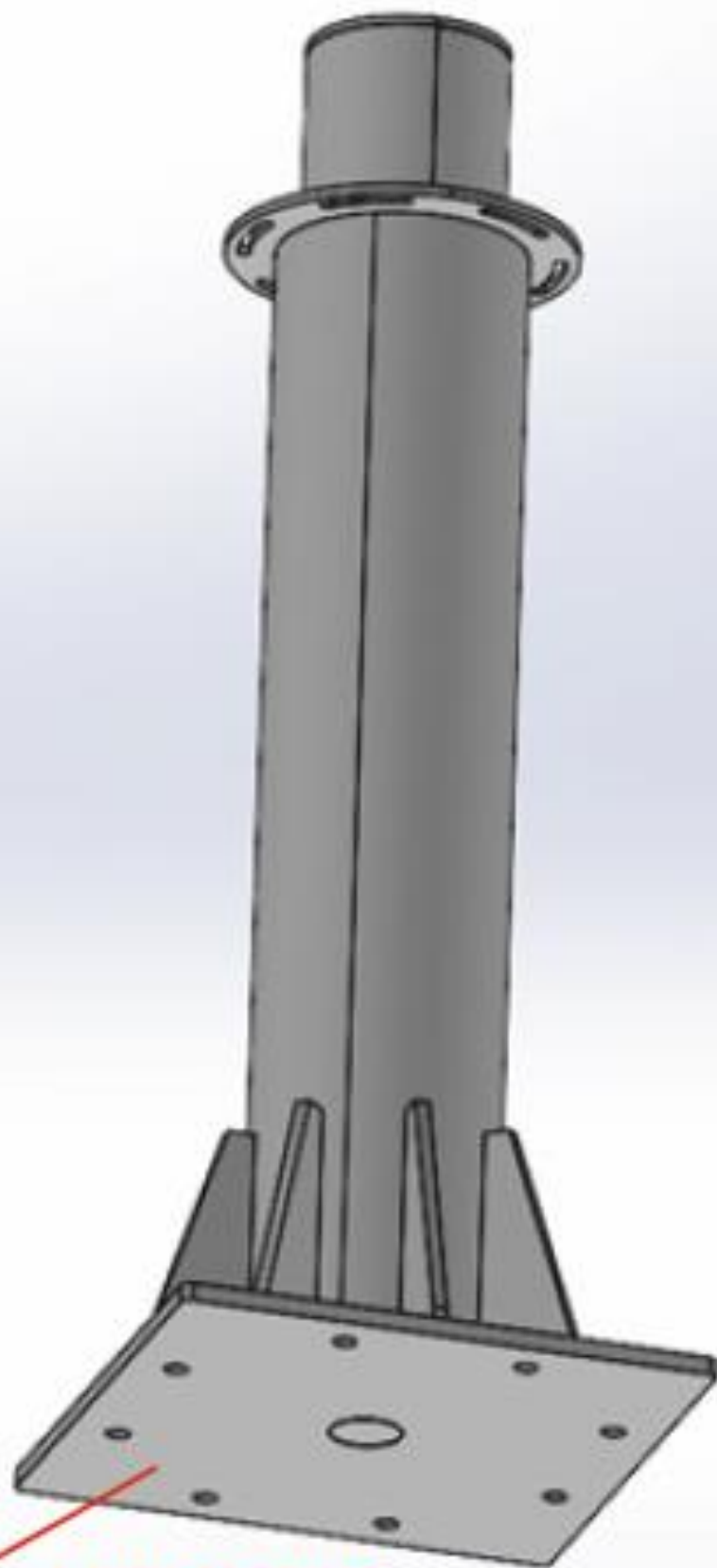
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75179 Pforzheim
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Tel +49 7231 298800
Fax +49 7231 298801

Email: info@apexsat.com



foundation kit plate



King Post base plate

Tehnički opis uz projekat izmene i dopune projekta konstrukcije za nosač parabolične antene prečnika 3.7m

Na zahtev naručioca, a na osnovu naknadno dostavljene dopune projektnog zadatka koji se odnosi na zahtevanu montažnu vezu stub postolja antene -čelična krovna konstrukcija za antenu dostavlja se izmena i dopuna projekta konstrukcije .

U skladu sa podacima o horizontalnoj ležišnoj ploči na stubu (KIT PLATE) kao i u skladu sa definisanim načinom ankerisanja preko dvostukih horizontalnih steznih ploča sa 8 pritežućih navojnih šipki daju se nužne izmene u projektu.

Obrazloženje izmene :

U vreme projektovanja čelične krovne konstrukcije za novu antenu (antena 2), mart 2026.g dostavljeni podatak o montažnoj vezi ,nije bio poznat .Pretpostavljena je i projektovana montažna veza u potpunosti kao za već izvedenu i montiranu identičnu antenu prečnika 3.7m (antena 1) na krovu objekta PEC Aberdareva 1, Beograd. Nova veza za antenu 2 nije ista razlikuje se u debljini

horizontalnih steznih ploča , dimenziji kvadratnih ležišnih ploča, položaju rupa u osnovi ploča , veličini rupa za prolaz navojnih šipki, prečniku navojnih šipki .

U skladu sa promenjenim naknadno dobijenim podacima , svi elementi projekta konstrukcije ostaju nepromenjeni , izuzev sledećih neophodnih izmena zbog nešto drugačijeg položaja i geometrije navedene veze.

Izvršene su sledeće izmene i dopune :

-Limovi horizontalnih steznih ploča na vezi (donja i gornja) oznake 16, imaju novu dimenziju 600.600.20

-Položaj rupa na steznim pločama za prolaz navojnih šipki je promenjen i korigovan

- Dimenzije rupa na limovima steznih ploča su promenjene i povećane na D23mm shodno prolazu navojnih šipki d 22mm

- prečnik i dužina navojnih šipki je promenjena na D22 l=400mm

-broj navrtki promenjen na M22 i povećan na 40 kom.

-Dimenzija podloški je promenjen usaglašene sa prečnikom navojne šipke

-Položaj nosača pos G4 (kom.2) je neznatno korigovan u cilju nesmetanog prolaza navojnih šipki na novi osni međurazmak 660mm .

-Položaj nosača pos G5 (kom.3) je neznatno korigovan na nove osne među razmake 2 x330mm

-dužina nosača pos G5 (kom.3) je povećana za 170mm shodno promeni razmaka nosača pos G4

Sve navedene izmene sprovedene su kroz crteže detalja konstrukcije , kroz specifikacije i predmer radova.

Navedena korekcija u geometriji nema uticaja na deo analize opterećenje , proračuna i dimenzionisanja koji je zadržan bez promena !

Na delu krova objekta koji je dilatiran i odvojen zatvorenim konturnim prstenom a.b parapetnih greda nalazi se postojeća parabolična antena prečnika 4.5m na postolju oslonjenom direktno na krovnu ploču i koja je predviđena za demontažu.Osim nje na tom delu krova nalazi se i parabolična antena pod radnim nazivom „antena 1“ prečnika 3.7 m na svom postolju i nosačima antena koji datim rešenjem nisu oslonjeni direktno na a.b krovnu ploču već indirektno na konturne krovne a.b parapetne grede. Antena 1 se zadržava na krovu i ostaje u funkciji.

Novi položaj antene pod radnim nazivom „antena2“ i nosača antene uslovljen je indirektnim oslanjanjem nosača , položajem tehnoloških zidanih otvora na krovu i samom dispozicijom nosača sa potrebnim međusobnim razmakom.

Za realizaciju izvođenja nosača prema datom rešenju konstrukcije preduslov je da se najpre demontira sadašnja antena od 4.5m, oprema i njen nosač ankerovan kroz krovne slojeve u a.b.krovnu ploču.

Sledeći neophodni korak je neophodna i adekvatna sanacija završnog krovnog sloja -hidroizolacije.

U daljem nizu koraka vrši se montaža nosača i poslednji korak podrazumeva montažu postolja , antene2 i njene opreme. Sve navedeno uslovljava tri nezavisne aktivnosti kako u nabavci tako i samom izvođenju ,horizontalnom transportu i vertikalnom podizanju na krov i montaži.

Konstrukcija nosača:

Konstrukcija se izvodi od čeličnih profila u kvalitetu S235 . Antikorozivna zaštita je predviđena toplim cinkovanjem sa debljinom sloja cinka od 120 mikrona. Dimenzije i oblik elemenata su prilagođene dimenzijama i uslovima cinkovanja u kadama. Za izradu konstrukcije koriste se dva profila IPB (HEB) 260 i INP 200 , limovi različitih debljina i potreban vijčani materijal.

Sva potrebna zavarivanja pojedinih sklopova i limova predviđena su isključivo u radionici pre toplog cinkovanja! Datim rešenjem na licu mesta nisu predviđena zavarivanja, niti sečenja profila. Ukoliko se ukaže potreba da je prilikom montaže neophodno, sečenje , bušenje , varničenje i sl. Izvođač je u obavezi da izvrši PP zaštitu u skladu sa zahtevima ZOP RTS i obavezama iz ugovora.

Glavni nosači su pos G1 i POS G2 (H E B 260) , postavljeni paralelno na međusobnom međurazmaku od 2.0m.

Sistema su proste grede nejednakih dužina zbog položaja oslonačkih parapeta , odignuti od krovne ravni za približno 10cm. Veza na osloncima ostvaruje se preko vertikalnog priključnog lima i ubušenih ankera za beton , 4 ankera M16 po vezi. Ankeri su isključivo opterećeni na smicanje.

Kako je jedan od nosača nešto kraći od 6m a drugi nešto duži od 6m a u zbiru su ukupno kraći od 2 x 6m (12m) što odgovara nabavnim dužinama HEB profila.Na nosaču pos G2 je data montažna vijčana veza preko limenih podvezica. Na rebu su dvostruke podvezice , dok su na nožicama nosača predviđene samo jednostruke spoljne podvezice. Položaj montažnog nastavka ,izbor veličine i debljine podvezica kao i raspored rupa na limovima i nosaču projektovan je tako da presek nastavka bude „statički pokriven“.

Ostali sekundarni nosači POSG3 ,POS G4, POS G5 su u zavarenom radioničkom sklopu sa predviđenom montažnom vijčanom vezom. Svi su od profila INP 200 sa odgovarajućim priključnim limovima za montažnu vezu i limovima za vertikalno ukrućenje nosača.

Izbor vijčanog materijal prilagođen je debljinama rebra i nožica profila. Sav vijčani materijal je klase 8.8

Konstrukcija je dimenzionisana sa više osnovnih slučajeva opterećenja i potom analizirana za merodavne kombinacije opterećenja u cilju zadovoljenja deformacija i naponskih uslova. Za najnepovoljnije statičke uticaje izvršeno je dimenzionisanje i usvajanje profila, limova i vijčanog materijala.

Slučajevi opterećenja su stalna težina nosača , postolja, antene i opreme (dati podaci)

Opterećenje vetrom osnovna brzina W(80km/h) radni opseg antene merodavan za deformacije antene u dva smera dejstva vetra i dva ortogonalna pravca , ukupno 4 slučaja opterećenja.

Opterećenje vetrom osnovna brzina W(217kmh) udarni maksimalni vetar na antenu merodavan za nosivost i stabilnost nosača (opstanak konstrukcije) , u dva smera dejstva vetra i dva ortogonalna pravca , ukupno 4 slučaja opterećenja.

Konstrukcija zadovoljava potrebne naponske uslove za definisane moguće kombinacije osnovnih slučajeva opterećenja.

Deformacije za antenu nisu date projektnim zadatkom ali su analizirane.

Za slučaj rotacije antene prema krutostima nosača levo i desno od azimut pravca približna rotacija 0.2 stepena , dok je promena nagibnog ugla u vertikalnoj ravni nekoliko puta manja i nije od značaja. Važno je napomenuti da ceo sistem ima deformacionu fleksibilnost .Osim analiziranih nosača krovne čelične konstrukcije ,deformaciju postje i na postolju antene (cevasti stub) kao i na samoj anteni (deformacija veza) tako da se sve ove deformacije superponiraju!

Redosled izvođenja konstrukcije :

1. Upoznavanje sa lokacijom , datim konstruktivnim rešenjem , uzimanje potrebnih podataka na licu mesta, sagledavanje mogućnosti transporta i vertikalnog podizanja.
2. Nabavka potrebnog materijala ,transport do radionice , radionička priprema elemenata konstrukcije.
3. Transport do mesta cinkovanja ,toplo cinkovanje konstrukcije i ponovni transport.
4. Doprema do podnožja objekta , vertikalni transport, podizanje do krova dizalicom odgovarajućeg kapaciteta prilagođenoj mestu podizanja, dužini $L_{max}=7m$ i težini najtežeg elementa $G=700kg$
5. Privremeno spuštanje elemenata na drvene podmetače u projektovani položaj ,obeležavanje i bušenje rupa u betonu na parapetima (oslonačka mesta konstrukcije) .
6. Montaža nosača Pos G1 i POS G2 (profili HEB 260).
7. Montaža sklopa koji je radionički pripremljen ,zavaren i sastoji se od POS G3, POS G4,POS G5 vi od INP 200. Međusobna veza je vijčana.
8. Montaža donje ležišne ploče i gornje ležišne ploče ,prirubnica sa rupama za navojne šipke , koje obuhvataju sklop nosača (posG3, G4, G5) i za njega se ankeruju. Navojne šipke preko niza navrtki pritežu prirubnice i predstavljaju vezu za opremu postolje nosača antene koji je stub cevasti sa svojom zavarenom prirubnicom i rupama za povezivanje.Stezni limovi se montiraju odozdo nagore zajedno sa navojnim šipkama . Na kon pritezanja donjeg lima preko unutrašnjih navrtki (jednostruke) i donjih navrtki (dvostruke) , sledi postavljanje gornje stezne ploče , cevastog stuba postolja antene i pritezanje sa gornjim navrtkama (dvostruke) za profile konstrukcije !
9. Popravke montirane konstrukcije izvesti sa cink pastom i zaštitnim cink premazima na licu mesta,
10. Uklanjanje viška materijala i čišćenje dela krova u zoni izvođenja radova.

U Beogradu , 04.09. 2026.g

sastavio:

Milan M. Šakotić dipl.građ.inž.

Opšta analiza opterećenja za nosač postolja :

Sopstvena težina :

Težina opreme ,antene i postolja

$$P_v = 11.50 \text{Kn}$$

Momenat ekscentriciteta od težine parabole

$$M_g = 3.05 \text{kn} \times 1.0 \text{m} = 3.05 \text{knm}$$

Težina glavnih nosača (HEB 260), POS G1 i POS G2

$$G_1 = 1.00 \text{Kn/m}$$

Težina sekundarnih nosača sa limovima za ukrućenje POS G3

$$G_2 = 0.25 \text{Kn/m}$$

Težina tercijarnih nosača pod prirubnicom postolja (POS 4 i POS G5)

$$G_3 = 0.25 \text{Kn/m}$$

Promenljivo opterećenje - dejstvo vetra (+) i (-) za dva ortogonalna pravca na anetnu i opremu sa postoljem

U okviru datih podataka za konkretnu antenu (prilog 2) definisana su ekvivalentna statička opterećenja za radni opseg antene pri osnoivnoj brzini vetra 22.4m/s(80km/h)

$$80 \text{km/h} \quad P = 3.026 \text{Kn}$$

$$217 \text{km/h} \quad P = 22.057 \text{Kn}$$

I „opstanak“ antene bri brzini od 60.4m/s (217km/h)

Kako azimut antene nije precizno definisan razmatraće se najnepovoljniji slučaj položaja aneten za oba ortogonalna pravca !

W1 – Vetar u radnom opsegu antene

Horizontalno dejstvo u pravcu nosača (pos G1 i pos G2)

$$P_{hy1} (80 \text{km/h}) = + - 3.03 \text{Kn}$$

Horizontalno dejstvo upravno na nosače (pos G1 i pos G2)

$$P_{hx1} (80 \text{km/h}) = + - 3.03 \text{Kn}$$

$$M_{x1} = M_{y1} = + - 3.03 \times 2.4 = 7.27 \text{knm}$$

W2 – Maksimalno opterećenje vetrom

Horizontalno dejstvo u pravcu nosača (pos G1 i pos G2)

$$P_{hy2} (217 \text{km/h}) = + - 22.06 \text{Kn}$$

Horizontalno dejstvo upravno na nosače (pos G1 i pos G2)

$$P_{hx2} (217 \text{km/h}) = + - 22.06 \text{Kn}$$

$$M_{x2} = M_{y2} = + - 22.06 \times 2.4 = 52.94 \text{knm}$$

Osnovni slučajevi opterećenja :

I stalno opterećenje

II $W1(+)$ y

III $W1(-)$ y

IV $W1(+)$ x

V $W1(-)$ x

VI $W2(+)$ y

VII $W2(-)$ y

VIII $W2(+)$ x

IX $W2(-)$ x

Za date slučajeve opterećenja i moguće kombinacije opterećenja izvrši se proračun uticaja i dimenzionisanje nosača prema naponskim i deformacionim uslovima!

antena 2 PEC NOSAC postolja

PLOCA	Set	d[m]	E[kN/m ²]	m	g[kN/m ³]	at[1/°C]	E2[kN/m ²]	G[kN/m ²]	a°
	1	0.01	2.10E+08	0.30	78.50	1.00E-05			

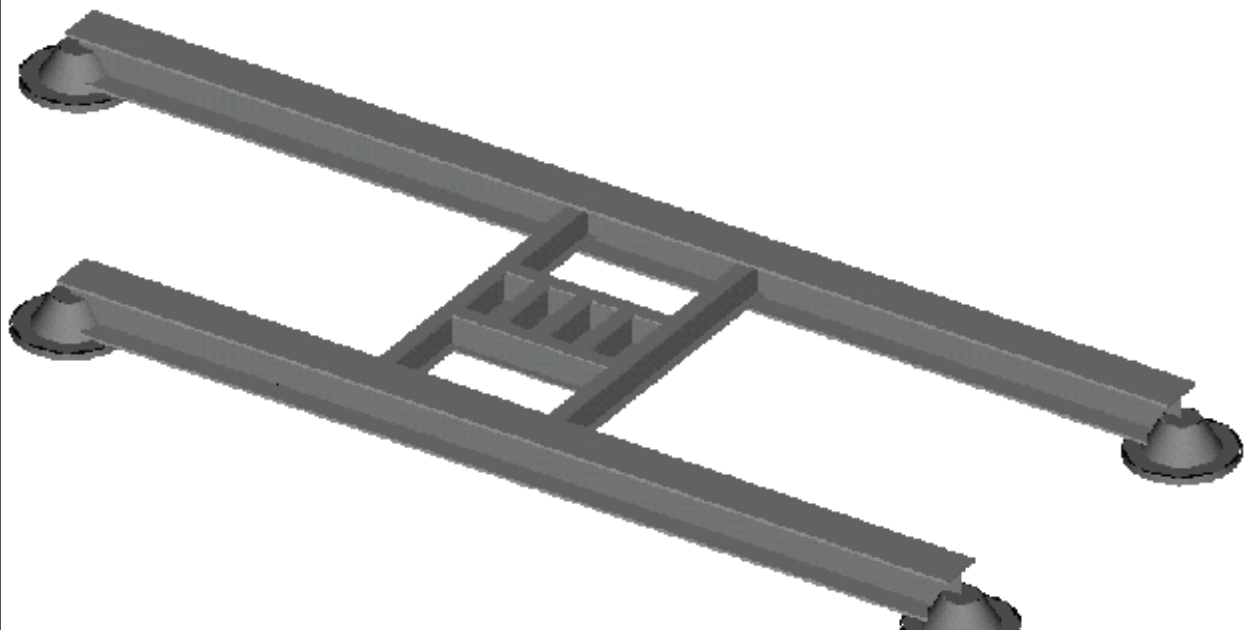
GREDA	Set	Ax[m ²] Ix[m ⁴]	Ay[m ²] Iy[m ⁴]	Az[m ²] Iz[m ⁴]	h[m] e[m]	E[kN/m ²] at[1/°C]	m	g[kN/m ³]
	{1}	1.180000E-02	2.600000E-03	9.160000E-03	2.600000E-01	2.10E+08	0.30	78.50
		1.240000E-06	5.130000E-05	1.492000E-04	0.000000E+00	1.00E-05		
	{2}	3.340000E-03	1.500000E-03	2.034000E-03	2.000000E-01	2.10E+08	0.30	78.50
		1.350000E-07	1.170000E-06	2.140000E-05	0.000000E+00	1.00E-05		

Tac. osl.	Set	K _x -p	K _y -p	K _z -p	K _x -r	K _y -r	K _z -r
	(1)	1.000000E+10	1.000000E+10	1.000000E+10			

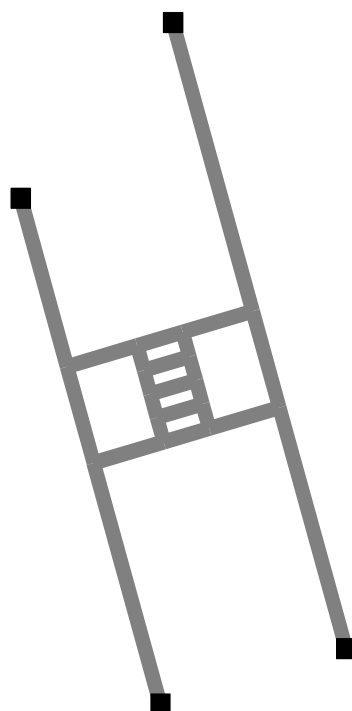
Lin. opt.	Set	qx1[kN/m] qx2[kN/m]	qy1[kN/m] qy2[kN/m]	qz1[kN/m] qz2[kN/m]	m1[kNm/m] m2[kNm/m]
	1	0.00 0.00	0.00 0.00	-1.00 -1.00	0.00 0.00

Tac. opt.	Set	Px[kN]	Py[kN]	Pz[kN]	Mx[kNm]	My[kNm]
	<1>	0.00	0.00	-11.50	0.00	0.00
	<2>	3.03	0.00	0.00	0.00	7.27
	<3>	-3.03	0.00	0.00	0.00	-7.27
	<4>	0.00	3.03	0.00	-7.27	0.00
	<5>	0.00	-3.03	0.00	7.27	0.00
	<6>	22.06	0.00	0.00	0.00	52.94
	<7>	-22.06	0.00	0.00	0.00	-52.94
	<8>	0.00	22.06	0.00	52.94	0.00
	<9>	0.00	-22.06	0.00	-52.94	0.00

