

INSTALLATION OF A 600 kWe COGENERATION UNIT IN DOLNÍ BĚŽANY

PS 04 - ELECTRICAL POWER OUTPUT FROM KGJ

DSPS



ACTUAL IMPLEMENTATION

"! "Ißg. Út8nISlav JafOŠ KooΛ!o!o! VítLepič v * vItLepik	* *** PD COGENERATION UNIT TP21_059 ELI BEAMLINES premises, Za Radníc 835, 25241, Doln Břežany	'o "" " 00
VIT LEPIČ s.r.o. PROJECTS, NONTdŽE AND REVISION OF ELECTRICAL Otnfče 43, 267 51 ZDICE call +420 603 170 931 ICO 27935981	I "o Extreme Light Infrastructure (ELIERIC) Document name: PS 04 - Electrical power output from KGJ Title page	Cílo zakázky: 2023011 Stupeň PD: DSPS Date: 02/2024 Font: A4 MořLo:

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TECHNICAL REPORT



ACTUAL IMPLEMENTATION

Projektant: Ing. Stanislav Jaroš Koordinovač: Vít Lepič Schválil: Vít Lepič	Akce: PDK0GENERACNIJEDNOTKYTP21_059 Areař ELI BEAMLINES Za Radnicí 835, 252 41, Dohň Břežany Areař ELI BEAMLINES, za Radnicí 835, 252 41, Dohň Břežany	Číslo výkresu: 02
VIT LEPIÖ s.r.o. PROJECT INSTALLATIONS AND PROJEKTY, MONTÁŽE A REVISION OF ELECTRICAL EQUIPMENT OFTICE 43, 267 51 ZDICE tel. +420 603 170 931 tel. +420 603 170 931 IČO: 27935981	Investor: Extreme Light Infrastructure (ELI ERIC) Extreme Light Infrastructure (ELI ERIC) NameDocument number: Název dokumentu: PS 04 - Electrical output from KGJ PS 04 - Vyvedení el. výkonu z KGJ Title page TZ Titulní strana TZ	Číslo zakázky: 2023011 Stage PD: 2023011 Stupeň PD: DSFS D arm: DSFS Datum: 02/2024 Formát: A4 Měřítko: -

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1. INTRODUCTION

This project documentation describes the technical design for the power output from the new 600 kWe low-voltage cogeneration unit (hereinafter referred to as KGJ). The power will be supplied mainly to the 22 kV high-voltage level of the ELI BEAMLINES facility, with surplus power being supplied to the distribution network of ČEZ Distribuce,

a.s. Power output is achieved by installing new equipment and modifying the existing distribution network in accordance with the technical connection conditions of ČEZ Distribuce, a.s.

Regulations and standards

The project complies with applicable implementing regulations, ČSN standards, and all statutory safety provisions.

ČSN 33 2000-4-41	Low-voltage electrical installations - Part 4-41: Protective measures to ensure safety - Protection against electric shock Chapter 41: Protection against electric shock
ČSN 33 2000-5-54	Low-voltage electrical installations - Part 5-54: Selection and construction of electrical equipment - Earthing, protective conductors and protective bonding conductors
ČSN 33 0120	Electrotechnical regulations. Standardized voltages IEC 38
ČSN 33 2000-5-52	Low-voltage electrical installations - Part 5-52: Selection and construction of electrical equipment - Electrical wiring
ČSN 33 2000-4-473	Electrical regulations. Electrical equipment. Part 4: Safety. Chapter 47: Use of protective measures to ensure safety. Section 473: Measures to protect against overcurrent
ČSN EN 50110-1 60 529 (enclosure rating - IP code)	Operation and work on electrical equipment ČSN EN Degrees of protection provided by enclosures
ČSN 332000-5-51	Electrical installations in buildings - Part 5-51: Selection and erection of electrical equipment - General requirements
ČSN EN 60 445	Basic and safety principles for human-machine interfaces, marking and identification - Identification of terminals, conductor ends and conductors.
ČSN 33 1500	Electrotechnical regulations. Inspection of electrical equipment

2. BASIS FOR PROJECT PREPARATION

- Technical conditions for connection ČEZ Distribuce, a.s., No. 4122218922
- Site plan of the gas boiler room
- Technical standards ČSN and other related regulations

3. CONSTRUCTION IDENTIFICATION DATA

Name of construction:	KGJ TP21_059
ČEZ Distribuce contract no.:	23_VN_1010718525
Date of processing:	installation
Nature:	02/2024
Construction site:	Power output from new KGJ 600 kWe
Municipality:	ELI BEAMLINES complex
Cadastral area:	Dolní Břežany
Contracting authority:	Dolní Břežany
Address:	Extreme Light Infrastructure (ELI ERIC)
Documentation processor:	Za Radnicí 835, 252 41 Dolní Břežany
Address	VÍT LEPIČ s.r.o. Otmíče 43, Zdice, 267 51

4. PROJECT CONTENTS

This project documentation addresses the method of transferring power from the 600 kWe LV KGJ to the newly built 22/0.4 kV transformer station and its connection to the 22 kV ELI BEAMLINES network.

The power output will include a switchboard with a generator switch, a KGJ control and protection switchboard, a kiosk transformer station (LV switchboard, HV switchboard, HV/LV transformer, HDO blocking elements), HV switchboard outlet panel =R22-ELI, and a plant control room cabinet. The operating file also addresses the main HV cable route and other cable distributions in the technological background area.

5. BASIC TECHNICAL DATA

5.1 Voltage systems

5.1.1 Voltage system of the R22 - ELI substation

3 x 22kV AC, 50Hz / IT

5.1.2 Voltage system of the TAA1 800kVA transformer

3 x 22kV AC, 50Hz / IT

3 PEN 400V AC, 50Hz / TN-C

5.1.3 RH01 switchgear voltage system

3 PEN 400V AC, 50Hz / TN-C

5.2 Protection against electric shock

5.2.1 In the 3 x 35kV, AC, 50Hz / IT system

According to ČSN EN 61140 ed.2 and ČSN EN 61936-1

Protection against direct contact:

- according to section 8.2.2.2 by a partition, barrier, position

Protective measures in case of contact with non-live parts:

- according to section 8.3 (and section 10, in particular 10.2.2) in connection with ČSN EN 61140- article 5.2.4 - automatic disconnection from the source

5.2.2 In a 3 PEN 400V AC, 50Hz / TN-C system

According to ČSN 33 2000-4-41 ed.2

Basic protection:

- according to Article 411.1 basic protection by basic insulation of live parts, covers or barriers

Protection in case of failure:

- according to Article 411.3.1 protective earthing and protective bonding
- according to Article 411.3.2 automatic disconnection from the source in the event of a fault

5.3 Degree of importance of electricity supply

According to ČSN 341610 – level no. 3

5.4 External influences on electrical equipment

5.4.1 Expected decisive external influences

According to ČSN 33 2000-5-51 ed.3 and ČSN 33 2000-4-41 ed.2 Z1 in the affected areas:

<u>Room name</u>	<u>Main influences</u>	<u>Premises</u>
Switchboard R22 – ELI, R22.1 – ELI transformer room	AB5, BA4, BB2, BC3 AB5, BA5, BB2, BC3	Dangerous area TAA1 Hazardous area
KGJ engine room	AG2, AH2, AR3, BA4, BC3, CB2	Hazardous area

6.

DESCRIPTION OF TECHNICAL SOLUTION

To connect the newly installed KGJ, a new AVB4, AVB5 double-pole high-voltage switch is installed in the existing =R22-ELI substation behind the AVB3 metering panel. Power from the generator is fed into the new TS-KGJ1 kiosk transformer station. The power from KGJ1 from the kiosk transformer station is fed via an underground HV cable to a new field in the =R22-ELI substation.

TS-KGJ1 will contain space for a 22kV high-voltage switchboard, space for a transformer =TAA1 22/0.4kV, and space for a low-voltage switchboard =RH01.

The USM universal metering cabinet has been modified and supplemented. The AXY dispatch control cabinet has been installed in the R22-ELI substation and the MTN and MTP in the metering field have been replaced.

The status of the disconnector and earthing switch is signaled from the supply fields to the AXY cabinet.

6.1 22kV distribution network ČEZ Distribuce, a.s.

The =R22-ELI substation is connected to the distribution system:

- a) HV support point on plot no. 459/2, cadastral area Dolní Břežany, overhead HV line no. VN4044 HODKOVICE
- b) HV cable network – HV switchboard in TS PZ_0377

Property boundary:

- a) The customer's equipment begins with the output terminals on the US PZ_453 sectional disconnector for connecting the HV cable connection
- b) The customer's equipment begins at the output terminals of the disconnector in the HV switchboard in TS PZ_0377 Switching element used to disconnect the equipment from the distribution system:
 - a) Section disconnect switch for HV connection for TS PZ_0459
 - b) HV disconnector in TS PZ_0377

6.2 Transformer station TS-KGJ1 22/0.4kV

New kiosk-type HV/LV transformer station TS-KGJ1, which will include a 22 kV switchgear =R22.1, a 22/0.4 kV transformer =TAA1, a 0.4 kV switchgear =RH01, and HDO blocking elements =RFB1. The kiosk transformer station includes grounding and external lightning protection, including internal electrical wiring.

The step-up transformer =TAA1 is located in the TS1 kiosk transformer station cellar, which will be constructed as a separate, isolated space with an oil catch basin. A natural ventilation system for excess heat is installed. It is equipped with an SGB 22/0.4kV, 800kVA oil transformer. On the 0.4kV side, the transformer is connected to 800kVA blocking elements, which will serve to prevent HDO signal attenuation due to KGJ operation.

6.2.1 Grounding of the TS-KGJ1 transformer station

A grounding system consisting of equipotential loops made of FeZn 30/4 tape has been installed around the new transformer station, KGJ, technology container, and storage tank. At the same time, a grounding tape has been laid at the bottom of the excavation for the newly built HV loop along the entire length of the HV cable route. The new grounding system is connected to the existing grounding system of the buildings. This new grounding system is connected to the existing grounding of the new KGJ building and has a total ground resistance of less than $2\ \Omega$.

The KGJ grounding is connected to the new common grounding system.

The neutral node and transformer frame =TAA1, HV switchgear frames, PEN busbars, PE, 0.4kV switchgear frames, and all metal structures of the building, technology, and ventilation systems are connected to the transformer station grounding network. The cross-section of the connection of the transformer neutral node to the grounding network is min. $120\ mm^2 Cu$.

6.3 Substation space =R22 - ELI

In the substation space =R22 – ELI, the existing switchgear has been modified and supplemented with a two-pole gas-insulated SafePlus 22kV switchgear in V, V configuration. The fields are marked AVB4, AVB5.

The fields contain outlets with a motor-driven switch and an earthing switch. Field AVB3 contains an MTP and MTN set with the first secondary core for billing measurement and the second secondary core for AXY dispatching measurement. The terminal blocks of the current and voltage measuring transformers are equipped with sealable covers.

