



TENDER DOCUMENTATION FOR THE SELECTION OF THE CONTRACTOR

**Refurbishment of the Combined Heat and Power Plant
in Mladá Boleslav**

Business Package OB 2

BOILER HOUSES

VOLUME III

TECHNICAL REQUIREMENTS

Annex A4.2 Electrical Part

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1 APPLICATION OF THE SOLUTION IN THE TENDER DOCUMENTATION

The tender documentation specifies the functional specification of LOT OB 2 that must be met. In addition, the Tender Documentation and the Actual Construction Permit Documents represent the proposed technical solution for LOT OB 2, this solution is subject to change by the BIDDER, and the BIDDER's flexibility in applying its technical solution, in designing and selecting specific equipment according to its technical practice, experience, and custom is acceptable. The BIDDER may offer just such a LOT OB 2 more technically advanced and more efficient for the CLIENT and in such a way as to meet the functional requirements specified in the Tender Documentation and the requirements, statements and opinions of the governmental authorities.

The BIDDER is obliged to describe his technical solution in an annex to his bid.

1.1 List of abbreviations

Abbreviation	Meaning of the abbreviation
AC	Alternating current
I&C	Automated management of technological process
APSS	Automatic Power Source Switch
ARB	Automatic Reserve Backup
BI	Binary input
CBS	Central battery system
Cu	Copper
CSN	Czech Technical Standard
DC	Direct current
DG	Dieselgenerator
DSP	Documents required for building permit
EMC	Electromagnetic Compatibility
EN	European standard
EFAS	Electric fire alarm system
F/F	insulation class F/F
FC	Frequency converter
GE	Manufacturer Name - General electric
HAZOP	Hazard and Operability Study
MPC	Main protective connection
IEC	International Electrotechnical Commission
I/O	Input/output
KKS	Power plant equipment code designation system (Kernkraftwerk Kennzeichen System)
LED	Light Emitting Diode
LPS	Lightning protection system
MaR	Measurement and regulation
LV	Low voltage
EL	Emergency lighting
PBR	Fire safety solutions

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Abbreviation	Meaning of the abbreviation
PLC	Programmable Logic Controller
PoUVV	Protocol for the determination of external influences
CS	Control system
SIL	Safety Integrity Level
WC	Weak Current
TMB/TMB	Heating plant Mladá Boleslav
SP	Solid pollutants
(U, I, P, Q)	Voltage, current, active power, reactive power
UPS	Uninterruptible Power Supply/Source
HF	High Frequency
HV	High voltage
ACS	Air-conditioning system
ZD	Tender documentation

2 GENERAL PROFESSIONAL REQUIREMENTS

2.1 Environment

- The OB 2 CONTRACTOR shall prepare a new protocol for the determination of external influences (PoUVV) for the boiler room K20 and associated premises according to the newly installed technology. The next stage of the project will detail the Ex zones to minimize electrical costs, due to the fact that the entire boiler room floor does not need to be in an Ex environment. This will be addressed by defining zones, e.g. 2m from the equipment. There is no free standing switchgear on any floor of the Boiler Room, they are all in the substation.
- The electrical installation must be designed according to the new PoUVV with particular regard to the effects of water, combustible dust, temperatures and other influences.
- In addition, the requirements of ITS Škoda Chapters 1.11 Electricity, 2.00 Artificial Lighting, 5.05 Electro energy, 5.15 Energy Metering Concepts shall be met. Substation air conditioning shall be addressed in the HVAC section.

2.2 LV switchgears

- LV switchgears must comply with the valid standards ČSN EN 61439-1 ed. 2 and ČSN EN 61439-2 ed. 2.
- Switchgears must withstand the mechanical and thermal effects of short-circuit currents at the point of connection without damage.
- The enclosure of the switchgear and its surface treatment must correspond to the environmental influences specified in the Protocol for Determination of External Influences. The minimum protection is IP40/IP20 when the door is open.
- LV switchgears will be preferably located in LV substations.
- The technology cabinets for PS201 will be of modular design.
- The technological switchgears for PS201 will be with APSS (automatic substitution).
- The main inlets and outlets from the LV switchgear must be solved from below (main substation), in local ones it is possible to solve both from below and above.