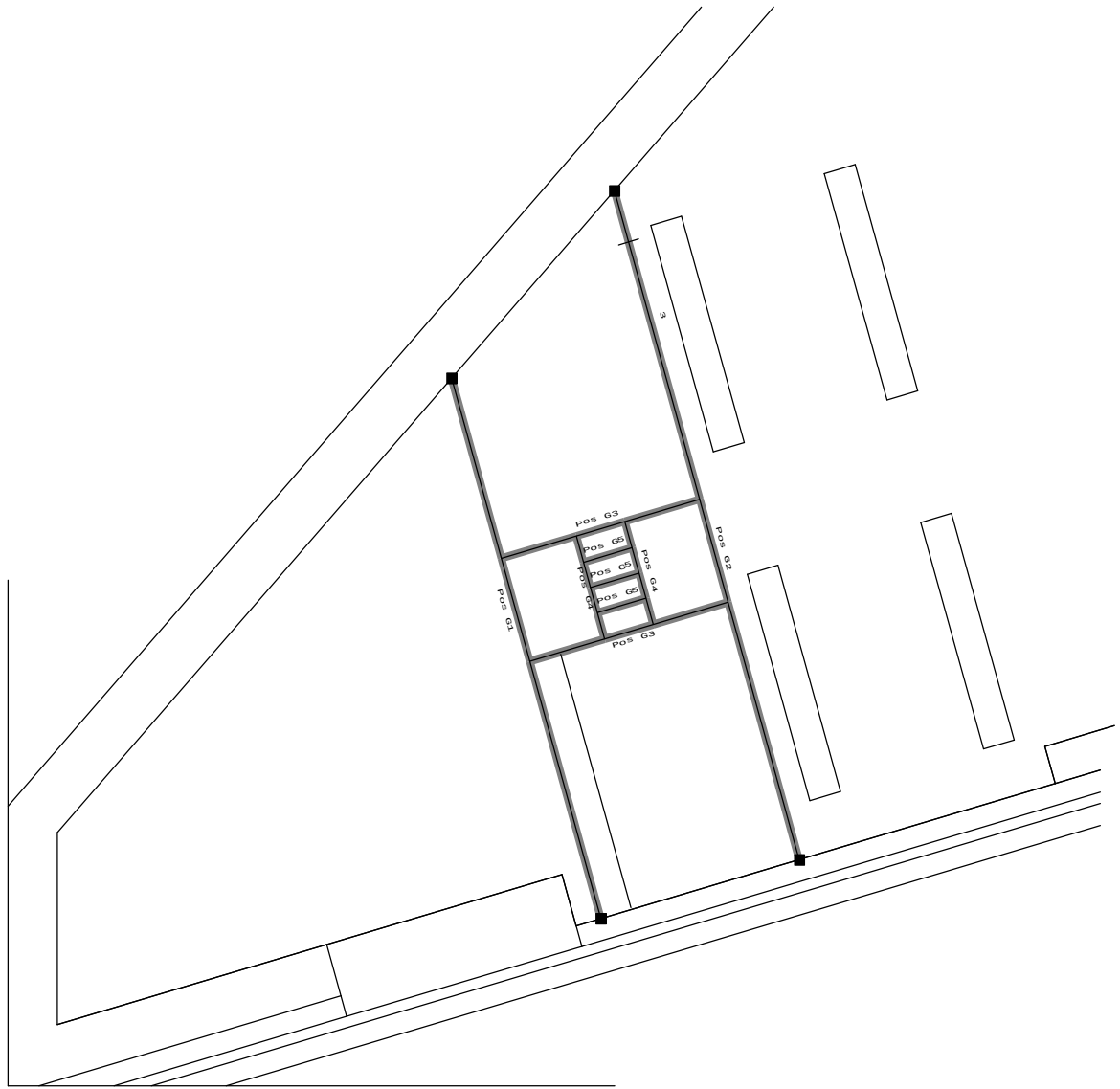
Legenda ulaznih podataka



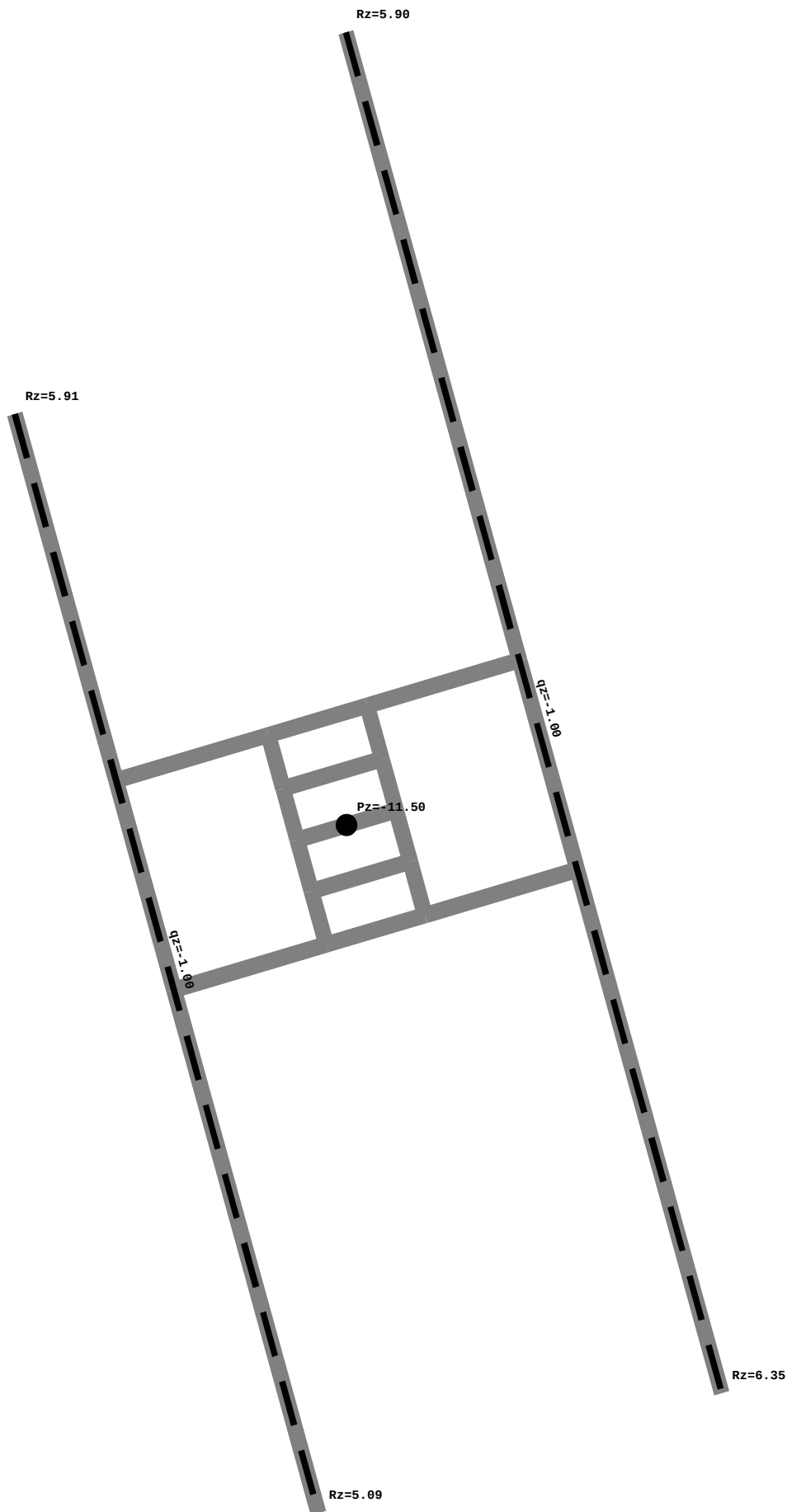
Ortogonalan 3D Prikaz



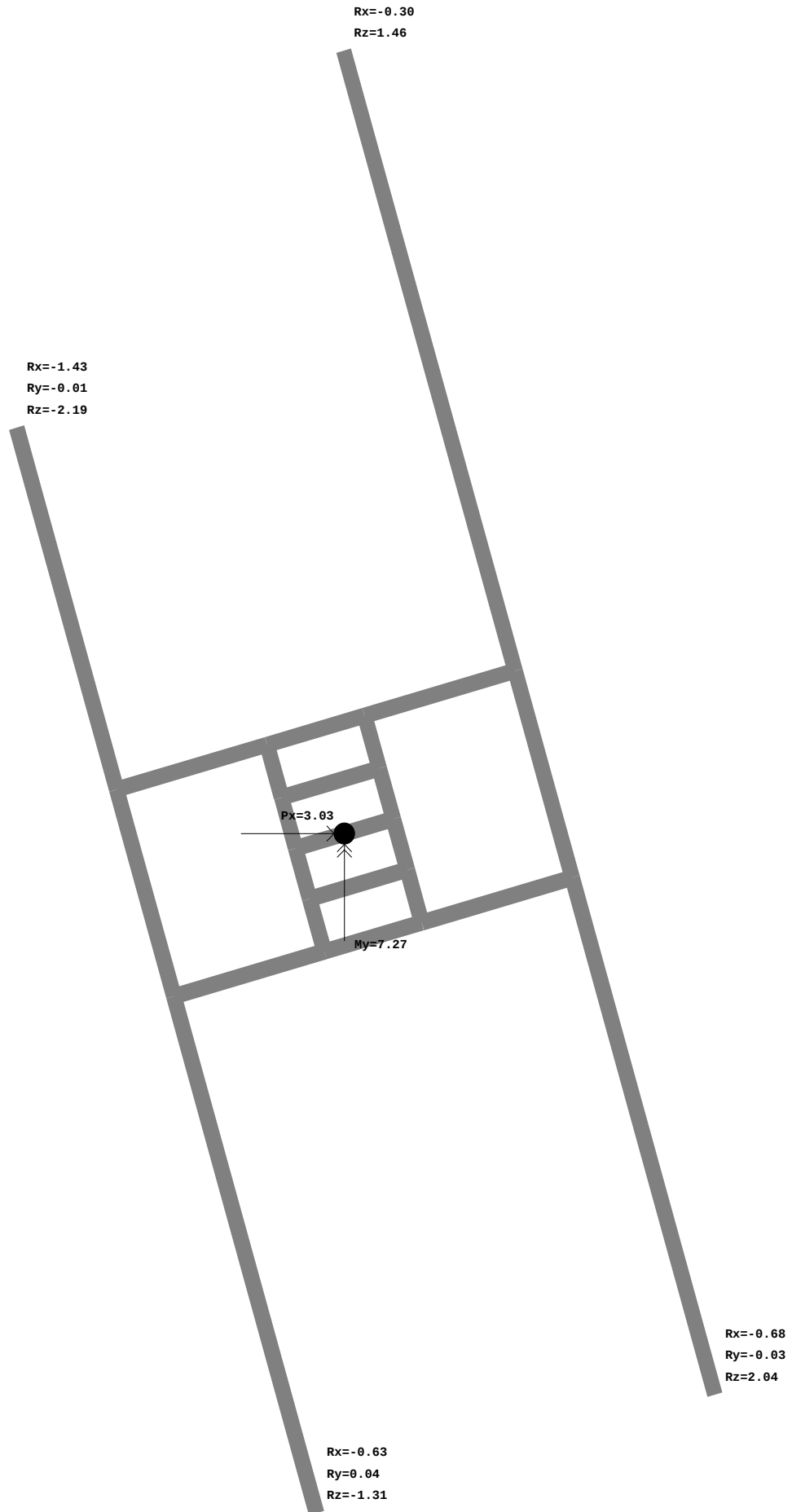
Opt. 1: stalno -
Ulazni podaci



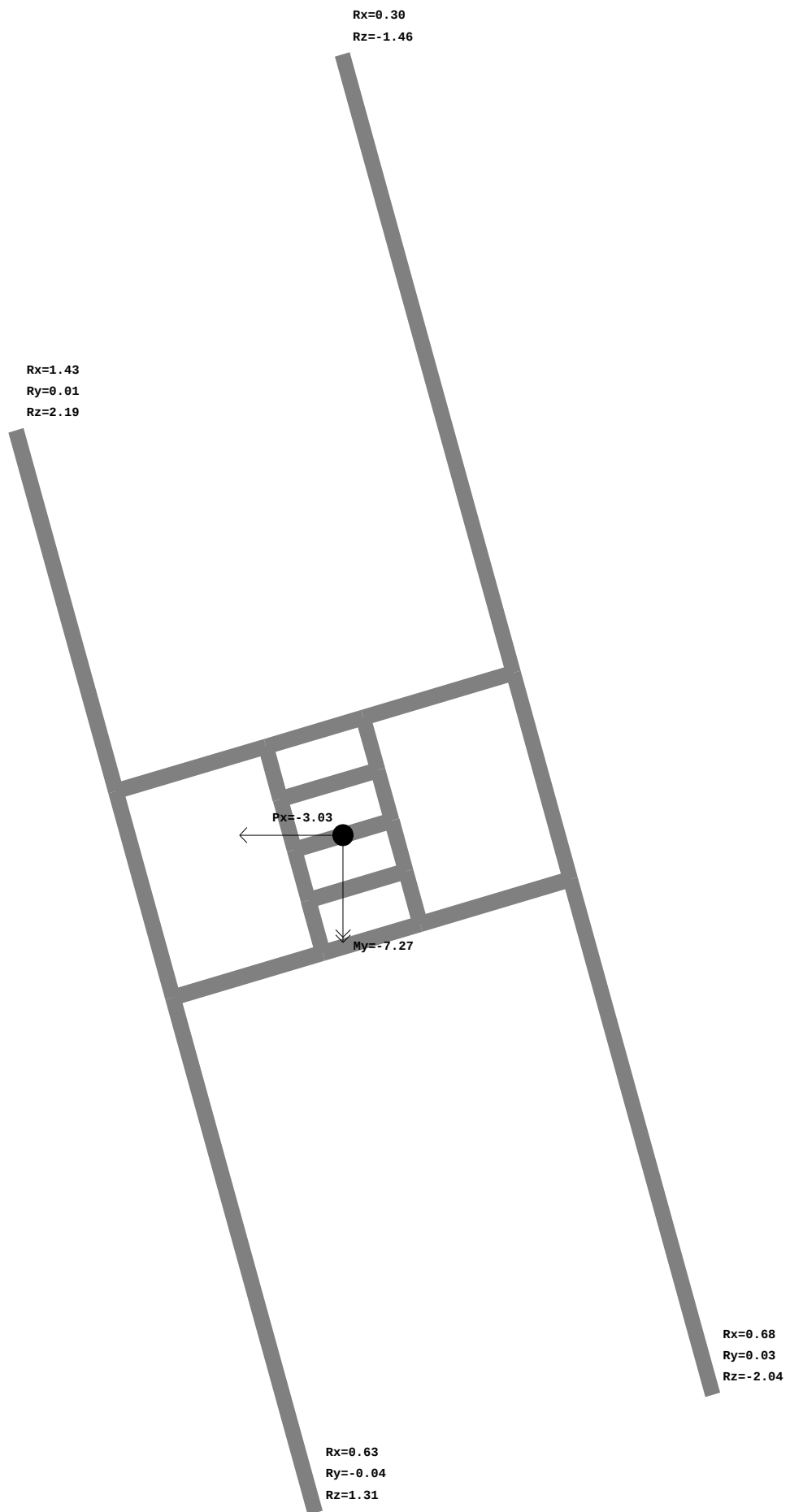
polozaj



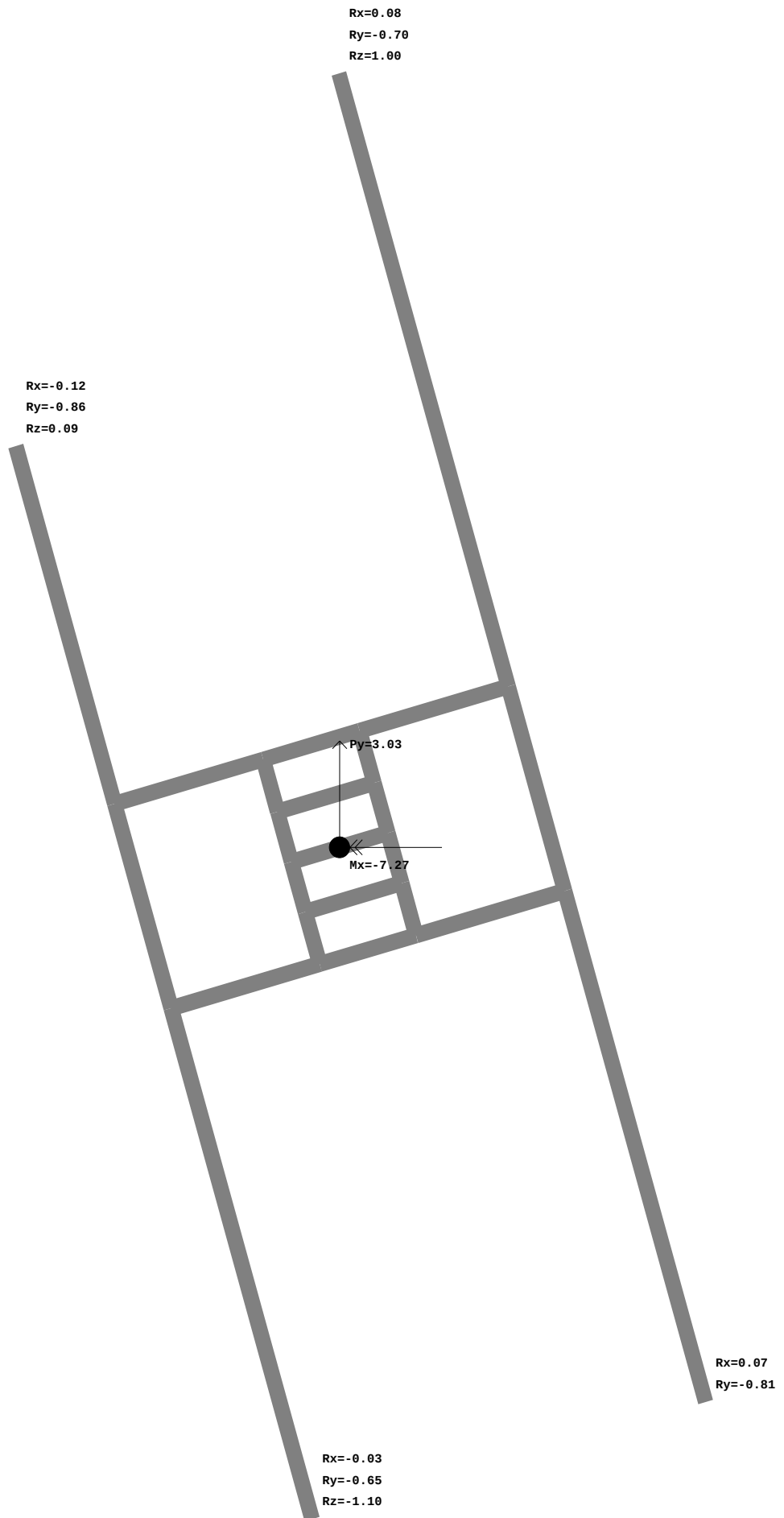
Opt. 1: stalno - Reakcije oslonaca (kN-kNm)



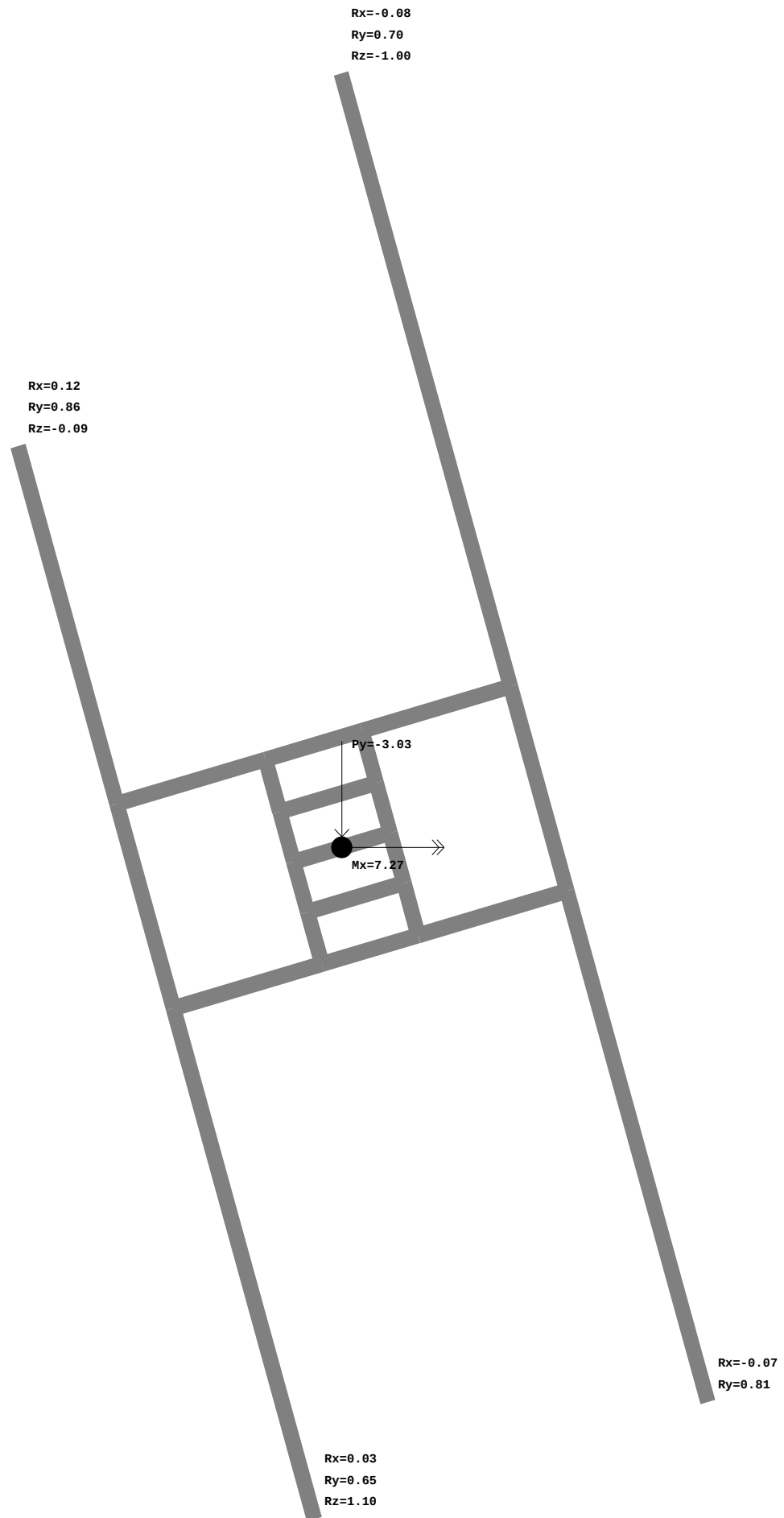
Opt. 2: + vetar X 80 - Reakcije oslonaca (kN-kNm)



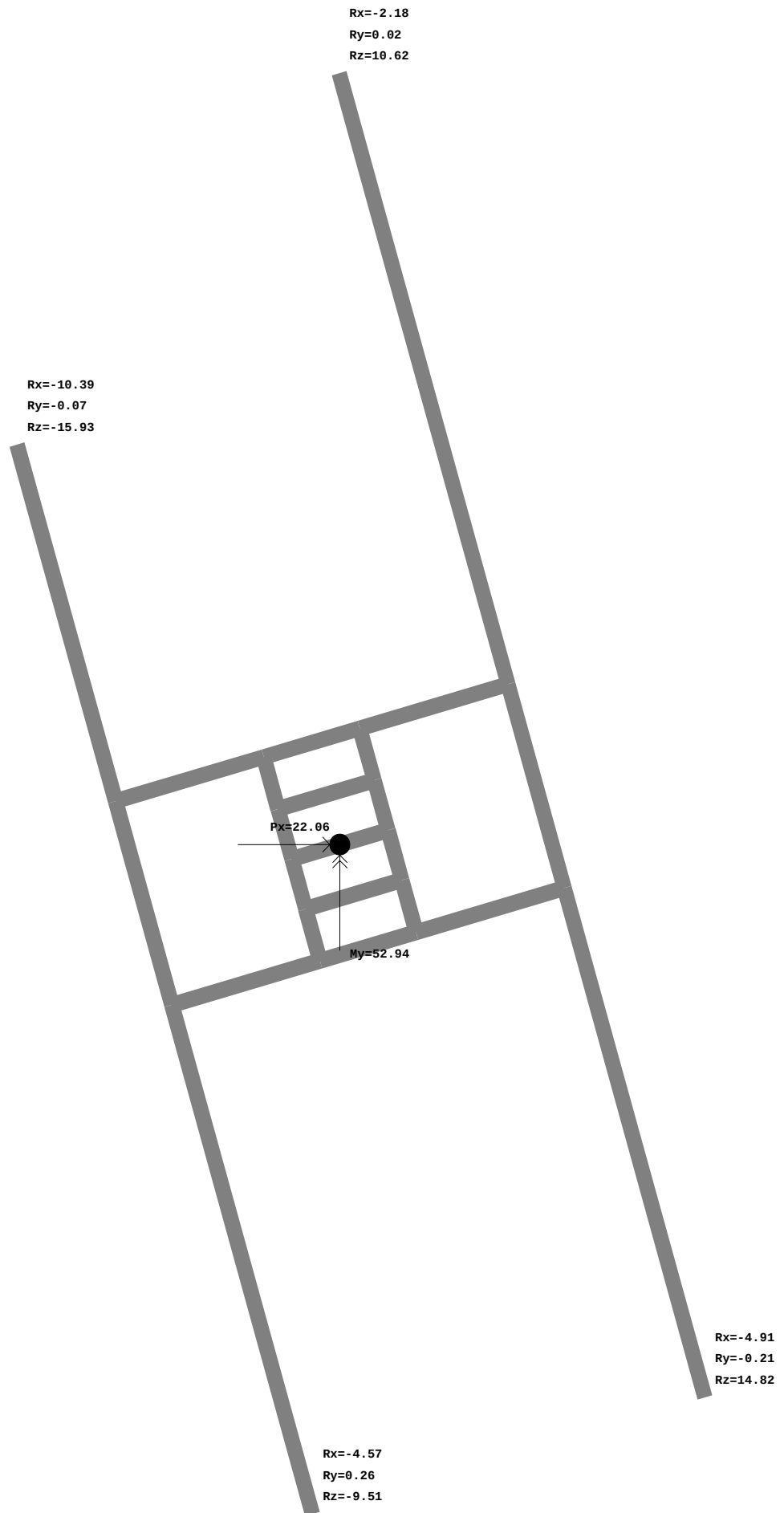
Opt. 3: - vetar X 80 - Reakcije oslonaca (kN-kNm)



Opt. 4: + vetar Y 80 - Reakcije oslonaca (kN-kNm)