6.4 Main LV switchboard =RH01 and HV switchboard =R22.1

Switchboards =RH01 and =R22.1 are located in a shared space in the kiosk transformer station TS-KGJ1. Switchboard =RH01 is connected by cable cable LV from the =TAA1 22/0.4kV, 800kVA. Switchboard =RH01 contains switching element QAB1 – 1250A outlet to phasing switchboard =GENCB1 located in the new KGJ container.

6.5 Commercial metering switchboard USM

Electricity supply is measured as type A measurement at the HV level in switchboard =R22 – ELI field AVB3. The current measuring transformers are officially calibrated. Conversion of current measuring transformers 75/5/5A, accuracy class 0.5S with a maximum rated load of 10VA, official calibration. Transformation of voltage measuring transformers $22/\sqrt{3}/0.1kV/\sqrt{3}\ kV/0.1\sqrt{3}$, 10VA, 0.5, officially calibrated.

The USM billing meter cabinet of ČEZ Distribuce, a.s. is installed in the existing LV substation. The switchboard cabinet contains a hinged panel with an electricity meter, HDO receiver, and opto-isolator located on the front. The HDO receiver can be sealed and will remain functional even after the power plant is disconnected from parallel operation with the distribution system.

The connecting line between the MTP and MTN with a short-circuit terminal block in the USM cabinet is made of CYKY-O 2x4mm², CYKY-O 4x4mm², and 1x CYKY-J 5x2.5mm² cables without interruption along the entire length; the length of the cables does not exceed 40m.

Remote meter reading will be provided via a GSM modem as part of the delivery and installation of the electricity meter by ČEZ Distribuce, a.s.

Multi-level control of KGJ active power will be primarily controlled by an HDO receiver, and secondarily by a control unit owned by the customer.

6.6 AXY dispatch system switchboard

The AXY cabinet is a standard type with an interface for information transfer in accordance with the rules of distribution system operation. The switchboard is equipped with RTU data collection equipment for control dispatch.

For monitoring and control of the production plant, commands and signals will be transmitted to the DS control room:

- measurement of three-phase active and three-phase reactive power, first, second and third phase currents, phase and combined voltages for dispatch control

- active power control commands, including KGJ shutdown (the plant will be capable of multi-level active power control primarily using HDO receiver relays and secondarily P control will be possible via a backup route through the RTU AXY control system)

- signaling of the status of the QM1 breakdown point switching element
- signaling of network protection operation in the switchboard =R22-ELI field AVB5

6.7 Energy balance

The installed capacity of the new KGJ generator is 600 kW.

Technical data of the consumption/transfer point:

- | | |
|--|-------------|
| -voltage level | 22 kV |
| -reserved power consumption: | 2593.000 kW |
| -total installed capacity: | 912,800 kW |
| -reserved capacity of KGJ power plant: | 600,000 kW |
| -reserved capacity of the FVE plant: | 312,800 kW |

6.8 KGJ operation

The output of the new KGJ will be mainly supplied to the 22kV high-voltage level of the ELI BEAMLINES complex, with surplus output then being supplied to the distribution network of the DS operator (ČEZ Distribuce a.s.). In the event of a network failure, the KGJ will be automatically shut down (the plant will not be capable of island operation).

The power plant can automatically connect to the distribution system at the earliest when the voltage in the distribution system has been at least 5 minutes without interruption at values corresponding to the grid voltage with a power increase gradient of 10% Pn/min.

The regulation of changes in the power supply of the KGJ power plant will be carried out in all phases simultaneously at the following levels: 0, 50, 75, 100% of the rated power, while the regulation of the FVE power plant will be carried out simultaneously. Regulation between the individual stages will take place without transition to the intermediate stage of 100% or 0%. The plant must not exceed the specified power supply value; the plant may be operated at a lower power as needed or as possible by the plant operator, or the power supply may be interrupted, i.e., the plant may be temporarily (for the necessary period) disconnected. In the case of combined heat and power generation, regulation is performed for generation above the range that does not jeopardize heat supply.

The plant may be connected provided that it is equipped with the Q(U), LVRT, and P(f) functions in accordance with Annex 4 of the Distribution System Operation Rules, chapter "Behavior of Plants in the Network" (hereinafter P4 PPDS), and these functions must be demonstrably activated at commissioning with the settings specified in Annex 3 of the contract.

- Reactive power control Q(U) – according to P4 PPDS
- Dynamic network support – according to P4 PPDS curve Ability to bridge faults in directly connected generators
- Reduction of active power during overfrequency P(f) – power plants connected to the DS that do not disconnect automatically must be capable of reducing instantaneous active power by a gradient of 40% per Hz at frequencies above 50.20 Hz.

Note: These functions will be ensured by regulating the excitation of the KGJ synchronous generator.

6.9 Protections and emergency shutdown

The breakpoint between the power plant source and the distribution system is the QM1 switch in the R22-ELI AVB5 switchboard. The circuit breaker is operated by network protections set according to the rules for connection to the distribution system (PPDS).

The MV protections are connected to the combined voltage.

Network protection settings:

Protection	Setting	Delay	Note
Undervoltage 1st stage	U<70%	0.5	Instantaneous value of VM synchronization
Undervoltage 2nd stage	U<<45%	0.2	Instantaneous value
Oversupply 1st degree	U>111%	0s	10 min. average
Oversupply 2nd degree	U>>115%	5s	Instantaneous value
Oversupply 3rd degree	U>>>120%	0.1s	Instantaneous value
Underfrequency	f<47.5Hz	0.1s	Instantaneous value
Overfrequency	f>51.5Hz	0.1	Instantaneous value

6.9.1 Breakdown point

According to the PDS definition, the switch in the AVB5 field of the substation =R22-ELI will form the breakdown point for power output from the KGJ.

6.9.2 Emergency shutdown (CENTRAL-STOP)

A button labeled "CENTRAL-STOP" is installed in the area in front of the entrance to the TS-KGJ1 kiosk of the new transformer station. This button will switch off the QM1 switching element in the =R22-ELI switchboard in the AVB5 field. The connection is made together with the data cables using a WS5 CYKY-J 5x1.5 cable.

6.10 Cable distribution

6.10.1 HV cable distribution

The 22kV HV cable connection between the switchboard =R22 - ELI and the newly built TS1 consumer transformer station is made with 22-AXEKVCEY 1x120/16mm² cables. The outdoor route is laid underground.

The internal connection TS-KGJ1 approx. 4 m between the distribution board =R22.1 ELI and the transformer =TAA1 is made with 22-AXEKVCEY 1x120/16 mm² cables. The cables are stored in bundles secured with appropriate screw clamps.

6.10.2 LV cable distribution in TS-KGJ1 – connection =TAA1 – =RH01

The connection of the LV side of the transformer to the switchboard =RH01 is made with 3x (2II NSGAFOU 1.8/3kV 1x240) + 1x NSGAFOU 1.8/3kV 1x240 cables. The cables are stored in bundles secured with appropriate screw clamps on galvanized steel cable trays. The total length of the cable route is approx. 6 m.

6.10.3 LV cable distribution between TS-KGJ1 and the new KGJ container

The route between the TS-KGJ1 kiosk (switchboard = RH01) and the new KGJ kiosk (switchboard = GENCB1), approx. 6 m long, is laid in the ground outside and inside the new KGJ kiosk. The cables are stored in bundles. An FeZn 30x4 grounding strip is routed into the new KGJ kiosk together with the cables.

The connection between switchboard =RH01 and switchboard =GENCB1 is made using 4x 3xNYY 1x240mm² cables and, for the PEN conductor dimension, 2x NYY 1x240mm² cables.

6.10.4 LV cable distribution between the KGJ generator terminals and the switchboard =GENCB1

The route between the =GENCB1 switchboard and the KGJ GA1 generator terminals is made using 3x (2II NSGAFOU 1.8/3kV 1x240) + 1x NSGAFOU 1.8/3kV 1x240. The cables are laid in bundles.

7. TECHNICAL SPECIFICATION

7.1 600 kW cogeneration unit

Type	Synchronous
Natural gas consumption	
Electrical output	600 kW
Generator voltage	400V
Dimension	
s Weight	

7.2 Switchboard =RH01

Dimensions Input/Output	(HxWxD) 2000x800x500mm
Voltage system	top/bottom
Protection open/closed	3 PEN 400V AC, 50Hz / TN-C IP 44/20