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- The busbars will be made of copper waist conductor for normal short circuit currents, for higher values of short circuit currents Cu profile busbar systems can be used.
- The busbars can be equipped against accidental contact with a cover designed for this purpose by the manufacturer.
- The circuit breakers in the supply fields of the main LV switchgears and in the longitudinal division shall be of such a design that it is possible to ensure visible disconnection of these components (e.g. pull-out design, etc.).
- There must be 15% space reserve and 30% equipped outlet reserve in the switchgear after the new technology is put into operation.
- The main switchgear feeders shall have two separate feeders with an automatic feeder switch between them in the first field switchgear, always one or two per substation, feeding from independent sources. There will be no APSS in the terminal buildings (SO204, SO205). If APSS is required, it will be added to the terminal buildings.
- The cross-section of the conductors in the switchgear must correspond to the permissible load according to the protection, but the minimum cross-section of the conductors in the switchgear will be:
 - for power circuits - 2.5 mm²,
 - for control circuits - 1 mm²,
 - for current measurement circuits - 2.5 mm²,
 - for measurement circuits - (4-20mA) - 1.5 mm²,
 - for voltage measurement circuits - 1.5 mm²,
 - for I/O circuits for PLC (24VDC) - 0,5 mm².
- All wires in the switchgear must have bidirectional markings (from where - to where).
- In accordance with EN 61439-1 ed. 2 and EN 61439-2 ed. 2.
 - the busbar systems will be tested in the switchgear by the original switchgear manufacturer, who will provide the relevant reports and inspection reports.
 - the manufacturer of the switchgear will also provide:
 - all documents for the design verification,
 - technical information of different manufacturers and their types, with the minimum dimensions of each compartment defined and the type of connection defined, a detailed document on load possibilities and short circuit resistance. It will include a detailed technical description of the switchgears supplied, including dimensional drawings of the switchgears and assembly diagrams, itemised lists of all switchgear equipment and technical data sheets for non-standard items (as an example: converters, voltage converters, automatic switches, analysers, etc.), unit test reports, wiring diagrams and dimensional and assembly drawings of each type of socket (module), etc.
- All switchgears and cabinets located outdoors must have a roof installed over them with a minimum overlap of 10 cm on all sides.
- Energy metering - according to ITS 5.15 Energy metering concept.
- Visualization and balance in Energis - network ŠA zone - P-ENRG.
- Requirement for installation of data sockets in HV and LV substations.

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2.3 HV switchgears

- The enclosure of the switchgear and its surface treatment must correspond to the environmental influences, which are specified in the Protocol on Determination of External Influences.
- Inlets and outlets from the HV switchgear must be designed from below, cable penetrations must be fire separated from other rooms of the new buildings.
- Insulation of HV switchgears will be air (not gas) insulated HV switchgears. Type of HV switches: vacuum.

2.3.1 Newly supplied equipment for existing HV switchgear

- HV switches must meet the requirements of the applicable IEC standards and norms. They must also be able to safely handle operational, transient and emergency conditions.
- Electrical digital protection must meet the requirements of the applicable IEC standards and norms. The parameters of the protectors must meet the needs of the protection system in terms of input/output characteristics, response speed, linearity, suppression of excessive short-circuit currents, etc., and must reliably protect the designated section.
- Siemens protectors will be required for integration into the existing system
- The protection must be compatible with the existing protection system of the heating plant and meet the conditions for connection and integration into this system.
- The HV switchgears should be equipped with an automatic jump between the feeders, which can be realized by the above mentioned digital electrical protections.
- Newly delivered armaments must:
 - comply with applicable standards
 - be fully compatible with existing HV switchgear equipment
 - withstand without damage the mechanical and thermal effects of short-circuit currents at the point of connection.

2.4 Frequency converters LV

- The design of the frequency converters must match the required performance of the technology and the nature of the load.
- The FC shall be compatible with the type of electric motor supplied so that it is capable of starting the equipment from zero speed and continuously regulating from the required minimum to 100% of the required speed of the driven equipment with the required dynamics and in a manner that will not cause operational problems in the technology.
- The electric motor insulation must be designed to withstand the steep voltage spikes generated by the frequency converter.
- The motor must also be designed to withstand the additional heat loss generated by the frequency converter.
- The motor will be operated with the frequency converter in insulation class F/F.
- The frequency converter must meet the following basic criteria:
 - max. reliability,
 - easy operation and maintenance,
 - min. energy intensity,
 - automatic restart during short-term outages of LV supply and auxiliary voltages,