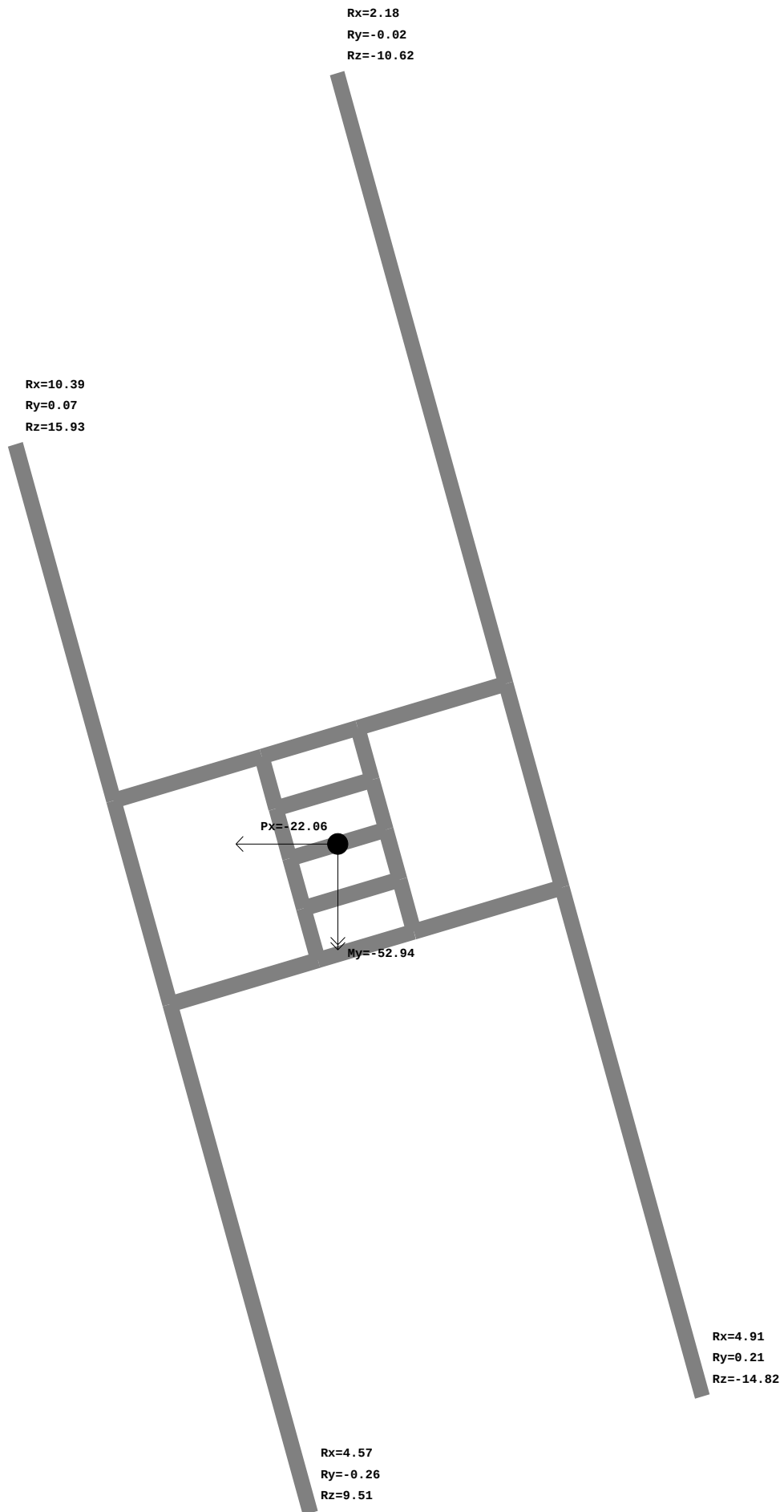


Opt. 5: - vetar Y 80 - Reakcije oslonaca (kN-kNm)

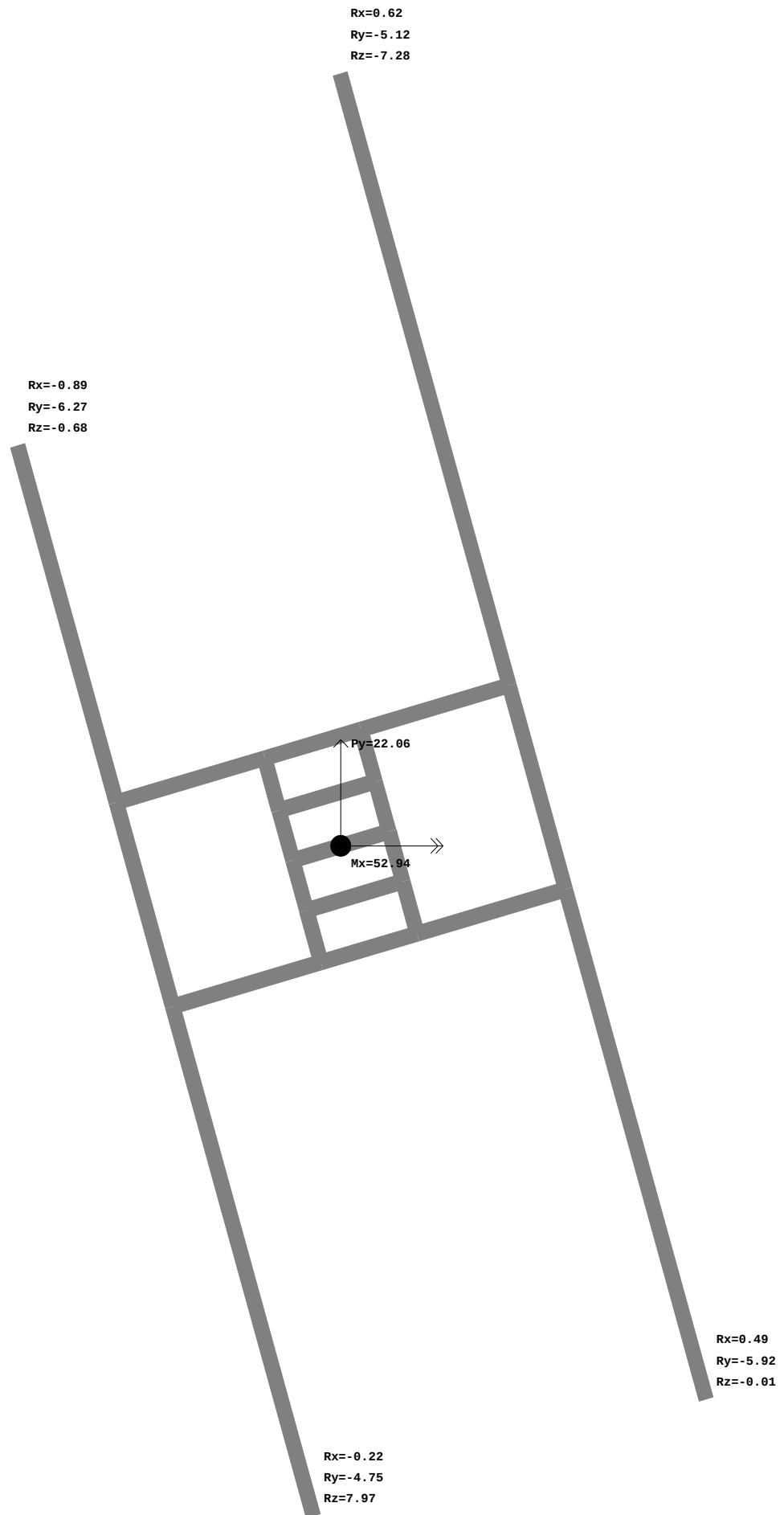


Opt. 6: +vetar X 217 - Reakcije oslonaca (kN-kNm)

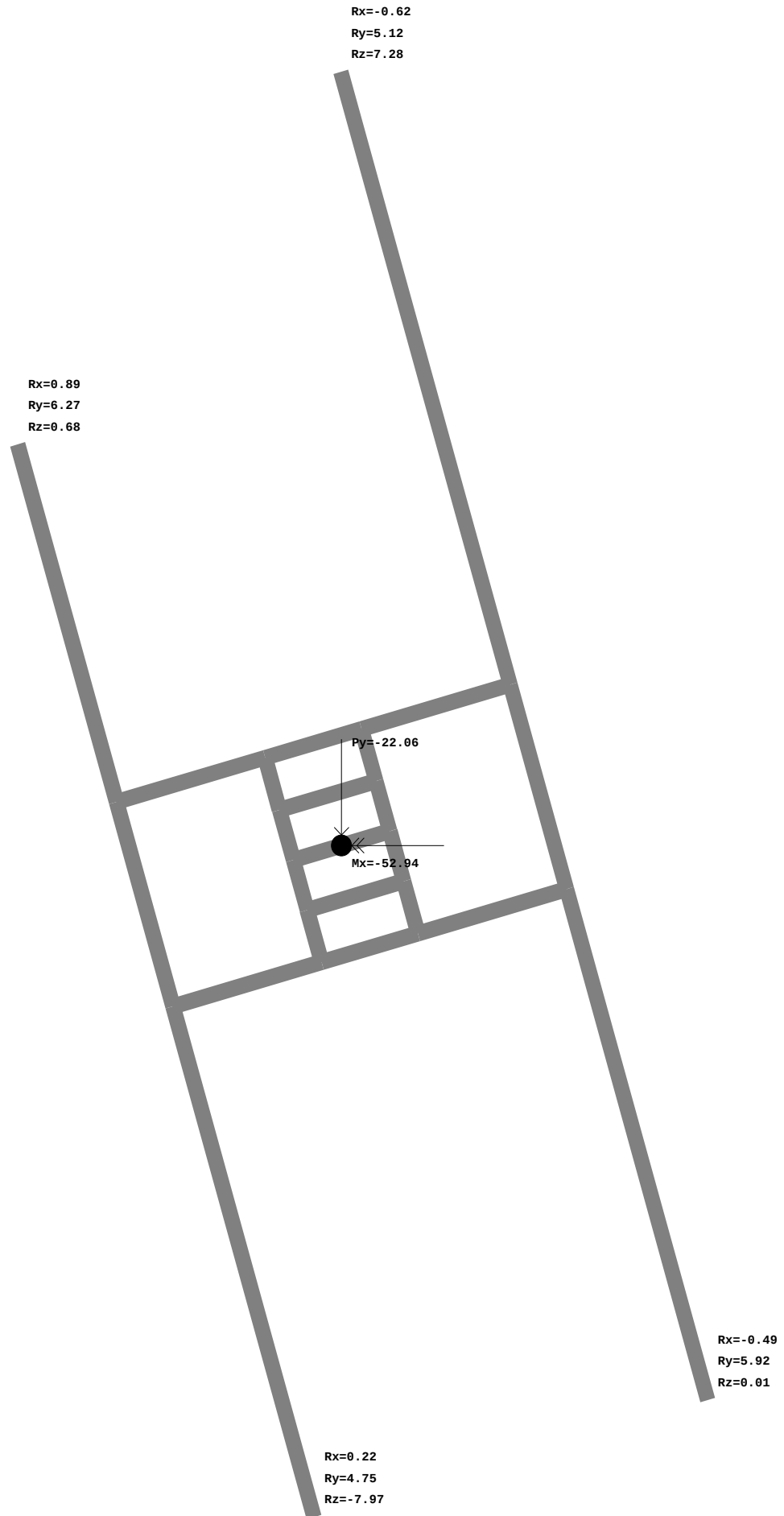
antena 2 PEC NOSAC postolja



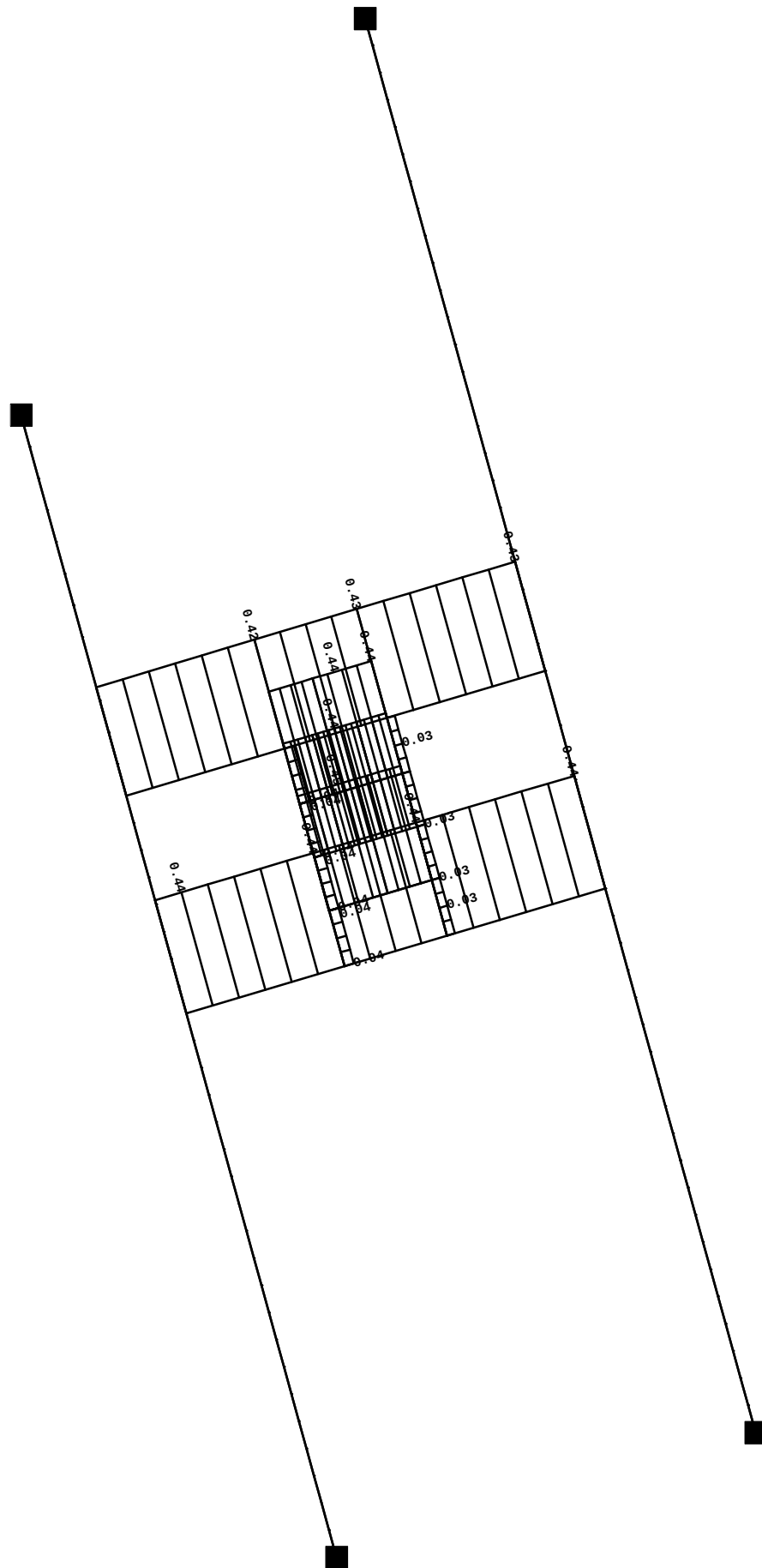
Opt. 7: -vetar X 217 - Reakcije oslonaca (kN-kNm)



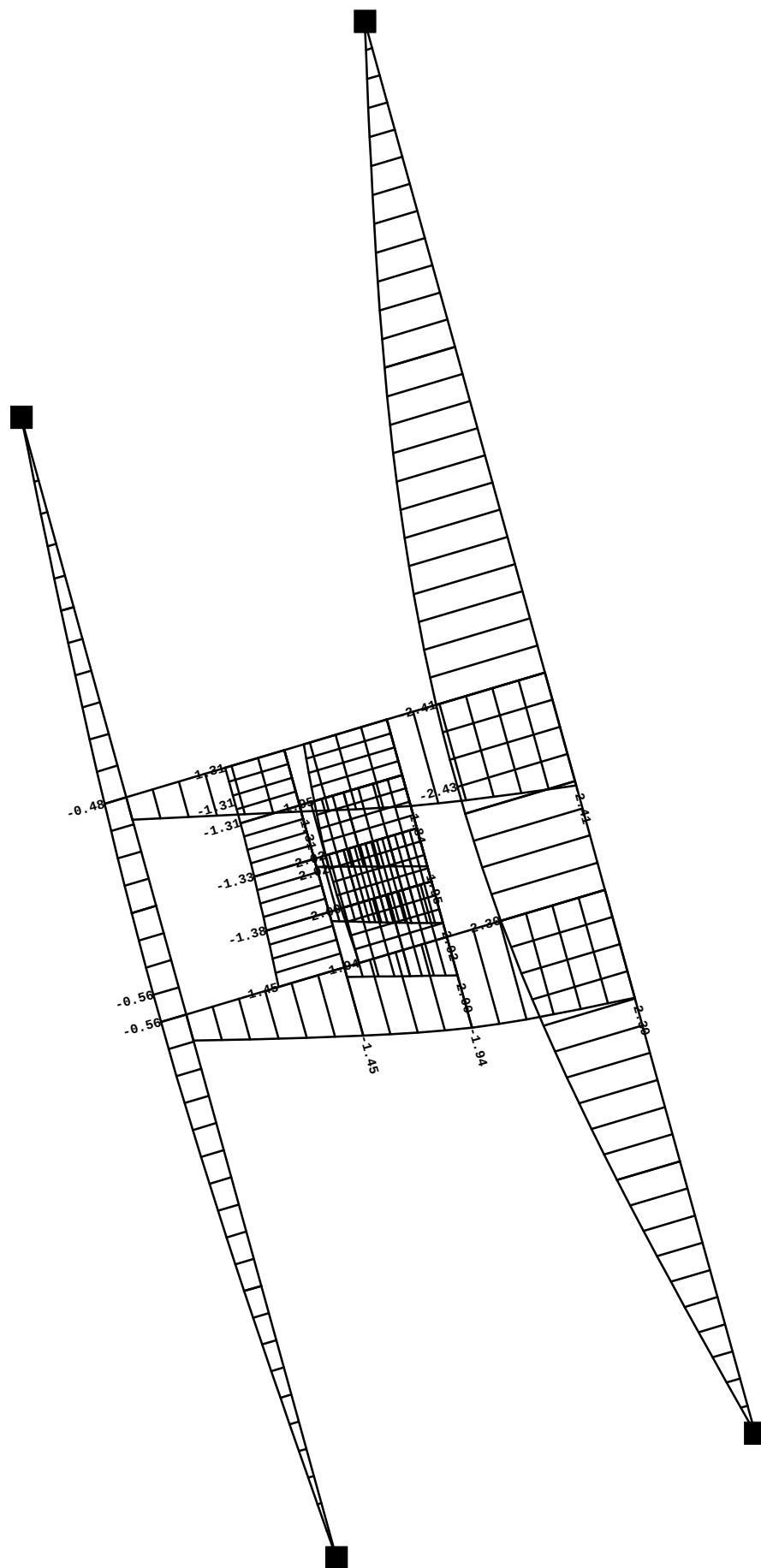
Opt. 8: +vetar y 217 - Reakcije oslonaca (kN-kNm)



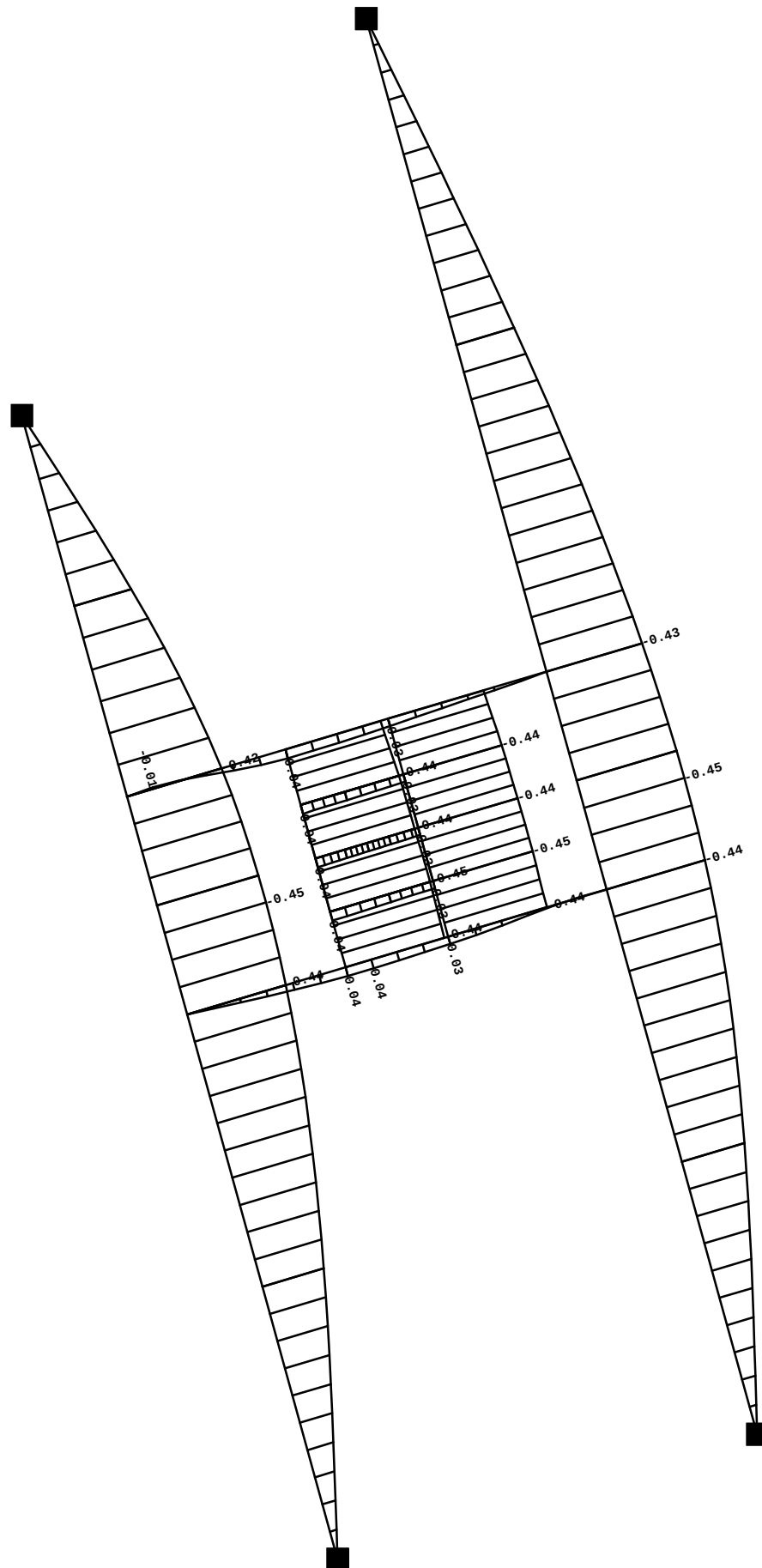
Opt. 9: -vetar Y 217 - Reakcije oslonaca (kN-kNm)



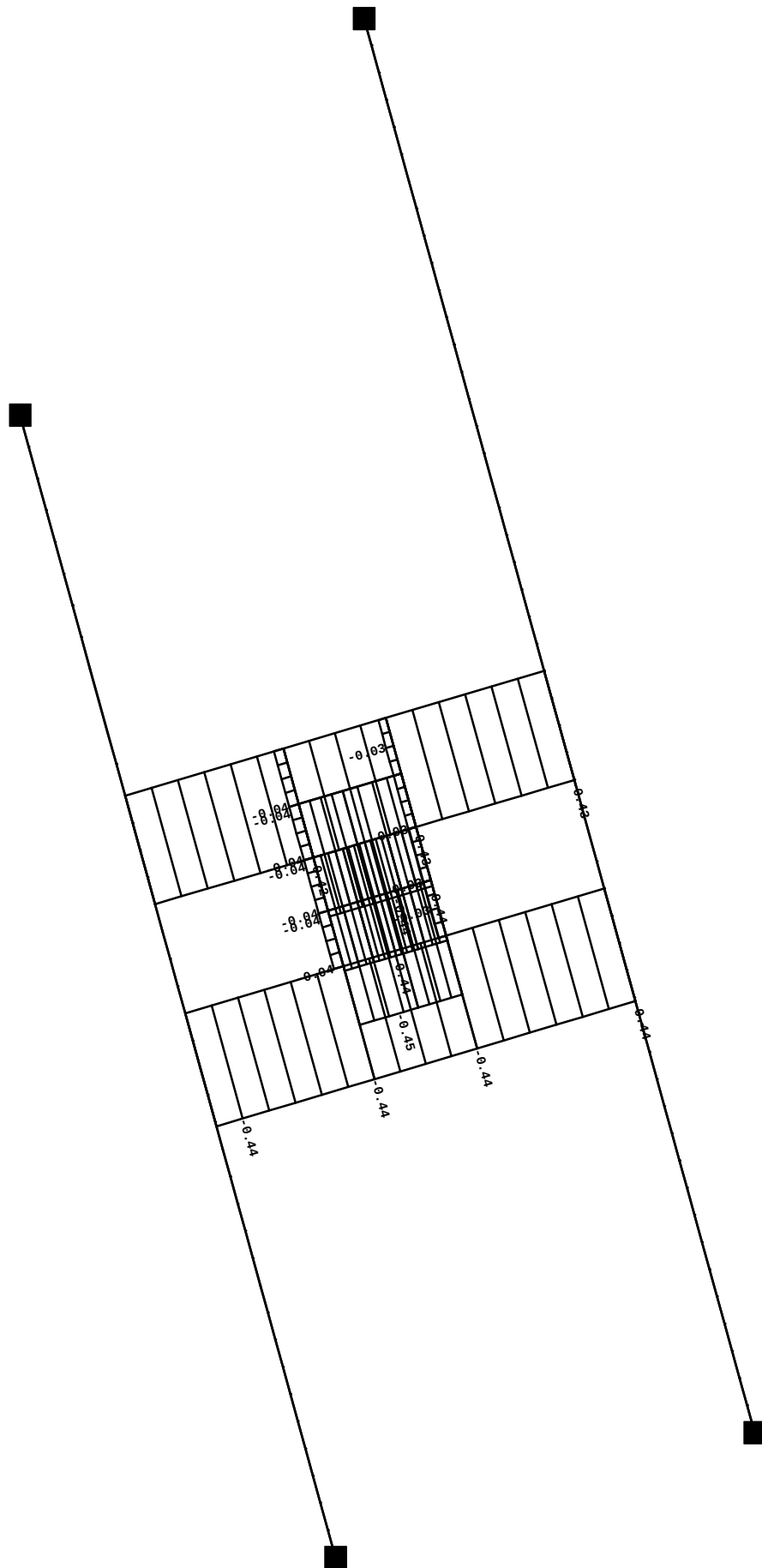
Opt. 10: 1xI+1xII - Uticaji u gredi: Xp (m)
(fs=1000)