7.3 Transformer 22/0.4kV

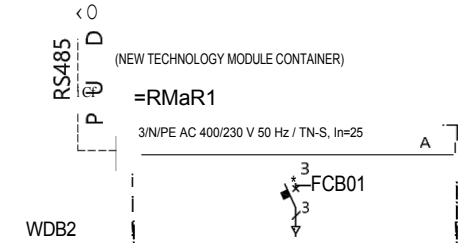
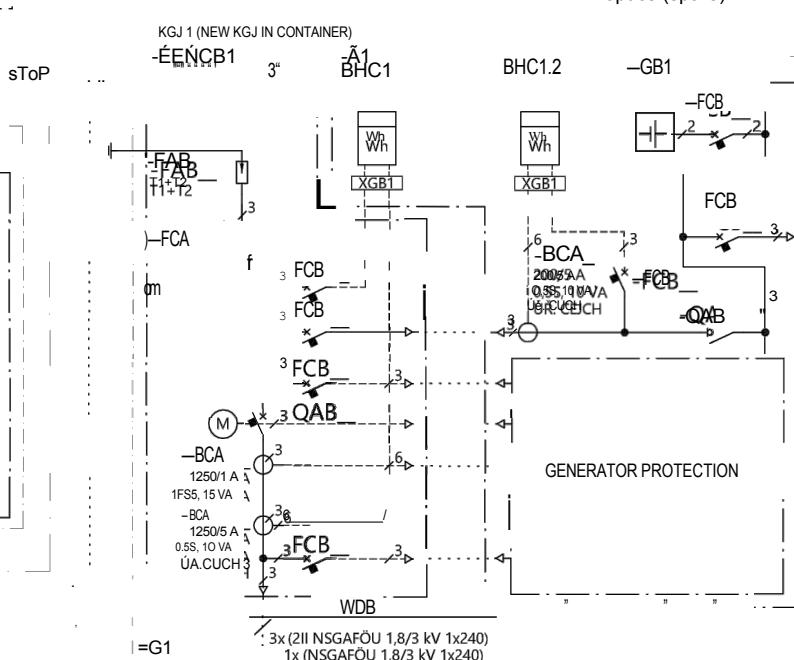
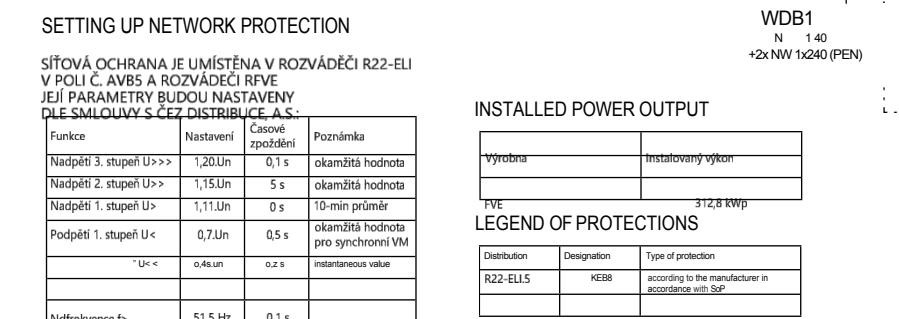
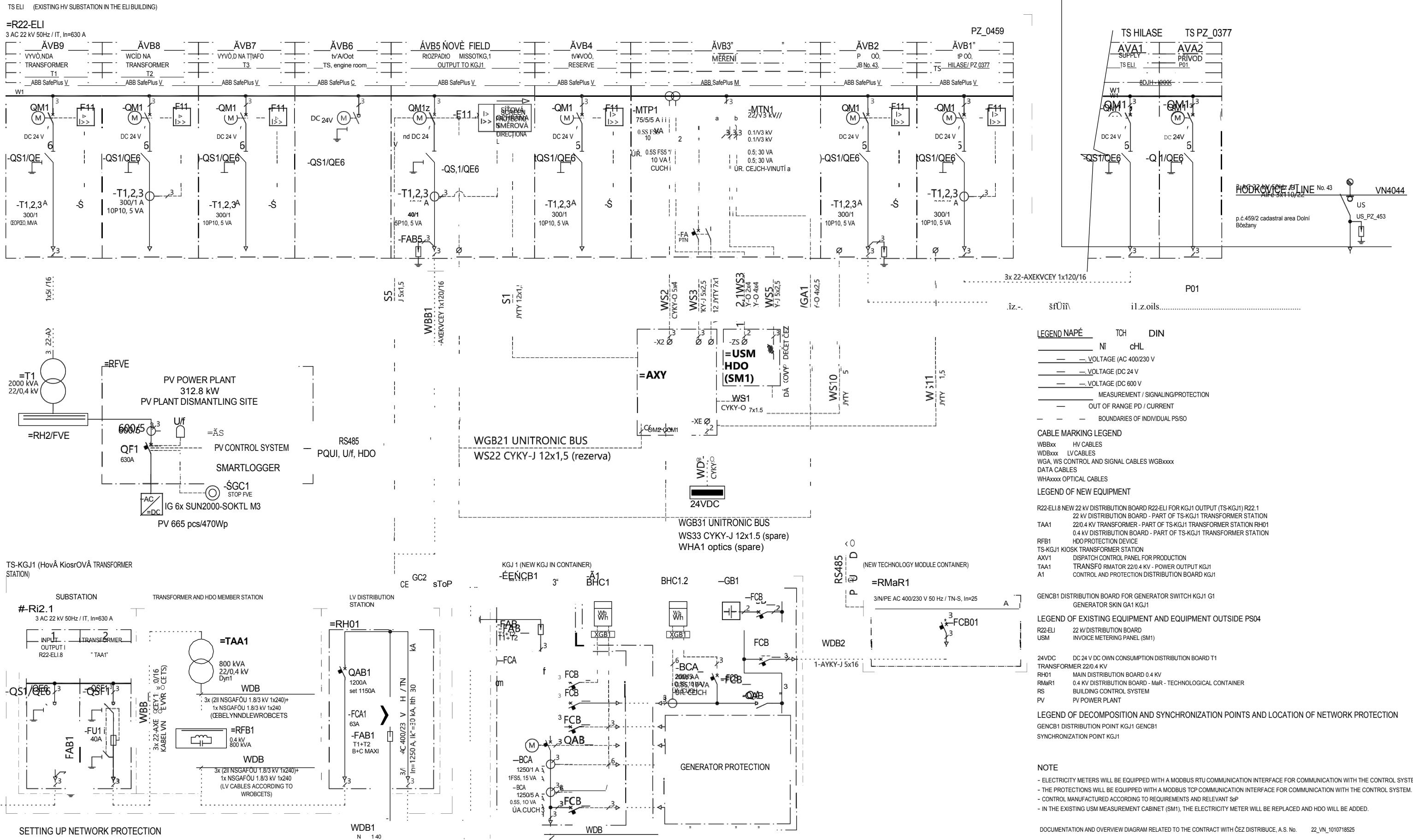
Manufacturer	SGB
Type	DOTUL 800H/30
Electrical power	800kVA
Short-circuit voltage	6%
Dimensions	1800x1000x1600mm
HxWxD	
Weight	2400 kg

8

CONCLUSION

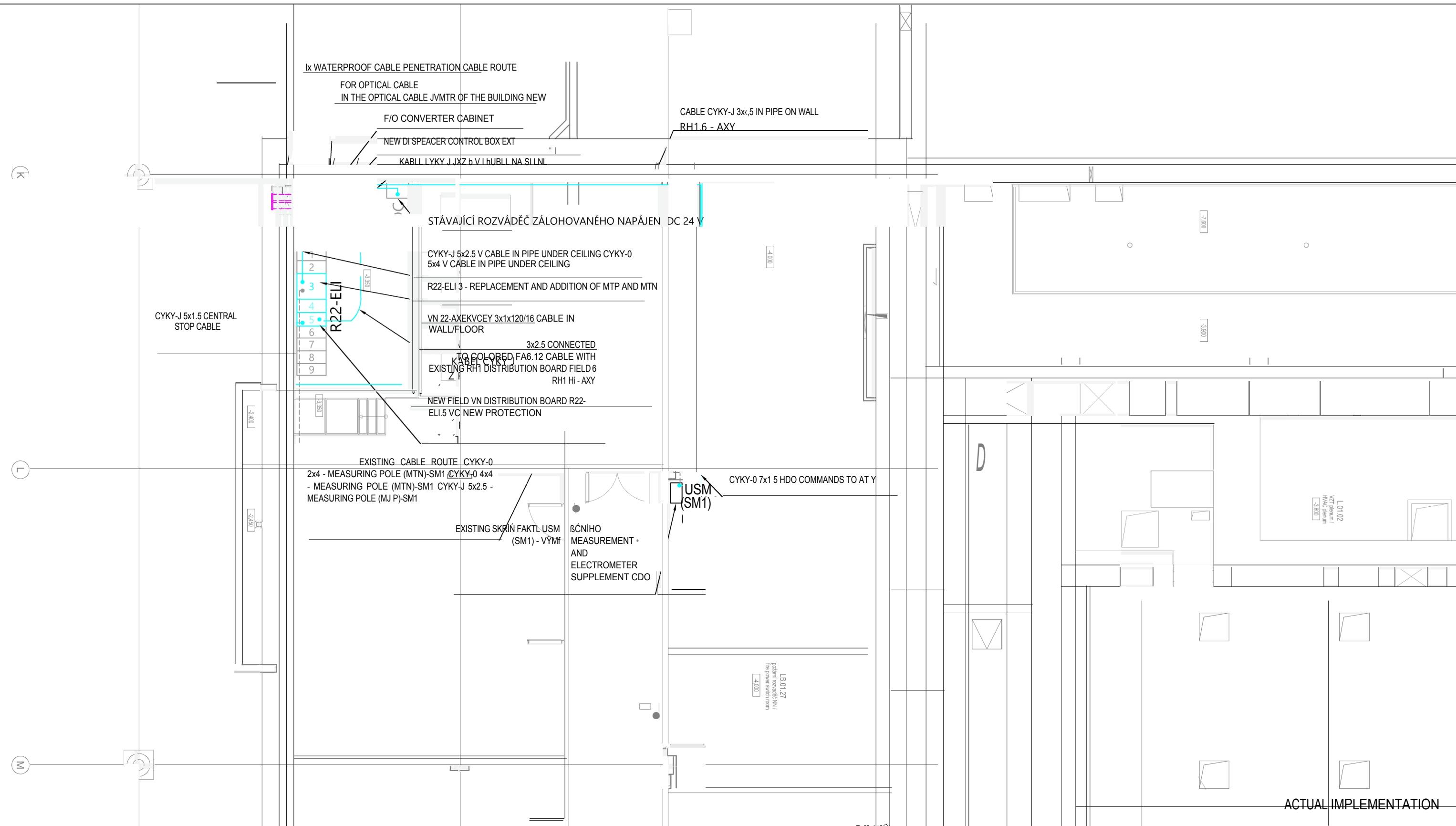
This technical report is an integral part of the project documentation and must always be made available with the drawing documentation. All installation work must be carried out in accordance with ČSN standards and other implementation and safety regulations. Installation work may only be performed by a person with a professional qualification to perform activities in electrical engineering in accordance with Government Regulation 194/2022 Coll. Instruments and equipment must be designed for the relevant external influences. All instruments must be located so that they are accessible for maintenance and any repairs or calibration. All devices must be marked with permanently attached labels with a description and a surface resistant to the surrounding environment. The installation company is responsible for the installation. After completion of the work, documentation of the actual implementation must be prepared. The project documentation is binding for the implementing company in its entirety!

After the electrical part has been installed in accordance with the project documentation, the electrical equipment will not pose a threat to the safety of persons or property. Before putting the electrical equipment into operation, it is necessary to carry out an initial inspection of the electrical equipment in accordance with ČSN 33 2000 – 6.