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- The frequency converter installed in the substation must be of a switchgear mounting design. The design of the FM and its enclosure shall be carried out in accordance with the Protocol for the Determination of External Influences and in accordance with the requirements of the manufacturer Siemens.
- FC cooling must be air-cooled. For the highest outputs, water cooling may be used in agreement with the CLIENT.
- When designing the FC and its installation, it is necessary to consider the ambient temperature and the heat loss from the FC must be dissipated by ventilation, air conditioning of the switchgear or substation.
- Adequate clear space must be maintained around the FC for cooling, installation and servicing in accordance with the manufacturer's requirements.
- The motor must be connected to the inverter with a shielded cable as recommended by the FC manufacturer (Siemens).
- The FC shall be protected against overvoltage and overcurrent by protectors of the type recommended by the FC manufacturer.
- The activities of the FC will be monitored and managed by the CS.
- The records (faults) of the frequency converter must be recorded with time data.
- The frequency converter must be supplied with a control panel in the Czech language and with manual. At the CLIENT 's request, an adapter can also be supplied for possible placement of the panel on the switchgear door.
- FC must be designed to:
 - supply voltage according to the CLIENT 's requirement,
 - power, output voltage, current, frequency according to the motor to be powered and technology,
 - possibility of overloading according to the load requirement, or according to the CLIENT's requirement,
 - Efficiency min. 97%,
 - vector control (for higher outputs, direct torque control is advantageous with respect to reactions to network disturbances),
 - the possibility of resistive braking if the application requires it,
 - the possibility of recuperation to the network if the application requires it,
 - possibility of external power supply of control circuits (at the CLIENT's request),
 - instant start during a power failure,
 - bridging of power failure within 2 s or depending on the load without power failure.
- All wires in FC must have bidirectional markings (from where to where).
- FC must include:
 - filters at the output of the frequency converter (dU/dt, sinusoidal, etc.) will be used according to the installation requirement, the type and performance of the filter will be according to the specific technology supplied, so as to prevent any influence and interference from being introduced back into the network.
 - the frequency converter in the installation must not exceed the prescribed values given in the EMC standards for installations with frequency converters,
 - Safety functions (torque cut-off, safe speed, etc.) as required by SIL class,

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- communication card with the required Profinet protocol.
- All frequency converters will be from Siemens and will be included in the TIA Portal software-based system.

2.5 HV frequency converters

- The design of the frequency converters must match the required performance of the technology and the nature of the load.
- The FC shall be compatible with the type of electric motor supplied so that it is capable of starting the equipment from zero speed and continuously regulating from the required minimum to 100% of the required speed of the driven equipment with the required dynamics and in a manner that will not cause operational problems in the technology.
- The electric motor insulation must be designed to withstand the steep voltage spikes generated by the frequency converter.
- The design of the FC and its covering shall be carried out with regard to the Protocol for the Determination of External Influences and in accordance with the manufacturer's requirements.
- FC cooling must be air-cooled. For the highest outputs, water cooling may be used in agreement with the CLIENT.
- When designing the FC and its installation, it is necessary to consider the ambient temperature and the heat loss from the FC must be dissipated by means of HVAC or substation air conditioning.
- Adequate clearance must be maintained around the FC for cooling and servicing in accordance with the manufacturer's requirements.
- HV power cables (i.e. cables between the frequency converter and the motor) must be shielded, core material Cu. The design of the HV cabling shall be in accordance with the FC manufacturer's recommendations.
- The FC shall be protected against overvoltage and overcurrent by protectors of the type recommended by the FC manufacturer.
- The motor will be effectively protected against overload and short circuit by the FC electronic overload and short circuit protectors during FC operation.
- A loss of control voltage must not cause the machine to shut down.
- FC activities will be monitored and managed by the CS.
- The FC fault record shall be recorded with a time indication of the fault.
- The FC shall be equipped with a visualisation and diagnostic panel. The panel shall allow the operator to monitor fault messages and evaluate fault conditions. Access to the panel setup and parameterisation menus shall be password protected.
- The panel shall visualize basic FC status information (desired speed, actual speed, input voltage, etc.).
- All wires in FC must have bidirectional markings (from where to where).
- FC must be designed to:
 - supply voltage according to the CLIENT's requirement,
 - power, output voltage, current, frequency according to the motor to be powered,
 - possibility of overloading according to the load requirement, or according to the CLIENT's requirement,
 - efficiency min. 96%,

