

## **Installation Report met mast 150m HURUIESTI - Romania**



	<b>MET MAST INSTALATION REPORT</b>	Huruiesti 150m - Report	
		NO 1	Rev.: 01

## ELECTROCENTRALE BORZESTI SRL

Sos. Nordului no. 62D  
 floor 4, sector 1  
 postal code 021186  
 Bucharest, RO  
 CUI 398054561

## CUSTOMER

## UNION WIND SRL

Bulevardul Soseaua NORDULUI 62D  
 floor 4, sector 1  
 postal code 021186  
 Bucharest, RO  
 CUI 43539778

## METHOD

Measurements for Wind Resource Assessment according to:

ANNEX G of IEC 61400-12-1:2005. & ANNEX G of IEC 61400-2017
MEASNET "Evaluation of site-specific wind conditions. V.2

GENERAL			
PROJECT	Huruiesti 150m		
HEIGHT	150.0		
ACTIVITY	Installation	ACTIVITY DATE	29.10.2024
PERFORMED BY	Vincene Marius & Pandelescu Sergiu		
CITY	Huruiesti	COUNTRY	Romania
OFFICIAL TIME	08:30 (UTC+2)	LOGGER TIME	08:30 (UTC+3)

VERSION CONTROL			
VERSION	STARTING DATE*	PRESENT REPORT	NUMBER OF PAGES
00	29.10.2024	WM – Huruiesti 150m - No1 REV01	70

\*From now on, the data recorded by the measuring instruments are correct and can be considered

Released by: Pandelescu Sergiu: Energy engineer, report date: 02.11.2024



Approved by Matei Nicusor : Energy engineer manager



Equipment	Brand/Model	Serial number	Height (m)	Boom orientation	Input channel	Programmed slope	Programmed offset
Cup anemometer	NRG S1	94120005879	150 m	60°	CH1	0.09339	0.14091
Cup anemometer	NRG S1	94120005880	150 m	240°	CH2	0.09329	0.15011
Cup anemometer	NRG S1	94120005881	120 m	60°	CH3	0.09321	0.16236
Cup anemometer	NRG S1	94120005882	90 m	240°	CH4	0.09353	0.12762
Cup anemometer	NRG S1	94120005867	90 m	60°	CH5	0.09363	0.11632
Cup anemometer	NRG S1	94120005868	60 m	240°	CH6	0.09376	0.11125
Wind vane	200M Wind Direction Vane	1007000032897	135 m	240 °	CH13	147.39	-0.67
Wind vane	200M Wind Direction Vane	1007000032894	90 m	240 °	CH14	147.51	-2.44
Temp sensor	NRG T60 Temp	9411002092	145 m	0 °	CH16	44.6763	-40.9215
Temp sensor	NRG T60 Temp	9411002095	15 m	0 °	CH17	44.6763	-40.9215
Pyranometer sensor	LI-COR PYRA	PY112970	15 m	0 °	CH20	14.18	0

PROGRAMMED VANE OFFSETS			
Channel	Boom orientation	Wind vane. orientation on the boom	Programmed offset
CH13	240.0°	To the mast	-0.67
CH14	240.0°	To the mast	-2.44

SITE DESCRIPTION			
POSITION Latitude: 46.222573		Longitude: 27.233993	TIME ZONE:  UTC +2:00
ELEVATION	219 m		

OBSTACLES DESCRIPTION		
OBSTACLE	POSITION	DESCRIPTION
Farm road, vineyard	360°	Plain field around the mast, farm road, an old vineyard



Equipment	Brand /Model	Code	Height
Logger	SymphoniePRO Logger, SN: 820613734		15 m
Battery	Victron energy AGM 12-90		15 m
iPACK	LTE-G, SN: 943400911		15 m
Solar panel	Longi LR4-72HPH-450M -2 PIECES		15 m and 25 m
Solar controller	Victron smart solar controller MPPT 100115		15 m
Aviation light	QUASAR 24V TIP B- 4 PIECES		75 m and 150 m
Aviation light	QUASAR 24V TIP B- 6 PIECES		37.5 m and 112.5 m

### CONNECTION PLAN

Sensor	Channel	Terminal	Color	Function
Anemometer NRG S1	CH1	GND		ground (-)
		SIG		signal
		SHD		signal jamming
		EXC		line (+)
Anemometer NRG S1	CH2	GND		ground (-)
		SIG		signal
		SHD		signal jamming
		EXC		line (+)
Anemometer NRG S1	CH3	GND		ground (-)
		SIG		signal
		SHD		signal jamming
		EXC		line (+)
Anemometer NRG S1	CH4	GND		ground (-)
		SIG		signal
		SHD		signal jamming
		EXC		line (+)
Anemometer NRG S1	CH5	GND		ground (-)
		SIG		signal
		SHD		signal jamming
		EXC		line (+)
Anemometer NRG S1	CH6	GND		ground (-)
		SIG		signal
		SHD		signal jamming
		EXC		line (+)

200M Wind Direction Vane	CH13	GND		ground (-)
		SIG		signal
		SHD		signal jamming
		EXC		line (+)
200M Wind Direction Vane	CH14	GND		ground (-)
		SIG		signal
		SHD		signal jamming
		EXC		line (+)
NRG T60 Temp	CH16	GND		ground (-)
		SIG		signal
		SHD		signal jamming
		EXC		line (+)
NRG T60 Temp	CH17	GND		ground (-)
		SIG		signal
		SHD		signal jamming
		EXC		line (+)
Pyranometer	CH20	GND		null
		SIG		line
		SHD		signal jamming



## **PICTURES**



Pictures taken from anchors 1,2,3



Pictures taken from anchors 4,5,6



Pictures taken from anchors 7,8,9

Picture of the logger box outside with locks



Picture of the logger box outside with locks



Picture from Logger cabinet inside





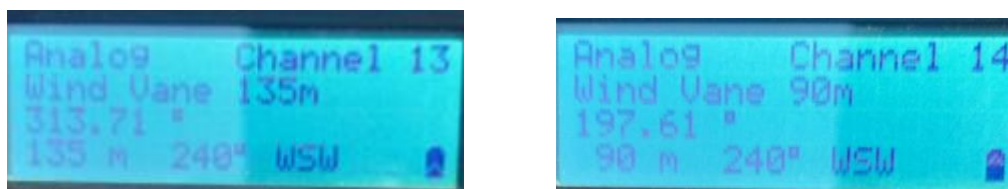
Picture from Logger cabinet at 10m level of the tower



Pictures of antenna outside the logger cabinet



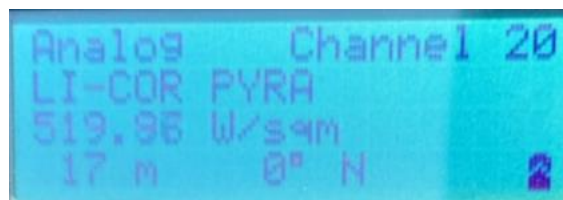
Pictures inside the logger cabinet with anemometers values



Pictures inside the logger cabinet with Wind Vanes values



Pictures inside the logger cabinet with Temperatures values



Picture inside the logger cabinet with Pyranometer value

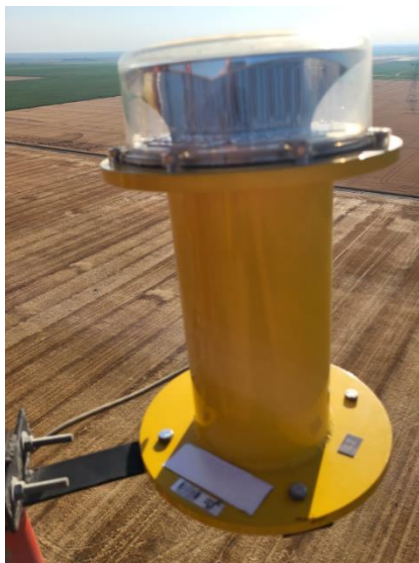


Aviation light from 150 m height





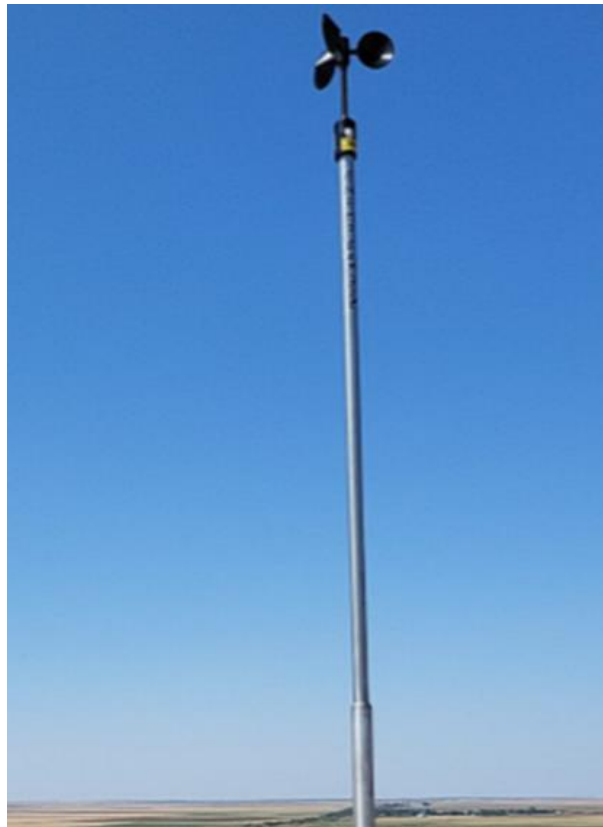
Aviation light from 112.5 m height



Aviation light from 75 m height



Aviation light from 37.5 m height



Anemometer 60 m





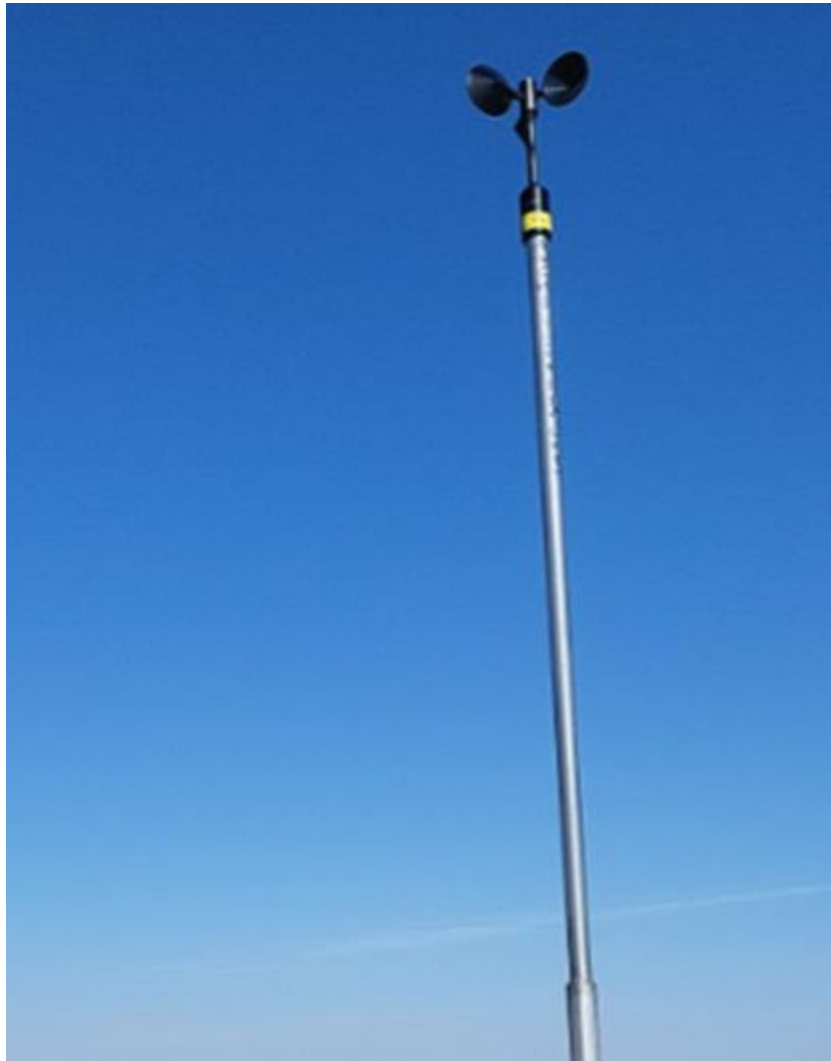
Anemometer 90 m



Anemometer 90 m



Anemometer 120 m



Anemometer 120 m



Anemometer 150 m



Anemometer 150 m





Wind vane 90 m



Wind vane 135 m



Temperature 145 m



Temperature 15 m





Bird spikes system



Marked screws on the windmast





Anchor bolts marked



Bottom view of the windmast

# Svend Ole Hansen ApS

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WIND  
ENGINEERING  
FLUID  
DYNAMICS

## CERTIFICATE OF CALIBRATION

### Calibrated item

Type	NRG S1
Serial No.	94120005879
Manufacturer	NRG Systems, Inc., Riggs Road 110, 05461 Hinesburg VT USA
Item received	July 10, 2024
Remarks	-

### Calibration

Calibration institute	Svend Ole Hansen ApS, Sct. Jørgens Allé 5C, DK-1615 København V
Procedure	IEC 61400-12-1:2022, Annex F
Client	Electrocentrale Borzesti SRL, Sos. Nordului no. 62D, floor 6, 014104 Bucharest, RO
Calibrated by	Operator, ca 
Date of calibration	July 10, 2024
Approved by	Calibration engineer, sfo 
Post calibration	No
Re-calibration due	-

### Certificate

Certificate No.	24.02.16112
Date of issue	July 11, 2024
Issued by	ca
Number of pages	4

### Accreditation

Accredited to ISO 17025:2017 by DANAK. DANAK is signatory to the European co-operation for Accreditation (EA) Multilateral Agreement and to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement.