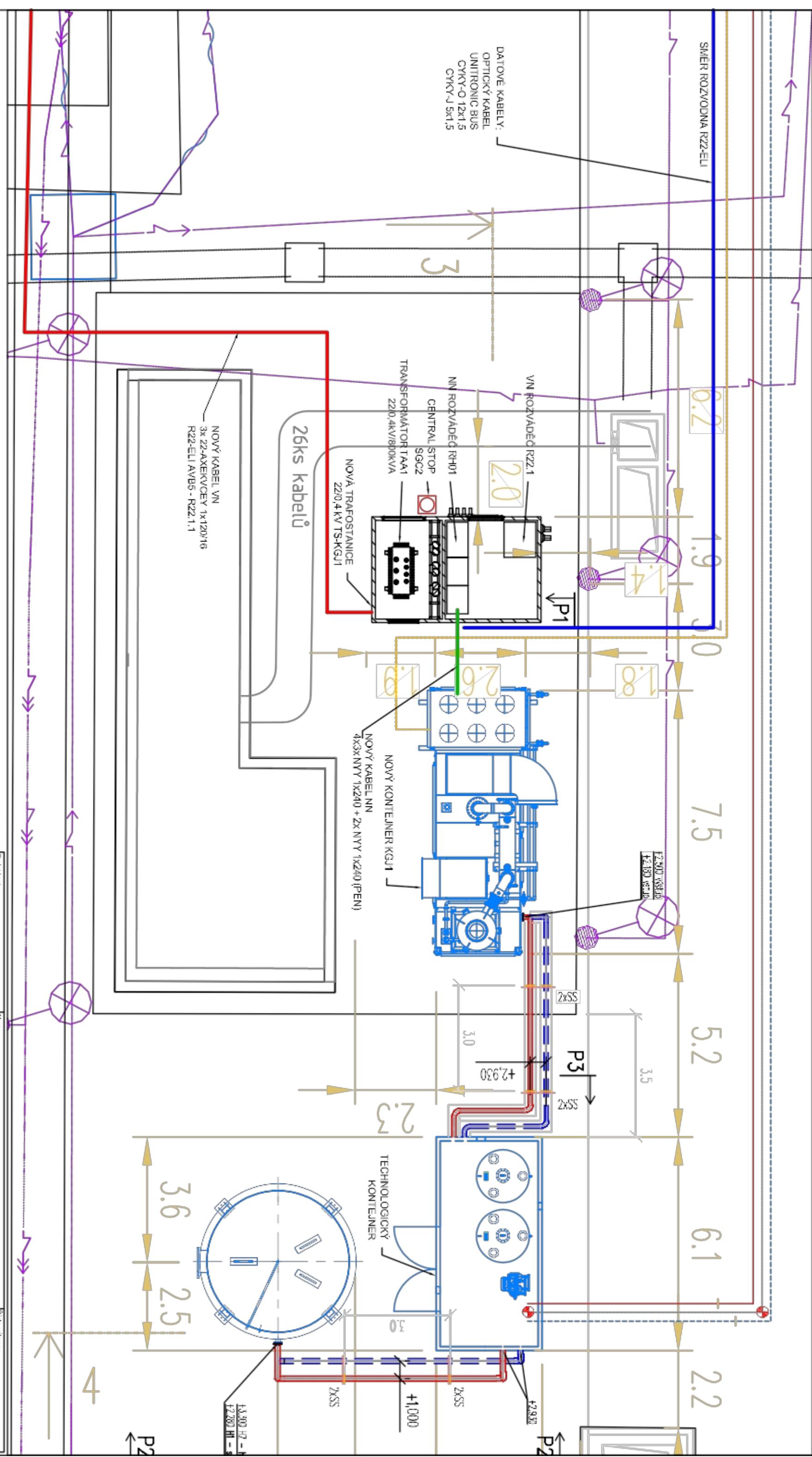


<p>Síťové řízení ELI Lepič ELI Lepič</p> <p>Č.s.r.o. INSTALLATIONS SOLUTIONS OF EQUIPMENT 67 51 ZDICE 3 170 931 ID: 27935981</p>	<p>PD COGENERATION UNIT TP21 059 ELI BEAMLINES premises, Za Radnicí 835, 252 41, Dolní Břežany</p> <p>Extreme Light Infrastructure (ELI ERIC)</p> <p>Document name:</p> <p>PS 04 - Electrical power output from KGJ Single-pole overview diagram</p>	<p>321-4-PS04-E03</p> <p>Číslo zakázky: 202301</p> <p>Stupeň PD: DSPS DOD: 02/2024</p> <p>A3 Formát: Měřítko:</p>
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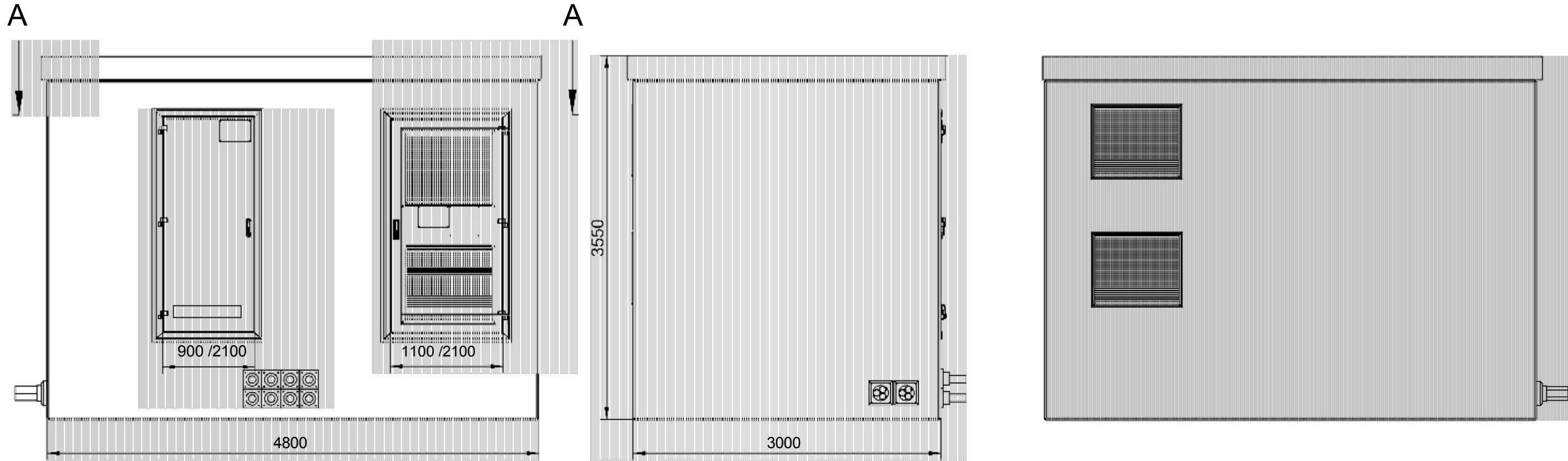




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ZDICE		Distribution substation	
tel: +420 603 170 931			
IČO: 27935981			
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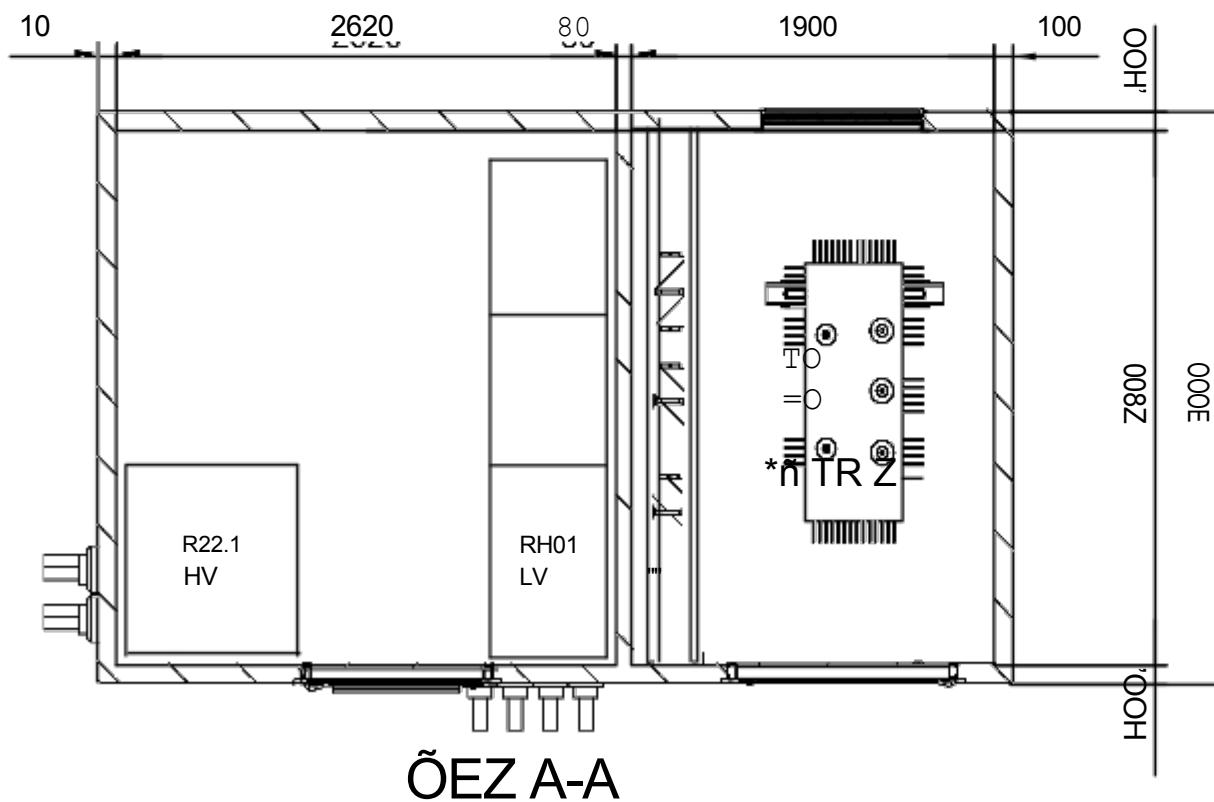


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[ČD]: 27935981				
PS 04 - Vyvedení el. výkonu z KGJ				
Dispozice - Technologické zázemí				
		Formát:	A3	Měřítko:
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ELTRAF TRANSFORMER STATION:

type: ETSbb 348_25



VOLTAGE SYSTEMS:

3 AC 22 kV 50 Hz / IT2

- Protection against direct contact: insulation, covers and barriers, positioning, barriers
- Protection in case of contact with non-live parts: earthing (according to ČSN EN 61936-1 and ČSN EN 50522)

3/PEN AC 400/230 V 50 Hz / TN-C-S

Protection against electric shock (ČSN 33 2000-4-41 ed.2)

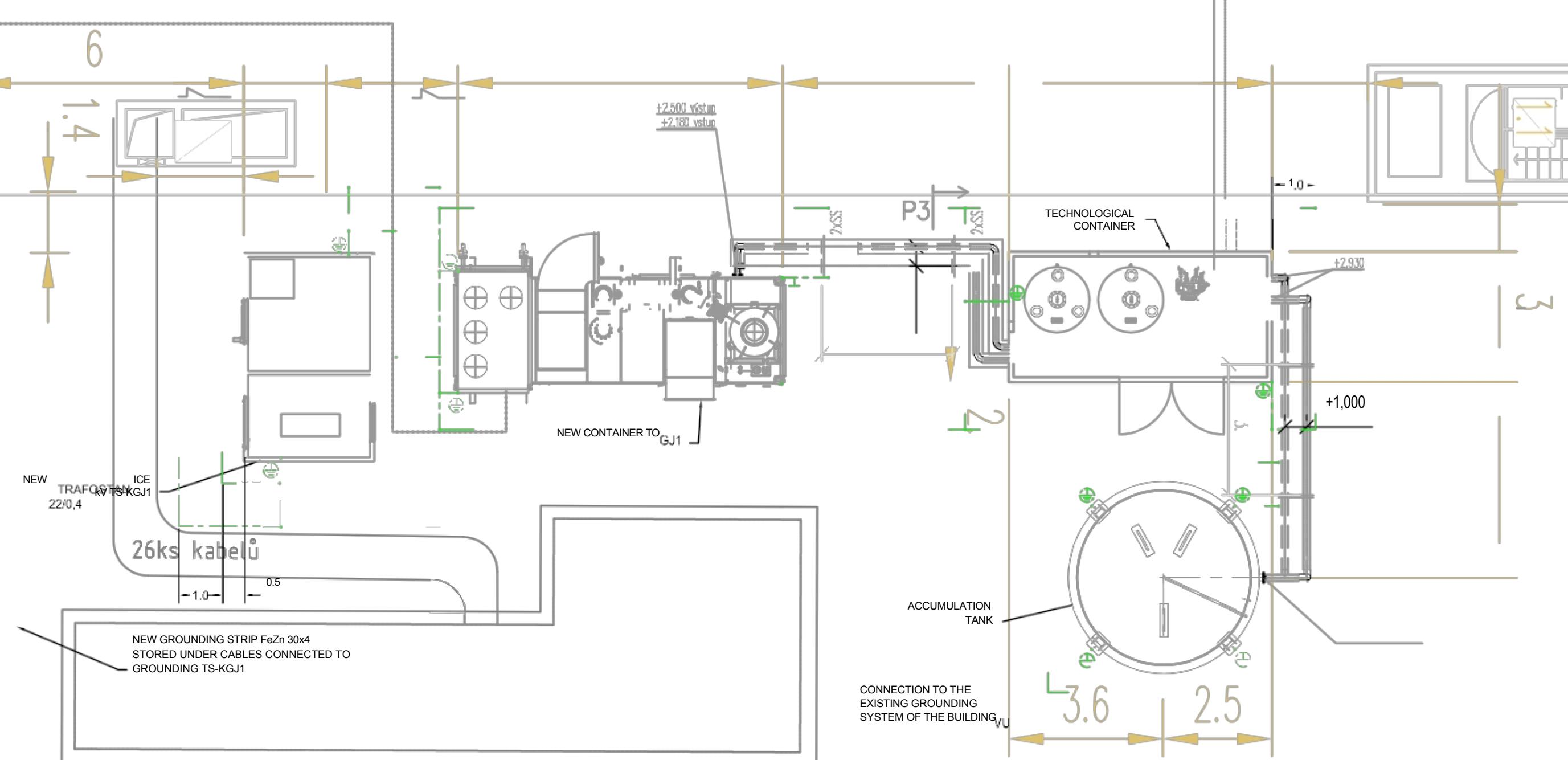
- Basic protection against contact with live parts: insulation, covers and barriers, positioning, barriers
- protection against faults (protection against contact with live parts): protective earthing, protective bonding, automatic disconnection from the source
- supplementary protection: residual current devices, supplementary protective bonding