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- the management method must meet the requirements for the management of the technology,
 - possibility of external power supply of control circuits,
 - instant start during a power failure,
 - Bridging power failure of the FC control unit within 2 s, depending on the load, without failure.
- FC must include:
 - technical measures to limit the return effects on the network as much as possible, reducing the content of the harmonic currents drawn from the network and limiting HF interference below the values required by the standards for the environment,
 - Safety functions (torque cut-off, safe speed, etc.) as required by SIL class,
 - communication card with the required protocol (Profinet).
- Requirements for HV frequency converters:
 - the device will contain a voltage intermediate circuit,
 - oil-immersed transformers or chokes are not allowed,
 - the frequency converter must allow scalar and vector control of the motor, it must be able to handle a soft start - at certain motor speeds the FC is able to switch on even in a still spinning machine.
- All frequency converters will be from Siemens and will be included in the TIA Portal software-based system.

2.6 Cable support system

2.6.1 General requirements

- The cable support system will be of modular design, i.e. the individual prefabricated parts will be assembled together. The cable support system can be dismantled (no welding will be used).
- The material and surface finish of the cable support system must correspond to the environmental influences specified in the Protocol for Determination of External Influences.
- When determining the surface treatment of the cable carrier system, corrosion classes according to ČSN EN ISO 12944-2 will be specified.
- In the event of damage to the anti-corrosion coatings or surface treatments of the affected steel structures and cable support system, the OB 2 CONTRACTOR must ensure adequate anti-corrosion protection of the damaged areas.
- The type and dimensions of the cable route must comply with, among other things:
 - segregationist group,
 - the type and number of cables that will be stored in it,
 - the environment in which the route is located.
- The cable support system will be designed with a space margin of 20%.
- The OB 2 CONTRACTOR shall submit the design of the cable support system to the CLIENT for approval.
- If there are cable routes in the buildings with a requirement for functional integrity in case of fire - i.e. EFAS, EL, and other fire safety equipment, these routes will be specified in the project.

2.6.2 Marking of cable routes

- Cable routes will be marked with the KKS code.

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- Cable routes will be provided with metal stainless steel descriptive labels stating:
 - KKS code according to the methodology used at the heating plant,
 - segregationist group.

2.6.3 Installation of cable routes

- The vertical spacing between the booms of cable routes for individual segregation groups will be at least 250 mm.
- The clear distance between cables laid on one gangway and cables laid on a parallel gangway at the same height level shall be at least 100 mm. Cable trays in parallel laid above each other - different voltage levels of laid cabling from lowest (WC) to highest (HV). Distance from sheath 250mm.
- The cable routes will be anchored according to the weight in particular:
 - into masonry structures using through-hole anchors,
 - to the steel structure using the mounting parts provided for this purpose.
- In necessary cases where cabling will have to be buried in the ground, the requirements of ČSN 73 6005, ČSN 73 6006 and related standards must be met as a minimum. When the cable route passes under the road or crosses other networks, the cabling shall be placed in the protectors provided for this purpose. Laying of the cable routes in the ground falls within the scope of the OB 6 CONTRACTOR.

2.7 Cabling

2.7.1 General requirements

- All new cabling will be all-plastic.
- The types and cross-sections of cables must respect other specific requirements, especially the effects, in addition to the relevant standards (CSN 33 2000-5-52 ed.2, CSN 33 2000-4-41 ed.3, etc.):
 - short-circuit currents,
 - voltage drop,
 - max. permissible permanent operating load,
 - method of storage,
 - the surrounding environment (temperature, humidity, vibrations, the possibility of aggressive substances, fire hazards, etc.),
 - minimizing the amount of cabling in cable routes.
- The type of cable must match the powered device, the exact designation and length will be part of the documentation of the new device.
- Signals of different voltage levels must not be routed in the same cable (exceptions are justified cases that comply with the relevant articles of ČSN 33 2000-5-52 ed.2.)
- The maximum temperature of the cable cores and the ambient temperature must not exceed the permissible values set by the manufacturer. The temperature reserve of the cable cores must be at least 20%.
- The OB 2 CONTRACTOR shall submit the wiring design to the CLIENT for approval.
- All connection points of individual devices, including installation boxes, must be easily accessible without the use of auxiliary structures (scaffolding, platforms, etc.).