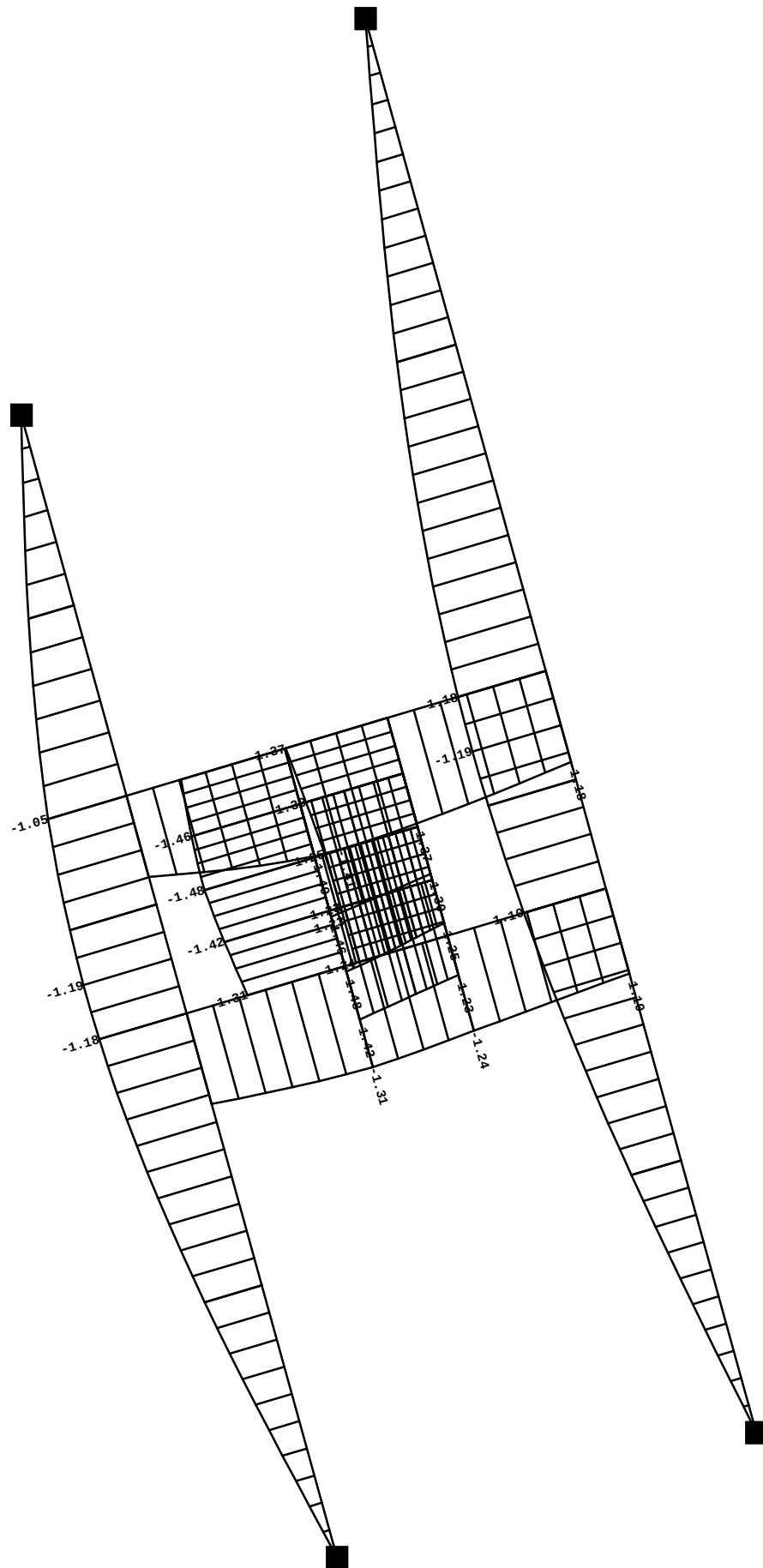
Opt. 10: 1xI+1xII - Uticaji u gredi: γ_p (m)
($f_s=1000$)



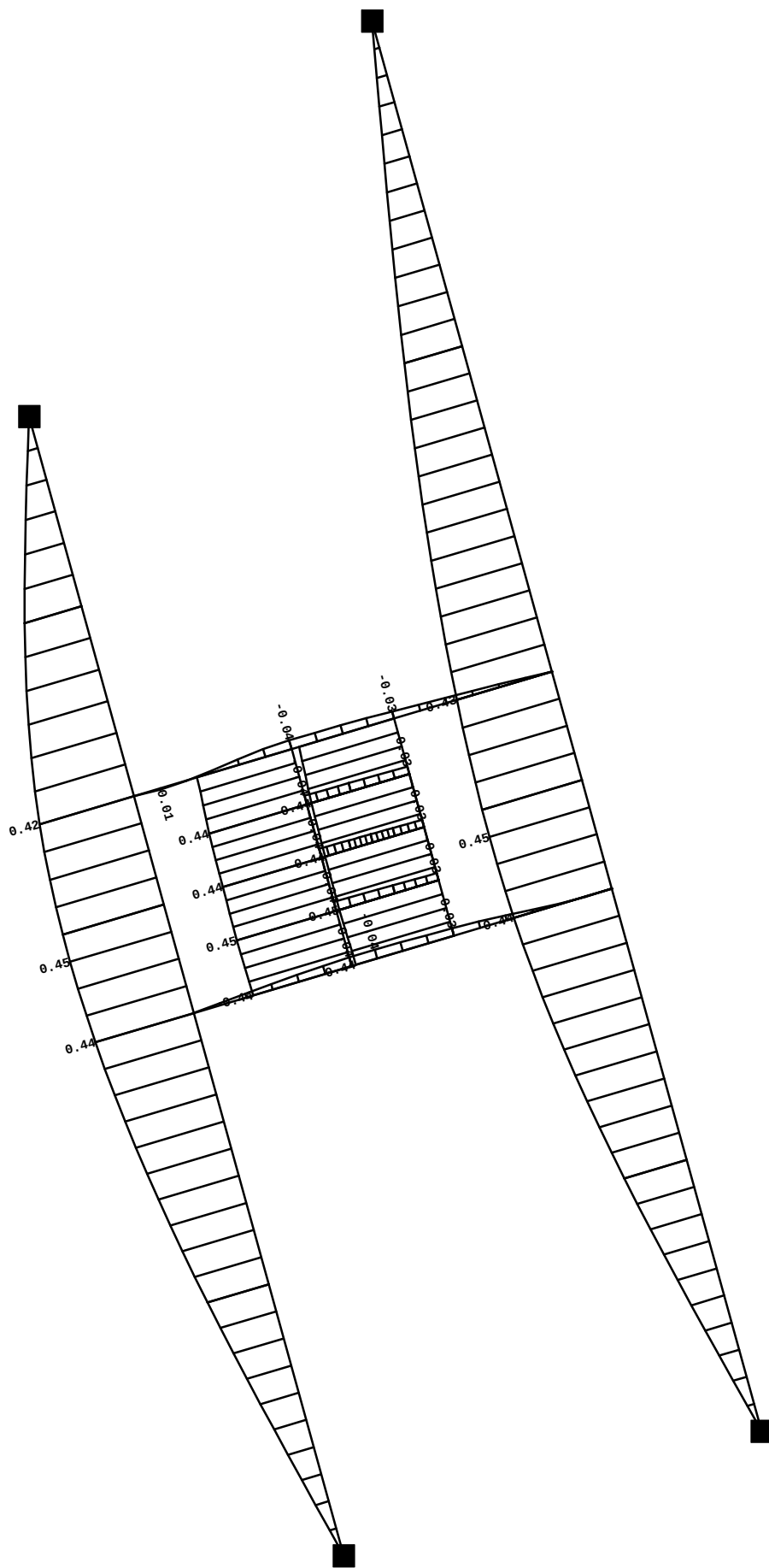
Opt. 10: 1xI+1xII - Uticaji u gredi: Zp (m)
(fs=1000)



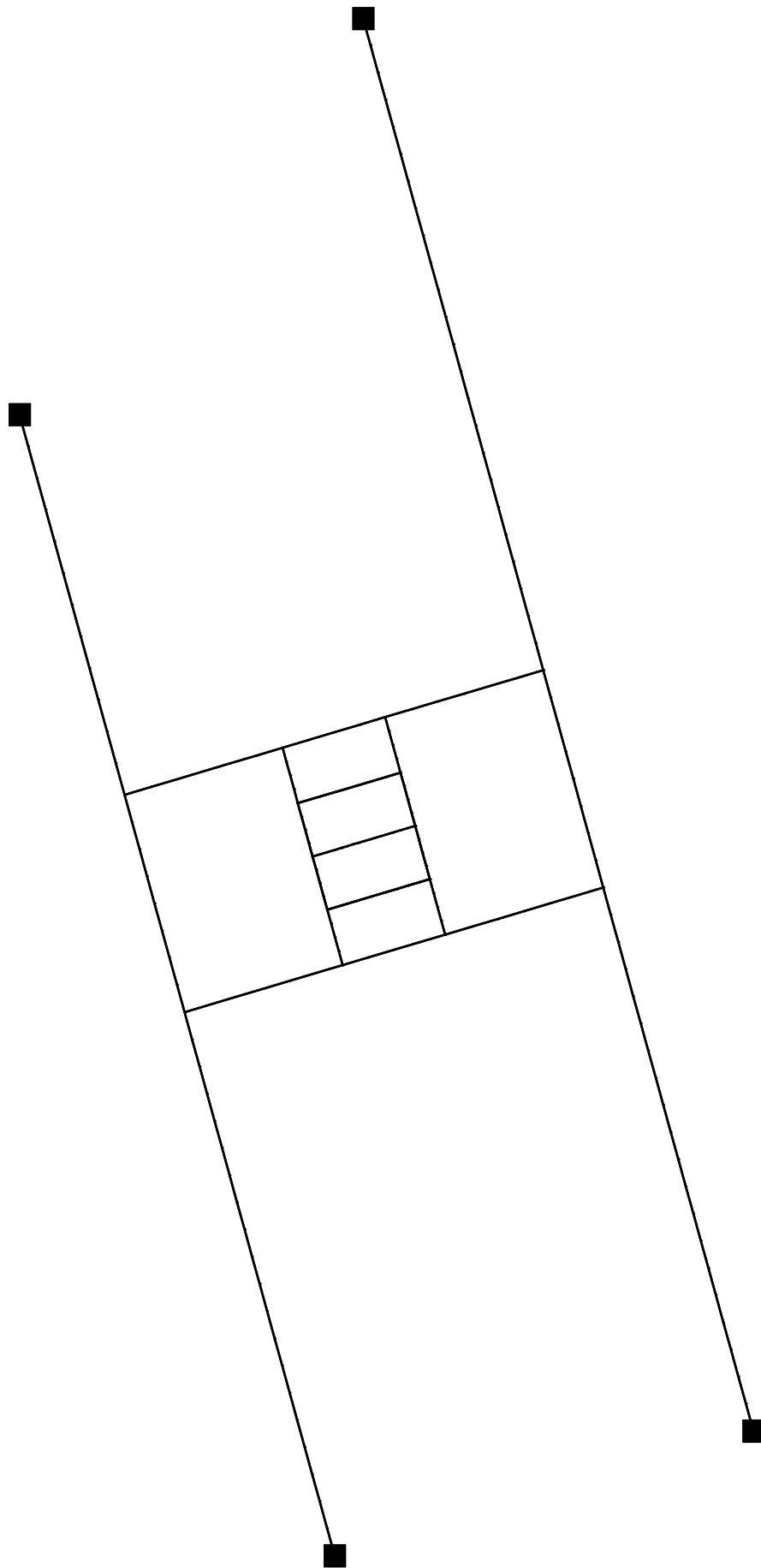
Opt. 11: 1xI+1xIII - Uticaji u gredi: Xp (m)
(fs=1000)



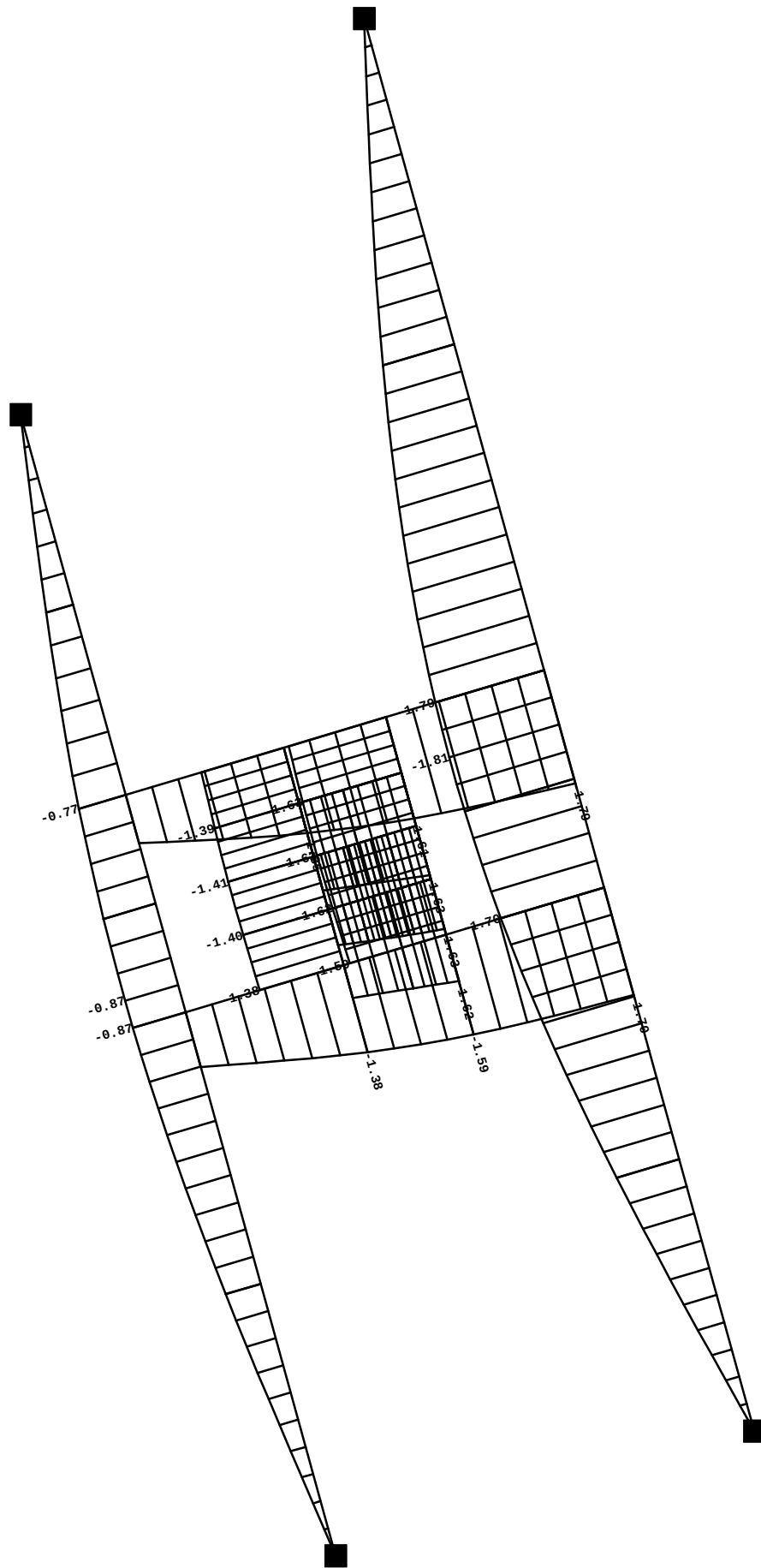
Opt. 11: 1xI+1xIII - Uticaji u gredi: Yp (m)
(fs=1000)



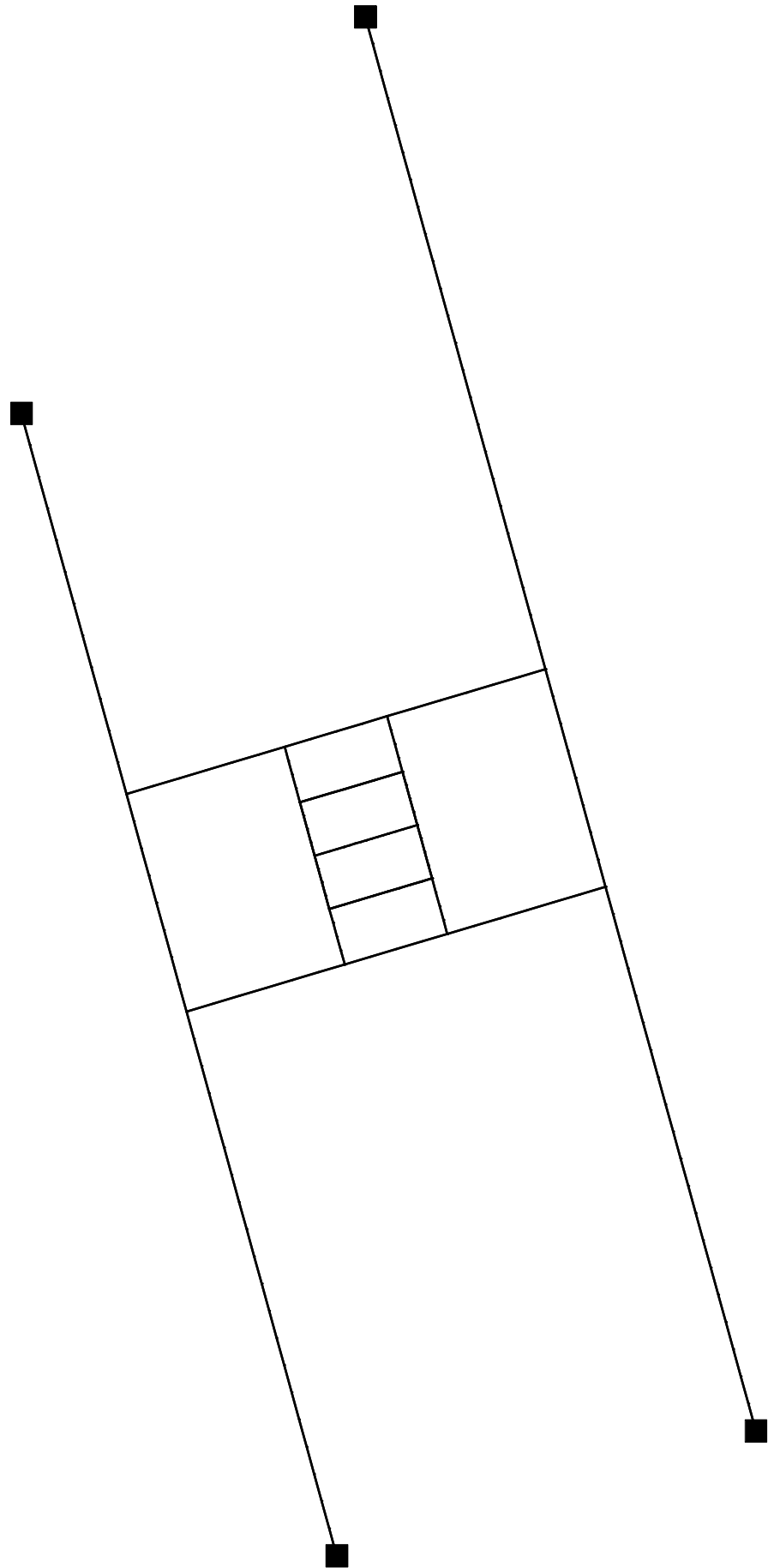
Opt. 11: 1xI+1xIII - Uticaji u gredi: Zp (m)
(fs=1000)



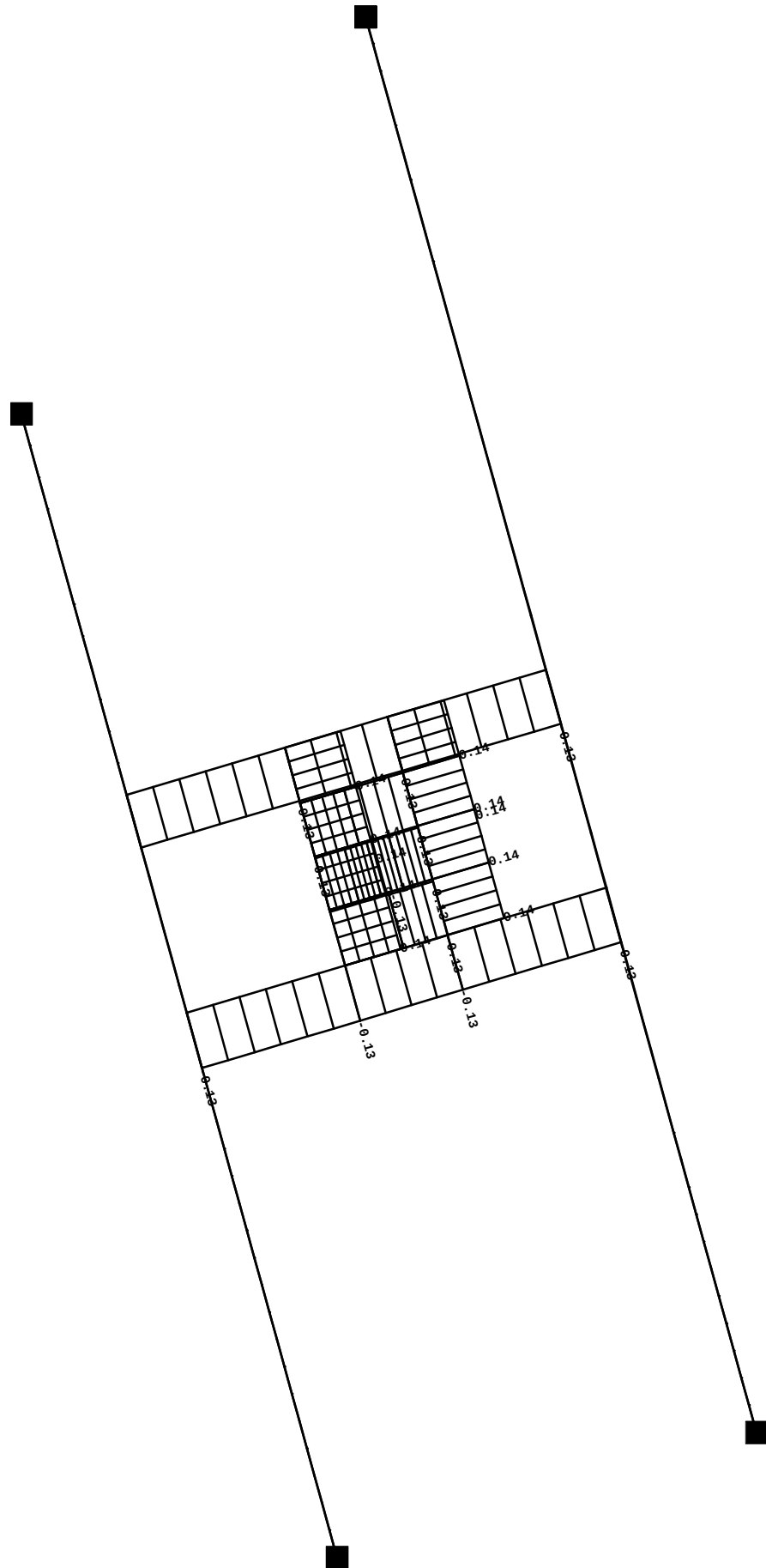
Opt. 12: 1xI+1xIV - Uticaji u gredi: Xp (m)
(fs=1000)



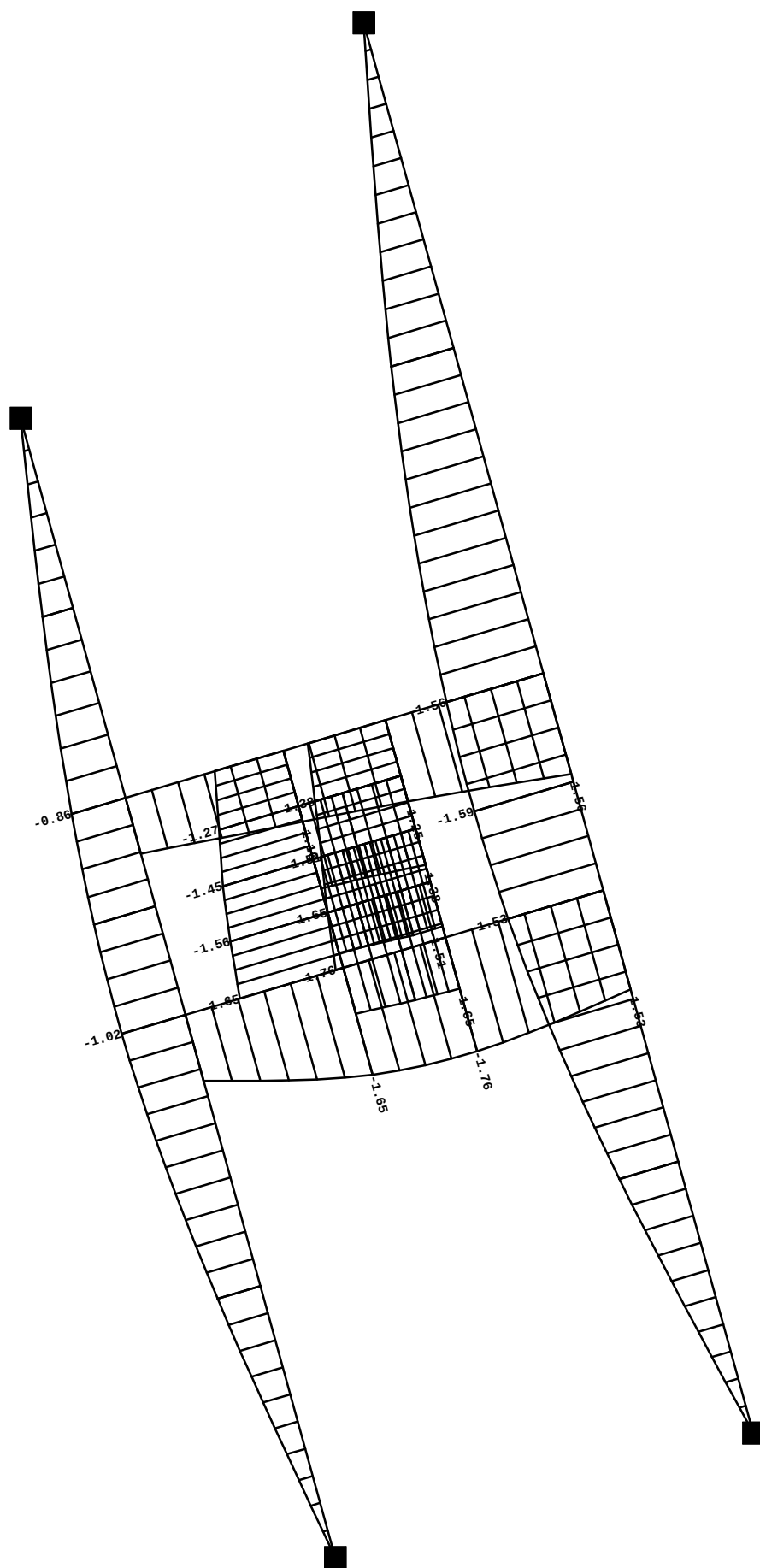
Opt. 12: 1xI+1xIV - Uticaji u gredi: Yp (m)
(fs=1000)