The calibration institute is approved by MEASNET and IECRE.



  
CAL Reg.nr. 452





### Calibration conditions

Turbulence intensity	< 2 % (alongwind)
Air temperature	31.2 °C (average value)
Barometric pressure	1012.8 hPa (average value)
Relative humidity	38.6 % (average value)
Air density	1.15 kg/m <sup>3</sup> (average value)
Flow inclination	< 0.2°
Anemometer yaw orientation	(Not relevant)
Remarks	(none)

### Calibration results

Calibration equation  $v \text{ [m/s]} = 0.09339 \cdot f \text{ [Hz]} + 0.14091$

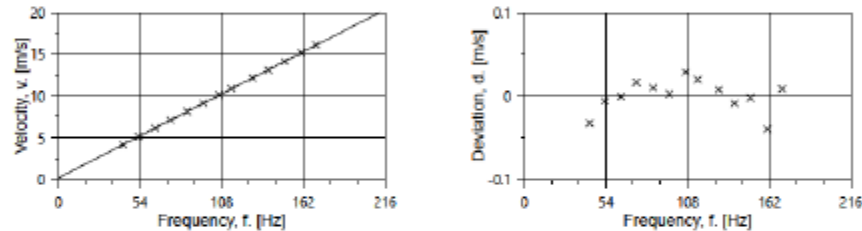
The calibration equation is obtained from a linear regression of the reference air velocity upon the Device Under Test (DUT) output. The residual is the deviation of the calibration equation prediction from the reference air velocity.

The calibration results relate only to the calibrated item.

Succession #	Velocity pressure [Pa]	Air temperature [°C]	Air density [kg/m <sup>3</sup> ]	Ref. air velocity, $v$ [m/s]	Uncertainty $U (k = 2)$ [m/s]	DUT output Frequency, $f$ [Hz]	Residual, $d$ [m/s]
1-first	9.84	30.7	1.15	4.130	0.029	43.0661	-0.033
13-last	14.98	31.1	1.15	5.099	0.032	53.1615	-0.007
2	21.64	30.7	1.15	6.124	0.037	64.0752	-0.001
12	28.92	31.3	1.15	7.087	0.041	74.2005	0.016
3	37.97	30.7	1.15	8.113	0.046	85.2572	0.010
11	47.68	31.4	1.15	9.103	0.051	95.9404	0.002
4	59.03	30.7	1.15	10.117	0.057	106.5149	0.028
10	67.84	31.6	1.15	10.862	0.060	114.5880	0.019
5	85.01	30.9	1.15	12.145	0.067	128.4479	0.008
9	98.87	31.8	1.15	13.117	0.072	139.0377	-0.009
6	114.69	31.1	1.15	14.113	0.077	149.6241	-0.002
8	131.46	31.8	1.15	15.126	0.082	160.8774	-0.040
7	148.63	31.5	1.15	16.076	0.087	170.5367	0.008



### Visual presentation of calibration results



### Linear regression results

Method	Least squares linear regression
Slope	0.09339 (m/s)/Hz
Offset	0.14091 m/s
Coefficient of correlation	$\rho = 0.999988$
Standard error of estimate	0.0201 m/s
Slope standard error	0.00014 (m/s)/Hz
Offset standard error	0.01589 m/s
Slope and offset covariance	-0.000002076 (m/s) <sup>2</sup> /Hz
Remarks	Linearity complies with IEC 61400-12-1:2017, Annex F.

### Uncertainties

The uncertainties stated under *Calibration results* relate to the reference air velocity at each calibration point. The reported, expanded uncertainty is stated as the total combined standard uncertainty  $u_c$  multiplied by a coverage factor of  $k = 2$ , such that the coverage probability corresponds to approximately 95 %, in accordance with EA-4/02. The uncertainty complies with the requirements in IEC 61400-12-1:2017, Annex F. The uncertainty due to the wind tunnel correction function has been documented to be 0.1 % ( $k = 2$ ).

The slope and offset uncertainties and their covariance stated under *Linear regression results* are related to the linear regression only, and do not relate to the reference air velocity uncertainties. The slope and offset uncertainties have  $\nu = 11$  degrees of freedom.





### Calibration wind tunnel

ID	DK1
Test section	Octagonal, h <sub>xw</sub> = 1.20x1.75 m
Effective area of test section	2.10 m <sup>2</sup>
Setup report	SOH document No. 18.1.001
Blockage ratio*	~0.9 % (Anemometer and mounting pole)

\* The effect of blockage is taken into account in the calibration results.

### Equipment used

Function	ID	Model / comments	Re-calibration due
QC Anemometer	94120000038	94120000038	-
Mounting	-	Mounting tube, diameter = 25 mm	-
Tunnel Temperature	T2	PT100 Temperature sensor	2026-03-25
Differential Pressure	9904031	PPC500 Pressure manometer	2026-03-18
Relative Humidity	X4650038	HMW71U Humidity transmitter	2026-04-12
Barometric Pressure	X4350042	PTB100A Analogue barometer	2026-03-26
Pitot tube	A37AB	Ellipsoidal tip pitot tube	2027-02-22
Data acquisition	1A841F0	Computer Board: ME-REDLAB 1608GX.	-
Computer	-	PC dedicated to data acquisition	-

Calibrations of the relevant equipment are carried out by external accredited institutions, and are traceable to national standards. A real-time analysis module within the data acquisition software detects pulse frequency.

### Setup photo

The shown anemometer is of the same type as the one calibrated.



End of certificate

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## CERTIFICATE OF CALIBRATION

### Calibrated item

Type	NRG S1
Serial No.	94120005880
Manufacturer	NRG Systems, Inc., Riggs Road 110, 05461 Hinesburg VT USA
Item received	July 10, 2024
Remarks	-

### Calibration

Calibration institute	Svend Ole Hansen ApS, Sct. Jørgens Allé 5C, DK-1615 København V
Procedure	IEC 61400-12-1:2022, Annex F
Client	Electrocentrale Borzesti SRL, Sos. Nordului no. 62D, floor 6, 014104 Bucharest, RO
Calibrated by	Operator, ca 
Date of calibration	July 10, 2024
Approved by	Calibration engineer, sfo 
Post calibration	No
Re-calibration due	-

### Certificate

Certificate No.	24.02.16113
Date of issue	July 11, 2024
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Number of pages	4

### Accreditation

Accredited to ISO 17025:2017 by DANAK. DANAK is signatory to the European co-operation for Accreditation (EA) Multilateral Agreement and to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement.

The calibration institute is approved by MEASNET and IECRE.





### Calibration conditions

Turbulence intensity	< 2 % (alongwind)
Air temperature	31.3 °C (average value)
Barometric pressure	1013.0 hPa (average value)
Relative humidity	38.4 % (average value)
Air density	1.15 kg/m <sup>3</sup> (average value)
Flow inclination	< 0.2°
Anemometer yaw orientation	(Not relevant)
Remarks	(none)

### Calibration results

Calibration equation  $v \text{ [m/s]} = 0.09329 \cdot f \text{ [Hz]} + 0.15011$

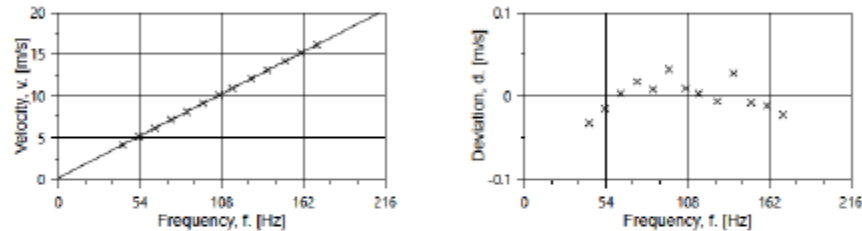
The calibration equation is obtained from a linear regression of the reference air velocity upon the Device Under Test (DUT) output. The residual is the deviation of the calibration equation prediction from the reference air velocity.

The calibration results relate only to the calibrated item.

Succession #	Velocity pressure [Pa]	Air temperature [°C]	Air density [kg/m <sup>3</sup> ]	Ref. air velocity, $v$ [m/s]	Uncertainty $U (k=2)$ [m/s]	DUT output Frequency, $f$ [Hz]	Residual, $d$ [m/s]
1-first	9.74	30.8	1.15	4.109	0.029	42.7881	-0.033
13-last	15.03	31.2	1.15	5.109	0.032	53.3183	-0.015
2	21.49	30.8	1.15	6.104	0.037	63.7920	0.003
12	29.31	31.4	1.15	7.136	0.042	74.7026	0.017
3	37.80	30.7	1.15	8.095	0.046	85.0766	0.008
11	47.73	31.5	1.15	9.108	0.051	95.6864	0.032
4	58.90	30.8	1.15	10.106	0.056	106.6302	0.009
10	68.19	31.7	1.15	10.891	0.060	115.1126	0.003
5	83.70	31.0	1.15	12.051	0.066	127.6407	-0.007
9	98.48	31.9	1.15	13.092	0.072	138.4461	0.027
6	115.14	31.2	1.15	14.141	0.077	150.0569	-0.008
8	131.21	31.9	1.15	15.112	0.082	160.5147	-0.012
7	148.88	31.6	1.15	16.091	0.087	171.1136	-0.023



### Visual presentation of calibration results



### Linear regression results

Method	Least squares linear regression
Slope	0.09329 (m/s)/Hz
Offset	0.15011 m/s
Coefficient of correlation	$\rho = 0.999988$
Standard error of estimate	0.0196 m/s
Slope standard error	0.00014 (m/s)/Hz
Offset standard error	0.01544 m/s
Slope and offset covariance	-0.000001962 (m/s) <sup>2</sup> /Hz
Remarks	Linearity complies with IEC 61400-12-1:2017, Annex F.

### Uncertainties

The uncertainties stated under *Calibration results* relate to the reference air velocity at each calibration point. The reported, expanded uncertainty is stated as the total combined standard uncertainty  $u_c$  multiplied by a coverage factor of  $k = 2$ , such that the coverage probability corresponds to approximately 95 %, in accordance with EA-4/02. The uncertainty complies with the requirements in IEC 61400-12-1:2017, Annex F. The uncertainty due to the wind tunnel correction function has been documented to be 0.1 % ( $k = 2$ ).

The slope and offset uncertainties and their covariance stated under *Linear regression results* are related to the linear regression only, and do not relate to the reference air velocity uncertainties. The slope and offset uncertainties have  $\nu = 11$  degrees of freedom.



### Calibration wind tunnel

ID	DK1
Test section	Octagonal, h <sub>tw</sub> = 1.20x1.75 m
Effective area of test section	2.10 m <sup>2</sup>
Setup report	SOH document No. 18.1.001
Blockage ratio*	~0.9 % (Anemometer and mounting pole)

\* The effect of blockage is taken into account in the calibration results.

### Equipment used

Function	ID	Model / comments	Re-calibration due
QC Anemometer	9412000038	9412000038	-
Mounting	-	Mounting tube, diameter = 25 mm	-
Tunnel Temperature	T2	PT100 Temperature sensor	2026-03-25
Differential Pressure	9904031	PPC500 Pressure manometer	2026-03-18
Relative Humidity	X4650038	HMW71U Humidity transmitter	2026-04-12
Barometric Pressure	X4350042	PTB100A Analogue barometer	2026-03-26
Pitot tube	A37AB	Ellipsoidal tip pitot tube	2027-02-22
Data acquisition	1A841F0	Computer Board: ME-REDLAB 1608GX.	-
Computer	-	PC dedicated to data acquisition	-

Calibrations of the relevant equipment are carried out by external accredited institutions, and are traceable to national standards. A real-time analysis module within the data acquisition software detects pulse frequency.

### Setup photo

The shown anemometer is of the same type as the one calibrated.



End of certificate



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WIND  
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## CERTIFICATE OF CALIBRATION

### Calibrated item

Type	NRG S1
Serial No.	94120005881
Manufacturer	NRG Systems, Inc., Riggs Road 110, 05461 Hinesburg VT USA
Item received	July 10, 2024
Remarks	-

### Calibration

Calibration institute	Svend Ole Hansen ApS, Sct. Jørgensen Allé 5C, DK-1615 København V
Procedure	IEC 61400-12-1:2022, Annex F
Client	Electrocentrale Borzesti SRL, Sos. Nordului no. 62D, floor 6, 014104 Bucharest, RO
Calibrated by	Operator, ca 
Date of calibration	July 10, 2024
Approved by	Calibration engineer, sfo 
Post calibration	No
Re-calibration due	-

### Certificate

Certificate No.	24.02.16114
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Number of pages	4

### Accreditation

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The calibration institute is approved by MEASNET and IECRE.