ACTUAL DESIGN

ř oj e k n u t. Stanislav Jaroš Coordinate výkona Vít Lepič Vít Lepič	PD COGENERATION UNIT TP21_059 ELI BEAMLINES premises, Za Radnicí 835, 252 41, Dolní Brežany	„ 10 „ r „ 321-4-PS04-E07
VÍT LEPIČ s.r.o. PROJECTS, NON-PROFIT ORGANIZATIONS AND REVISION ELEK TROZA ZEN Eltnfče 43, 267 01 ZDICE tel. +420 603 170 931 IČD 27935981	In st., Extreme Light Infrastructure (ELI ERIC)	Order number: 2023011
	Documentation name: PS 04 - Electrical output from KGJ Layout of TS-KGJ1 transformer station	PD stage: DSPS Dhera „ 02/2024
		Format: A3 Měřitko:

CONNECTION TO THE EXISTING GROUNDING SYSTEM OF THE BUILDING

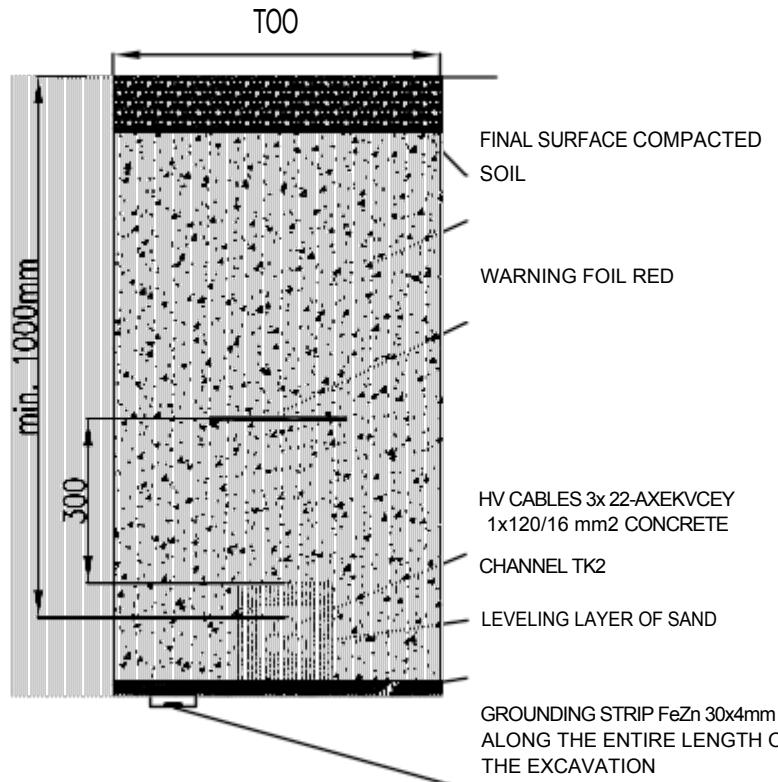
CONNECTION TO THE EXISTING GROUNDING SYSTEM OF THE BUILDING



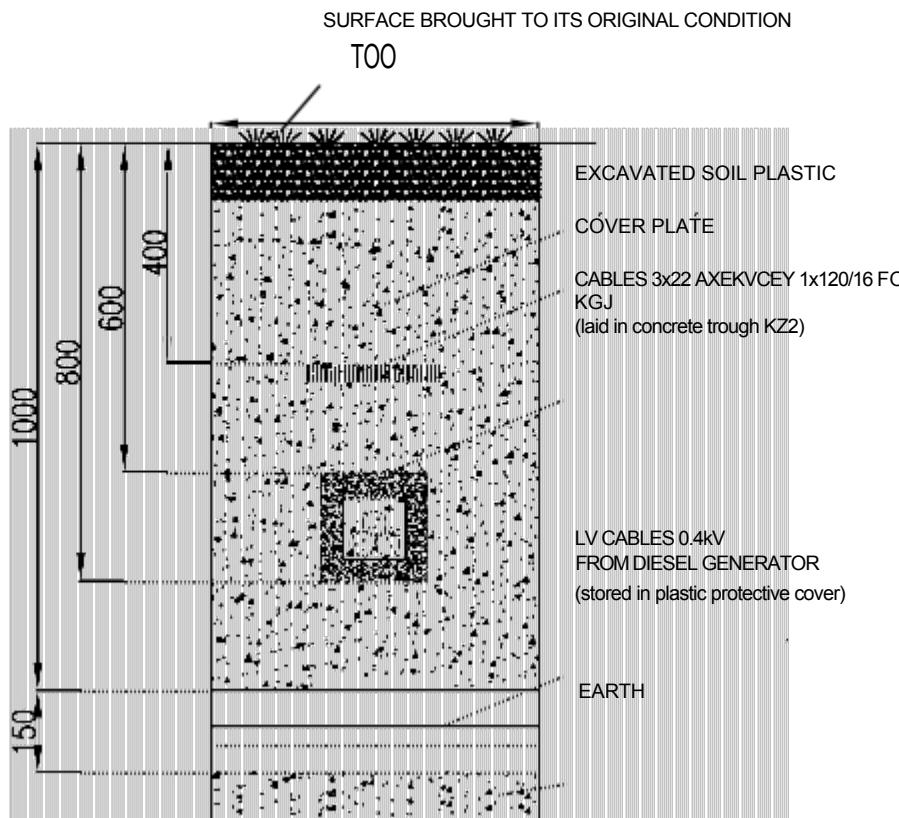
ACTUAL DESIGN

Designer: Eng. Štefan Fišer	Project: PD COGENERATION UNIT TP21_059	Serial number: S0001e u
KOOŁUJÓVSKÝ Vít Lepič	Area: ELI BEAMLINES, Za Radnicí 835, 25241, Doní Běžany	321-4-PS04-E08
SchVB/I. Vít Lepič		
VIT LEPIČ s.r.o. PROJEKTY, NONT řEZA	Extreme Light Infrastructure (ELI ERIC)	Order number: 2023011
ELECTRICAL INSPECTION AČZ ZENZ Otnice 43, 267 A1 ZDICE tel. +420 603 170 931 ID No. 27936981	PD stage: DS/PS	Documentation name: PS 04 - Electrical output from KGJ Layout - Grounding
	Date: 02T2024	Format: A3 Scale:

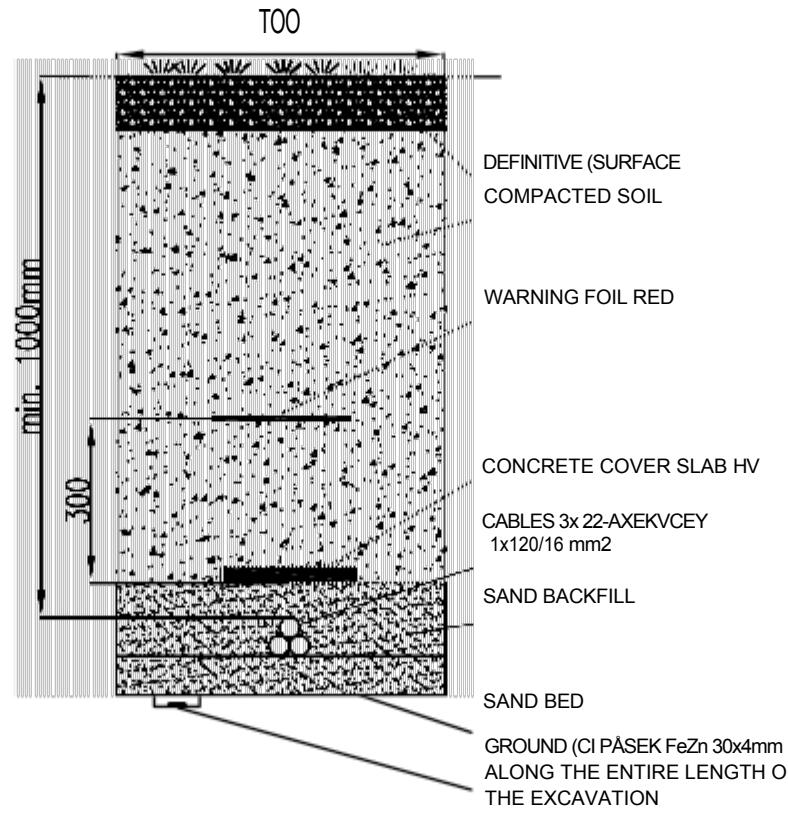
**REZ A-A' HIGH-VOLTAGE CABLE STORAGE
UNDER THE ROAD AND REINFORCED AREA**



**HV CABLE LAYING
CROSSING WITH 0.4kV LV CABLES FROM DIESEL GENERATOR**



**REZ B-B'
STORAGE OF HV CABLES
IN THE FIELD**



MINIMUM PERMITTED VERTICAL DISTANCES FOR CROSSING UNDERGROUND NETWORKS ACCORDING TO ČSN 73 6005 IN m:

TYPE SÍTI	Power cables				communication cables		water supply networks connections		sewer networks and sewerage connections
	up to 1kV	up to 10kV	up to 35kV	up to 220kV	unprotected	in protective covers	unprotected	in protective covers	
power cables	0.05	0.15	0.20	0.20	0.30	0.10	0.40	0.20	0.30
up to 1kV	0.15	0.15	0.20	0.20	0.80	0.30	0.40	0.20	0.30
up to 35kV	0.20	0.20	0.20	0.25	0.80	0.30	0.40	0.20	0.50
up to 220kV	0.20	0.20	0.25	0.25		0.50	0.40	-	0.5

*)Lower voltage cable stored in a protective cover.