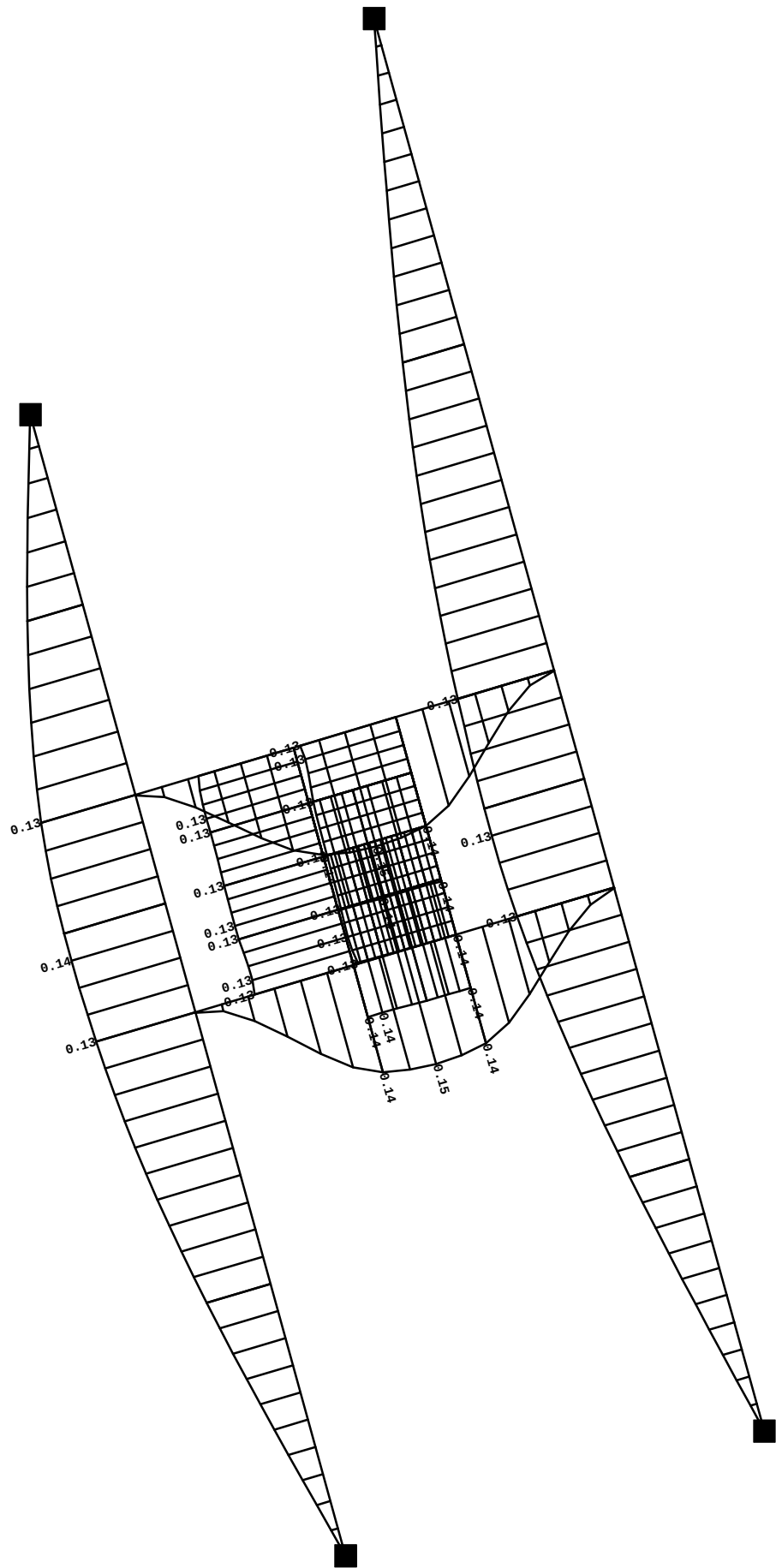
Opt. 12: 1xI+1xIV - Uticaji u gredi: Zp (m)
(fs=1000)



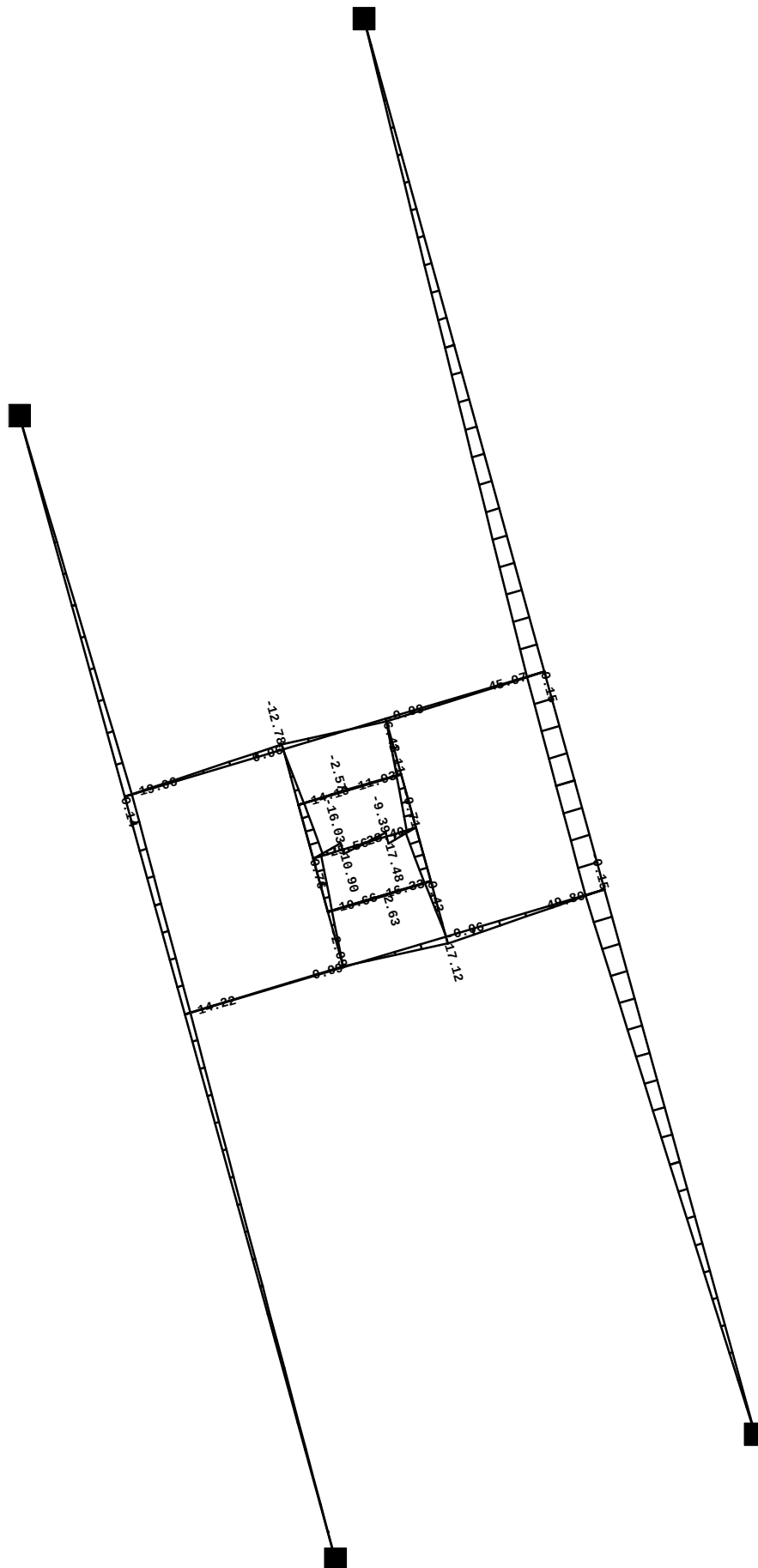
Opt. 13: 1xI+1xV - Uticaji u gredi: Xp (m)
(fs=1000)



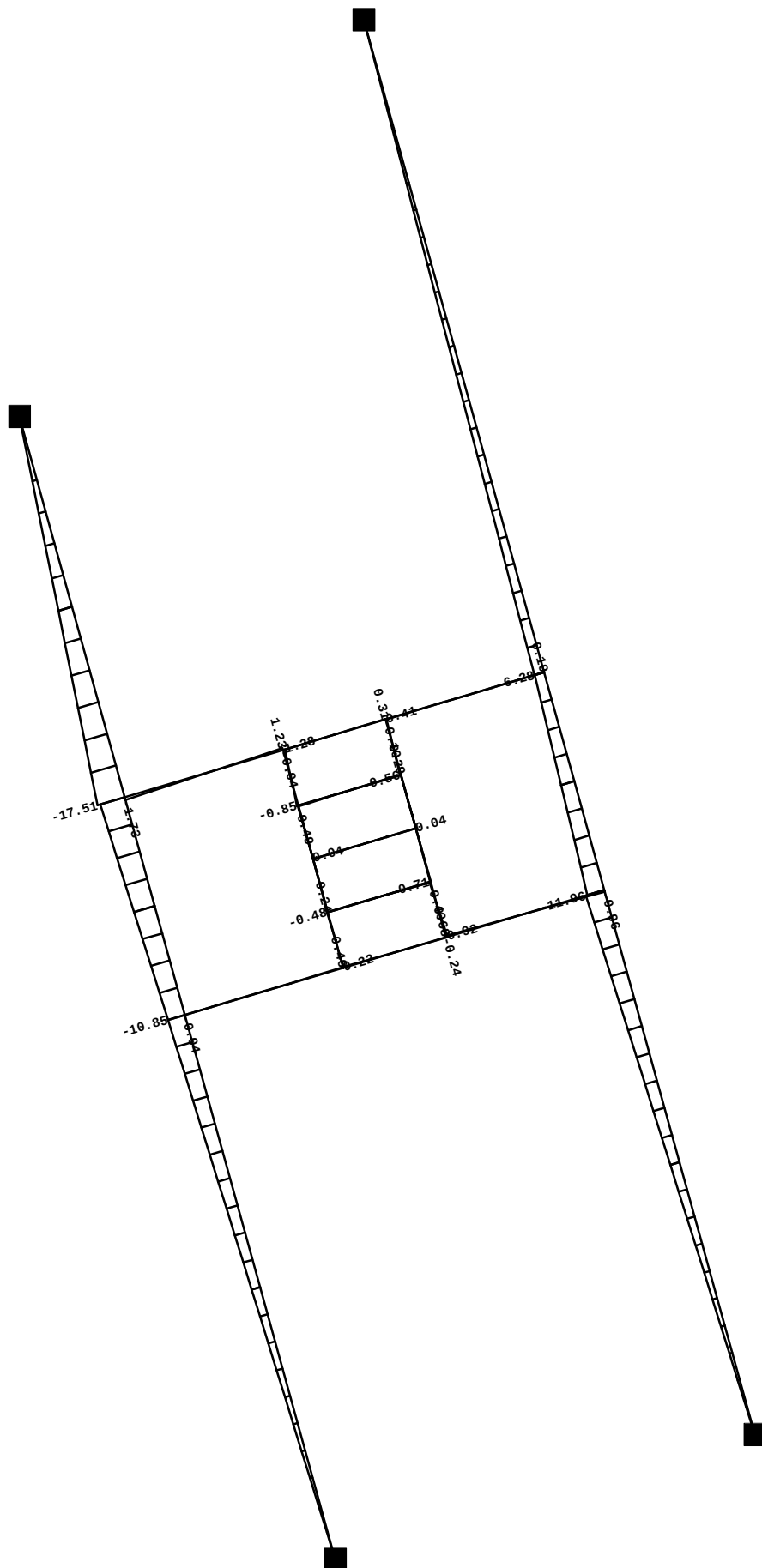
Opt. 13: 1xI+1xV - Uticaji u gredi: γ_p (m)
(fs=1000)

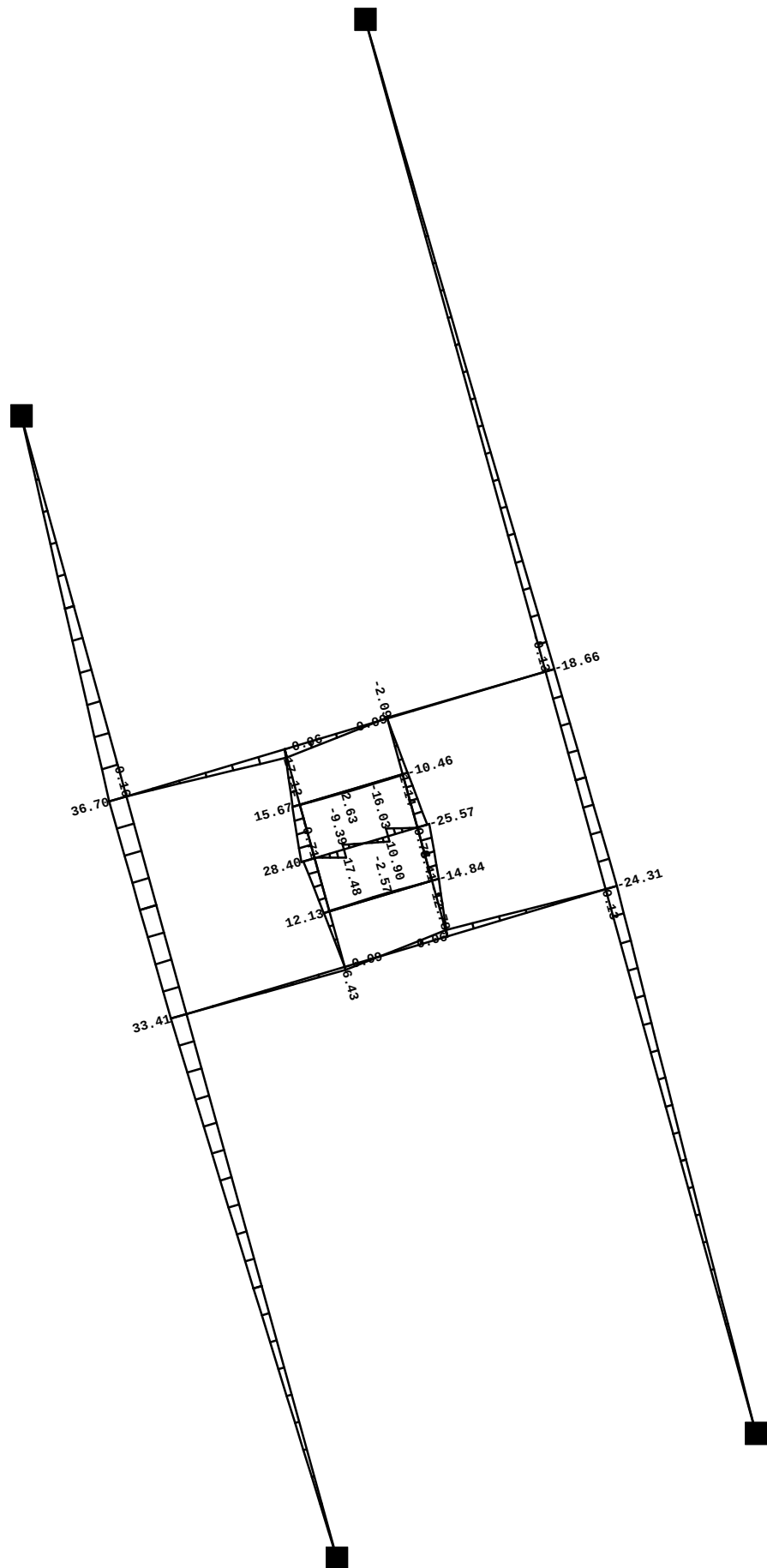


Opt. 13: 1xI+1xV - Uticaji u gredi: Zp (m)
(fs=1000)

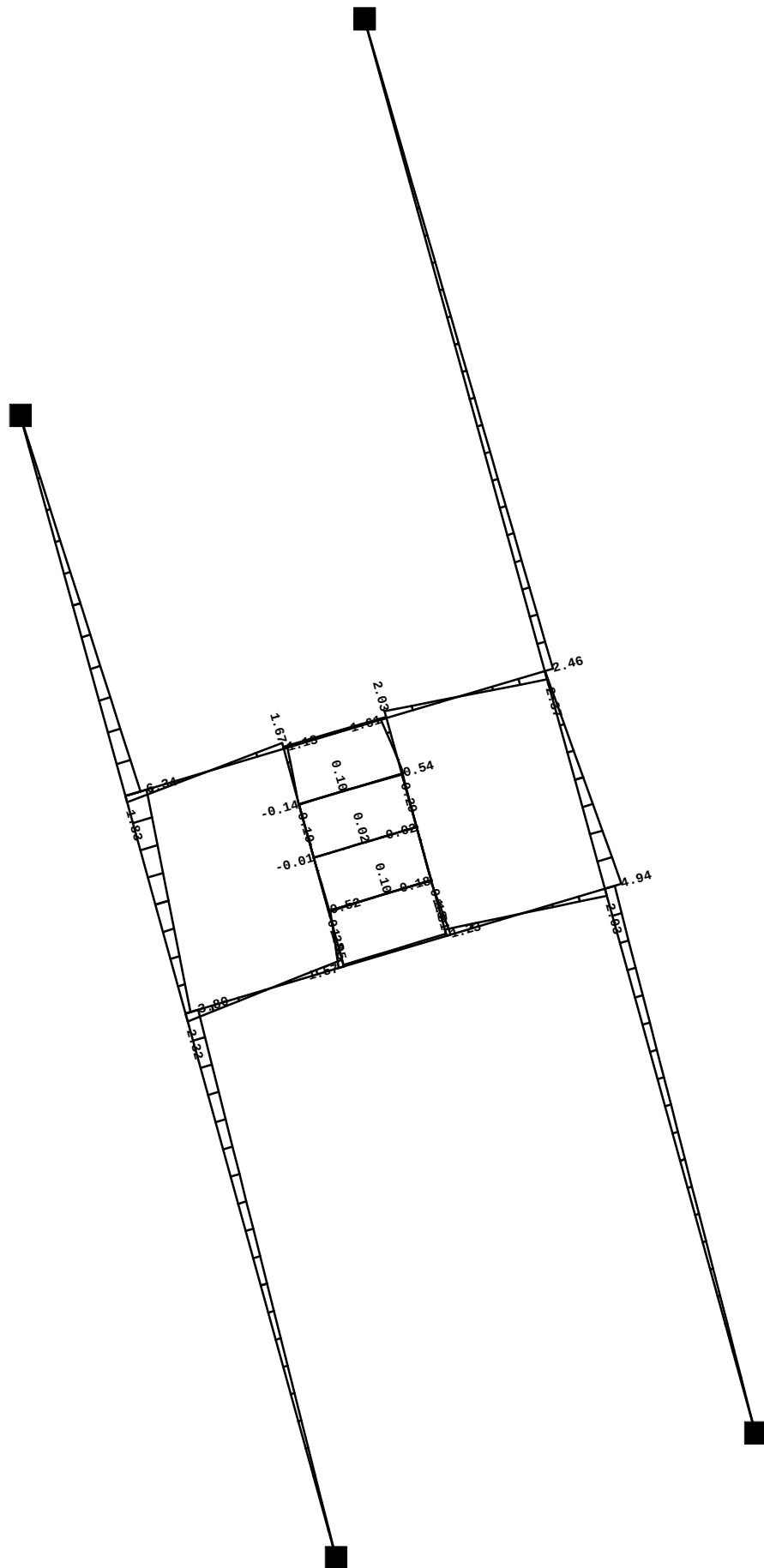


Opt. 14: 1xI+1xVI - Uticaji u gredi: Mz (kNm)

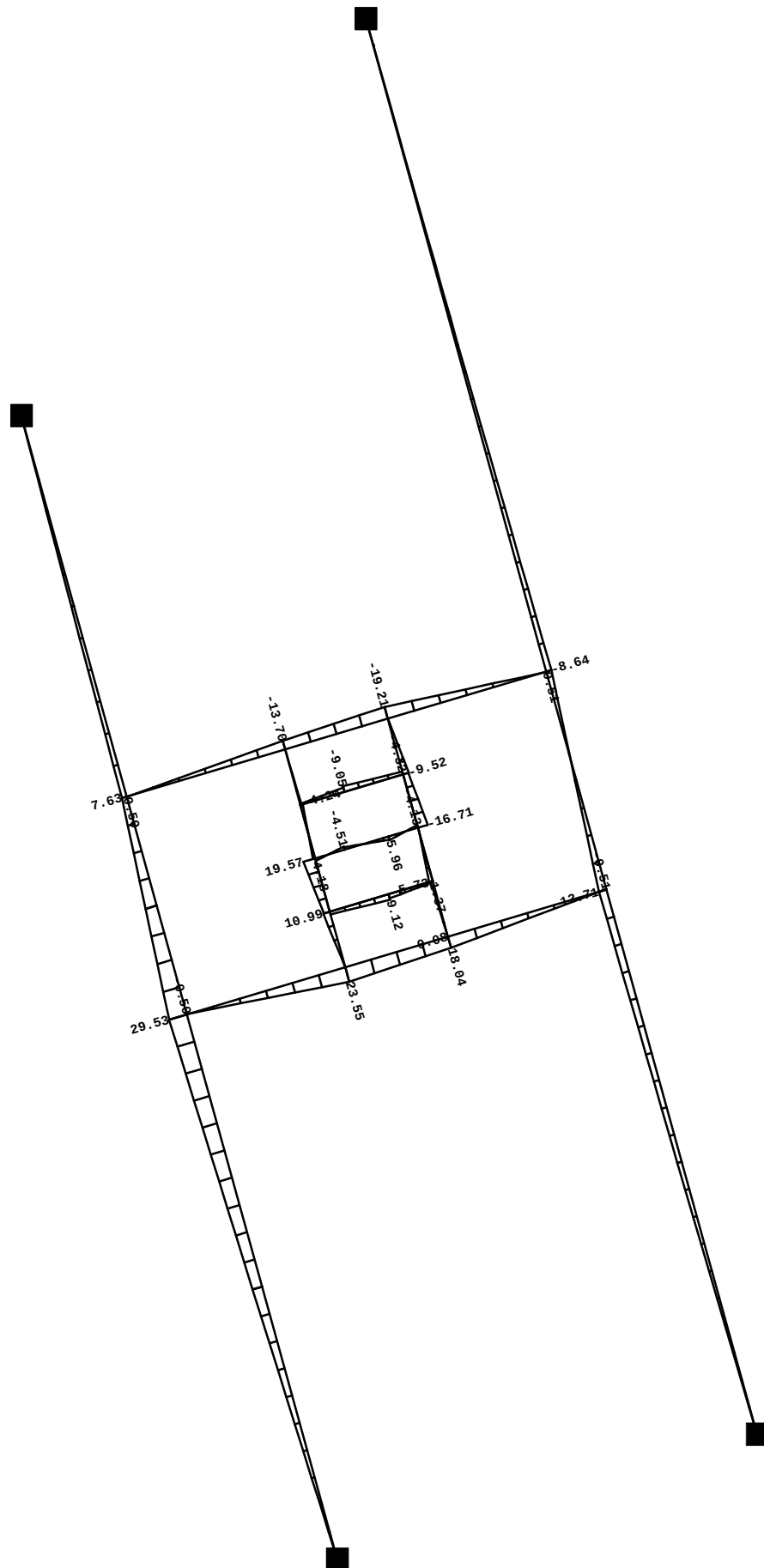




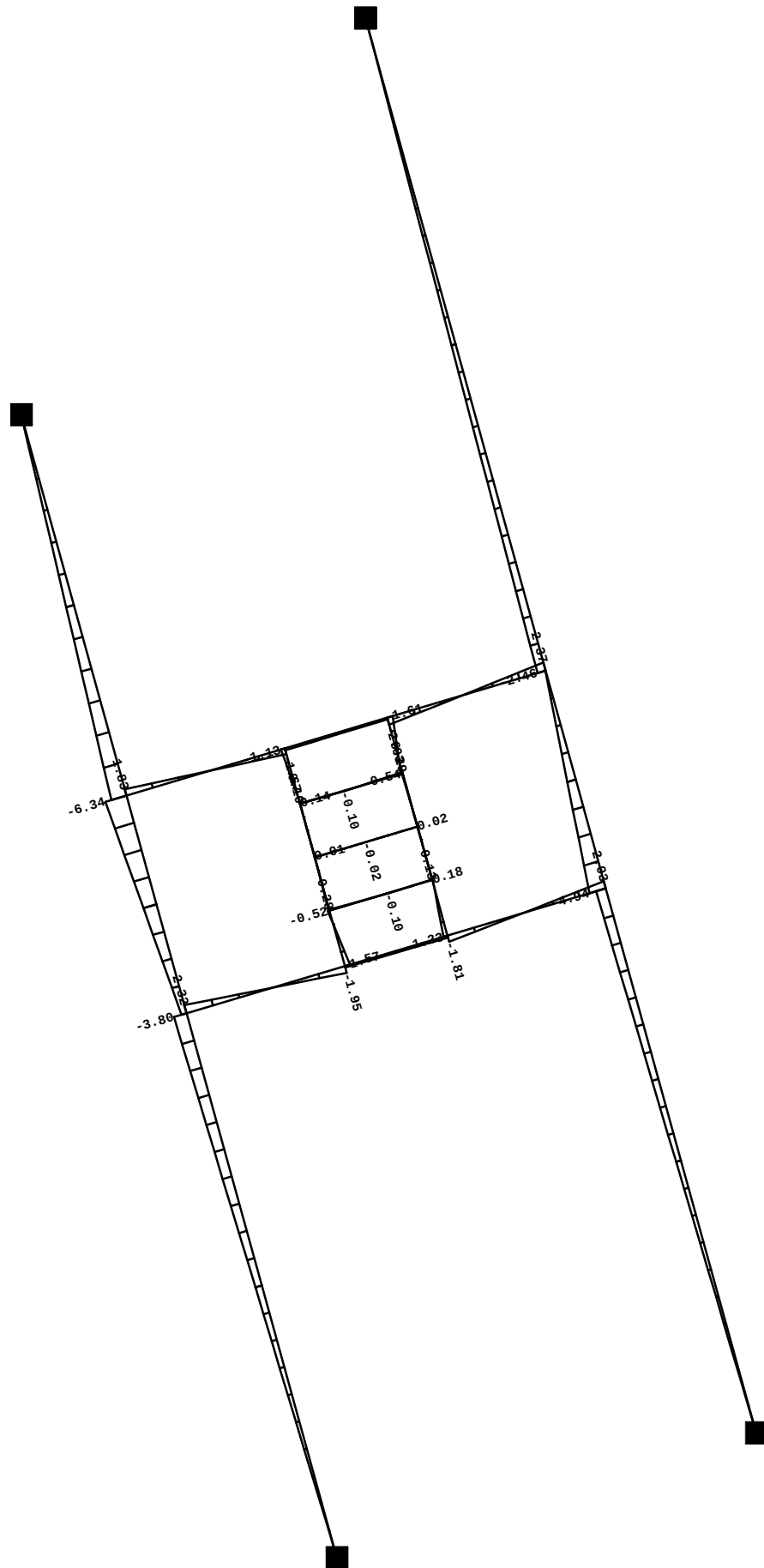
Opt. 15: 1xI+1xVII - Uticaji u gredi: Mz (kNm)