### Calibration conditions

Turbulence intensity	< 2 % (alongwind)
Air temperature	31.3 °C (average value)
Barometric pressure	1013.0 hPa (average value)
Relative humidity	38.3 % (average value)
Air density	1.15 kg/m <sup>3</sup> (average value)
Flow inclination	< 0.2°
Anemometer yaw orientation	(Not relevant)
Remarks	(none)

### Calibration results

Calibration equation  $v \text{ [m/s]} = 0.09321 \cdot f \text{ [Hz]} + 0.16236$

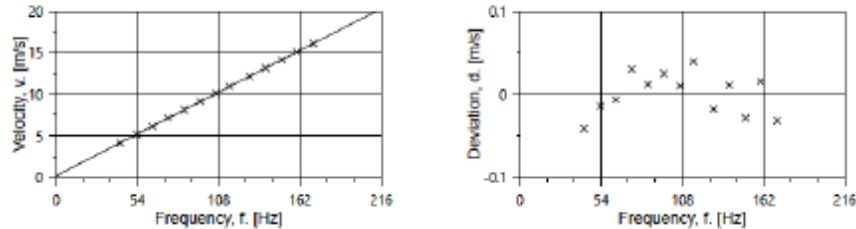
The calibration equation is obtained from a linear regression of the reference air velocity upon the Device Under Test (DUT) output. The residual is the deviation of the calibration equation prediction from the reference air velocity.

The calibration results relate only to the calibrated item.

Succession #	Velocity pressure [Pa]	Air temperature [°C]	Air density [kg/m <sup>3</sup> ]	Ref. air velocity, $v$ [m/s]	Uncertainty $U (k = 2)$ [m/s]	DUT output Frequency, $f$ [Hz]	Residual, $d$ [m/s]
1-first	9.66	30.9	1.15	4.094	0.029	42.6266	-0.041
13-last	15.26	31.2	1.15	5.147	0.032	53.6380	-0.015
2	21.56	30.9	1.15	6.115	0.037	63.9356	-0.007
12	29.27	31.3	1.15	7.131	0.042	74.4364	0.030
3	37.91	30.9	1.15	8.109	0.046	85.1315	0.011
11	47.78	31.5	1.15	9.113	0.051	95.7599	0.025
4	58.73	30.9	1.15	10.093	0.056	106.4441	0.010
10	68.75	31.7	1.15	10.934	0.061	115.1500	0.039
5	84.77	31.1	1.15	12.129	0.067	128.5856	-0.018
9	99.48	31.8	1.15	13.156	0.072	139.2984	0.010
6	114.80	31.3	1.15	14.122	0.077	150.0775	-0.029
8	130.77	31.8	1.15	15.086	0.082	159.9440	0.015
7	148.51	31.7	1.15	16.072	0.087	171.0295	-0.032



### Visual presentation of calibration results



### Linear regression results

Method	Least squares linear regression
Slope	0.09321 (m/s)/Hz
Offset	0.16236 m/s
Coefficient of correlation	$\rho = 0.999979$
Standard error of estimate	0.0265 m/s
Slope standard error	0.00018 (m/s)/Hz
Offset standard error	0.02094 m/s
Slope and offset covariance	-0.000003604 (m/s) <sup>2</sup> /Hz
Remarks	Linearity complies with IEC 61400-12-1:2017, Annex F.

### Uncertainties

The uncertainties stated under *Calibration results* relate to the reference air velocity at each calibration point. The reported, expanded uncertainty is stated as the total combined standard uncertainty  $u_c$  multiplied by a coverage factor of  $k = 2$ , such that the coverage probability corresponds to approximately 95 %, in accordance with EA-4/02. The uncertainty complies with the requirements in IEC 61400-12-1:2017, Annex F. The uncertainty due to the wind tunnel correction function has been documented to be 0.1 % ( $k = 2$ ).

The slope and offset uncertainties and their covariance stated under *Linear regression results* are related to the linear regression only, and do not relate to the reference air velocity uncertainties. The slope and offset uncertainties have  $\nu = 11$  degrees of freedom.



### Calibration wind tunnel

ID	DK1
Test section	Octagonal, h <sub>tw</sub> = 1.20x1.75 m
Effective area of test section	2.10 m <sup>2</sup>
Setup report	SOH document No. 18.1.001
Blockage ratio*	~0.9 % (Anemometer and mounting pole)

\* The effect of blockage is taken into account in the calibration results.

### Equipment used

Function	ID	Model / comments	Re-calibration due
QC Anemometer	94120000038	94120000038	-
Mounting	-	Mounting tube, diameter = 25 mm	-
Tunnel Temperature	T2	PT100 Temperature sensor	2026-03-25
Differential Pressure	9904031	PPC500 Pressure manometer	2026-03-18
Relative Humidity	X4650038	HMW71U Humidity transmitter	2026-04-12
Barometric Pressure	X4350042	PTB100A Analogue barometer	2026-03-26
Pitot tube	A37AB	Ellipsoidal tip pitot tube	2027-02-22
Data acquisition	1A841F0	Computer Board: ME-REDLAB 1608GX.	-
Computer	-	PC dedicated to data acquisition	-

Calibrations of the relevant equipment are carried out by external accredited institutions, and are traceable to national standards. A real-time analysis module within the data acquisition software detects pulse frequency.

### Setup photo

The shown anemometer is of the same type as the one calibrated.



End of certificate

# Svend Ole Hansen ApS

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WIND  
ENGINEERING  
FLUID  
DYNAMICS

## CERTIFICATE OF CALIBRATION

### Calibrated item

Type	NRG S1
Serial No.	94120005882
Manufacturer	NRG Systems, Inc., Riggs Road 110, 05461 Hinesburg VT USA
Item received	July 10, 2024
Remarks	-

### Calibration

Calibration institute	Svend Ole Hansen ApS, Sct. Jørgensen Allé 5C, DK-1615 København V
Procedure	IEC 61400-12-1:2022, Annex F
Client	Electrocentrale Borzesti SRL, Sos. Nordului no. 62D, floor 6, 014104 Bucharest, RO
Calibrated by	Operator, ca 
Date of calibration	July 10, 2024
Approved by	Calibration engineer, sfo 
Post calibration	No
Re-calibration due	-

### Certificate

Certificate No.	24.02.16109
Date of issue	July 11, 2024
Issued by	ca
Number of pages	4

### Accreditation

Accredited to ISO 17025:2017 by DANAK. DANAK is signatory to the European co-operation for Accreditation (EA) Multilateral Agreement and to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement.

The calibration institute is approved by MEASNET and IECRE.







### Calibration conditions

Turbulence intensity	< 2 % (alongwind)
Air temperature	30.9 °C (average value)
Barometric pressure	1012.5 hPa (average value)
Relative humidity	39.0 % (average value)
Air density	1.15 kg/m <sup>3</sup> (average value)
Flow inclination	< 0.2°
Anemometer yaw orientation	(Not relevant)
Remarks	(none)

### Calibration results

Calibration equation  $v \text{ [m/s]} = 0.09353 \cdot f \text{ [Hz]} + 0.12762$

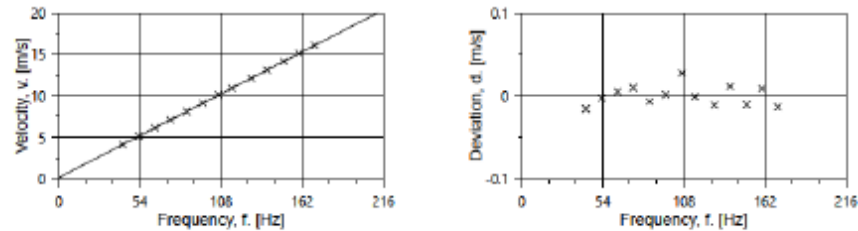
The calibration equation is obtained from a linear regression of the reference air velocity upon the Device Under Test (DUT) output. The residual is the deviation of the calibration equation prediction from the reference air velocity.

The calibration results relate only to the calibrated item.

Succession #	Velocity pressure [Pa]	Air temperature [°C]	Air density [kg/m <sup>3</sup> ]	Ref. air velocity, $v$ [m/s]	Uncertainty $U (k = 2)$ [m/s]	DUT output Frequency, $f$ [Hz]	Residual, $d$ [m/s]
1-first	9.73	30.4	1.15	4.105	0.029	42.6949	-0.016
13-last	15.08	30.8	1.15	5.114	0.032	53.3461	-0.003
2	21.61	30.3	1.15	6.118	0.037	63.9938	0.005
12	28.99	31.0	1.15	7.093	0.041	74.3733	0.009
3	37.83	30.3	1.15	8.094	0.046	85.2436	-0.007
11	47.69	31.1	1.15	9.101	0.051	95.9234	0.001
4	59.14	30.4	1.15	10.122	0.057	106.5650	0.027
10	68.43	31.3	1.15	10.906	0.060	115.2427	-0.001
5	84.54	30.6	1.15	12.105	0.066	128.1769	-0.011
9	98.99	31.5	1.15	13.120	0.072	138.7924	0.011
6	115.09	30.8	1.15	14.131	0.077	149.8330	-0.011
8	131.06	31.5	1.15	15.097	0.082	159.9484	0.009
7	148.53	31.2	1.15	16.064	0.087	170.5320	-0.014



### Visual presentation of calibration results



### Linear regression results

Method	Least squares linear regression
Slope	0.09353 (m/s)/Hz
Offset	0.12762 m/s
Coefficient of correlation	$\rho = 0.999995$
Standard error of estimate	0.0127 m/s
Slope standard error	0.00009 (m/s)/Hz
Offset standard error	0.01005 m/s
Slope and offset covariance	-0.00000832 (m/s) <sup>2</sup> /Hz
Remarks	Linearity complies with IEC 61400-12-1:2017, Annex F.

### Uncertainties

The uncertainties stated under *Calibration results* relate to the reference air velocity at each calibration point. The reported, expanded uncertainty is stated as the total combined standard uncertainty  $u_c$  multiplied by a coverage factor of  $k = 2$ , such that the coverage probability corresponds to approximately 95 %, in accordance with EA-4/02. The uncertainty complies with the requirements in IEC 61400-12-1:2017, Annex F. The uncertainty due to the wind tunnel correction function has been documented to be 0.1 % ( $k = 2$ ).

The slope and offset uncertainties and their covariance stated under *Linear regression results* are related to the linear regression only, and do not relate to the reference air velocity uncertainties. The slope and offset uncertainties have  $\nu = 11$  degrees of freedom.



### Calibration wind tunnel

ID	DK1
Test section	Octagonal, hwxw = 1.20x1.75 m
Effective area of test section	2.10 m <sup>2</sup>
Setup report	SOH document No. 18.1.001
Blockage ratio*	~0.9 % (Anemometer and mounting pole)

\* The effect of blockage is taken into account in the calibration results.

### Equipment used

Function	ID	Model / comments	Re-calibration due
QC Anemometer	94120000038	94120000038	-
Mounting	-	Mounting tube, diameter = 25 mm	-
Tunnel Temperature	T2	PT100 Temperature sensor	2026-03-25
Differential Pressure	9904031	PPC500 Pressure manometer	2026-03-18
Relative Humidity	X4650038	HMW71U Humidity transmitter	2026-04-12
Barometric Pressure	X4350042	PTB100A Analogue barometer	2026-03-26
Pitot tube	A37AB	Ellipsoidal tip pitot tube	2027-02-22
Data acquisition	1A841F0	Computer Board: ME-REDLAB 1608GX.	-
Computer	-	PC dedicated to data acquisition	-

Calibrations of the relevant equipment are carried out by external accredited institutions, and are traceable to national standards. A real-time analysis module within the data acquisition software detects pulse frequency.

### Setup photo

The shown anemometer is of the same type as the one calibrated.



End of certificate

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WIND  
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## CERTIFICATE OF CALIBRATION

### Calibrated item

Type	NRG S1
Serial No.	94120005867
Manufacturer	NRG Systems, Inc., Riggs Road 110, 05461 Hinesburg VT USA
Item received	July 10, 2024
Remarks	-

### Calibration

Calibration institute	Svend Ole Hansen ApS, Sct. Jørgens Allé 5C, DK-1615 København V
Procedure	IEC 61400-12-1:2022, Annex F
Client	Electrocentrale Borzesti SRL, Sos. Nordului no. 62D, floor 6, 014104 Bucharest, RO
Calibrated by	Operator, ca 
Date of calibration	July 10, 2024
Approved by	Calibration engineer, sfo 
Post calibration	No
Re-calibration due	-

### Certificate

Certificate No.	24.02.16102
Date of issue	July 11, 2024
Issued by	ca
Number of pages	4

### Accreditation

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The calibration institute is approved by MEASNET and IECRE.





### Calibration conditions

Turbulence intensity	< 2 % (alongwind)
Air temperature	30.0 °C (average value)
Barometric pressure	1011.9 hPa (average value)
Relative humidity	39.7 % (average value)
Air density	1.16 kg/m <sup>3</sup> (average value)
Flow inclination	< 0.2°
Anemometer yaw orientation	(Not relevant)
Remarks	(none)

### Calibration results

Calibration equation  $v \text{ [m/s]} = 0.09363 \cdot f \text{ [Hz]} + 0.11632$

The calibration equation is obtained from a linear regression of the reference air velocity upon the Device Under Test (DUT) output. The residual is the deviation of the calibration equation prediction from the reference air velocity.