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- The OB 2 OB 2 CONTRACTOR shall supply, install and connect all cabling (including accessories) required for the proper and reliable operation of the entire LOT OB 2 as part of the performance of the LOT OB 2.
- The project documentation will also include plan drawings of the cable routes. In cases where it is technically more advantageous to use a cable connection instead of a conventional cable connection, the connection will be designed in a so-called busbar design.

2.7.2 Marking of cabling

- The cabling will be marked with the KKS code.
- The cabling will be fitted with stainless steel metal labels stating:
 - where the cable is routed from (KKS code of the switchgear, field and outlet),
 - cable marking (KKS code),
 - cable type - number of cores - cross-section of cores,
 - where the cable is routed (KKS code of the powered device or KKS code of the switchgear, field and outlet)
- The cabling will be marked:
 - on both ends,
 - when turning,
 - when passing through a wall, ceiling or firewall at both ends,
 - when crossing routes.

2.7.3 Installation of cabling

- The laying and routing of cables must be carried out in such a way that the risk of mechanical damage to the cables is reduced to a minimum. For routes with a higher risk of mechanical damage to cables, cables shall be routed either in closed troughs or in protective tubes.
- The bending radii of the laid cables and the method of laying shall comply with the conditions, relevant standards, regulations and recommendations specified by the cable manufacturers.
- The separation and segregation of the cabling will be maintained during the installation of the cabling.
- Cabling will be divided into basic segregation groups:
 - HV power cables,
 - LV power cables,
 - control cables and analogue measurement cables up to 60 V,
 - control cables and analogue measurement cables above 60 V,
 - communication cables, serial communication cables (optical and metallic),
 - EFAS cables.
- The cables are laid in the cable routes in the following order, always from top to bottom. In justified cases where it is necessary to place HV cables under other cables, a bulkhead will be inserted between the HV cables and the other cables (see 2.7.4 Fire protection measures).
- Cables at HV level may be laid side by side with a gap of at least one cable diameter wide. Separate two different lines in parallel on a common cable grid by a sufficient air distance or, better, by a non-combustible barrier.
- Cables at LV level can be laid side by side - this layout must be taken into account in the cabling design.

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- Control cables and analogue measurement cables can be stored in bundles.
- The cables will be attached to the cable trays by means of shackles or in another way as agreed with the CLIENT.
- Before connecting the new cabling to the existing power supply system, the OB 2 CONTRACTOR is obliged to verify whether there is sufficient power reserve for the connection on the basis of the statement of the operation - the client.
- Before laying cabling in existing cable routes, the OB 2 CONTRACTOR shall verify that:
 - there is sufficient space in the route for new cabling,
 - the new load does not exceed the maximum permissible load of the route,
 - adding new cabling will not reduce the maximum current load on the existing cabling.

2.7.4 Fire protection measures

- After installation of the cables, all passages between the individual fire sections will be fire-sealed.
- Firestopping requirements (including fire resistance) will be specified in the Fire Safety Design (FSD). The FSD is included in the Documentation required for civil permit (DSP) that is attachment of the tender documentation.
- The OB 2 CONTRACTOR shall provide complete and clear accompanying documentation (QA/QC) for fire barriers and seals in accordance with the legislation, supplemented by a floor plan diagram of the location, to evaluate the quality and function of the fire barriers. This documentation shall demonstrate their serviceability and shall include in particular:
 - plotting in the drawing,
 - a statement that the person installing the seal is authorised by the manufacturer to do so,
 - catalogue sheet of gaskets,
 - seal certificate (certificate of quality and quality or similar document),
 - a declaration of conformity for the product,
 - Declaration of conformity for the installation of all pieces of gaskets (where and when installed, type used, fire resistance, number of pieces),
 - safety data sheets for the materials used,
 - technical conditions for individual seals and manufacturers' recommendations for installation and inspection (installation procedure).
- Each firestop will be marked with a label on both sides. The label will contain, as a minimum:
 - the name of the system and material used,
 - the date of completion of the firestopping,
 - the name of the supplier/OB 2 CONTRACTOR.
- In the event of a breach in the integrity of existing fire partitions and seals, the OB 2 CONTRACTOR shall have new fire partitions or fire seals constructed by an authorized person and shall provide for modifications in the project documentation, all in accordance with fire resistance requirements.
- In case of necessity, fire barriers (according to ČSN 33 2000-5-52 ed.2) will be used, which will be made of cement-fibre boards, 10 mm thick, non-absorbent, fire-resistant, resistant to the effects of electric arc and preventing the cable behind the barrier from exceeding the permissible temperature during short circuit (according to ČSN 33 2000-4-43 ed.2). This applies in particular to cases of cable crossings or the location of HV cables under LV cabling where the safe distance between the cabling is not observed.
- The above requirements also apply to the extent applicable to low-current and fibre-optic cabling.