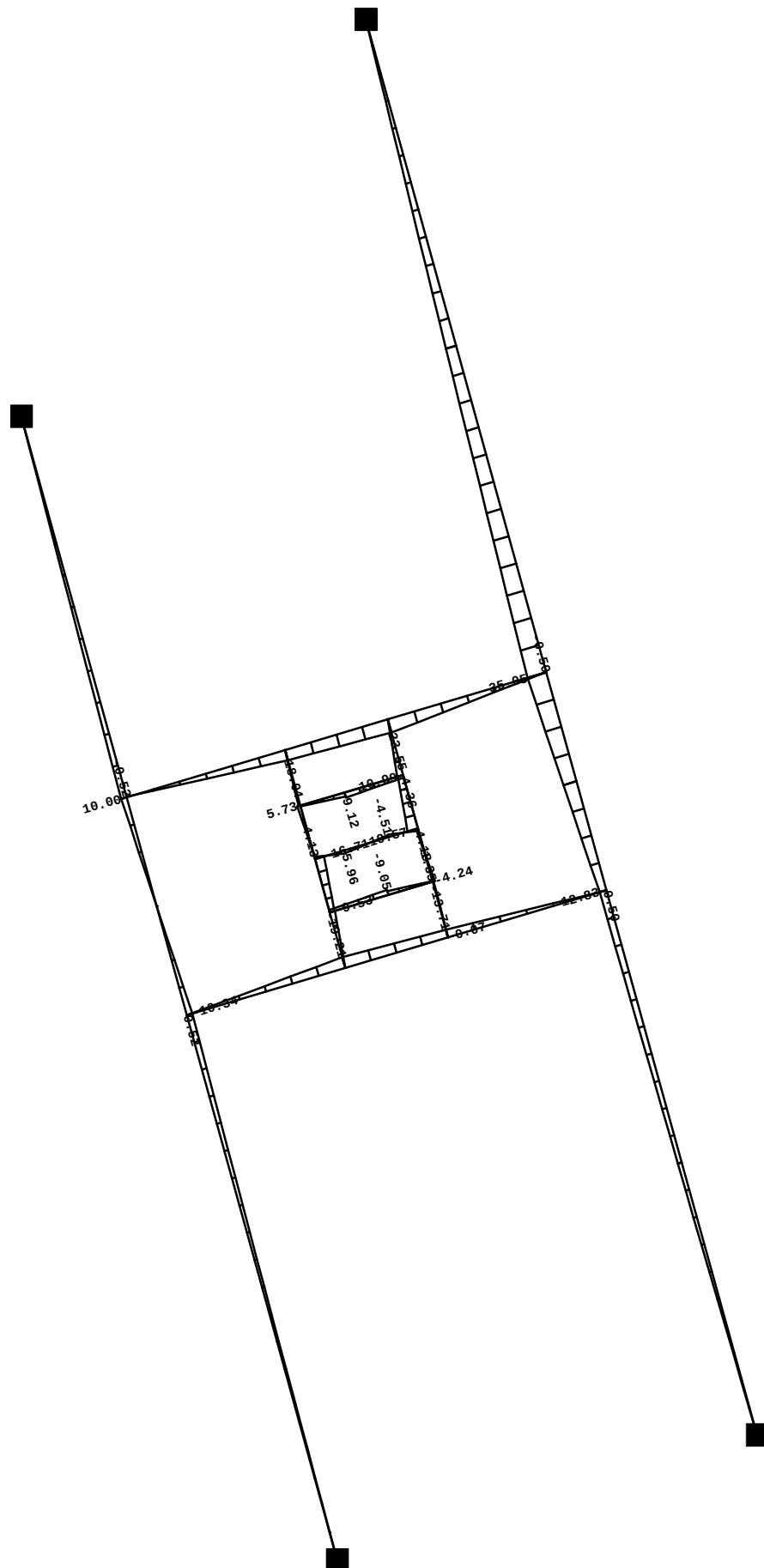
Opt. 17: 1xI+1xVIII - Uticaji u gredi: My (kNm)



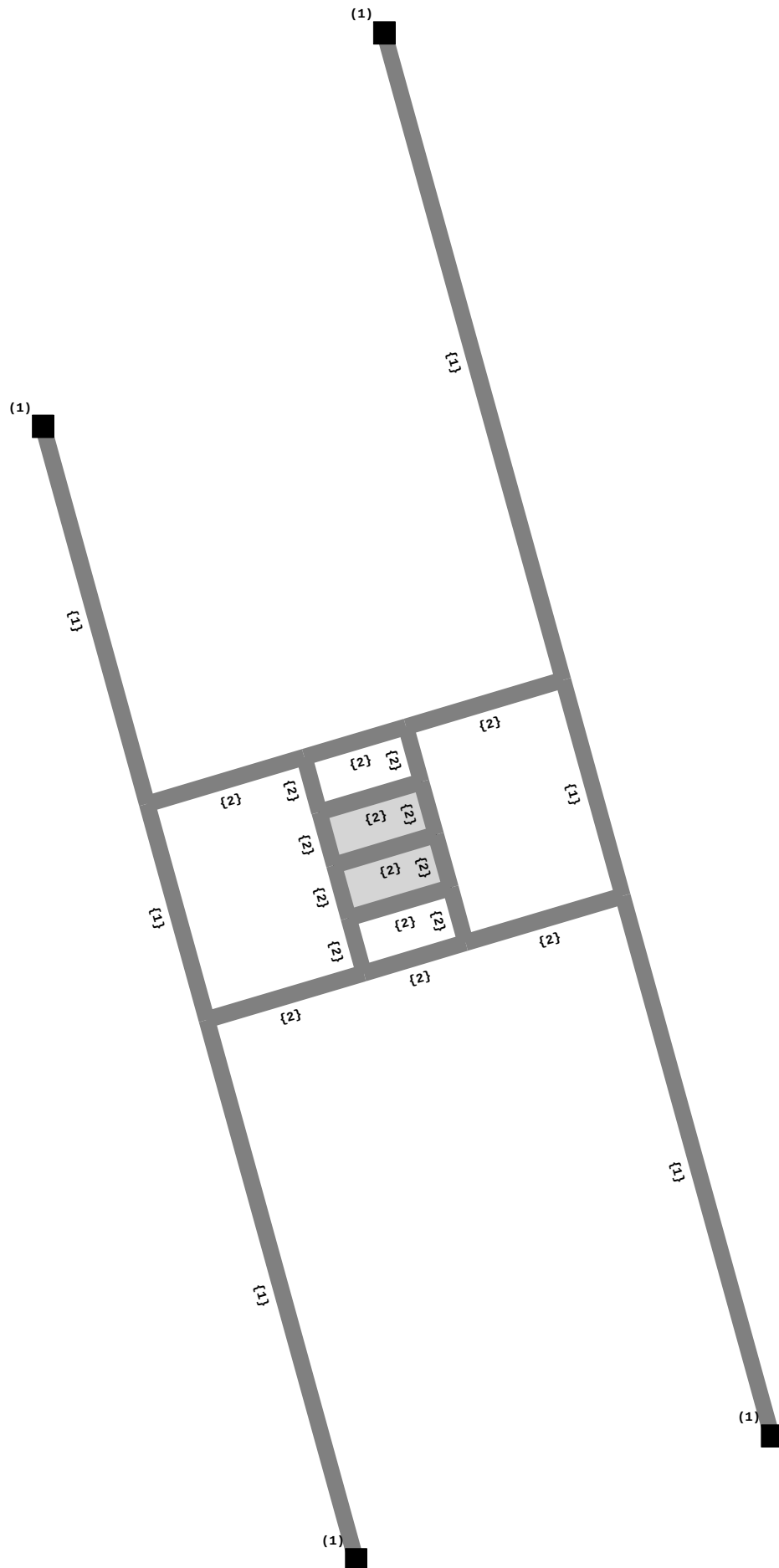
Opt. 17: 1xI+1xVIII - Uticaji u gredi: Mz (kNm)



Opt. 18: 1xI+1xIX - Uticaji u gredi: My (kNm)



Opt. 18: 1xI+1xIX - Uticaji u gredi: Mz (kNm)



Dimenzionisanje elemenata konstrukcije :

Pos G1 i POS g2 Glavni nosači

U proračunskom delu su dobijeni merodavni uticaji prema naponima i deformacijama za dimenzionisanje nosača

Merodavni uticaji za dimenzionisanje nosača postolja su za kombinaciju $G+W_x(+217\text{km/h})$

$$M_y = 11.96 \text{Kn}\cdot\text{m}$$

$$M_z = 45.07 \text{Kn}\cdot\text{m}$$

Za usvojeni nosač IPB260 (HEB)

Geometrijske karakteristike :

$$A_x = 118 \text{cm}^2 \quad g = 93 \text{kg/m} \quad B = 260 \text{mm} \quad t = 17.5 \text{mm} \quad s = 10 \text{mm} \quad J_z = 14920 \text{cm}^4 \quad J_y = 5130 \text{cm}^4$$

$$W_z = 1150 \text{cm}^3 \quad W_y = 395 \text{cm}^3$$

Maksimalni ugaoni napon u ivičnom vlaknu :

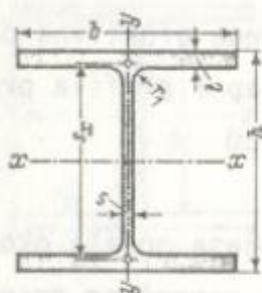
$$M_z/W_z + M_y/W_y = 4507/1150 + 1196/395 = 3.92 \text{Kn/cm}^2 + 3.02 \text{Kn/cm}^2 = 6.95 \text{Kn/cm}^2 < G_{dop}.$$

Usvojeni nosači zadovoljavaju naponske uslove !

6.1.4. VRUĆE VALJANI IPB (HEB) - NOSAČI

prema DIN 1025 B1.2
EURONORM 53

Tabela 6-IV



A = površina preseka

G = težina

O = površina obima za 1 m dužine

I = moment inercije

W = otporni moment

$i = \frac{I}{A}$ = poluprečnik inercije

S_x = statički moment polovine
I - preseka

$s_x = \frac{I_x}{S_x}$ = rastojanje središta
zatezanja i središta
pritiska

čelični materijal prema DIN 17100 i
drugim odgovarajućim standardima

IPB	Mere u mm						A cm²	G kg/m	O m²/m	Za ose			y-y			S _x cm²	S _x cm
	h	b	s	t	r ₁	r ₂				J _x cm⁴	^{x-x} W _x cm³	i _x cm	J _y cm⁴	W _y cm³	i _y cm		
100	100	100	6	10	12	—	26,0	20,4	0,567	450	89,9	4,16	167	33,5	2,53	52,1	8,63
120	120	120	6,5	11	12	—	34,0	26,7	0,686	864	144	5,04	318	52,9	3,06	82,6	10,5
140	140	140	7	12	12	—	43,0	33,7	0,805	1510	216	5,93	550	78,5	3,58	123	12,3
160	160	160	8	13	15	—	54,3	42,6	0,918	2490	311	6,78	889	111	4,05	177	14,1
180	180	180	8,5	14	15	—	65,3	51,2	1,04	3830	426	7,66	1360	151	4,57	241	15,9
200	200	200	9	15	18	—	78,1	61,3	1,15	5700	570	8,54	2000	200	5,07	321	17,7
220	220	220	9,5	16	18	—	91,0	71,5	1,27	8090	736	9,43	2840	258	5,59	414	19,6
240	240	240	10	17	21	—	106	83,2	1,38	11260	938	10,3	3920	327	6,08	527	21,4
260	260	260	10	17,5	24	—	118	93,0	1,50	14920	1150	11,2	5130	395	6,58	641	23,3
280	280	280	10,5	18	24	—	131	103	1,62	19270	1380	12,1	6590	471	7,09	767	25,1
300	300	300	11	19	27	—	149	117	1,73	25170	1680	13,0	8560	571	7,58	934	26,9
320	320	300	11,5	20,5	27	—	161	127	1,77	30820	1930	13,8	9240	616	7,57	1070	28,7
340	340	300	12	21,5	27	—	171	134	1,81	36660	2160	14,6	9690	646	7,53	1200	30,4
360	360	300	12,5	22,5	27	—	181	142	1,85	43190	2400	15,5	10140	676	7,49	1340	32,2
400	400	300	13,5	24	27	—	198	155	1,93	57680	2880	17,1	10820	721	7,40	1620	35,7
450	450	300	14	26	27	—	218	171	2,03	79890	3550	19,1	11720	781	7,33	1990	40,1
500	500	300	14,5	28	27	—	239	187	2,12	107200	4290	21,2	12620	842	7,27	2410	44,5
550	550	300	15	29	27	—	254	199	2,22	136700	4970	23,2	13080	872	7,17	2800	48,9
600	600	300	15,5	30	27	—	270	212	2,32	171000	5700	25,2	13530	902	7,08	3210	53,2
650	650	300	16	31	27	—	286	225	2,42	210600	6480	27,1	13980	932	6,99	3650	57,5
700	700	300	17	32	27	—	306	241	2,52	256900	7340	29,0	14440	963	6,87	4160	61,7
800	800	300	17,5	33	30	—	334	262	2,71	359100	8980	32,8	14900	994	6,68	5110	70,2
900	900	300	18,5	35	30	—	371	291	2,91	494100	10980	36,5	15820	1050	6,53	6240	78,5
1000	1000	300	19	36	30	—	400	314	3,11	644700	12890	40,1	16280	1090	6,38	7430	86,8

Kontrola deformacija za radni opseg W(80km/h):

Obrtanje -rotacija kao uglovna mera po azimutu dobija se kao razlika translatornog pomeranja u horizontalnoj ravni najudaljenijih tačaka gornje konstrukcije od POS G#, POSG4 i POS G5 podeljeno sa udaljenjem tih tačaka

$F_{hor}=2.43\text{mm}$ udaljenje do ose rotacije 500mm

$\tan \alpha = 2.43/500\text{mm} = 4.86\text{E-}3$ pa je $\alpha = 0.278$ stepena

Očekivano uglovna pomeranje signala po azimutu u horizontalnoj ravni u pravcu kazaljke ili suprotno od kazaljke zavisno od smera duvanja vetra za radni opseg antene $V=80\text{Km/h}$ kao posledica krutosti nosača postolja .

Obrtanje je dodatno uslovljeno i krutošću same opreme , antene i postolja što se sa sračunatim obrtanjem superponira!

Obrtanje -rotacija u vertikalnoj ravni je posledica razlike u vertikalnom ugibu pos G1 i POS G2 podeljene sa razmakom nosača

Dobija se $fz1-fz2=2.43-0.48\text{mm}=1.95\text{mm}$

$\tan \beta = 1.95/2000 = 9.75\text{E-}4$ pa $\alpha = 5.59\text{e-}2 = 0.056$ stepeni

Dobijeni ugao je pomeranje signala naviše ili naniže u odnosu na projektovani pravac signala

Osetljivost sistema nosač je znatno veća na rotaciju u horizontalnoj ravni!

POS G3 , POS G4 i POS G5 Sekundarni i tercijarni nosači

$\max Mz=25.57\text{kNm}$

usvaja se INP 200 $g=26,2\text{kg/m}$ $Wz=214\text{cm}^3$ $Wy=36\text{cm}^3$

Kontrola napona za merodavno savijane pri ekstremnom vetru V(217kmh):

$G=2557/214=11.94\text{Kn/cm}^2$ $<G_{dop}$ (II slučaj) $=18\text{Kn/cm}^2$

Svi ovi nosači se radionički zavaruju i dopremaju kao gotov sklop.

Na svim mestima ukrućenja nosača izvode se radionički zavareni čvorni limovi

Veza sa primarnim nosačima POS G1 i POS G2 je montažna vijčana donje čelične ploče i 4 zavrtnja po vezi.

6.1. VRUĆE VALJANI ČELIČNI PROIZVODI

6.1.1. VRUĆE VALJANI I - NOSAČI

prema JUS C.B3.131
DIN 1025 B1.1

Tabela 6-I

A = površina preseka

G = težina

O = površina obima za 1 m dužine

I = moment inercije

W = otporni moment

$i = \frac{I}{A}$ = poluprečnik inercije

S_x = statički moment polovine I - preseka

$s_x = \frac{I_x}{S_x}$ = rastojanje središta zatezanja i središta pritiska

Čelični materijal prema JUS C.B0.500, DIN 17100
i drugim odgovarajućim standardima

I	Mere u mm					A	G	O	Za osu						S_x	s_x
	h	b	$a = r_c$	t	r_s				x - x			y - y				
									J_x	W_x	i_x	J_y	W_y	$i_y = i_x$		
cm	cm	cm	cm	cm	cm	cm ²	kg/m	m ² /m	cm ⁴	cm ³	cm	cm ⁴	cm ³	cm	cm ⁴	cm
80*	80	42	3,9	5,9	2,3	7,57	5,94	0,304	77,8	19,5	3,20	6,29	3,00	0,91	11,4	6,84
100*	100	50	4,5	6,8	2,7	10,6	8,34	0,370	171	34,2	4,01	12,2	4,88	1,07	19,9	8,57
120*	120	58	5,1	7,7	3,1	14,2	11,1	0,439	328	54,7	4,81	21,5	7,41	1,23	31,8	10,3
140*	140	66	5,7	8,6	3,4	18,2	14,3	0,502	573	81,9	5,61	35,2	10,7	1,40	47,7	12,0
160*	160	74	6,3	9,5	3,8	22,8	17,9	0,575	935	117	6,40	54,7	14,8	1,55	68,0	13,7
180*	180	82	6,9	10,4	4,1	27,9	21,9	0,640	1 450	181	7,20	81,3	19,8	1,71	93,4	15,5
200*	200	90	7,5	11,3	4,5	33,4	26,2	0,709	2 140	214	8,00	117	26,0	1,87	125	17,2
220*	220	98	8,1	12,2	4,9	39,5	31,1	0,775	3 060	278	8,80	162	33,1	2,02	162	18,9
240*	240	106	8,7	13,1	5,2	46,1	36,2	0,844	4 250	354	9,59	221	41,7	2,20	206	20,6
260*	260	113	9,4	14,1	5,6	53,3	41,9	0,906	5 740	442	10,4	288	51,0	2,32	257	22,3
280*	280	119	10,1	15,2	6,1	61,0	47,9	0,966	7 590	542	11,1	364	61,2	2,45	316	24,0
300*	300	125	10,8	16,2	6,5	69,0	54,2	1,03	9 800	653	11,9	451	72,2	2,56	381	25,7
320*	320	131	11,5	17,3	6,9	77,7	61,0	1,09	12 510	782	12,7	555	84,7	2,67	457	27,4
340*	340	137	12,2	18,3	7,3	86,7	68,0	1,15	15 700	923	13,5	674	98,4	2,80	540	29,1
360*	360	143	13,0	19,5	7,8	97,0	76,1	1,21	19 610	1 090	14,2	818	114	2,90	638	30,7
380*	380	149	13,7	20,5	8,2	107	84,0	1,27	24 010	1 260	15,0	975	131	3,02	741	32,4
400*	400	155	14,4	21,5	8,6	118	92,4	1,33	29 210	1 460	15,7	1 160	149	3,13	857	34,1
425*	425	163	15,3	23,0	9,2	132	104	1,41	36 970	1 740	16,7	1 440	176	3,30	1 020	36,2
450*	450	170	16,2	24,3	9,7	147	115	1,48	45 850	2 040	17,7	1 730	203	3,43	1 200	38,3
475*	475	178	17,1	25,8	10,3	163	128	1,55	56 480	2 380	18,6	2 090	235	3,50	1 400	40,4
500*	500	185	18,0	27,0	10,8	179	141	1,63	68 740	2 750	19,6	2 480	268	3,72	1 620	42,4
550*	550	200	19,0	30,0	11,9	212	165	1,80	99 180	3 610	21,6	3 490	349	4,02	2 120	46,8
600*	600	215	21,8	32,4	13,0	254	199	1,92	139 000	4 630	23,4	4 670	434	4,30	2 730	50,9

Veza postolja antene King post i sklopa nosača pos G3,pos G4 i pos G5 :

Kroz "paket " nosača I200 provlači se 8 navojnih šipki M22 za vezu sa ležišnom pločom prirubnicom postolja .

Sa navojnim šipkama i navrtkama se sa donjom prirubnicom i gornjom prirubnicom vrši pritezanje -sidrenje ankera koji okrenuti naviše prihvataju prirubnicu postolja -antene.

Na ovaj način moguće je na licu mesta izvršiti i po potrebi manju korekciju rotaciju položaja postolja i odrediti precizan pravac orijentacije antene .

Dimenzionisanje montažnih veza pos G1,G2 sa nosačima POS G3:

Usvaja se veza preko zavarene ležišne ploče za I 200 t=10mm i zavrtnjeva 4 M16 po vezi

Montažna veza nosača POS G2

Kao je uobičajena standardna dužina nosača 6m daje se rešenje montažne veze -montažni nastavak HEB 260

Nastavak rebra: Podvezice od lima 2 x# 10x170 i sa svake strane dvosečni ankeri 6 M12 klasa 8.8

Nastavak donje i gornje nožice, profila :

Izvodi se preko spoljnih podvezica (jedna po nožici) # 22x280 i 6 M20 klasa 8.8 u cik cak poretku i razmaku prema skici :

Dimenzionisanje oslonačkih ankera:

Max merodavna horizontalna smičuća komponenta na osloncu $H_x=10.39\text{kN}$

Max merodavna odogovarajuća vertikalna komponenta na osloncu $V_x= 15.93\text{KN}$

Rezultanta smičuće sile je $V_{stv}= \text{SQR}(107.95+253.76)=19.01\text{Kn}$

Usvojiće se ankeri za beton FISCHER TIP FAZ II ili bolji

Dozvoljena nosivost jednog ankera na smicanje je $V_d=15\text{Kn}$

Usvajaju se 4 ankera M16 Lsidrenja ef.= min 150mm, po svakom oslonačkom mestu.