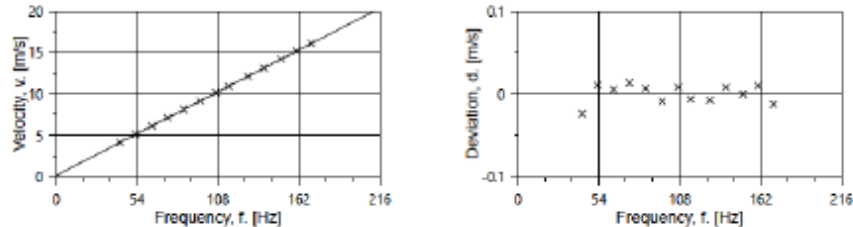
The calibration results relate only to the calibrated item.

Succession #	Velocity pressure [Pa]	Air temperature [°C]	Air density [kg/m <sup>3</sup> ]	Ref. air velocity, $v$ [m/s]	Uncertainty $U (k=2)$ [m/s]	DUT output Frequency, $f$ [Hz]	Residual, $d$ [m/s]
1-first	9.76	29.5	1.16	4.106	0.029	42.8592	-0.024
13-last	15.00	29.9	1.16	5.095	0.032	53.0693	0.010
2	21.59	29.4	1.16	6.107	0.037	63.9191	0.005
12	29.14	30.1	1.16	7.103	0.041	74.4799	0.013
3	37.98	29.4	1.16	8.099	0.046	85.1849	0.007
11	48.01	30.2	1.15	9.120	0.051	96.2519	-0.009
4	59.44	29.5	1.16	10.134	0.057	106.8999	0.008
10	68.48	30.4	1.15	10.895	0.060	115.1850	-0.007
5	84.65	29.7	1.16	12.097	0.066	128.0391	-0.008
9	99.34	30.6	1.15	13.127	0.072	138.8637	0.008
6	116.31	29.9	1.16	14.187	0.078	150.2725	0.000
8	132.19	30.6	1.15	15.142	0.082	160.3689	0.010
7	149.00	30.3	1.15	16.068	0.087	170.4974	-0.013





### Visual presentation of calibration results



### Linear regression results

Method	Least squares linear regression
Slope	0.09363 (m/s)/Hz
Offset	0.11632 m/s
Coefficient of correlation	$\rho = 0.999996$
Standard error of estimate	0.0115 m/s
Slope standard error	0.00008 (m/s)/Hz
Offset standard error	0.00911 m/s
Slope and offset covariance	-0.000000682 (m/s) <sup>2</sup> /Hz
Remarks	Linearity complies with IEC 61400-12-1:2017, Annex F.

### Uncertainties

The uncertainties stated under *Calibration results* relate to the reference air velocity at each calibration point. The reported, expanded uncertainty is stated as the total combined standard uncertainty  $u_c$  multiplied by a coverage factor of  $k = 2$ , such that the coverage probability corresponds to approximately 95 %, in accordance with EA-4/02. The uncertainty complies with the requirements in IEC 61400-12-1:2017, Annex F. The uncertainty due to the wind tunnel correction function has been documented to be 0.1 % ( $k = 2$ ).

The slope and offset uncertainties and their covariance stated under *Linear regression results* are related to the linear regression only, and do not relate to the reference air velocity uncertainties. The slope and offset uncertainties have  $v = 11$  degrees of freedom.



### Calibration wind tunnel

ID	DK1
Test section	Octagonal, h <sub>xw</sub> = 1.20x1.75 m
Effective area of test section	2.10 m <sup>2</sup>
Setup report	SOH document No. 18.1.001
Blockage ratio*	~0.9 % (Anemometer and mounting pole)

\* The effect of blockage is taken into account in the calibration results.

### Equipment used

Function	ID	Model / comments	Re-calibration due
QC Anemometer	94120000038	94120000038	-
Mounting	-	Mounting tube, diameter = 25 mm	-
Tunnel Temperature	T2	PT100 Temperature sensor	2026-03-25
Differential Pressure	9904031	PPC500 Pressure manometer	2026-03-18
Relative Humidity	X4650038	HMW71U Humidity transmitter	2026-04-12
Barometric Pressure	X4350042	PTB100A Analogue barometer	2026-03-26
Pitot tube	A37AB	Ellipsoidal tip pitot tube	2027-02-22
Data acquisition	1A841F0	Computer Board: ME-REDLAB 1608GX.	-
Computer	-	PC dedicated to data acquisition	-

Calibrations of the relevant equipment are carried out by external accredited institutions, and are traceable to national standards. A real-time analysis module within the data acquisition software detects pulse frequency.

### Setup photo

The shown anemometer is of the same type as the one calibrated.



End of certificate

# Svend Ole Hansen ApS

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WIND  
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## CERTIFICATE OF CALIBRATION

### Calibrated item

Type	NRG S1
Serial No.	94120005868
Manufacturer	NRG Systems, Inc., Riggs Road 110, 05461 Hinesburg VT USA
Item received	July 10, 2024
Remarks	-

### Calibration

Calibration institute	Svend Ole Hansen ApS, Sct. Jørgensen Allé 5C, DK-1615 København V
Procedure	IEC 61400-12-1:2022, Annex F
Client	Electrocentrale Borzesti SRL, Sos. Nordului no. 62D, floor 6, 014104 Bucharest, RO
Calibrated by	Operator, ca 
Date of calibration	July 10, 2024
Approved by	Calibration engineer, sfo 
Post calibration	No
Re-calibration due	-

### Certificate

Certificate No.	24.02.16105
Date of issue	July 11, 2024
Issued by	ca
Number of pages	4

### Accreditation

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The calibration institute is approved by MEASNET and IECRE.





### Calibration conditions

Turbulence intensity	< 2 % (alongwind)
Air temperature	30.4 °C (average value)
Barometric pressure	1012.0 hPa (average value)
Relative humidity	39.4 % (average value)
Air density	1.15 kg/m <sup>3</sup> (average value)
Flow inclination	< 0.2°
Anemometer yaw orientation	(Not relevant)
Remarks	(none)

### Calibration results

Calibration equation  $v \text{ [m/s]} = 0.09376 \cdot f \text{ [Hz]} + 0.11125$

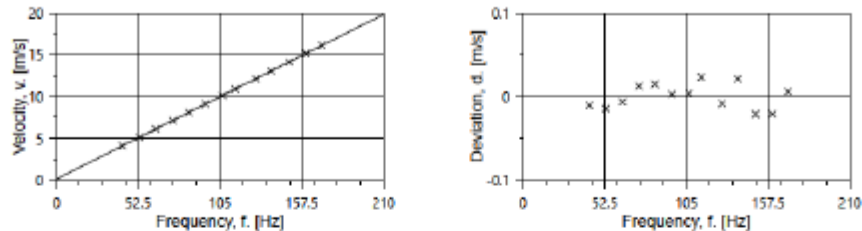
The calibration equation is obtained from a linear regression of the reference air velocity upon the Device Under Test (DUT) output. The residual is the deviation of the calibration equation prediction from the reference air velocity.

The calibration results relate only to the calibrated item.

Succession #	Velocity pressure [Pa]	Air temperature [°C]	Air density [kg/m <sup>3</sup> ]	Ref. air velocity, $v$ [m/s]	Uncertainty $U(k=2)$ [m/s]	DUT output Frequency, $f$ [Hz]	Residual, $d$ [m/s]
1-first	9.65	29.9	1.16	4.087	0.028	42.5163	-0.011
13-last	14.98	30.3	1.15	5.095	0.032	53.3097	-0.015
2	21.49	29.8	1.16	6.097	0.037	63.9043	-0.007
12	29.22	30.5	1.15	7.117	0.041	74.5915	0.012
3	37.86	29.8	1.16	8.093	0.046	84.9650	0.015
11	47.67	30.7	1.15	9.093	0.051	95.7678	0.003
4	59.13	29.9	1.16	10.116	0.056	106.6604	0.003
10	68.23	30.8	1.15	10.883	0.060	114.6343	0.023
5	84.65	30.1	1.16	12.107	0.066	128.0256	-0.009
9	98.21	31.0	1.15	13.060	0.072	137.8774	0.021
6	114.76	30.3	1.15	14.102	0.077	149.4455	-0.021
8	131.59	31.0	1.15	15.118	0.082	160.2747	-0.021
7	149.38	30.7	1.15	16.100	0.087	170.4615	0.006



### Visual presentation of calibration results



### Linear regression results

Method	Least squares linear regression
Slope	0.09376 (m/s)/Hz
Offset	0.11125 m/s
Coefficient of correlation	$\rho = 0.999992$
Standard error of estimate	0.0158 m/s
Slope standard error	0.00011 (m/s)/Hz
Offset standard error	0.01249 m/s
Slope and offset covariance	-0.000001285 (m/s) <sup>2</sup> /Hz
Remarks	Linearity complies with IEC 61400-12-1:2017, Annex F.

### Uncertainties

The uncertainties stated under *Calibration results* relate to the reference air velocity at each calibration point. The reported, expanded uncertainty is stated as the total combined standard uncertainty  $u_c$  multiplied by a coverage factor of  $k = 2$ , such that the coverage probability corresponds to approximately 95 %, in accordance with EA-4/02. The uncertainty complies with the requirements in IEC 61400-12-1:2017, Annex F. The uncertainty due to the wind tunnel correction function has been documented to be 0.1 % ( $k = 2$ ).

The slope and offset uncertainties and their covariance stated under *Linear regression results* are related to the linear regression only, and do not relate to the reference air velocity uncertainties. The slope and offset uncertainties have  $\nu = 11$  degrees of freedom.





### Calibration wind tunnel

ID	DK1
Test section	Octagonal, h <sub>xw</sub> = 1.20x1.75 m
Effective area of test section	2.10 m <sup>2</sup>
Setup report	SOH document No. 18.1.001
Blockage ratio*	~0.9 % (Anemometer and mounting pole)

\* The effect of blockage is taken into account in the calibration results.

### Equipment used

Function	ID	Model / comments	Re-calibration due
QC Anemometer	94120000038	94120000038	-
Mounting	-	Mounting tube, diameter = 25 mm	-
Tunnel Temperature	T2	PT100 Temperature sensor	2026-03-25
Differential Pressure	9904031	PPC500 Pressure manometer	2026-03-18
Relative Humidity	X4650038	HMW71U Humidity transmitter	2026-04-12
Barometric Pressure	X4350042	PTB100AAnalogue barometer	2026-03-26
Pitot tube	A37AB	Ellipsoidal tip pitot tube	2027-02-22
Data acquisition	1A841F0	Computer Board: ME-REDLAB 1608GX.	-
Computer	-	PC dedicated to data acquisition	-

Calibrations of the relevant equipment are carried out by external accredited institutions, and are traceable to national standards. A real-time analysis module within the data acquisition software detects pulse frequency.

### Setup photo

The shown anemometer is of the same type as the one calibrated.



End of certificate

# Svend Ole Hansen ApS

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WIND  
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## CERTIFICATE OF CALIBRATION FOR WIND DIRECTION SENSOR

### Calibrated item

Type	NRG 200M
Serial No.	1007000032897
Manufacturer	NRG Systems, Inc., Riggs Road 110, 05461 Hinesburg VT USA
Item received	July 10, 2024
Remarks	(none)

### Calibration

Calibration institute	Svend Ole Hansen ApS, Sct. Jørgensen Allé 5C, DK-1615 København V
Procedure	IEC 61400-12-1:2022, Annex N
Client	Electrocentrale Borzesti SRL, Sos. Nordului no. 62D, floor 6, 014104 Bucharest, RO
Calibrated by	Operator, ca 
Date of calibration	July 11, 2024
Approved by	Calibration engineer, sfo 
Post calibration	No
Re-calibration due	(none)

### Certificate

Certificate No.	24.02.16127
Date of issue	July 11, 2024
Issued by	sfo
Number of pages	5

### Accreditation

Accredited to ISO 17025:2017 by DANAK. DANAK is signatory to the European co-operation for Accreditation (EA) Multilateral Agreement and to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement.



  
CAL Reg nr. 452



### Calibration conditions

Velocity	8.32 m/s (average value)
Turbulence intensity	< 2 % (alongwind)
Air temperature	29.1 °C (average value)
Barometric pressure	1013.3 hPa (average value)
Relative humidity	41.7 % (average value)
Air density	1.16 kg/m <sup>3</sup> (average value)
Flow inclination	< 0.2°
Sensor ref. direction	Vane North upstream
Remarks	(none)

### Calibration results

Calibration equation  $\beta [^\circ] = 147.39 \cdot \alpha [V] + 0.67^\circ$

The calibration equation is obtained from a linear regression of the Device Under Test (DUT) output against the mean reference flow direction. The residual  $d$  is the deviation of the calibration equation prediction from the reference flow direction. The coefficient of correlation is 0.999997.

Stepwise calibration has been applied. The wind direction sensor was rotated from -10° to 370° and then back to -10° with increments of 2°. Each direction step was measured for 4 seconds. Data was analyzed using 10° bin-widths and the table mean values indicate overall mean values for each bin. Data sampling rate was 8 kHz.

The reference flow direction is the angle from the instrument's north indicator to the mean flow direction. The angle is measured clockwise when seen from above.

Some measurement points around the dead-band are not included, because the measurement contained samples in the anemometer's dead-band. This covers approx. 358-2 degrees.