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- The OB 2 CONTRACTOR shall provide an initial inspection of all electrical wiring. All available documentation for this purpose shall be provided by the CLIENT.

2.8 Socket cabinets

- The enclosure and surface finish of the socket cabinet and individual components must match the environmental influences specified in the Protocol for Determination of External Influences.
- Socket cabinets will be placed where they are expected to be used. The final location of the socket cabinets will be agreed by the CLIENT.
- Type socket cabinets will be delivered according to the technical specification of the CLIENT. At the CLIENT's request, the requirements for specific socket cabinets may be changed.
- Connection of socket cabinets will be from technological switchgears.

2.9 Building electrical installations

2.9.1 Interior lighting

- Artificial interior lighting will be provided in all buildings. As regards retrofits, it is presumed that the existing lighting will be preserved and new lighting will only be added in newly built premises.
- Lighting in individual rooms will be determined according to the applicable standard with regard to the activities carried out. Each space will be classified according to the standard and thus the minimum requirements for artificial lighting (intensity, uniformity, colour rendering, glare, cylindrical illuminance) will be determined. These minimum requirements will be increased where necessary to take account of the requirements of the standard (increased quality requirements, lack of daylight, continuous operation, etc.), hygiene requirements, fire regulations and the requirements of the client. The values will be determined and approved at the start of the design work, in accordance with the requirements of ITS 2.00 Artificial Lighting.
- Calculations of lighting of individual spaces will be prepared by a calculation program and will be an annex to the project documentation.
- The lighting design must be carried out with regard to minimum energy consumption of operation (use of high-quality luminaires and optical parts, switching of luminaires, sections, etc.), minimum maintenance requirements (required replacement periods of sources, maintenance of luminaires, etc.) and using the latest knowledge and technologies.
- When designing the lighting, the conditions from the Protocol on Determination of External Influences and PBR must also be observed - especially ambient temperature, dustiness, chemical aggressiveness, vibrations, explosion or fire hazard, fire resistance.
- The project documentation of the lighting will include drawings of the luminaire layout with indication of the power supply point, integration into the control group, and the control system. The documentation will also include operating and maintenance instructions.

2.9.2 Emergency lighting

- Emergency lighting (EL) in individual rooms will be determined according to the standard and according to the requirements of the PBR (Fire Safety Solutions).
- The emergency lighting will only be in operation when the main lighting fails, with the exception of any permanently operating luminaires – based on legislative requirements. Emergency lighting in the premises is designed as escape lighting as standard, unless there is a requirement for panic lighting. The design of the lighting according to the standard, provides in particular lighting for escape and communication routes, high risk areas, first aid areas, fire extinguisher areas and fire detectors.

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- The new facilities will be connected to the new CBS or to the existing UPS system. The new CBS will be included in the “central stop” (CS) and “total stop” (TS) system.
- It is required for boiler room SO 201 to connect EL to the new CBS. CBS for object K20 (the text is deleted, we do not want an extra cable, the connection from RM201 is the best solution) will have to be connected to the CS/TS of the K20 building. Option that could arise during the creation of the PD - in case of conflict with the requirement of the Fire Brigade, connect from RM_SO201 - within object K20, from the place that will remain energized after equipping the CS button - i.e. before the main circuit breaker.
- It is required for the existing K80,90 to connect the new EL to the existing EL cabling in SO 203.
- Remote monitoring and visualization are required due to legislation (PBR) in structurally complex objects where the use of separate battery luminaires would be inappropriate due to regular inspections - objects SO 201.
- The room with the CBS switchgear or a separate switchgear is required in a design - separate fire separated room with air conditioning cooling to ensure optimal conditions for the batteries.
- Selected luminaires will be marked with appropriate pictograms. If CBS is used, the luminaires will be labelled with the address within the system and this marking will be included in the project documentation of the actual design.
- The emergency lighting will be connected to the standards with cables with functional capability in case of fire, placed in certified routes.
- Calculations of emergency lighting of individual spaces will be prepared by a calculation program and will be an annex to the project documentation.
- The design of the emergency lighting system must be carried out mainly with regard to its operational reliability. Minimal energy consumption in operation (use of high-quality luminaires and optical components, batteries, etc.), minimal maintenance (required replacement times for power supplies, batteries, luminaire maintenance, etc.) and using the latest knowledge and technologies that are compatible with ITS are required.
- The design of the EL system must include provisions for the conduct of periodic inspections (daily, monthly and annual) and the issuance of inspection reports.
- When designing emergency lighting, the conditions from the Protocol on Determination of External Influences and PBR must also be observed - especially ambient temperature, dustiness, chemical aggressiveness, vibrations, explosion or fire hazard, fire resistance.
- The lighting design documentation will also include plan drawings of the luminaire layout with indication of the supply point, integration into the control group. The luminaires will be physically numbered on the drawing.
- The documentation will also include operating and maintenance instructions, an operating log, technical data sheets for the designed emergency luminaires, a commissioning report and verification by functional test.