Nosivost 4 ankera je $V_d=4 \times 15=60\text{Kn}$ > pot $V_{stv}=19.01\text{Kn}$

Ukupna količina čelika : $G=2209.80\text{kg}$

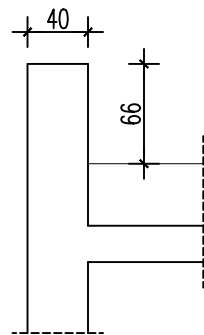
U Beogradu , 04.09.2026.g

sračunao :

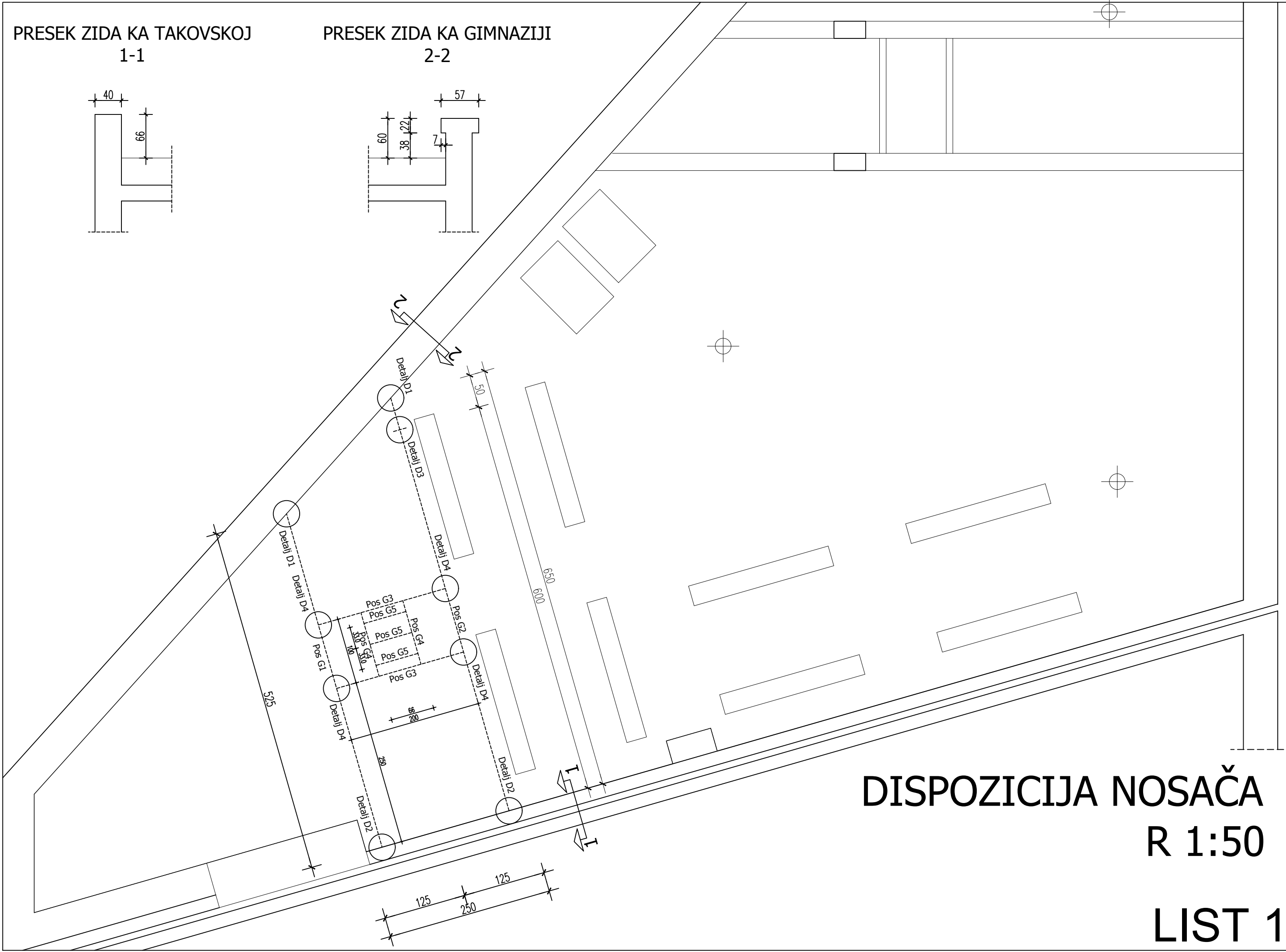
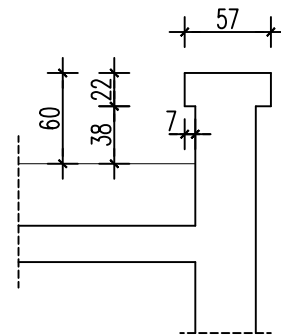
The image shows a handwritten signature in blue ink over a white background. To the right of the signature is a blue official stamp. The stamp is hexagonal with a double border. Inside the border, the text reads: "Милан М. Шакотић" (Milan M. Šakotić), "дипл. грађ. инж." (dipl. grad. inž.), and "311 4217 03". The outer border of the stamp contains the text "РЕПУБЛИКА КОМУНА СРБИЈЕ" (Republic of Serbia) at the top and "ОДГОВОРНИ ПРОЈЕКТАНТ" (Responsible Designer) at the bottom.

Milan M. Šakotić dipl.grad.inž.

PRESEK ZIDA KA TAKOVSKOJ
1-1

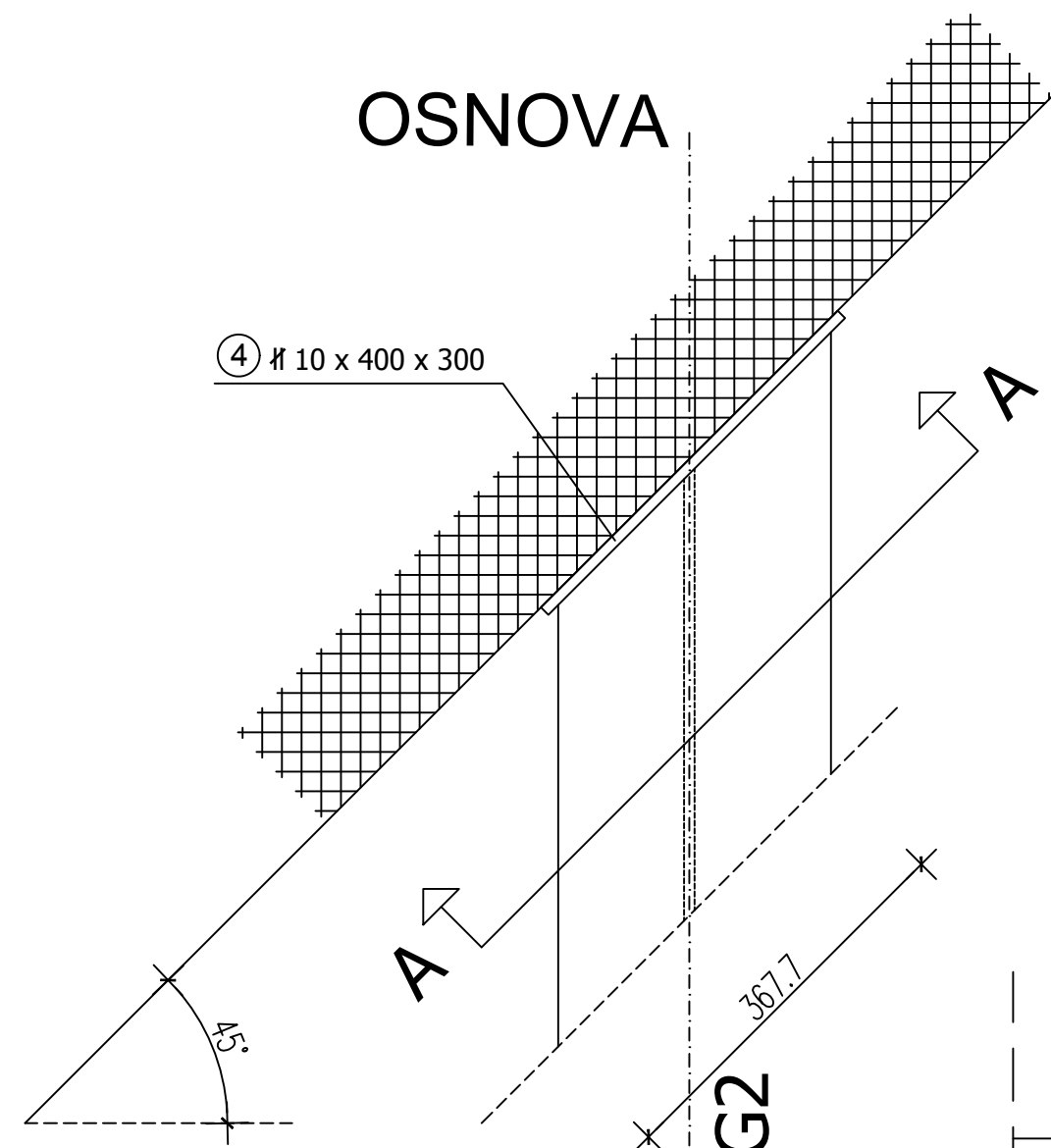


PRESEK ZIDA KA GIMNAZIJI
2-2



DISPOZICIJA NOSAČA
R 1:50

LIST 1

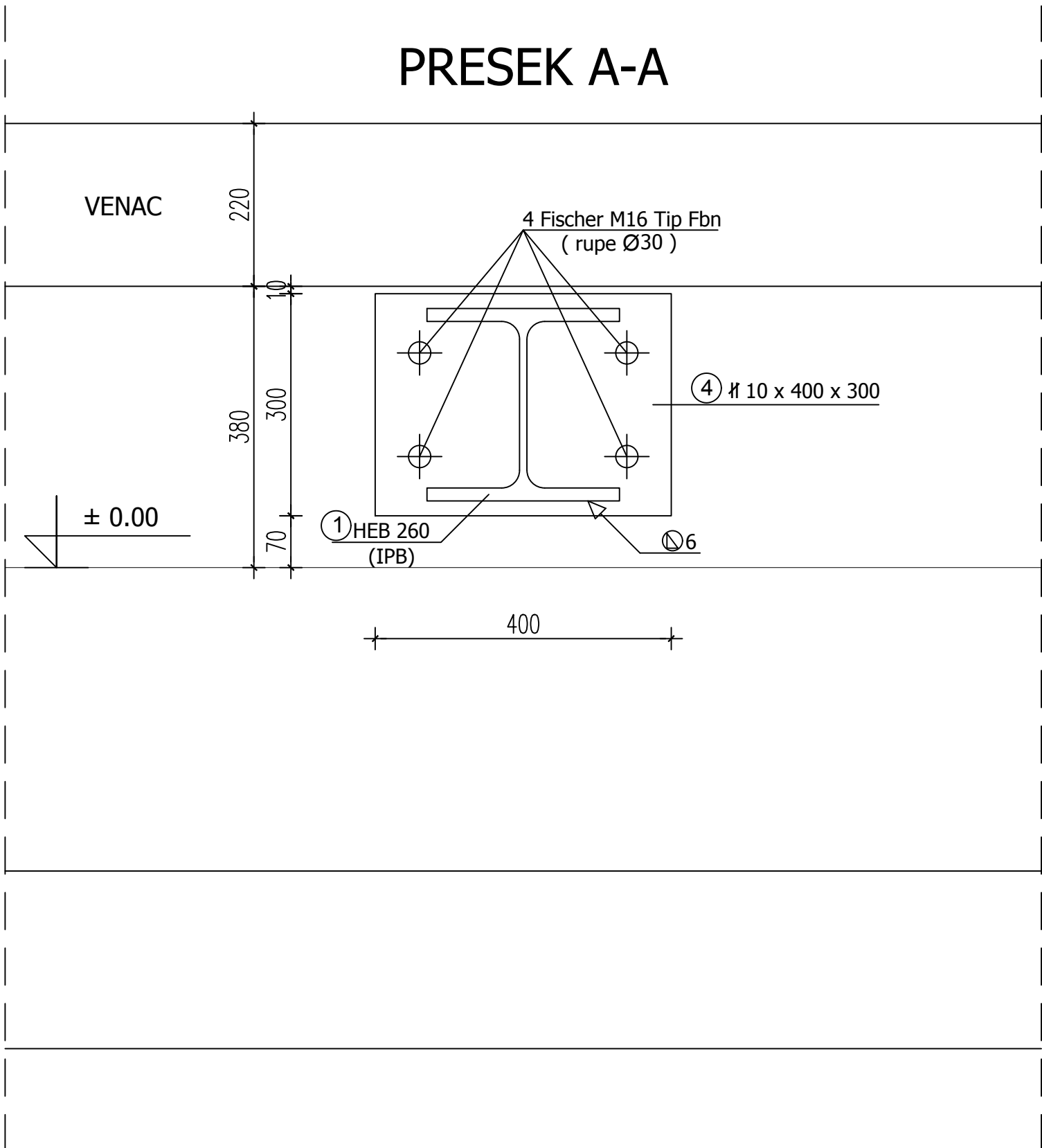


osa nosača POS G1 I G2

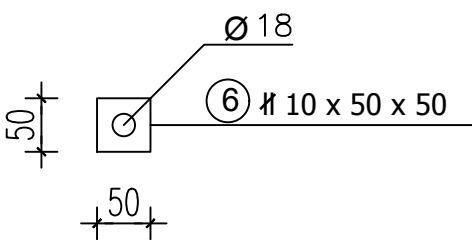
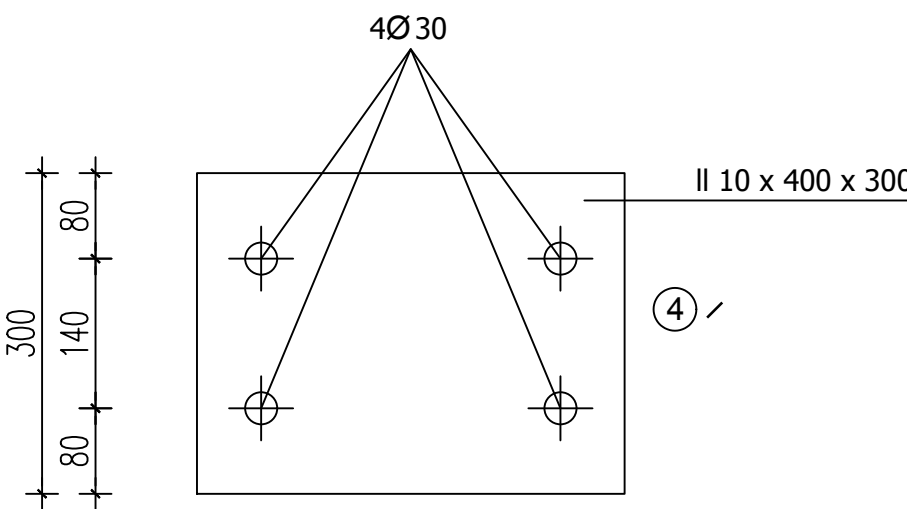
DETALJ D1 / R 1:10

DETALJ VEZE NOSAČA SA
AB KROVNIM PARAPETOM
POD UGLOM

PRESEK A-A



RASPORED RUPA



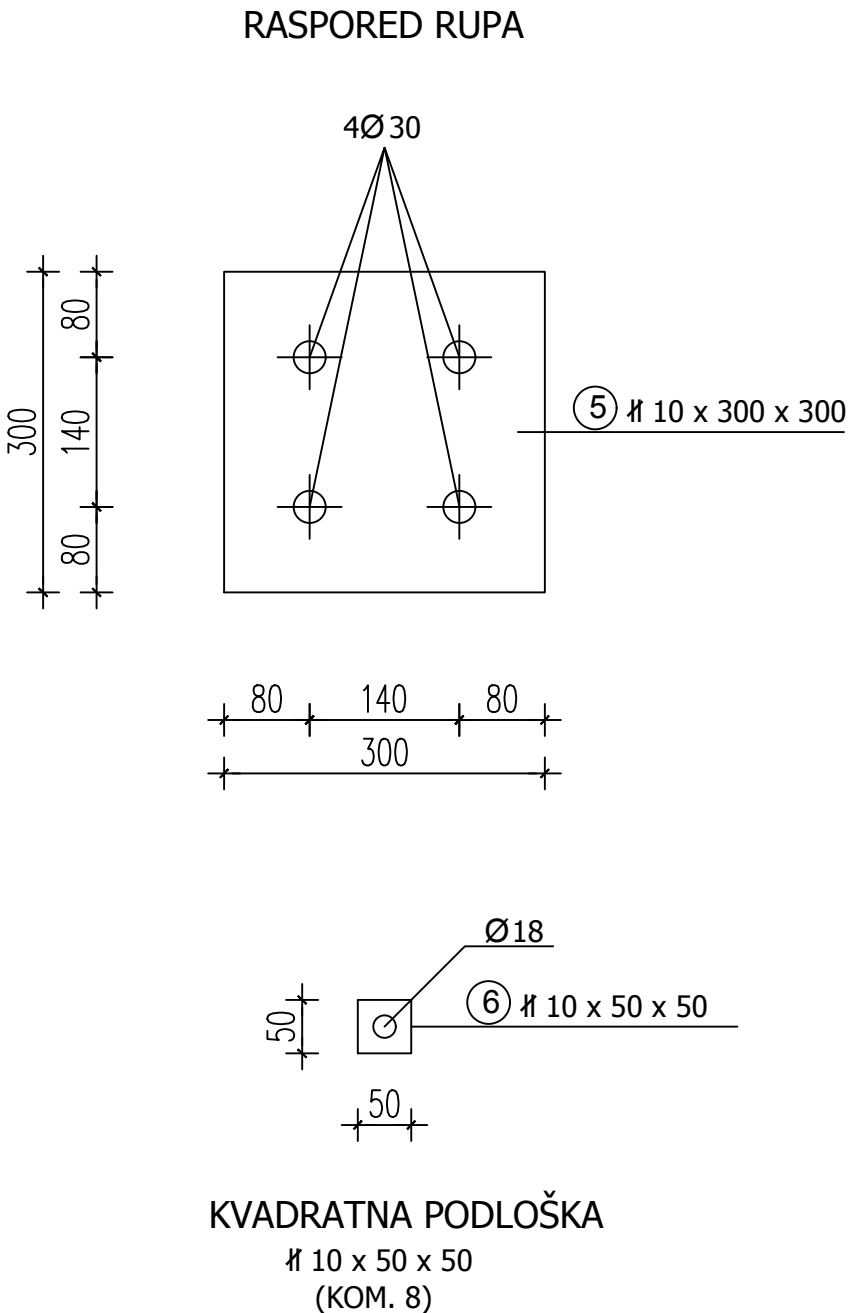
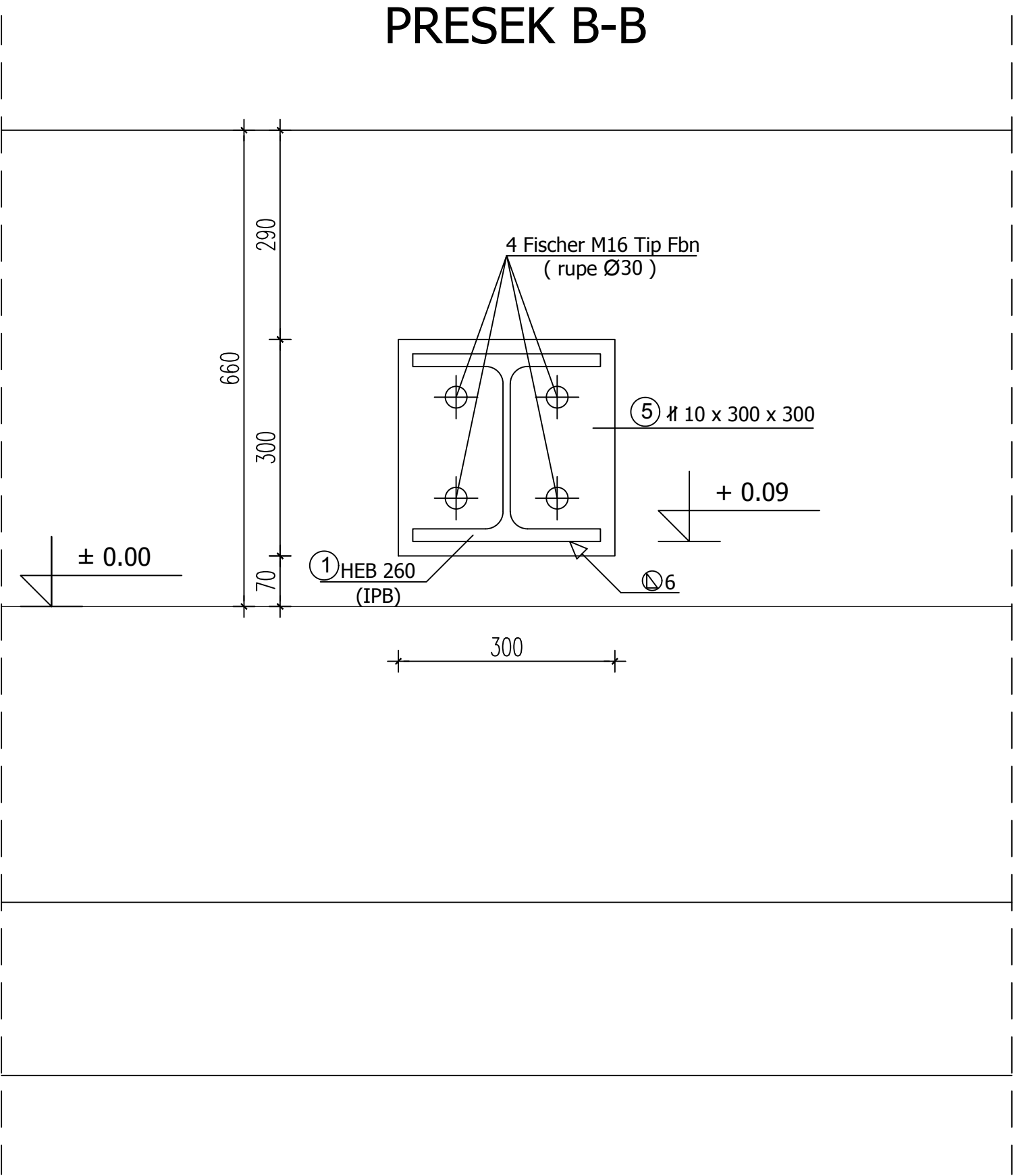
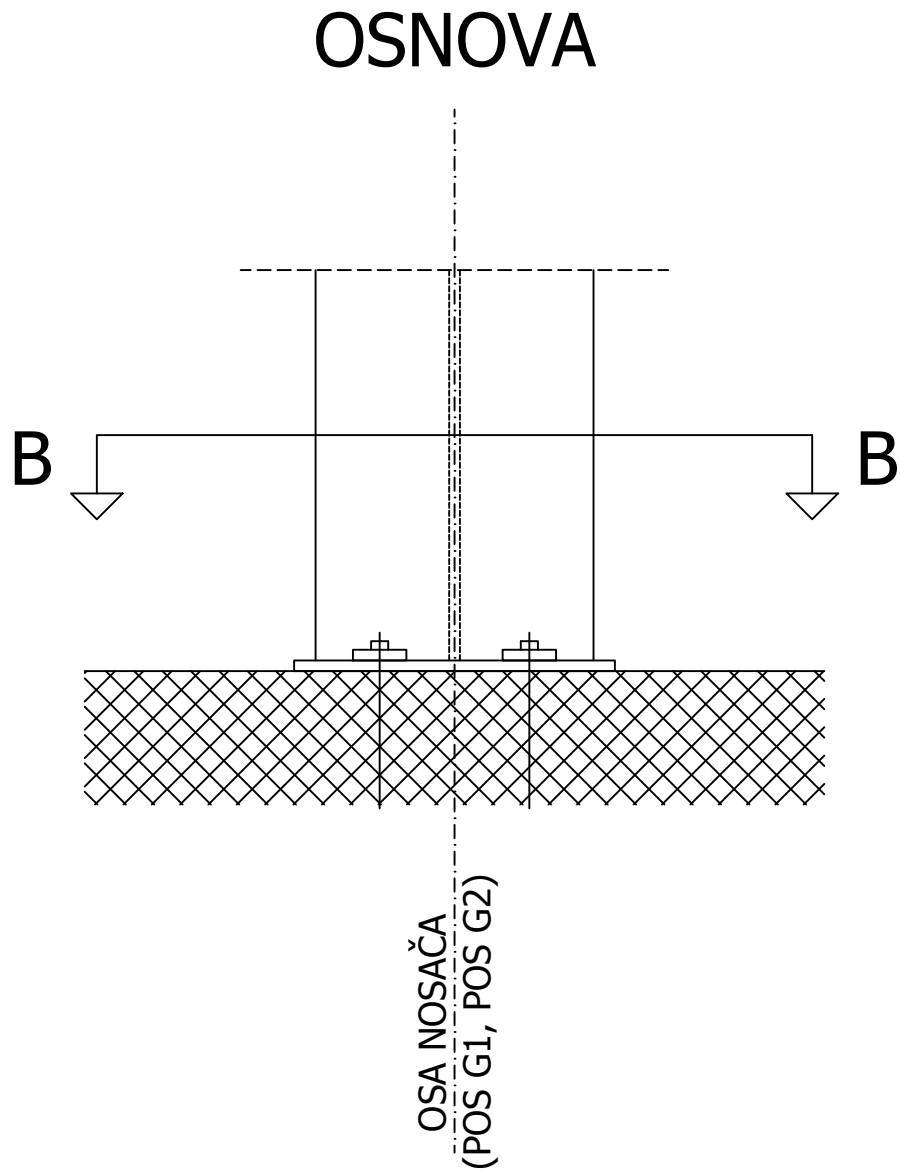
KVADRATNA PODLOŠKA

10 x 50 x 50
(KOM. 8)

* NAPOMENA:
UGAO $\alpha = 45^\circ$ PROVERITI NA KROVU PRE IZRADE!