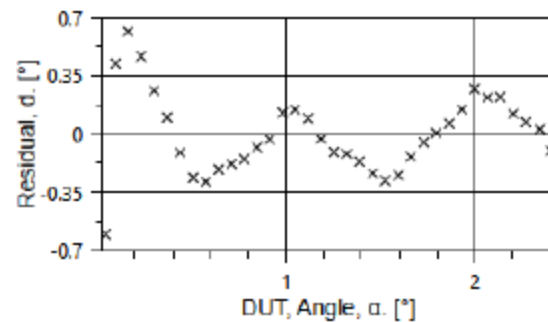
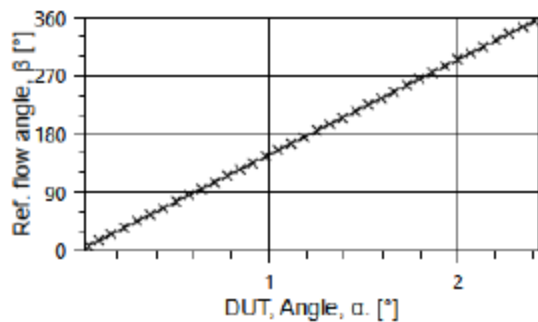
The calibration results relate only to the calibrated item.

Nominal bin center	Bin size	Mean ref. air velocity	Mean ref. flow direction, $\beta$	Uncertainty ( $k=2$ )	Mean DUT output, $\alpha$	Residual, $d$
[°]	[#]	[m/s]	[°]	[°]	[V]	[°]
5	14	8.3	6.47	0.88	0.0434	-0.603
15	10	8.3	15.31	0.88	0.0964	0.426
25	10	8.3	25.33	0.88	0.1631	0.617
35	10	8.3	35.29	0.88	0.2317	0.467
45	10	8.3	45.29	0.88	0.3009	0.261
55	10	8.3	55.28	0.88	0.3698	0.101
65	10	8.3	65.26	0.88	0.4390	-0.111
75	10	8.4	75.28	0.88	0.5080	-0.263
85	10	8.3	85.23	0.88	0.5757	-0.287
95	10	8.3	95.29	0.88	0.6434	-0.213
105	10	8.3	105.23	0.88	0.7106	-0.180
115	10	8.3	115.26	0.88	0.7785	-0.151
125	10	8.3	125.24	0.88	0.8457	-0.080
135	10	8.3	135.23	0.88	0.9132	-0.032



145	10	8.4	145.26	0.88	0.9801	0.127
155	10	8.3	155.22	0.88	1.0476	0.147
165	10	8.3	165.26	0.88	1.1161	0.095
175	10	8.3	175.23	0.88	1.1845	-0.030
185	10	8.3	185.28	0.88	1.2533	-0.108
195	10	8.3	195.23	0.88	1.3209	-0.119
205	10	8.3	205.28	0.88	1.3893	-0.165
215	10	8.3	215.27	0.88	1.4576	-0.236
225	10	8.3	225.27	0.88	1.5258	-0.280
235	10	8.3	235.30	0.88	1.5936	-0.249
245	10	8.3	245.28	0.88	1.6606	-0.138
255	10	8.3	255.34	0.88	1.7282	-0.050
265	10	8.3	265.30	0.88	1.7954	0.006
275	10	8.3	275.37	0.88	1.8634	0.063
285	10	8.3	285.33	0.88	1.9304	0.148
295	10	8.3	295.37	0.88	1.9976	0.272
305	10	8.3	305.35	0.88	2.0657	0.220
315	10	8.3	315.35	0.88	2.1336	0.223
325	10	8.3	325.36	0.88	2.2022	0.122
335	10	8.3	335.33	0.88	2.2701	0.071
345	12	8.3	346.10	0.88	2.3435	0.029
355	18	8.3	354.81	0.88	2.4035	-0.101

### Visual presentation of calibration results





### Uncertainties

The uncertainties stated under *Calibration results* are the total combined standard uncertainty  $u_c$  multiplied by a coverage factor of  $k = 2$ , such that the coverage probability corresponds to approximately 95 %, in accordance with EA-4/02. The uncertainty complies with the requirements in IEC 61400-12-1:2017, Annex N.

### Calibration wind tunnel

ID	DK1
Test section	Octagonal, h <sub>rw</sub> = 1.20x1.75 m
Effective area of test section	2.10 m <sup>2</sup>
Setup report	SOH document No. 20.1.001

### Equipment used

Function	ID	Model / comments	Re-calibration due
QC Sensor	W1	Wind direction wedge	-
Mounting	-	Mounting tube, diameter = 25 mm	-
Angular Encoder	27312667	Hengstler, 0545302	-
Tunnel Temperature	T2	PT100 Temperature sensor	2026-03-25
Differential Pressure	9904031	PPC500 Pressure manometer	2026-03-18
Relative Humidity	X4650038	HMW71U Humidity transmitter	2026-04-12
Barometric Pressure	X4350042	PTB100A Analogue barometer	2026-03-26
Pitot tube	A37AB	Ellipsoidal tip pitot tube	2027-02-22
Data acquisition	1A841F0	Computer Board: ME-REDLAB 1608GX	-
Computer	-	PC dedicated to data acquisition	-

Calibrations of the relevant equipment are carried out by external accredited institutions, and are traceable to national standards. A real-time analysis module within the data acquisition software detects pulse frequency.





### *Setup photo*

The shown sensor is of the same type as the one calibrated.



### *Comments*

(none)

End of certificate

# Svend Ole Hansen ApS

SCT. JØRGENSEN ALLÉ 5C · DK-1615 KØBENHAVN V · DENMARK

TEL: (+45) 33 25 38 38 · [WWW.SOHANSEN.DK](http://WWW.SOHANSEN.DK)





WIND  
ENGINEERING  
FLUID  
DYNAMICS

## CERTIFICATE OF CALIBRATION FOR WIND DIRECTION SENSOR

### Calibrated item

Type	NRG 200M
Serial No.	1007000032894
Manufacturer	NRG Systems, Inc., Riggs Road 110, 05461 Hinesburg VT USA
Item received	July 29, 2024
Remarks	(none)

### Calibration

Calibration institute	Svend Ole Hansen ApS, Sct. Jørgens Allé 5C, DK-1615 København V
Procedure	IEC 61400-12-1:2022, Annex N
Client	Electrocentrale Borzesti SRL, Sos. Nordului no. 62D, floor 6, 014104 Bucharest, RO
Calibrated by	Operator, ca 
Date of calibration	July 29, 2024
Approved by	Calibration engineer, sfo 
Post calibration	No
Re-calibration due	(none)

### Certificate

Certificate No.	24.02.16298
Date of issue	August 06, 2024
Issued by	ca
Number of pages	5

### Accreditation

Accredited to ISO 17025:2017 by DANAK. DANAK is signatory to the European co-operation for Accreditation (EA) Multilateral Agreement and to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement.



  
CAL Reg.nr. 452



### Calibration conditions

Velocity	8.32 m/s (average value)
Turbulence intensity	< 2 % (alongwind)
Air temperature	25.1 °C (average value)
Barometric pressure	1020.4 hPa (average value)
Relative humidity	44.3 % (average value)
Air density	1.19 kg/m <sup>3</sup> (average value)
Flow inclination	< 0.2°
Sensor ref. direction	Vane North upstream
Remarks	(none)

### Calibration results

Calibration equation  $\beta [^\circ] = 147.51 \cdot \alpha [V] + 2.44^\circ$

The calibration equation is obtained from a linear regression of the Device Under Test (DUT) output against the mean reference flow direction. The residual  $d$  is the deviation of the calibration equation prediction from the reference flow direction. The coefficient of correlation is 0.999988.

Stepwise calibration has been applied. The wind direction sensor was rotated from -10° to 370° and then back to -10° with increments of 2°. Each direction step was measured for 4 seconds. Data was analyzed using 10° bin-widths and the table mean values indicate overall mean values for each bin. Data sampling rate was 8 kHz.

The reference flow direction is the angle from the instrument's north indicator to the mean flow direction. The angle is measured clockwise when seen from above.

Some measurement points around the dead-band are not included, because the measurement contained samples in the anemometer's dead-band. This covers approx. 359-1 degrees.

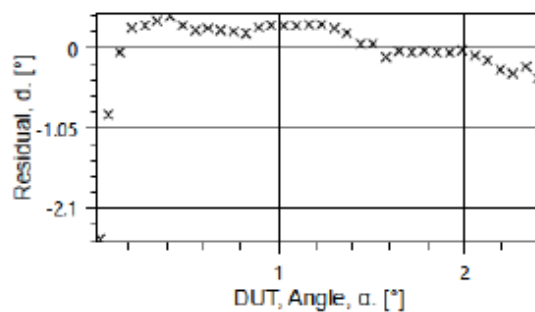
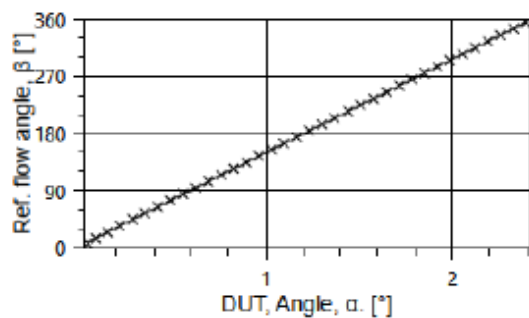
The calibration results relate only to the calibrated item.

Nominal bin center	Bin size	Mean ref. air velocity	Mean ref. flow direction, $\beta$	Uncertainty ( $k = 2$ )	Mean DUT output, $\alpha$	Residual, $d$
[°]	[#]	[m/s]	[°]	[°]	[V]	[°]
5	12	8.3	6.46	0.88	0.0442	-2.508
15	10	8.3	14.60	0.88	0.0884	-0.871
25	10	8.3	24.57	0.88	0.1503	-0.048
35	10	8.3	34.61	0.88	0.2163	0.269
45	10	8.3	44.60	0.88	0.2838	0.303
55	10	8.3	54.62	0.88	0.3513	0.363
65	10	8.3	64.64	0.88	0.4187	0.432
75	10	8.3	74.62	0.88	0.4872	0.304
85	10	8.3	84.66	0.88	0.5558	0.240
95	10	8.3	94.64	0.88	0.6232	0.265
105	10	8.3	104.69	0.88	0.6915	0.242
115	10	8.3	114.66	0.88	0.7592	0.227
125	10	8.3	124.68	0.88	0.8273	0.203
135	10	8.3	134.66	0.88	0.8945	0.274



145	10	8.3	144.65	0.88	0.9620	0.305
155	10	8.3	154.65	0.88	1.0298	0.299
165	10	8.3	164.61	0.88	1.0974	0.298
175	10	8.3	174.63	0.88	1.1652	0.316
185	10	8.3	184.58	0.88	1.2326	0.317
195	10	8.3	194.61	0.88	1.3010	0.265
205	10	8.3	204.55	0.88	1.3687	0.206
215	11	8.3	215.05	0.88	1.4409	0.058
225	9	8.3	225.02	0.88	1.5085	0.062
235	11	8.3	234.99	0.88	1.5773	-0.111
245	10	8.3	245.50	0.88	1.6480	-0.032
255	10	8.4	255.45	0.88	1.7156	-0.048
265	10	8.3	265.48	0.88	1.7834	-0.027
275	10	8.3	275.43	0.88	1.8510	-0.048
285	10	8.3	285.45	0.88	1.9190	-0.055
295	10	8.3	295.41	0.88	1.9863	-0.019
305	10	8.3	305.41	0.88	2.0545	-0.093
315	10	8.3	315.40	0.88	2.1227	-0.152
325	10	8.3	325.35	0.88	2.1910	-0.278
335	10	8.3	335.34	0.88	2.2591	-0.329
345	11	8.3	345.65	0.88	2.3283	-0.237
355	20	8.3	355.05	0.88	2.3931	-0.392

### Visual presentation of calibration results





### Uncertainties

The uncertainties stated under *Calibration results* are the total combined standard uncertainty  $u_c$ , multiplied by a coverage factor of  $k = 2$ , such that the coverage probability corresponds to approximately 95 %, in accordance with EA-4/02. The uncertainty complies with the requirements in IEC 61400-12-1:2017, Annex N.

### Calibration wind tunnel

ID	DK1
Test section	Octagonal, h <sub>xw</sub> = 1.20x1.75 m
Effective area of test section	2.10 m <sup>2</sup>
Setup report	SOH document No. 20.1.001

### Equipment used

Function	ID	Model / comments	Re-calibration due
QC Sensor	W1	Wind direction wedge	-
Mounting	-	Mounting tube, diameter = 25 mm	-
Angular Encoder	27312667	Hengstler, 0545302	-
Tunnel Temperature	T2	PT100 Temperature sensor	2026-03-25
Differential Pressure	9904031	PPC500 Pressure manometer	2026-03-18
Relative Humidity	X4650038	HMW71U Humidity transmitter	2026-04-12
Barometric Pressure	X4350042	PTB100A Analogue barometer	2026-03-26
Pitot tube	A37AB	Ellipsoidal tip pitot tube	2027-02-22
Data acquisition	1A841F0	Computer Board: ME-REDLAB 1608GX.	-
Computer	-	PC dedicated to data acquisition	-

Calibrations of the relevant equipment are carried out by external accredited institutions, and are traceable to national standards. A real-time analysis module within the data acquisition software detects pulse frequency.