**)High-voltage cables and communication cables stored in protective covers, length of protective cover overlap 2.0 m on each side from the connection point.

MINIMUM PERMISSIBLE VERTICAL DISTANCES FOR UNDERGROUND CABLES ACCORDING TO ČSN 73 6005 In m:

TYPE OF NETWO RK	Power cables				communication cables		water supply networks and connections		sewer networks and sewer connection s
	up to 1kV	up to 10kV	up to 35kV	up to 220kV	unprotected	in protective covers	unprotected	in protective covers	
... sítě IY	0.05	0.15	0.20	0.20	0.3	0.10	0.40	0.50	
up to 10 kV	0.15	0.15	0.20	0.20	0.80	0.30	0.40	0.50	
up to 35kV	0.20	0.20	0.20	0.25	0.80	0.30	0.40	0.50	
up to 220 kV	0.20	0.20	0.20	0.5	0.80**)		0.4	1	

*)In a technical duct or concrete conduits

**)Sdělovací cable in concrete protective sleeve filled with asphalt, length of protective sleeve overlap 1500 mm, on each side from the end of the parallel run

MINIMUM PERMISSIBLE COVERAGE ACCORDING TO ČSN 73 6005:

POWER CABLE	MINIMUM COVERAGE IN m		
	sidewalk	roadway	open terrain
up to 1kV	0.35	1.00	0.35/0.70"
up to 10kV	0.50	1.00	0.7
up to 35kV	1.00	1.00	1.00
up to 200kV	1.30	1.30	1.30

*) Cables without protection against mechanical damage.

Note:

Excavation width 500 mm. Cable laid in sand backfill using a concrete cover plate in the section of the route outside the road. Backfill will be carried out using excavated material with the laying of warning foil.

Cable laying must comply with ČSN 33 2000-5-52 ed.2.

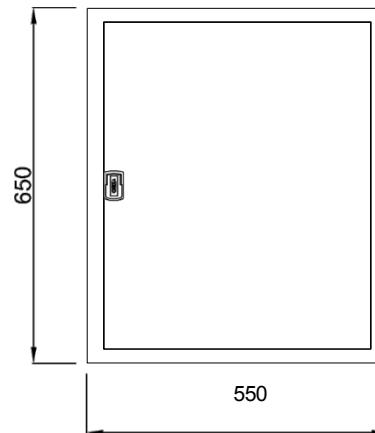
ACTUAL DESIGN

ro j.k'an' Ing. Stanislav Jaroš Coordinate vle pič Approved by: Vít Lepič	Akc o" PD COGENERATION UNIT TP21_059 AreáEI LI BEAMLINES., Za Radnicí 835, 252 41, Dolní Břežany	S, 0 v, kr, su, 321-4-PS04-E09
VIT LEPIČ s.r.o. PRODUCTS, INSTALLATIONS AND ELECTRICAL INSPECTIONS ElznTče43, 267 51 ZDICE teü +420 603 170 931 Company ID No. 27935981	In e, o" Extreme Light Infrastructure (ELI ERIC)	Order number: 2023011
Document name: PS 04 - Electrical power output from KGJ Cable placement in trench OUTDOOR HV DISTRIBUTION	D a'uM: 0212024	PD level: DSPS
	Format: A3	Scale: Sheet: I
		Lists: I

Standing USM measurement

UNIVERSAL CABINET MĚŘÍENÍ USM
SM-1/33

FRONT VIEW



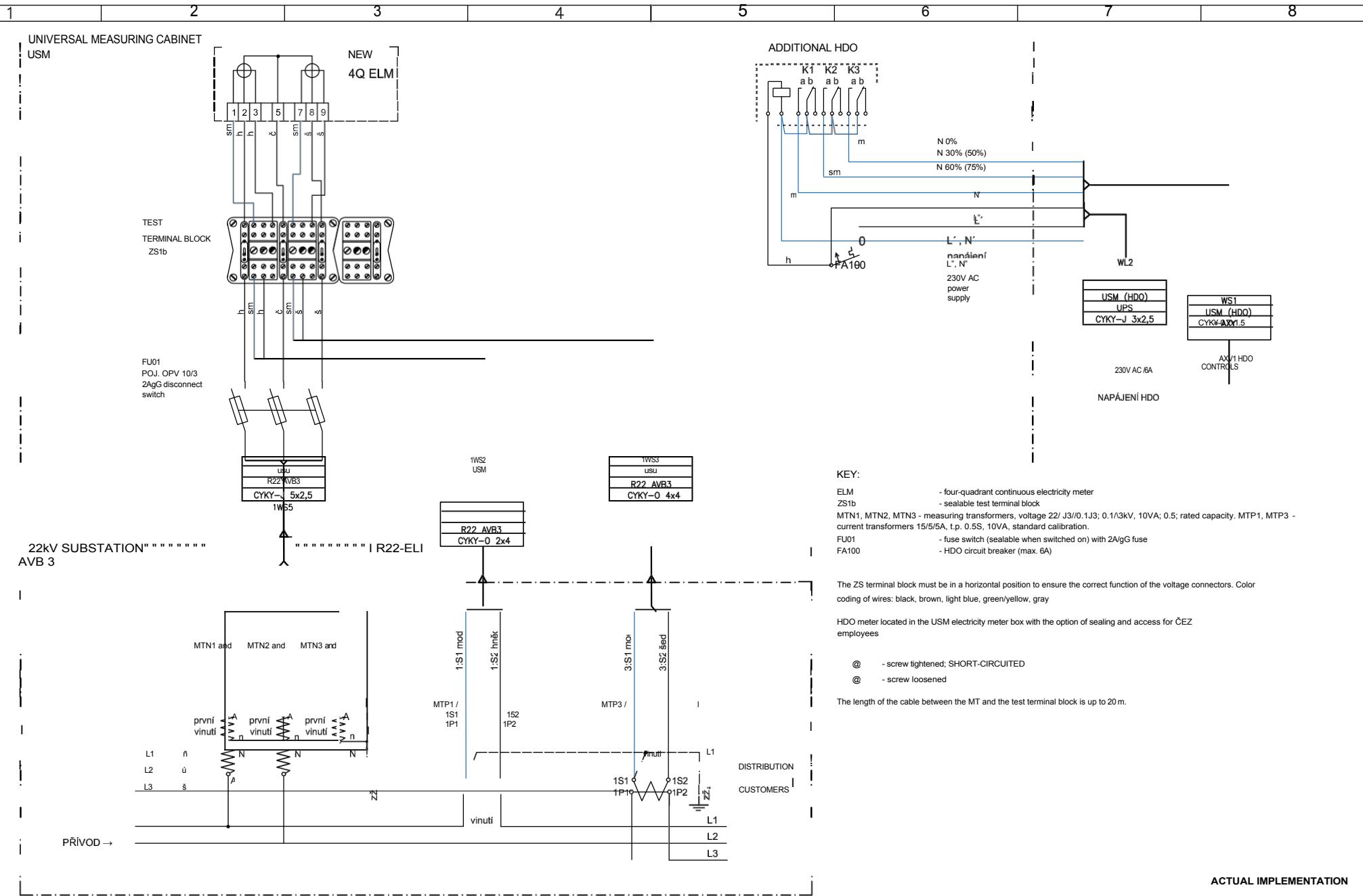
USM specifications - type cabinet (ES, CE): short-circuit resistance min. 10kA protection in outdoor environment IP43/IP20 protection in indoor environment IP40/IP20 rated current of measuring circuits 5A, power circuits 10A sealable covers of non-measured parts separate live parts of the measured distribution and space for the electricity meter and switch elements removable parts made of non-conductive materials

Equipment included:

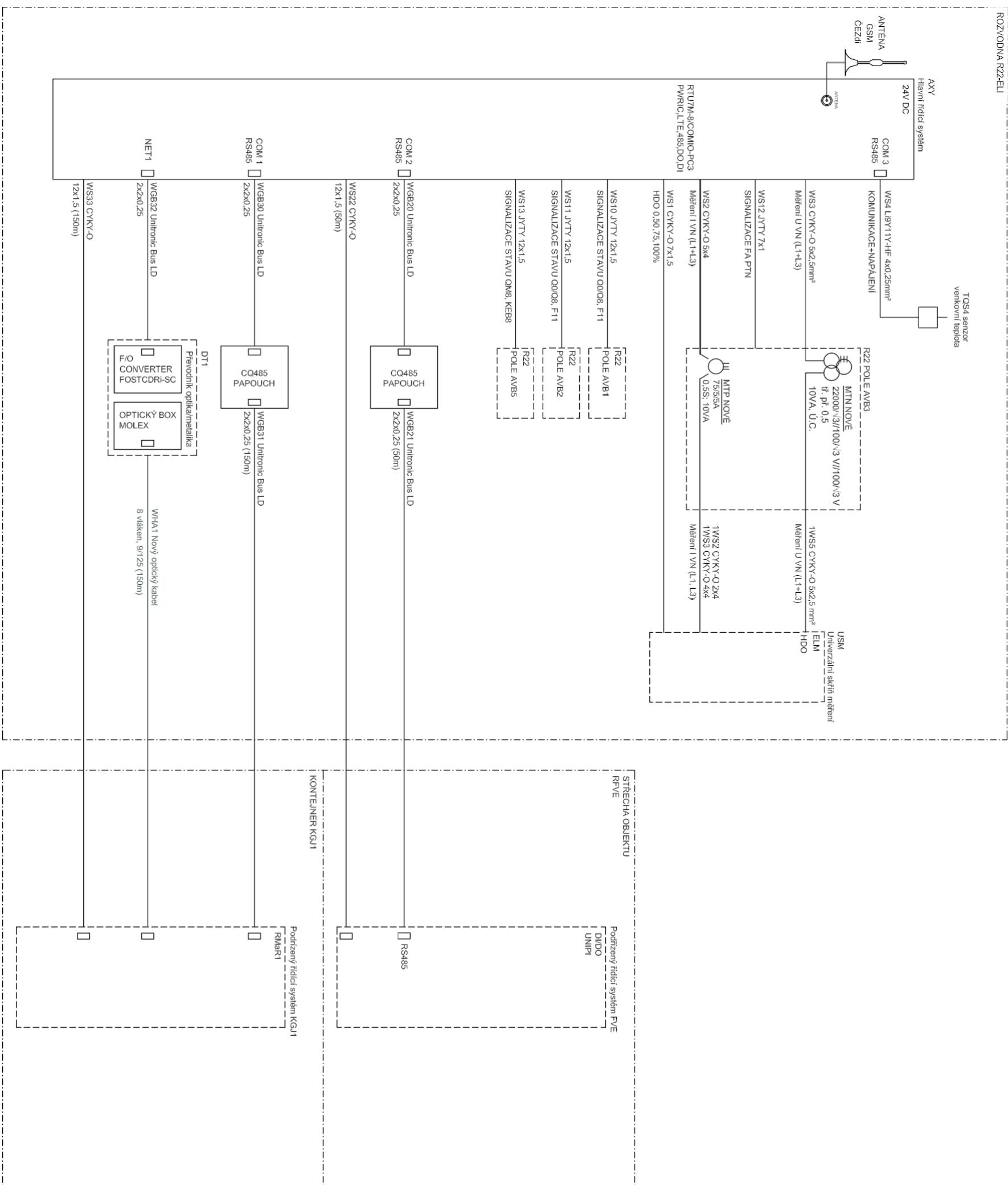
- electric meter, communication unit
- test terminal block (ZS1b)
- fuse switch sealable in the on position 2AgG circuit breaker for control relay 6A
- control relay in sealable modular cover (HDO receiver)
- lock with modification for lock and seal
- hinged panel, fixed rear panel
- glazed doors
- mounting bracket
- cable clip
- terminal block for 230V, 50Hz power supply and electricity meter signal circuits