DETALJ D2 / R 1:10

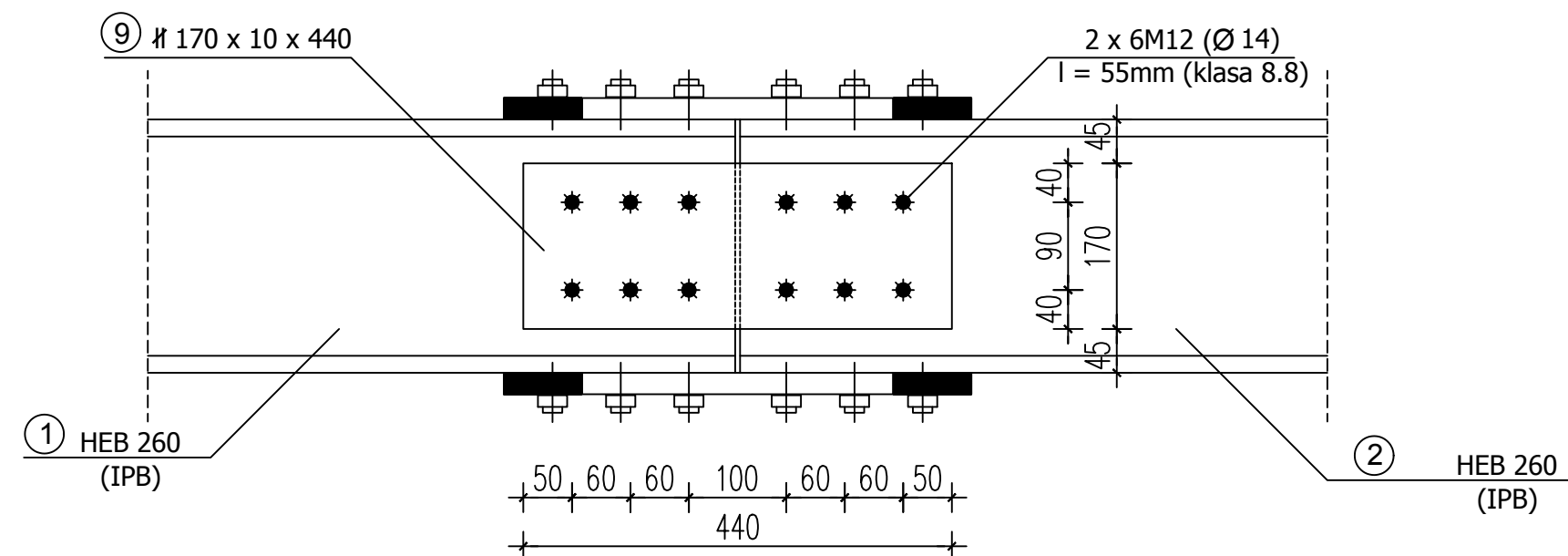
DETALJ VEZE NOSAČA SA
AB KROVNIM PARAPETOM
ORTOGONALNO



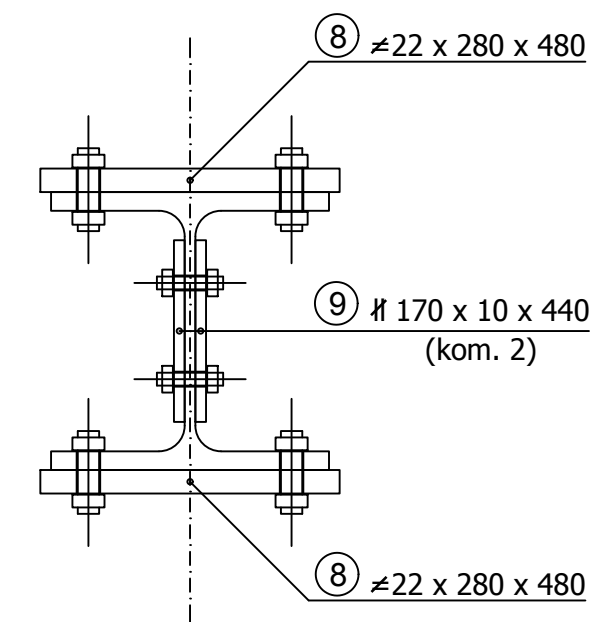
DETALJ D3 / R 1:10

DETALJ MONTAŽNOG NASTAVKA
(kom. 2)

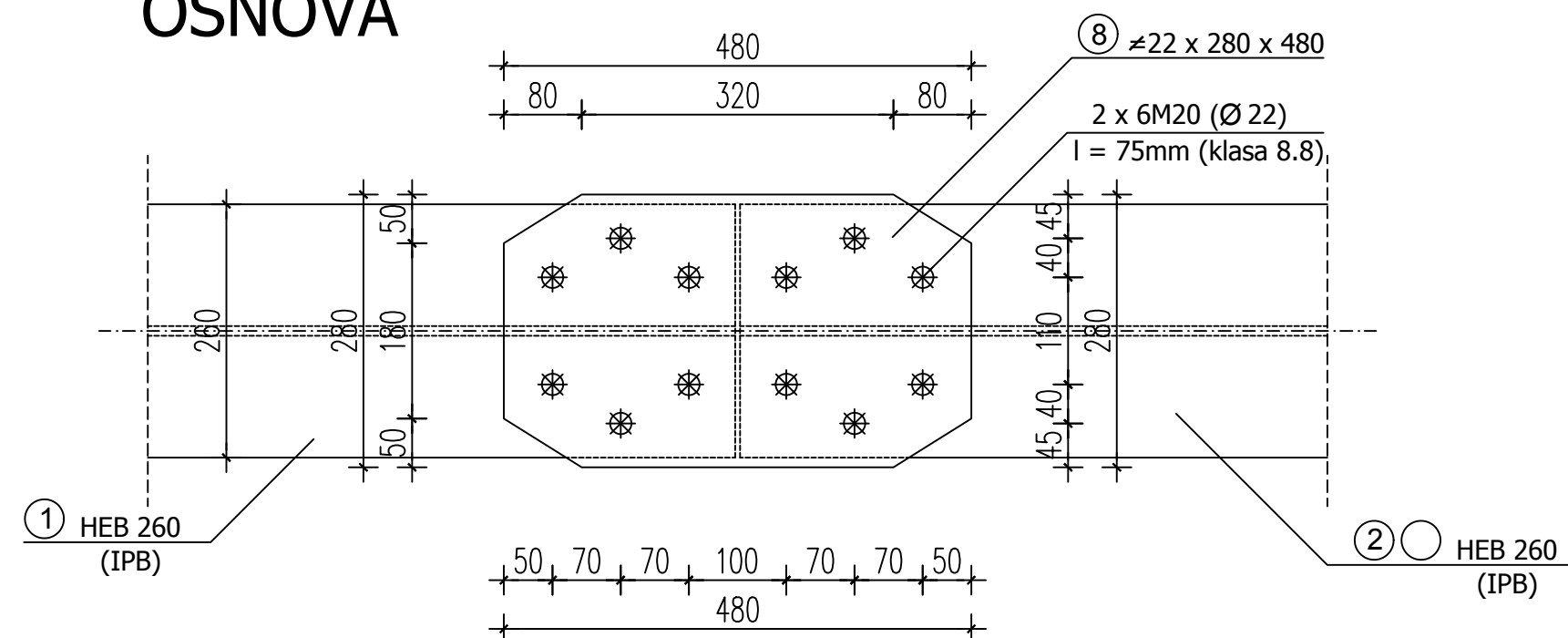
IZGLED E-E



PRESEK



OSNOVA

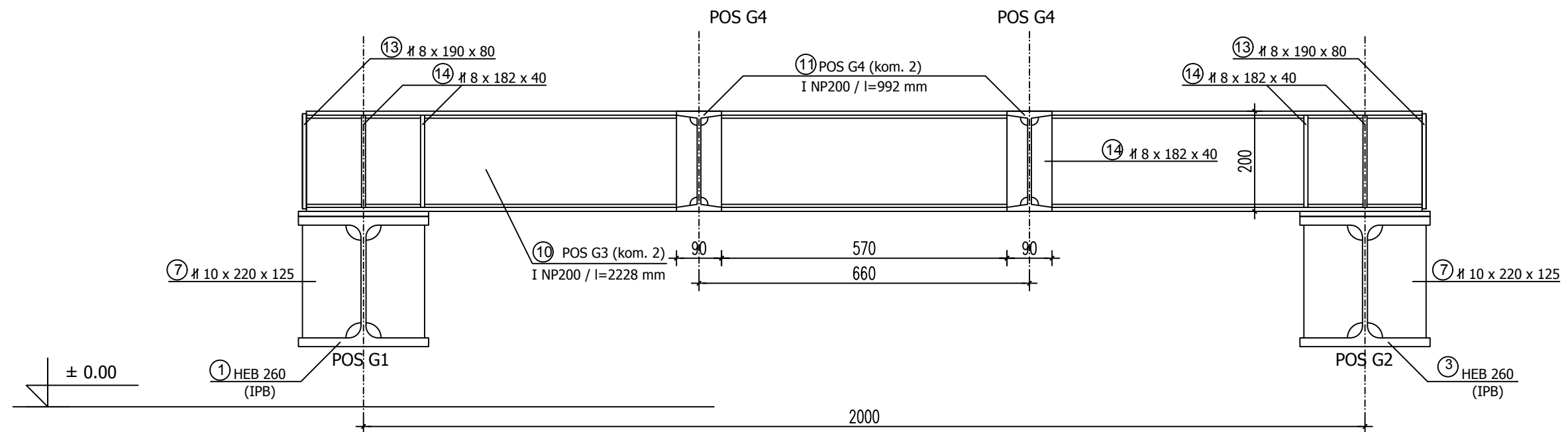


A diagram consisting of two upward-pointing arrows. A horizontal line connects the base of the left arrow to the base of the right arrow. The letter 'E' is placed to the left of the left arrow's base, and another 'E' is placed to the right of the right arrow's base.

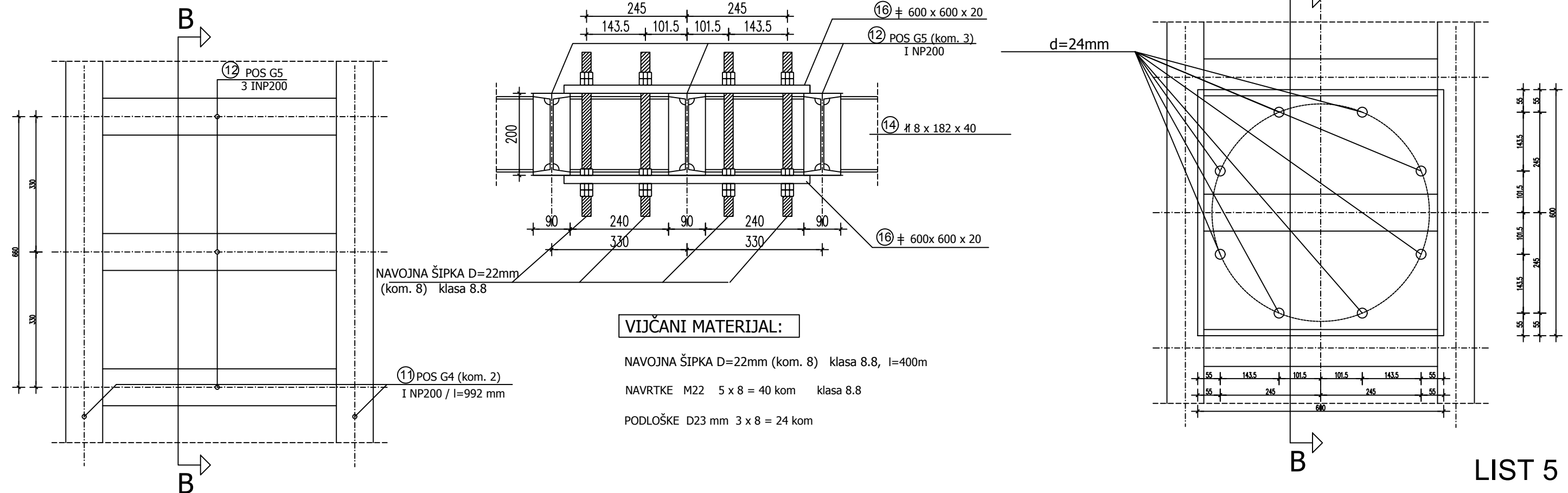
Sn 235

DETALJ D4 / R 1:10

DETALJI VEZE POZICIJA G1(G2) SA G3

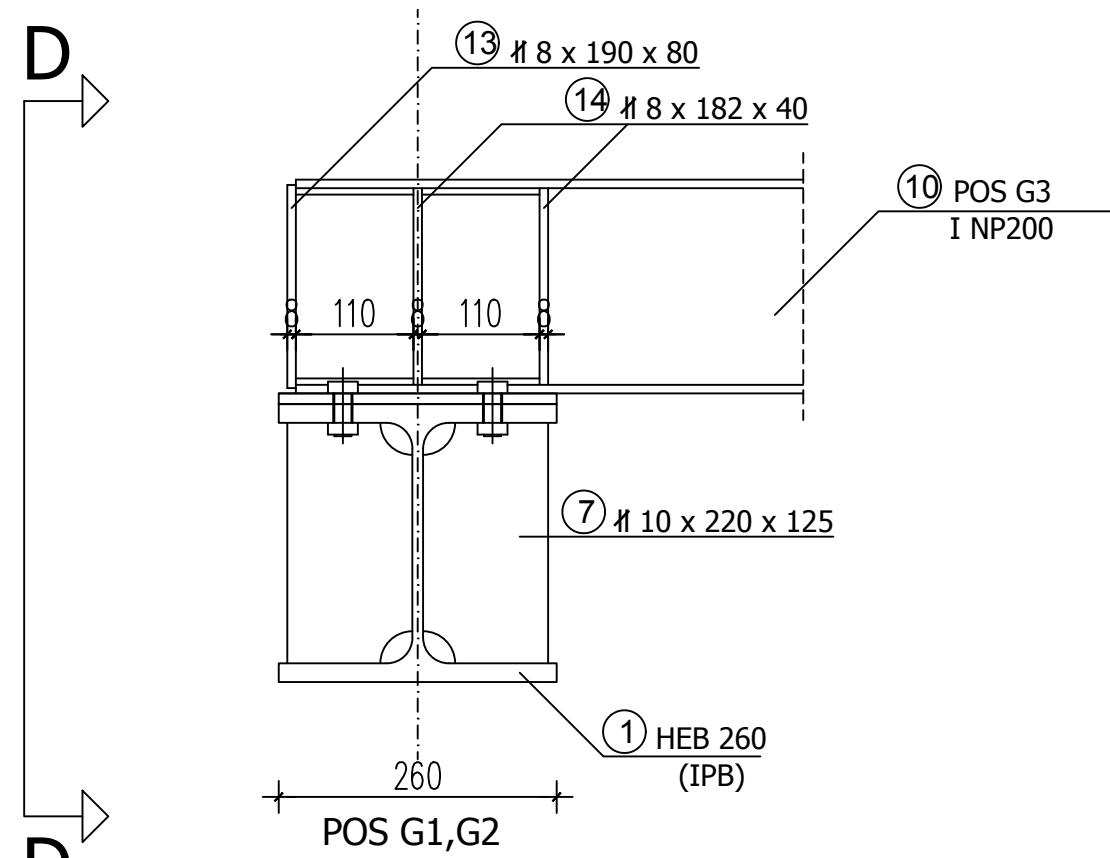


PRESEK B-B

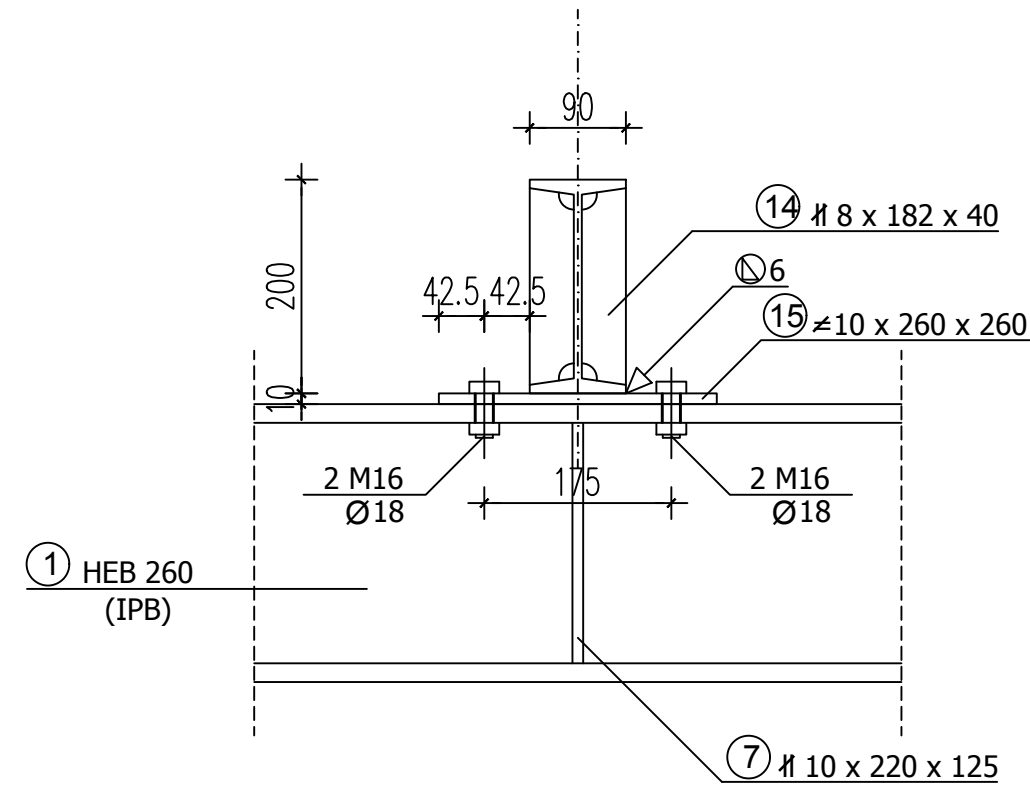


DETALJ D4 / R 1:10

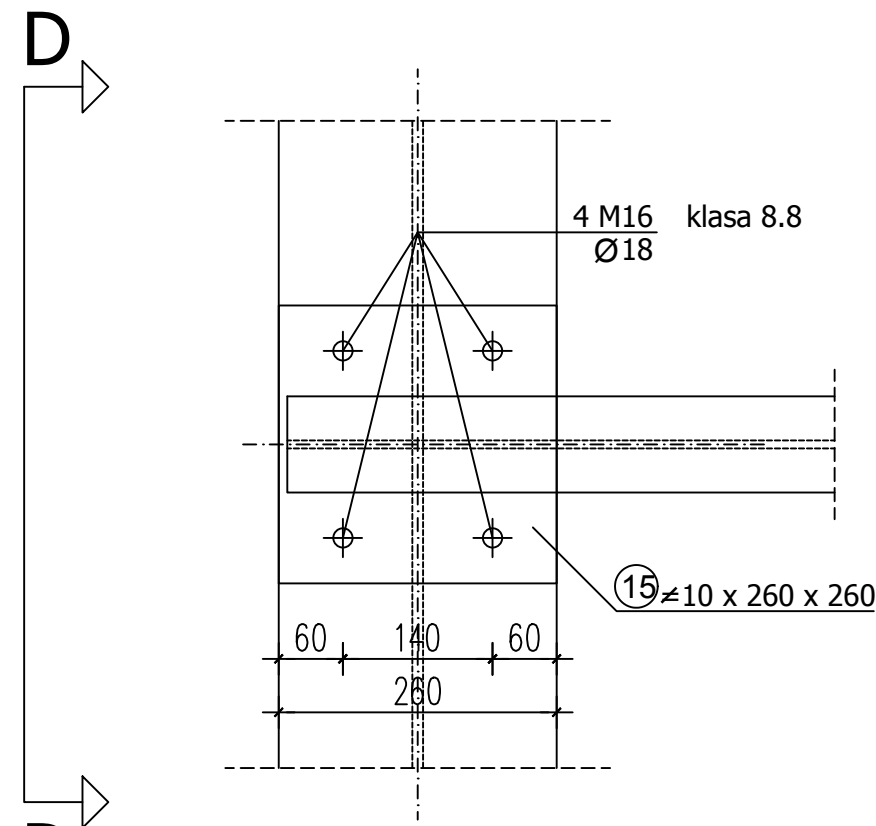
DETALJI VEZE POZICIJA G1(G2) SA G3



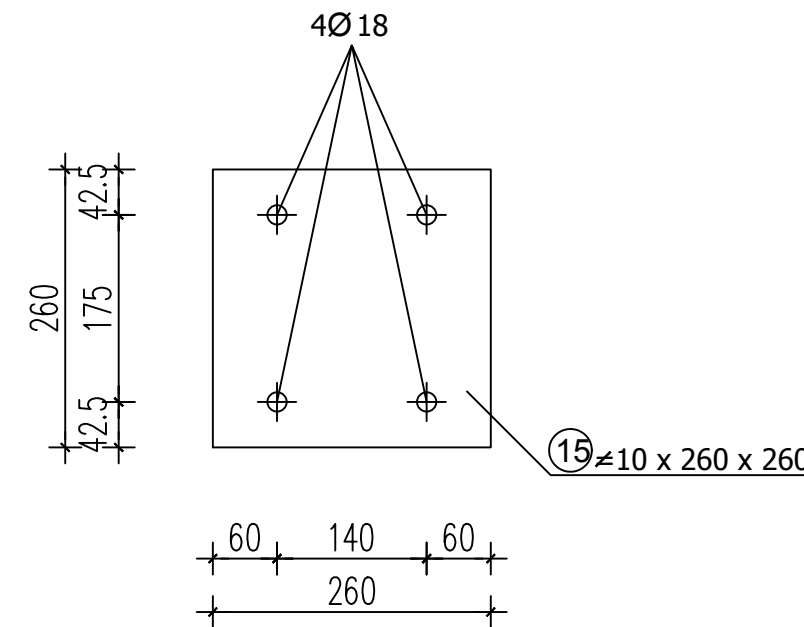
PRESEK



PRESEK D-D



OSNOVA



RASPORED RUPA

Sn 235

POSTOLJE ZA ANTENU d=3.7m
ABERDAREVA 1 RDU RTS BEOGRAD

[illegible]

sastavio: M.Šakotić

SPECIFIKACIJA VIJČANOG MATERIJALA :

1. ANKER ZAVRTNJEVI ZA RASPUCALI BETON FISCHER TIP FAZ II ili bolji
KOMPLETA 16 M16 ls ef. min 150mm
2. ZAVRTNJEVI 16 KOMPLETA M16 L=55mm KLASA 8.8
(u kompletu je zavrtanj,navrtka i dve podloške,sve od istog proizvođača)
- 4.ZAVRTNJEVI 12 KOMPLETA M12 L=55mm KLASA 8.8
(u kompletu je zavrtanj,navrtka i dve podloške,sve od istog proizvođača)
- 5.ZAVRTNJEVI 24 KOMPLETA M20 L=75mm KLASA 8.8
6. NAVOJNE ŠIPKE D=22mm L=400mm klasa 8.8 kom. 8
- 7 NAVRTKE M22 klasa 8.8 kom.5x8=40
8. PODLOŠKE za M22 D23 (Du=23mm Ds=44mm t=4mm) KOM 3x8=24

SASTAVIO:

Milan M. Šakotić dipl.građ.inž.

**ПРЕДМЕР РАДОВА ЗА ИЗРАДУ НОСАЧА ЗА ПАРАБОЛИЧНУ АНТЕНЕ ПРЕЧНИКА D=3.7M
КОЈЕ СЕ МОНТИРА ИЗНАД КРОВНЕ РАВНИ ОБЈЕКТА РТС, АБЕРДАРЕВА 1 ,БЕОГРАД :**

A ЧЕЛИЧНА КОНСТРУКЦИЈА
ОПИС ПОЗИЦИЈЕ

	j.m.	количина	материјал износ у динарима.	рад износ у динарима
1				
Набавка материјала , радионичка израда ,транспорт и монтажа челичне конструкције носача за антену у свему према датом пројекту конструкције ,опису , детаљима и спецификацијама. Израда челичне конструкције мора се извршити у свему према урађеној техничкој документацији, важећим прописима и стандардима а према дефинисаном квалитету материјала. S 235 .Све везе на конструкцији изводе се завртњевима класе 8.8 Након радионичке израде извршити пробно повезивање свих мотажних веза у радионици. Антикорозивна заштита изводи се топлим цинковањем дебљина слоја 120 микрона . Сва приспела конструкција мора се привремено слагати преко дрвених ослонаца на унапред одређено место како у кругу објекта, тако и након подизања на кров ,како се не би оштетила кровна изолација. Технологија монтаже мора обезбедити максимално остварење геометрије стиуба. Код монтаже постоља водити рачуна да се конструкција стуба одмах повеже са системом за уземљење на објекту. Завртњеви се не смеју загревати ! Јединичном ценом је обухваћена набавка основног материјала, спојна средства, рад,алати и помоћна потребна средства,за радионичку израду, пробну монтажу, антикорозивна заштита топлим цинковањем , утовар,транспорт и истовар на градилишту објекта са вертикалним подизањем на кров објекта и монтажа конструкције на лицу места бушење рупа у бетону за анкере. Ценом је обухваћено и узимање свих потребних података на				
Укупно	кг	1,740.00		

РТС, Таковска 10 Београд