**Setup photo**

The shown sensor is of the same type as the one calibrated.



**Comments**

(none)

End of certificate

# CERTIFICATE of CALIBRATION for LI-COR SENSOR

Pyranometer  
Model Number: LI-200

Serial Number: **PY112970**

Calibration Date: **September 17, 2021**  
Manufacture Date: **September 17, 2021**

## Calibration Constant(s):

Output: 70.55 microamps per 1000 watts  $m^{-2}$

## For use with LI-COR handheld meters and loggers:

Multiplier: -14.18 watts  $m^{-2}$  per microamp

## If this is an LI-200-BL (3-wire bare leads):

Multiplier: 14.18 watts  $m^{-2}$  per microamp

## For use with LI-COR 2220 (147 ohm) millivolt Adapter:

Multiplier: -96.43 watts  $m^{-2}$  per millivolt

## If this is an SL or SMV sensor:

Multiplier: -100 watts  $m^{-2}$  per millivolt

**IMPORTANT:** Read the appropriate instruction manual ([www.licor.com/200-manual](http://www.licor.com/200-manual)) before using this sensor

**IMPORTANT:** It is recommended that sensors be recalibrated every two years after field deployment.

Calibration Technician: John Brooks

Calibrations are traceable to the World Radiometric Reference through Secondary Standard Thermopile radiometers, which are calibrated annually by the National Renewable Energy Laboratory.

**LI-COR**

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Manual: [www.licor.com/200-manual](http://www.licor.com/200-manual)



# Certificate of Quality

NRG Systems T60 Temperature Sensor  
Serial No. 9411002092

## Product Description:

Manufacturer	Description	Cal. Date
NRG Systems	T60 Temperature Sensor	05/30/23

NRG Systems, hereby certifies that the above instrumentation has been tested to meet or exceed the published specifications. This testing was performed using instrumentation and standards that are traceable to the **National Institute for Standards and Technology (NIST)**.

Standard Uncertainty of Test Procedure =  $\pm 0.05^{\circ}\text{C}$

The output (in  $^{\circ}\text{C}$ ) for this T60 sensor is defined by:  $T = (\text{Slope} \times V_{\text{out}}) + \text{Offset}$

Criteria	Value	Units
T60 Slope	44.67629	$^{\circ}\text{C} / \text{Volt}$
T60 Offset	-40.92151	$^{\circ}\text{C}$
Linearity	0.99999	$R^2$

Slope (Scale Factor) and Offset Conversion Chart for NRG Systems' Data Loggers.

To Scale to...	SymphoniePLUS3 and Older <i>[Symphonie Data Retriever (SDR) software]</i>		SymphoniePRO Data Logger <i>[SymphoniePRO Desktop Application]</i>	
	enter Scale Factor	and enter Offset	enter Scale Factor	and enter Offset
$^{\circ}\text{C}$	0.10907	-40.92151	44.67629	-40.92151
$^{\circ}\text{F}$	0.19633	-41.65873	80.41732	-41.65873

Note: Transfer function above applies to 4.6 meter cable. For sensors with cable lengths longer than 4.6 meters, subtract 0.002922  $^{\circ}\text{C}$  (0.0052596  $^{\circ}\text{F}$ ) per additional meter from the transfer function offset.

Procedure: WI-ELE-516

Test performed by: lcb

Date: 05/30/23

NRG Systems' management system has been certified to ISO 9001: 2015.



# Certificate of Quality

NRG Systems T60 Temperature Sensor

## Serial No. 9411002095

### Product Description:

Manufacturer	Description	Cal. Date
NRG Systems	T60 Temperature Sensor	05/30/23

NRG Systems, hereby certifies that the above instrumentation has been tested to meet or exceed the published specifications. This testing was performed using instrumentation and standards that are traceable to the National Institute for Standards and Technology (NIST).

Standard Uncertainty of Test Procedure =  $\pm 0.05^{\circ}\text{C}$

The output (in  $^{\circ}\text{C}$ ) for this T60 sensor is defined by:  $T = (\text{Slope} \times V_{\text{out}}) + \text{Offset}$

Criteria	Value	Units
T60 Slope	44.67629	$^{\circ}\text{C} / \text{Volt}$
T60 Offset	-40.92151	$^{\circ}\text{C}$
Linearity	0.99999	$R^2$

Slope (Scale Factor) and Offset Conversion Chart for NRG Systems' Data Loggers.

To Scale to...	SymphoniePLUS3 and Older <i>[Symphonie Data Retriever (SDR) software]</i>		SymphoniePRO Data Logger <i>[SymphoniePRO Desktop Application]</i>	
	enter Scale Factor	and enter Offset	enter Scale Factor	and enter Offset
$^{\circ}\text{C}$	0.10907	-40.92151	44.67629	-40.92151
$^{\circ}\text{F}$	0.19633	-41.65873	80.41732	-41.65873

Note: Transfer function above applies to 4.6 meter cable. For sensors with cable lengths longer than 4.6 meters, subtract 0.002922  $^{\circ}\text{C}$  (0.0052596  $^{\circ}\text{F}$ ) per additional meter from the transfer function offset.

Procedure: WI-ELE-516

Test performed by: lcb


Date: 05/30/23

NRG Systems' management system has been certified to ISO 9001: 2015.

Ch 1

 NRG S1 150m S/N 94120005879 Effective Date: 10-25-2024 06:10:32  
Scale: 0.093390, Offset: 0.140910 (m/s) 11-18-2024 20:46:00

Ch 2

 NRG S1 150m S/N 94120005880 Effective Date: 10-25-2024 06:11:14  
Scale: 0.093290, Offset: 0.150110 (m/s) 11-18-2024 20:46:00


Ch 3

 NRG S1 120m S/N 94120005881 Effective Date: 10-25-2024 06:12:01  
Scale: 0.093210, Offset: 0.162360 (m/s) 11-18-2024 20:46:00

Ch 4

 NRG S1 120m S/N 94120005882 Effective Date: 10-25-2024 06:12:33  
Scale: 0.093530, Offset: 0.127620 (m/s) 11-18-2024 20:46:00

Ch 5

 NRG S1 90m S/N 94120005867 Effective Date: 10-25-2024 06:13:33  
Scale: 0.093630, Offset: 0.116320 (m/s) 11-18-2024 20:46:00

Ch 6

 NRG S1 60m S/N 94120005868 Effective Date: 10-25-2024 06:14:20  
Scale: 0.093760, Offset: 0.111250 (m/s) 11-18-2024 20:46:00

Ch 7

Ch 8


Ch 9

Ch 10


Ch 11

Ch 12

Ch 13


 Wind Vane 135m S/N 1007000032897 Effective Date: 10-25-2024 06:15:13  
Mounting Angle: 180.0 11-18-2024 20:46:00

Ch 14


 Wind Vane 90m S/N 1007000032894 Effective Date: 10-25-2024 06:15:45  
Mounting Angle: 180.0 11-18-2024 20:46:00

Ch 15

Ch 16

 NRG T60 Temp 145m S/N 9411002092 Effective Date: 02-28-2024 00:00:00  
Scale: 44.676300, Offset: -40.921500 (C) 11-18-2024 20:46:00


Ch 17

 NRG T60 Temp 15m S/N 9411002095 Effective Date: 02-28-2024 00:00:00  
Scale: 44.676300, Offset: -40.921500 (C) 11-18-2024 20:46:00