ACTUAL DESIGN

REVZE	KRgsuu			we. sí NisLav JAR03			Extreme Light Infrastructure (ELI FRic)			UXZAE:	sTUPoN Po: usT: 1	VIT LEPIC s.r.o.
	RESPONZOVACÍ MANGER	KRÉDITKED BY:	MILEVANISLAV JAROŠ	CONSTRU	PD KOGEUERACNI UNITS TP21 03	OBJEK:						
2				ODPOVĚDNÝ PROJ:	VIT LEPIC					Universal USM skříň měření	DSPS p,	usT: Z "
				DATUM:	02/2024					Front view	321-4-PS04-E10	ELEKROZARIZENI
č.	DESCRIPTION REVZE	DATA	NAME	SIGN	ZAKLÁDNY NUMBER: ČÍSLO ZAKÁZKY:	2023011 2023011					EMAIL: vit.lepic@seznam.cz	IČO: 27935981



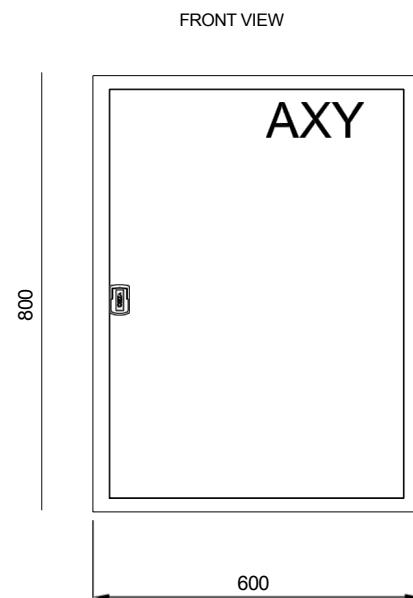
4	DESCRIPTION OF INSPECTION	DATA	NAME	SIGN	KRESLÍČKOVÝ NÚMERO: 2023011	ING. STANISLAV JAROŠ	CONSTRUC	UXZB:	Universal skříň měření USM	321-4-PS04-E10	TEL: +420 603 170 931
2	KONTROLÓVAL: VÍT LEPÍČ	ODPOVĚDNÝ PROJ.: VÍT LEPÍČ	DATUM: 02/2024	OBJEKT:	PS 04 - Vyvedení el. výkonu z KGJ	EMAILIC: 2703s961	OTMIČE 43, ZDICE 267 51				
1	ČÍSLO ZAKÁZKY:	2023011	REVIZE	4							



SKUTEČNĚ PROVEDENÍ

Projektant:	Ing. Stanislav Jaroš	Almac:	PD KOGENERAČNÍ JEDNOTKY TP21_059	Cíl výkresu:	
Koordinova:	Vilém Lepič	Areal:	Areál ELI BEAMLINES, Za Radnicí 835, 252 41, Dolní Břežany	Číslo základky:	321-4-PS04-E11
Společ:	Vilém Lepič	místnost:	Extreme Light Infrastructure (ELI ERIC)	Datum:	2023/01
VIT LEPIČ s.r.o.		Název dokumentace:		Stupej PD:	DSPS
PROJEKTY, MONTAŽE A					
REVIZE ELEKTROZÁŘÍZENÍ					
Otovice 43, 267 51 ZDICE					
tel: +420 603 170 931					
160 27935981					
PS 04 - Vvedení el. výkonu z KGJ					
Komunikační přehledové schéma					
Fyzická:	A3	Materiál:	-		

AXY dispatch control system


AXY specifications:

Steel sheet distribution box 600x800x250mm (W x H x D) Single-leaf solid door
 - IP54/IP20 protection
 Bottom inlet type DOS2151G1 sensing unit type RTU7M-5

Nominal voltage and network types

Supply voltage 1/N/PE 230V AC 50Hz TN-S Supply voltage 2 24V DC IT
 Measuring voltage 3/N/PE 230V (100V) AC 50Hz TT

Protection against electric shock

1/N/PE 230V AC 50Hz TN-S - automatic disconnection from the power source
 2 24V DC IT - automatic disconnection from the power source
 3/N/PE 230V (100V) AC 50Hz TT - automatic disconnection from the source

ACTUAL DESIGN

			KRZBUL:	ME SISTAVNÍSLUJAROČ	Extreme Light Infrastructure (ELI ERc)	UXZAE:	AXY control room	sTUPČN Po: DSPS	usT: 1	VIT LEPIČ s.r.o. PROJEKTY, MONTÁŽE A REVIZE ELECTRICAL EQUIPMENT
			CHEKED BY: KONTROLVAL:	VIT LEPIČ					usT: Z	
REVIS			RESPONSIBILITY: MANAGED BY:	VIT LEPIČ	CONSTRUCTION:	PD KOGEUERAČNÍ JEDUOTKY TP2109	Front view			
REV 2			DATUM:	02/2024	OBJEKTE:	PS 04 - Vyvedení el. výkonu z KGJ				
č.	DESCRIPTION REVIQE	DATE	NAME	SIGNATURE	ZAKOUPENÝ KOD:	2023011				IČO: 27935981

1 2 5 4 5 6 7 8

A

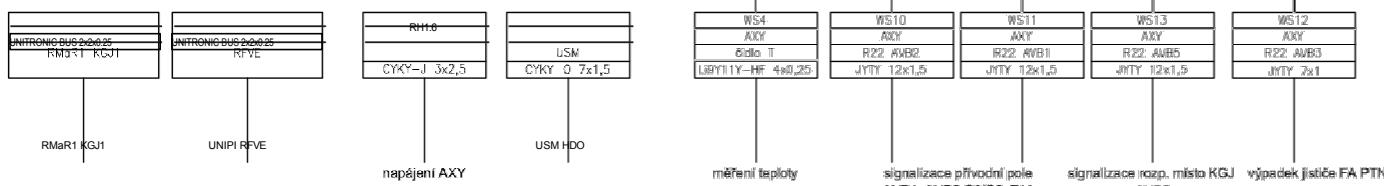
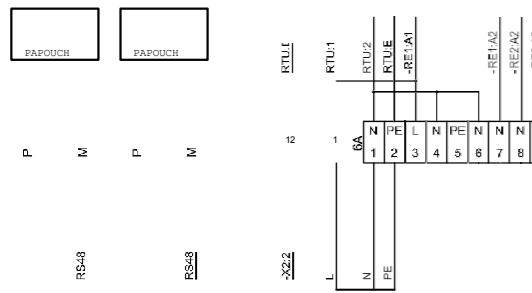
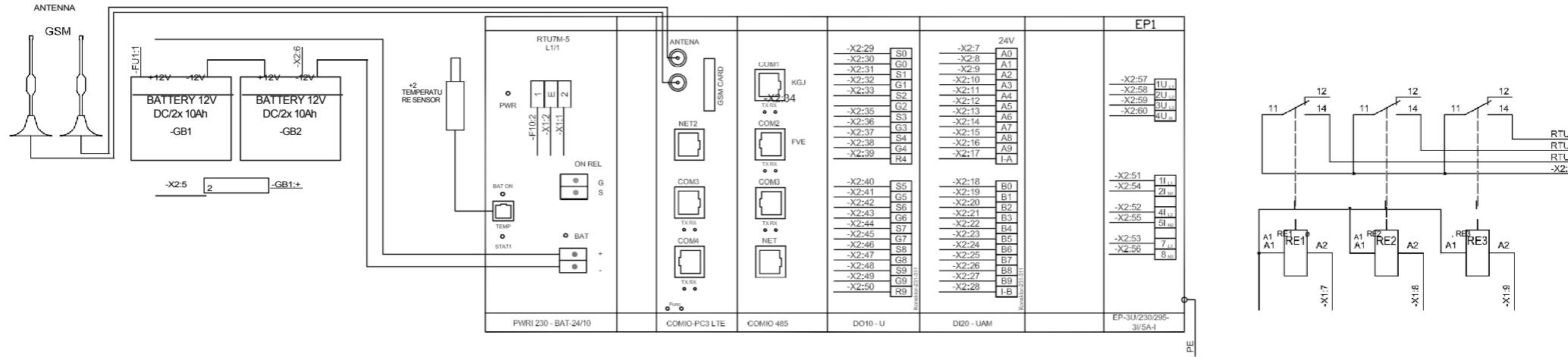
B

C

D

E

F



KRESLIL: we. s/ NisLav JAROS

Extreme Light Infrastructure (ELI ERIC)

AXY control room switchboard

Connectio
n

STUPSN PD: UST: VIT LEPIČ s.r.o.

DSPS	o, uTu, z	PROJEKTY, MONTÁŽE A REVIZE ELEKTROZARIENÍ
321-4-PS04-E12		EMAIL: vitlepic@seznam.cz IČO: 27935951

REVNZE	DESCRIPTION	NAME	SIGN	KRESLIL BY: ING. LEPIČ STANISLAV JAROS	RESPONSIBLE PROJECT MANAGER: VIT LEPIČ	CONSTRU CTION:	PD KOGEUERACNÍ JEDNOTKY TP2109
2							
1	REVIKE	DATUM:	02/2024	DATUM UZER:	02/2024	OBJEKTE:	PS 04 - Vyuvedení el. výkonu z KGJ

Bill of quantities:	Cable list
Project name:	Extreme Light Infrastructure (ELI ERIC)
Object:	PS04 - electrical power output from KGJ
Order no.:	2023011 Eli Beamlines
SOP:	Extreme Light Infrastructure ERIC 23_VN_1010718525
Prepared by:	SOB
Date	02/2024