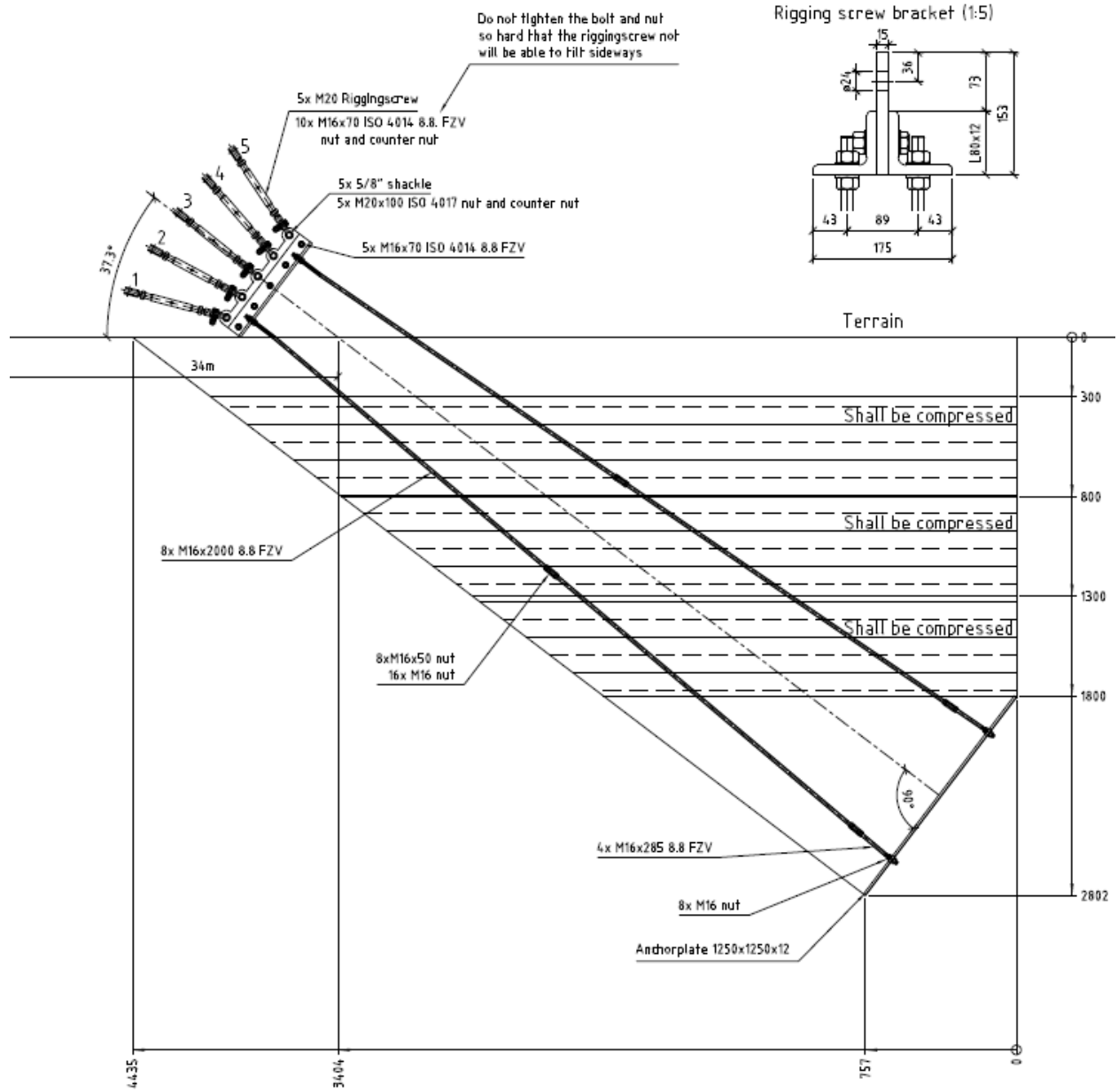
Ch 18

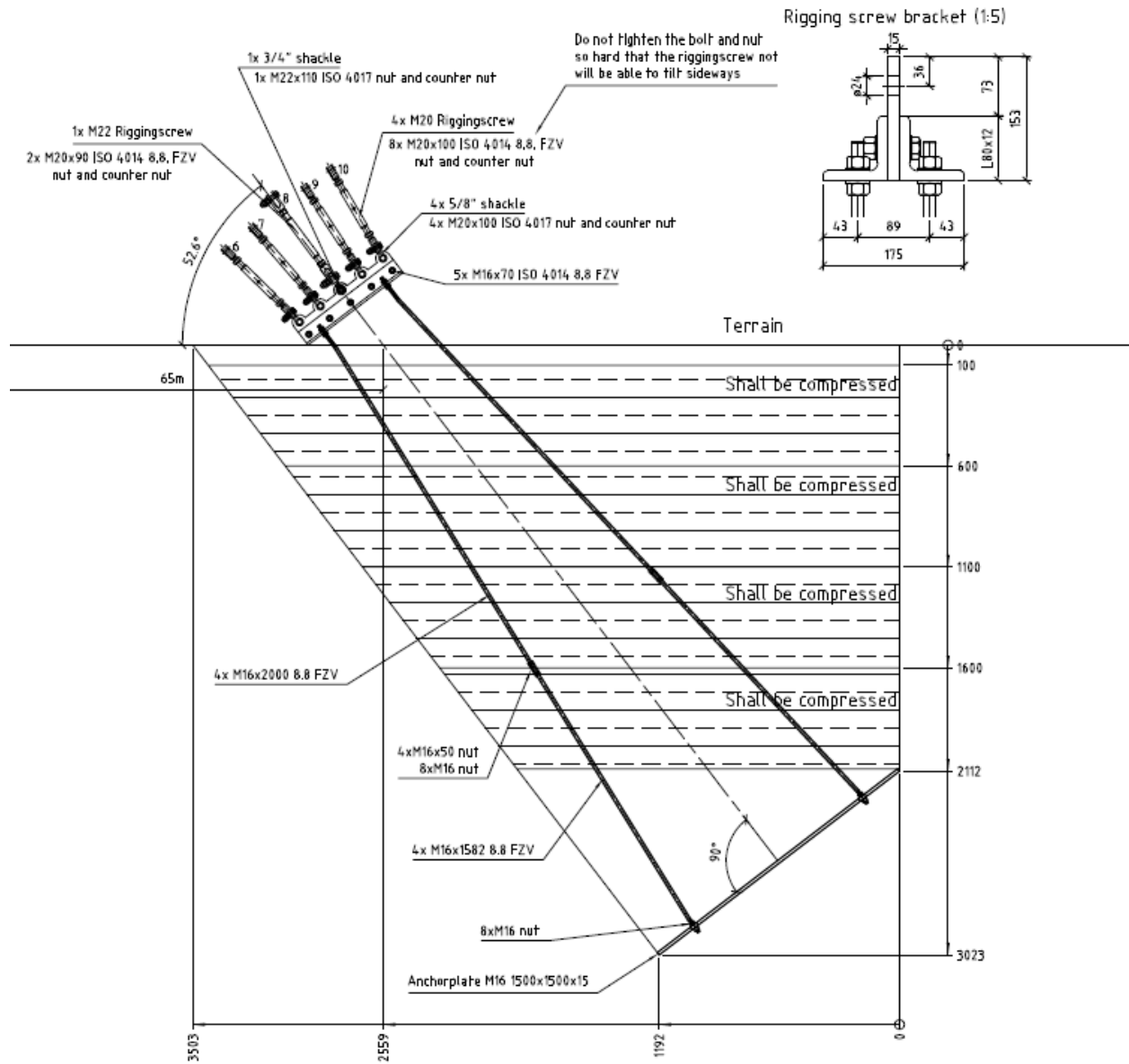
Ch 19

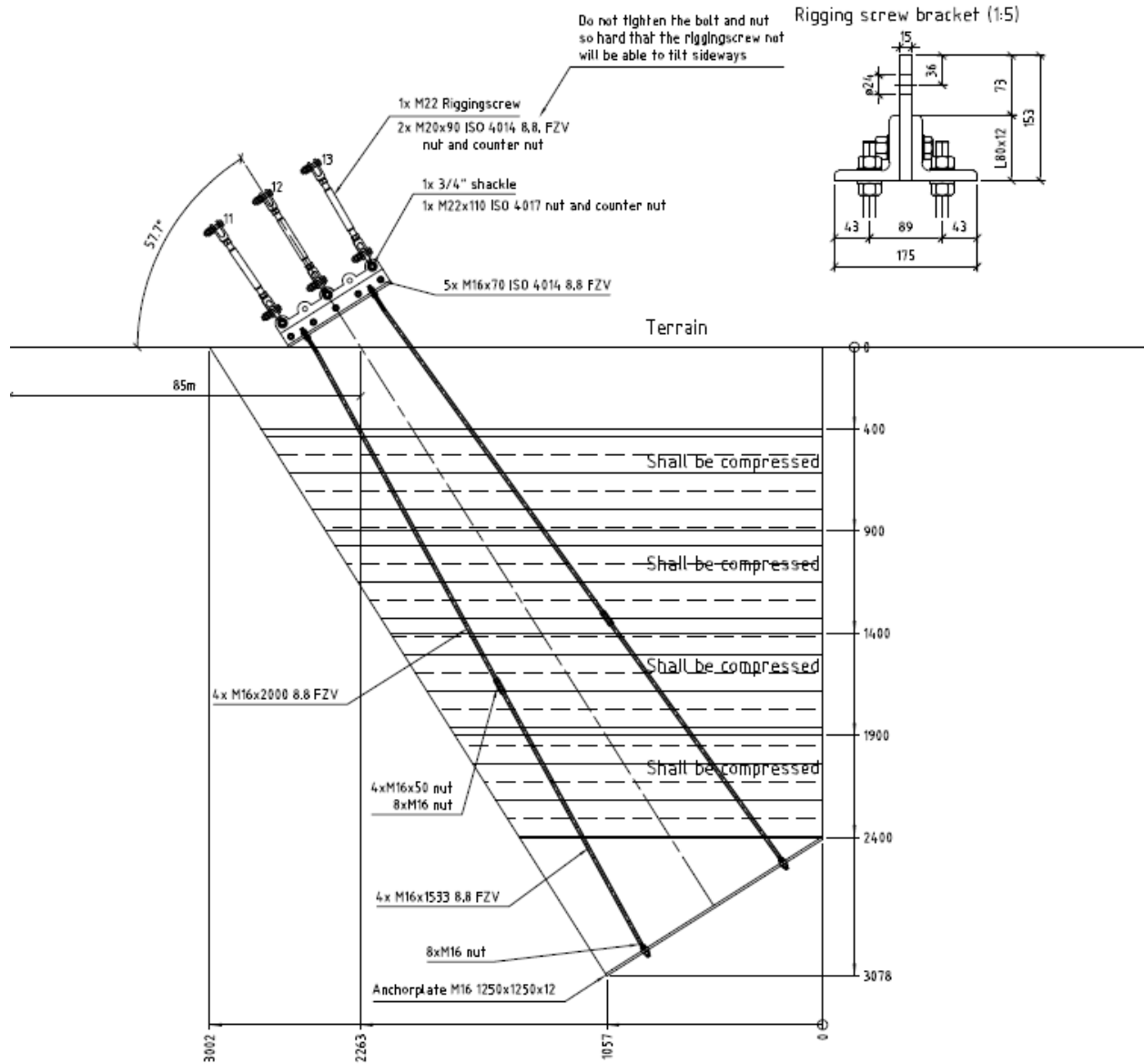
Ch 20

 LI-COR PYRA S/N PY112970 Effective Date: 10-25-2024 06:24:46  
Scale: 14.180000, Offset: 0.000000 (W/sqm) 11-18-2024 20:46:00

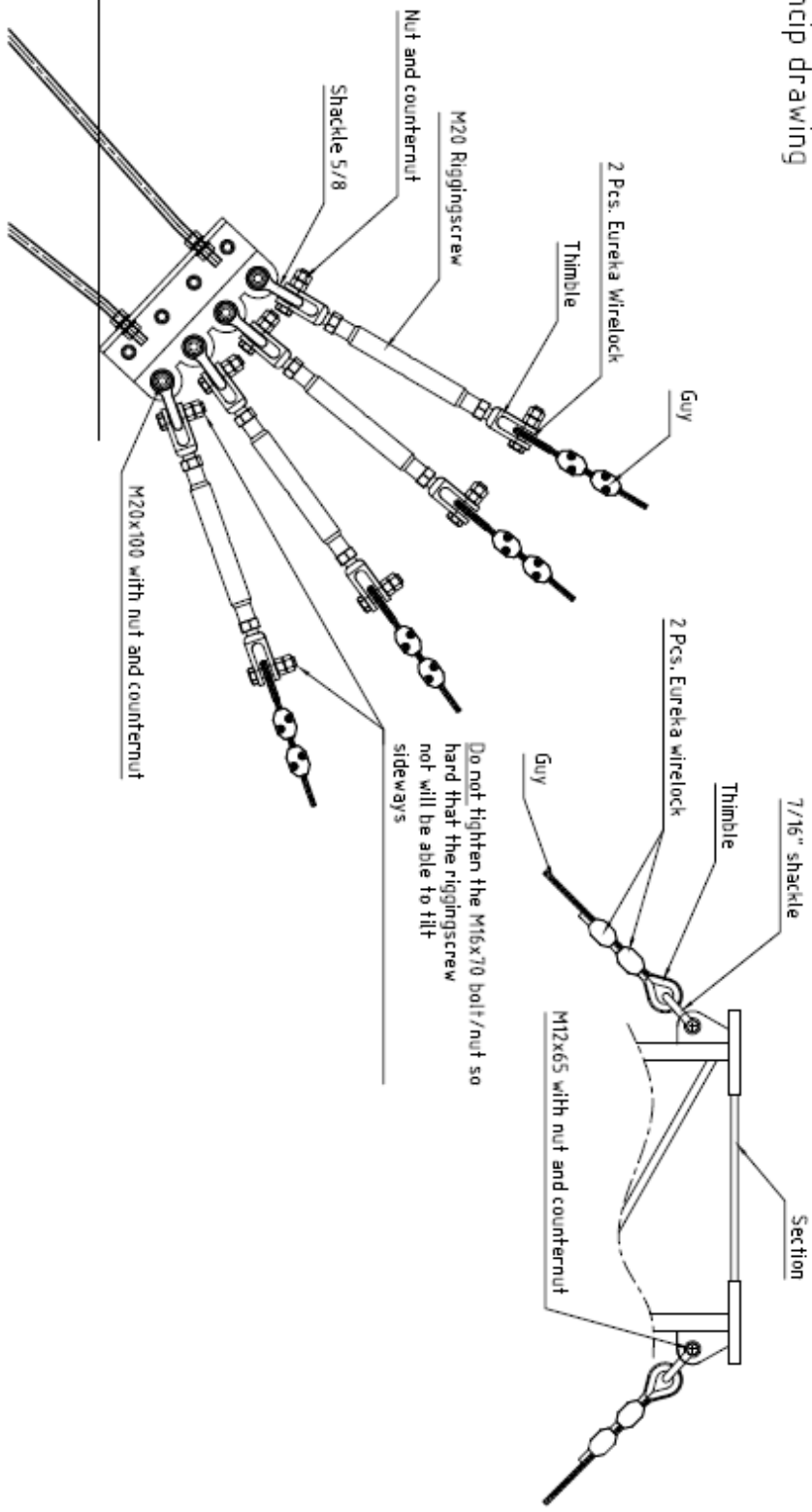








Princip drawing



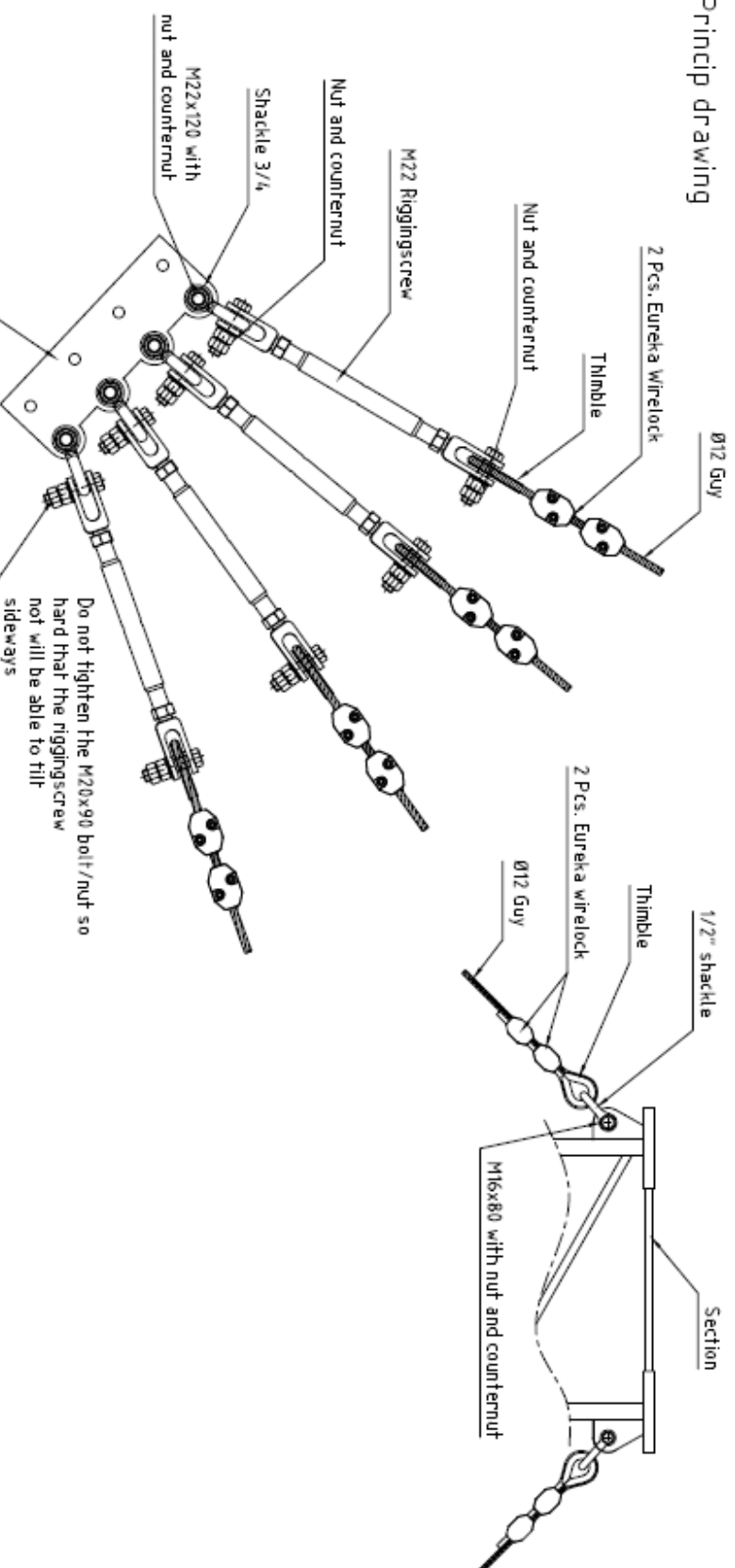
Guy Foundation



Customer:		Carl C. A/S	
Subject:		Assembly of guy wire ø10	
Date:	22.06.16	Order:	1:10
Rev. date:		Drawing no.:	wireguide
Rev./int.:		Production no.:	
		Int.:	SP
		Check:	
		Tolerance:	Angular: Base plate to structural member: ±0.2°
		Dimensions:	0-5000 ±1.0 mm
		6001- 6000 ±2.0 mm	
		Diameter of holes:	+0.5 / -0.0 mm

This drawing is our property and must not be copied, transferred or in any other way used by a third party without our written permission

# Princip drawing



Not included in the order

Guy Foundation

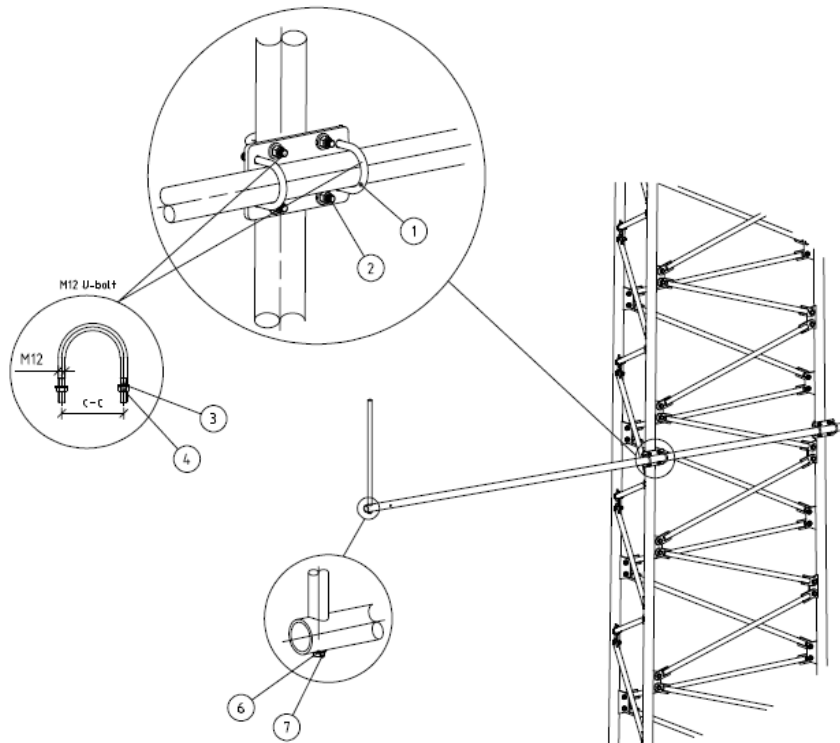
C	MRF	28-03-2022	M20x110 changed to M22x120
Rev.:	Int.:	Date:	Comment:
Customer: Carl C. A/S			
Subject: Assembly of Ø12 guy wire			
Date: 10-03-2016	Production no.:	Scale: 1:10	Projection:  Format: A4
Order no.:	Calculation:	Int.: MRF	Tolerance: 0-1000: ±1 mm 1001-5000: ±2 mm 5001-∞: ±3 mm
Drawing no.: wireguide Ø12	Note:		Hole diameter: ±0.5 mm Node distance: ±10 mm

This drawing is our property and must not be copied, transferred or in any other way used by a third party without our written permission



# 60 RS

Partlist 60 RS boom		
POS.	Part	PCS
1	M12 U-bolt c-c = 75	4
3	Washer HB200 FZV	16
4	M12 nut ISO 4032 FZV	16
6	Washer M10 DIN 9021 A4	1
7	M10x90 Setscrew A4 80	1



POS 2 M12 U-bolts (4PCS)	
Leg dim.	c-c
ø26-32	45
ø36-42	55
ø45-ø50	65
ø55-ø60	75
ø65-ø75	90
ø80-ø90	105
ø80-ø90	105
ø80-ø90	105
ø95-ø120	130
ø80-ø90	105
ø95-ø120	130



Customer:

Boom Kote:

Subjekt:

60 RS boom assembly

Date: 02-04-2013

Production no.:

Scale: 1:20

Projektion: Format: A4

Rev. date: 29-03-2022

Order no.:

Int.: hep

Tolerance: 0-1000: ±1 mm

1001-5000: ±2 mm

5001-~: ±3 mm

Holediameter: ±0,5 mm

Node distance: ±10 mm

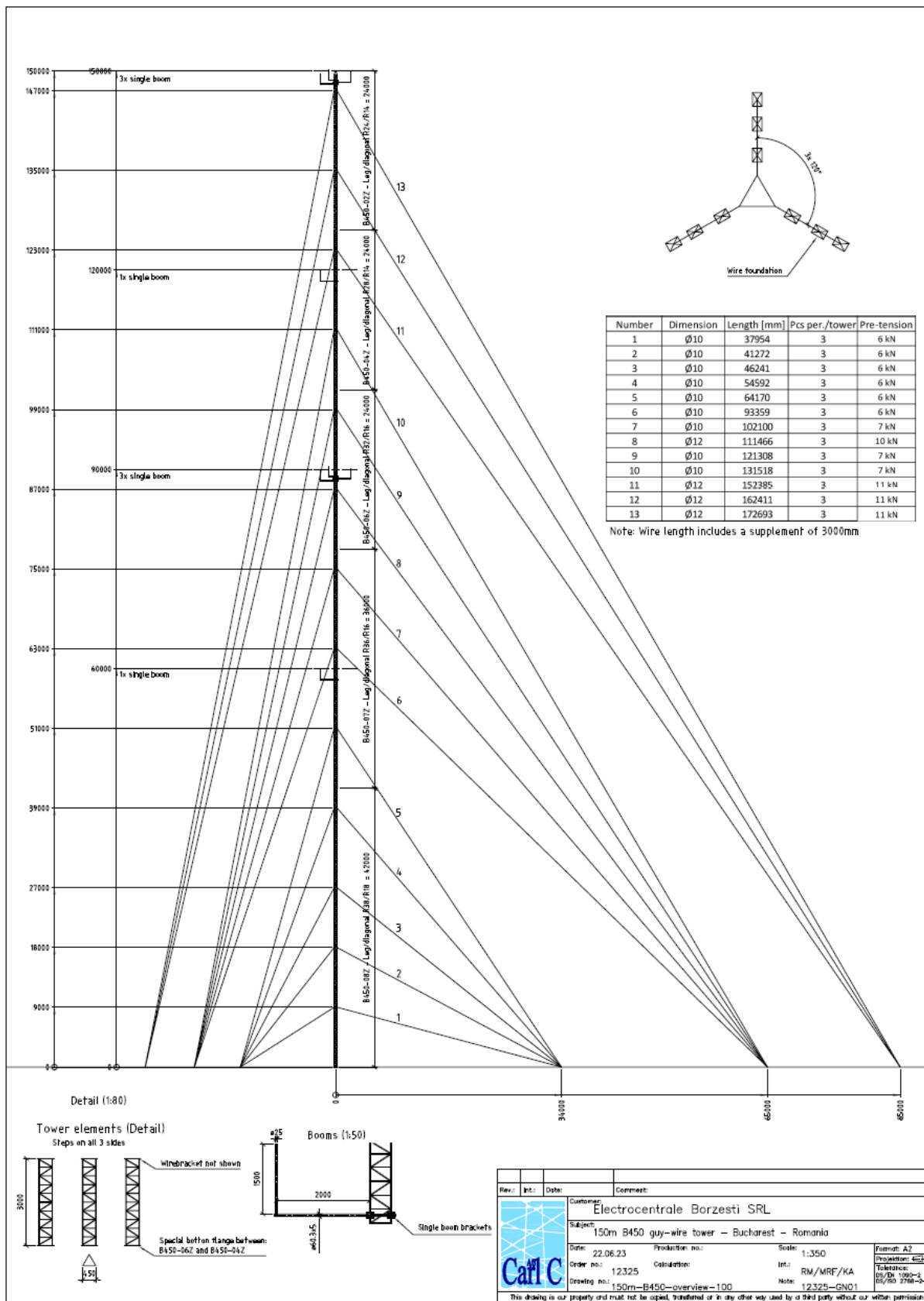
Rev./int.: B/MRF

Drawing no.:

60 RS Boom assembly

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Carl C A/S Manufacturing Engineering Commec Smedevj 2 DK-6900 Skjern Tel. +45 97351066 Fax +45 97351276



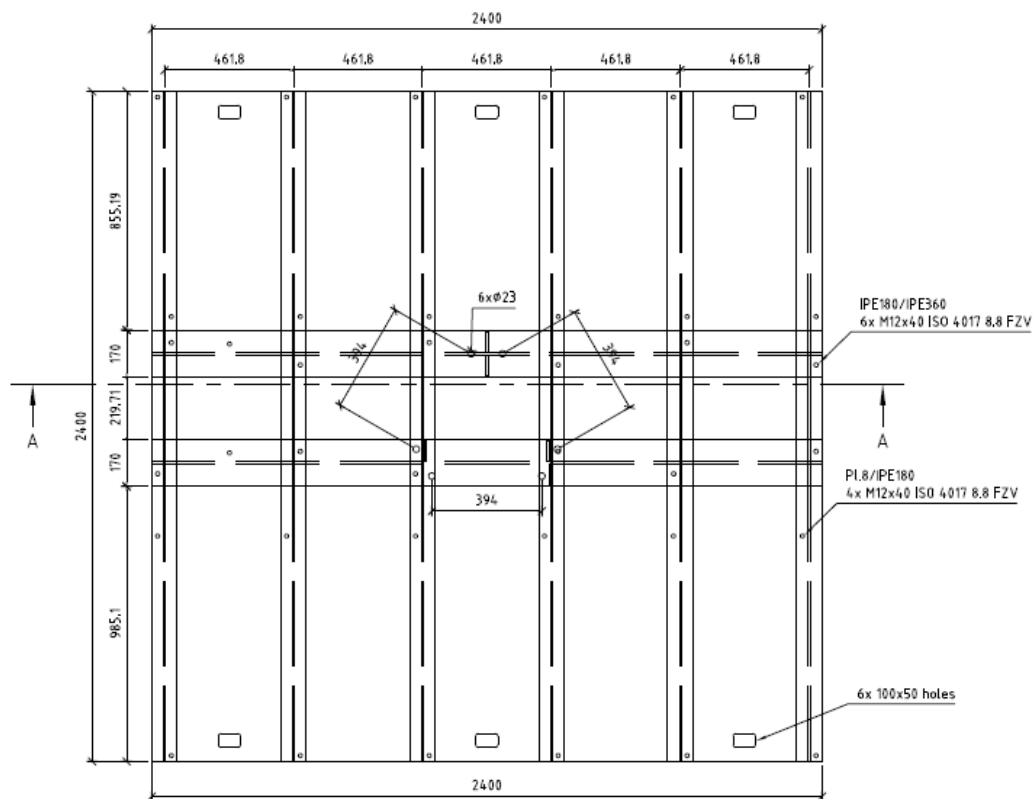
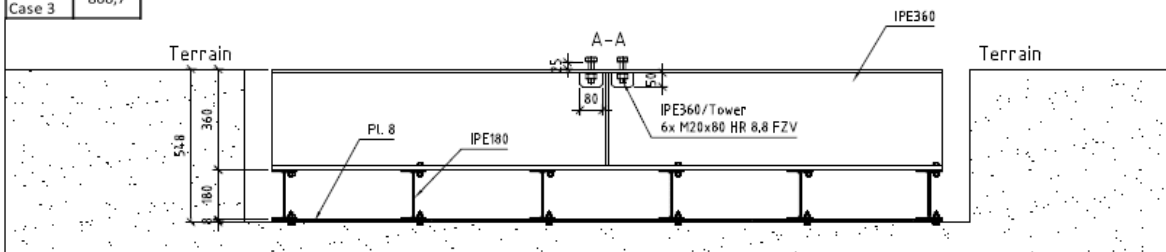
The following assumptions were used in foundation design, and must be verified before installation:



Soil bearing capacity  $c_v$ : 180 kN/m<sup>2</sup>  
 Fill density,  $\gamma_{fill}$ : 18 kN/m<sup>3</sup>  
 Ground Water Level below foundation.

Weight  
 PL 8 = 5,76m<sup>2</sup> = 360 kg  
 IPE180 = 14,4m = 271 kg  
 IPE360 = 4,8m = 275 kg  
 Total = 906 kg  
 With FZV = 955 kg

The following max test forces from design must be verified:

	Base [kN]
Load Case 3	866,7



Profile:	Base foundation		Rev.:	Int.:	Date:	Comment:
Quantity:	1 pcs/tower pcs/total		Customer:			
Material:	PL8/IPE180/IPE360		Electrocentrale Borzesti SRL			
Quantity:	5355		Subject:			
			Base foundation – 150m B450 guy-wire tower – Bucharest – Romania			
			Date:	Production no.:	Scale:	Format: A3
			Order no.:	Calculation:	Int.:	Projection: 
			12325		RM/MRF/KA	Tolerance: 05/EN 1060-2 05/ISO 2768-2
			Drawing no.:	Note:		
			base-found-100		12325-GN01	
This drawing is our property and must not be copied, transferred or in any other way used by a third party without our written permission						