Cable number	Type	From	Where to	length	unit	note
WL1	CYKY-J 3x2.5	RH1.6	AXY			AXY power supply
WL2	CYKY-J 3x2.5	UPS	USM			HDO power supply
WS1	CYKY-O 7x1.5	USM	AXY			HDO commands
WS2	CYKY-O 5x4	R22 AVB3	AXY			disp. Measurement I
WS3	CYKY-J 5x2.5	R22 AVB3	AXY			disp. Measurement U
WS4	Li9Y11Y-HF 4x0.25	AXY	Tsensor			Temperature measurement
WS5	CYKY-J 5x1.5	R22 AVB5	CENTRAL STOP			kiosk TS-KGJ1
1WS2	CYKY-O 2x4	R22 AVB3	USM			metering and billing
1WS3	CYKY-O 4x4	R22 AVB3	USM			Measurement and billing
1WS5	CYKY-J 5x2.5	R22 AVB3	USM			U measurement billing
WGA1	CYKY-O 4x2.5	R22 AVB3	AVB5			KGJ protection
WS10	JYTY 12x1.5	R22 AVB2	AXY			sign. Supply panel
WS11	JYTY 12x1.5	R22 AVB1	AXY			sign. Supply panel
WS12	JYTY 7x1	R22 AVB3	AXY			FA PTN failure
WS13	JYTY 12x1.5	R22 AVB5	AXY			sign. Budget Location KGJ
WS22	CYKY-O 12x1.5	AXY	RFVE			FVE data backup
WS33	CYKY-O 12x1.5	AXY	RMaR1 KGJ			PV data backup
WGB21	UNITRONIC BUS 2x2x0.25	AXY	RFVE			PV
WGB31	UNITRONIC BUS 2x2x0.25	AXY	RMaR1 KGJ			KGJ1
WGB32	UNITRONIC BUS 2x2x0.25	AXY	DT1			F/O converter
WHA1	UNIV optical cable 8 fibers, 9/125, single mode	DT1	RMaR1 KGJ			PV data backup
WBB1	3x 22-AXEKVCEY 1x120/16	R22 AVB5	TS-KGJ1			KGJ1 HV power output
WDB1	4x3x NYY 1x240 + 2x NYY 1x240 (PEN)	TS-KGJ1	KGJ1			KGJ1 LV power output

Appendix No. 1: Telemetry table – list of information transmitted to the DŘS

Description	PDS designation	To be completed by the applicant			To be completed by PDS (ČEZ Distribuce, a. s.)					Note		
		Designation in single-pole diagram	Voltage level	Field/cell number	Required transmission (YES/NO)	Transfer	IEC No.	Type	Address IEC 60870-5-104			
CONNECTION POINT of power plant, separate BSAE, separate consumption device, LDS												
States												
QM switch off / on	QM	QM1	22kV	AVB1	YES	2 bits	31					
QM switch off/on	QM	QM1	22kV	AVB2	YES	2 bits	31					
QS switch off/on	QS	QS1	VN	AVB1	YES	2 bit	31					
QS switch off/on	QS	QS1	VN	AVB2	YES	2 bit	31					
QSF fuse switch off/on	QSF				NO	2 bit	31					
Busbar disconnector Q1 off / on	Q1				NO	2 bit	31					
Terminal disconnector Q6 off / on	Q6				NO	2 bit	31					
QE6 terminal earthing switch off / on	QE6	QE6	22kV	AVB1	YES	2 bits	31					
QE6 terminal grounding switch off / on	QE6	QE6	22kV	AVB2	YES	2 bits	31					
FU1 fuse off/on	FU1				NO	2 bits	31					
Circuit breaker FA1 off / on	FA1				NO	2 bit	31					
Automatic island operation - AOP - ES part in island operation	F491OP				NO	1 bit	30			Only if the production plant is part of controlled PpS OP.		
Report												
Sum of protection actions	H100NAT			AVB1, AVB2, AVB5, R/P/E	YES	1 bit	30			Only in the case of a breakdown point = connection point.		
Measurement⁸⁾												
Phase L current I_2 [A]	I_2	MT-P1	22kV	AVB3	YES		36					
Combined voltage U_s [kV]	U_s	MT-N1	22kV	AVB3	YES		36			Average of combined voltage values.		
Active power P [MW]	P	---	22kV	AVB3	YES		36			Sign "-" for supply to DS, "+" for consumption from DS		
Reactive power Q [MVAr]	Q	---	22kV	AVB3	YES		36					
Power factor [-]	\cos_{fi}	---	22kV	AVB3	YES		36			(supply P x consumption Q has $-\cos$: supply P x supply Q has $+\cos$)		
Frequency f [Hz]	f	---	22kV	AVB3	YES		36					
HV/MV transformer tap [-]	Branch	---			NO		36					
BREAKDOWN POINT of the device, if it is not also the PV SYSTEM CONNECTION POINT												
States												
FA1 circuit breaker off/on ⁹	FA1	QF1	0.4kV	R/PV	YES	2 bits	31					
MEASUREMENT FROM EQUIPMENT TERMINALS⁸												
Active power P [MW]	P	---	0.4kV	R/PV	YES		36					
Reactive power Q [MVAr]	Q	---	0.4kV	R/PV	YES		36					
BREAKDOWN POINT of the device, if it is not also the CONNECTION POINT KGJ1												
States												
QM switch off / on	QM	QM1	22kV	AVB5	YES	2 bits	31			Sum of breakdown points		
Report												
Sum of protection actions	H100NAT	---	0.4kV		NO	1 bit	30			Sum of breakdown points		
MEASUREMENT FROM DEVICE TERMINALS⁸												
Active power P [MW]	P	---	0.4kV	GENC B1	YES		36			+" sign for production, "-" sign for consumption		
Reactive power Q [MVAr]	Q	---	0.4kV	GENC B1	YES		36					
Combined voltage U_s [kV]	U_s	---	0.4kV		NO		36			Applies to low voltage level.		
Battery capacity [%]	Cap-proc_BSAE	---	---	---	NO		36			Applies to BSAE with Pi 100 kW and above (state of charge).		
LIMITATION OF ACTIVE POWER P												
States												
100% of rated power (without limitation) ¹⁰⁾	SPG100	---	0.4kV	---	YES	1 bit	30			Applies to all types of production facilities.		

Appendix No. 1: Telemetry table – list of information transmitted to the DRS

Description	PDS designation	To be completed by the applicant			To be completed by PDS (ČEZ Distribuce, a. s.)					Note	
		Designation in single-pole diagram	Voltage level	Field/cell number	Required transmission (YES/NO)	Transfer	IEC No.	Type	Address IEC 60870-5-104		
60% of rated power ¹⁾	SPG060	---	---	---	NO	1 bit	30			Applies to PV and wind power plants.	
30% of nominal power ¹⁾	SPG030	---	---	---	NO	1 bit	30				
75% of rated power ¹⁾	SPG075	---	0.4kV	---	YES	1 bit	30			Applies to other types of production facilities except PV and wind power plants (including combinations of other types of production facilities with PV and wind power plants).	
50% of rated power ¹⁾	SPG050	---	0.4kV	---	YES	1 bit	30				
0% of rated power ¹⁾	SPG000	---	0.4kV	---	YES	1 bit	30			Applies to all types of production facilities.	
Report											
Exceeding limit P (active power degrees) ³⁾	H796F	---	0.4kV	---	YES	1 bit	30			Applies to all types of production facilities.	
Commands											
100% of rated power (without limitation) ⁴⁾	SPG100	---	0.4kV	---	YES	1 bit	45			Applies to all types of production facilities.	
60% of rated power	SPG060	---	---	---	NO	1 bit	45			Applies to PV and wind power plants.	
30% of rated power	SPG030	---	---	---	NO	1 bit	45				
75% of rated power	SPG075	---	0.4kV	---	YES	1 bit	45			Applies to other types of power plants except PV and wind power plants (including combinations of other types of power modules with PV and wind power plants).	
50% of nominal power	SPG050	---	0.4kV	---	YES	1 bit	45				
0% of rated power	SPG000	---	0.4kV	---	YES	1 bit	45			Applies to all types of power plants.	
VOLTAGE REGULATION U/Q											
States											
Automatic secondary voltage regulation - on/off	F471	---	---	---	NO	1 bit	30			Command feedback status.	
Measurement⁵⁾											
Specified voltage [kV]	Uzad	---	---	---	NO		36			Confirmation of the entered value.	
Entered power factor [-]	cos_fi-zad	---	---	---	NO		36				
Specified reactive power [MVAr]	Qzad	---	---	---	NO		36				
Regulation steepness (dQ/dt) [MVAr/s]	dQdt	---	---	---	NO		36				
Control time constant [s]	Treg	---	---	---	NO		36				
Specified tolerance U [kV]	Utol	---	---	---	NO		36				
Start delay of regulation [s]	Tsr	---	---	---	NO		36			Transmission/acknowledgement of set value (HV and VHV).	
Commands											
Automatic secondary voltage regulation - on/off	F471	---	---	---	NO	1 bit	45			Control from DRS.	
Specified voltage [kV]	Uzad	---	---	---	NO		50			Command type according to IEC: 50 or 63.	
Specified power factor [-]	cos_fi-zad	---	---	---	NO		50			Command type according to IEC: 50 or 63. Only in exceptional cases according to TPP SoP.	
Specified reactive power [MVAr]	Qzad	---	---	---	NO		50				
Regulation steepness (dQ/dt) [MVAr/s]	dQdt	---	---	---	NO		50				
Control time constant [s]	Treg	---	---	---	NO		50				
Specified tolerance U [kV]	Utol	---	---	---	NO		50				
Start delay of regulation [s]	Tsr	---	---	---	NO		50				
LOCAL MEASUREMENT											
Measurement											
Outdoor temperature [°C] ⁵⁾	T	---	---	---	YES		36			Production facilities with Pi 400 kW and above.	
Solar radiation intensity [W/m ²] ⁶⁾	SOL	---	---	---	NE		36			Applies to PV plants with Pi 400 kW and above.	
Wind speed [m/s] ⁷⁾	WS	---	---	---	NO		36			Applies to VTE with Pi 400 kW and above.	

Note: It is possible to add lines in the relevant paragraphs in the case of multiple devices, multiple connection points, multiple measurements, etc.

Legend:

1) The active power reduction level will be signaled by a common message, regardless of whether the reduction is performed via HDO or the control unit.

2) The signal "Active power at 100% (no reduction)" can be derived from the inactive levels of 60% (75%), 30% (50%), and 0%.

Appendix No. 1: Telemetry table – list of information transmitted to the DŘS

Description	PDS designation	To be completed by the applicant			To be completed by PDS (ČEZ Distribuce, a. s.)					Note
		Designation in single-pole diagram	Voltage level	Field/cell number	Requested transfer (YES/NO)	Transfer	IEC No.	Type	Address IEC 60870-5-104	

3) For the "P limit exceeded" signal, it is necessary to set the signal delay according to the response time of the production plant and the LDS control system to the new required level. The maximum response time of the production plant may be permitted on the basis of technical justification. The signaling will be derived from the maximum permitted power of the given stage (100%, 60% (75%), 30% (50%), and 0%), and the logical function must be solved within the control system. This also applies to the limitation of active power via HDO.

4) The command "100% power (no restrictions)" will cancel the previously selected level.

5) For temperature measurement, we recommend: range -30 to +40 °C, place the sensor on the north side of the building.

6) For measuring solar radiation, we recommend: range 0 to 1000 W/m², sensor facing south and vertically.

7) For wind speed measurement, we recommend: range 0 to 30 m/s.

5-7) For measurement, it is advisable to use converters to a current loop in the range of 4 ÷ 20 mA, or converters with a communication protocol for communication with the control system (e.g., MODBUS-RTU).