2.9.3 Protection against atmospheric influences

- The OB 2 CONTRACTOR shall design a new lightning protection system which will be connected to the external network of the PLANT through measurable points.
- The design must comply with the requirements of the norms and standards for protection against lightning and atmospheric surges.
- A risk calculation must be carried out and an appropriate protection method designed.
- Lightning rods must be designed and constructed from certified components.

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- Project documentation will be prepared for each individual SO, including calculations, situational drawings, installation depths, connection details, corrosion protection and maintenance requirements.

2.9.4 Earthing

- Performed by the OB 6 CONTRACTOR.

3 SPECIFIC TECHNICAL LEVEL REQUIREMENTS

3.1 Marking of individual components

- The OB 2 CONTRACTOR shall develop uniform marking of electrical equipment using the KKS marking system already in place at the existing heating plant.

3.2 Concept of power supply control of LV technological switchgears

- Control of the power supply to the main LV switchgears will be local (control buttons on the doors of the LV switchgears or automatic source switches, if designed and installed). The control circuit interlocks will be designed by the OB 2 CONTRACTOR.
- The control of the power supply to the LV sub-switchgears will be primarily local (control buttons on the doors of the LV switchgears). In case of legislative, technological or other requirements, the control of the power supply will also be remote from the superior control system of the substation. Logical links and el. The control circuit interlocks will be developed by the OB 2 CONTRACTOR.
- The "total stop" and „central stop“ safety buttons resulting from the fire protection of the UNIT will be installed in accordance with the requirements of the PBR, including the provision of monitoring of their function through the EFAS system according to ČSN and will be in accordance with ITS Škoda - 2.11 Fire protection and fire safety of buildings. Push buttons will be equipped with protection against accidental jamming.
- The installation of the STOP safety buttons, which must have a locked active position with signalling of the action to the control system, shall be determined by the OB 2 CONTRACTOR. The "emergency stop" safety button shall be part of the input field of the switchgear, machine, etc. Buttons shall be required in accordance with the relevant standard.
- Safety plates and signs for electric equipment shall be supplied and installed in accordance with applicable standards, regulations and documents that are related, both directly and indirectly, to the subject matter of LOT OB 2.
- The OB 2 CONTRACTOR will make the appropriate adjustments at the supply points where it will connect to the existing power supply. equipment. In particular, new electrical equipment, terminal boxes, cable glands, etc. shall be added.
- Control and signalling will be specified in the design so that the number of control and signalling points is minimised. OB 2 CONTRACTOR's proposed control and signal locations shall meet the requirements of the CLIENT, standards and other codes.
- Control of LV substations will be on 220 V DC.
- LV switchgear technology will have a power switch in the outlet.
- For each individual object, measure consumption at least at the input, or measure consumption of larger technological units or appliances.

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3.3 Concept of control of LV technological switchgear outlets

- The OB 2 CONTRACTOR will make the appropriate adjustments at the power supply points where it will connect to the existing power supply equipment. In particular, new sockets (modules), electrical devices, terminal boxes, cable glands, etc. shall be added. The new sockets connected from the existing substations will also be plug-in switchgears, which means to produce type sockets for these switchgears
- Control and signalling will be specified in the design so that the number of control and signalling points is minimised. OB 2 CONTRACTOR's proposed control and signal locations shall meet the requirements of the CLIENT, standards and other codes.
- The control of the actuator pins from the control system technology will be solved as follows:
 - commands - the command relay will be located in the LV switchgear, its coil will be supplied with a binary output signal at the voltage level 24VDC from the control system,
 - callbacks - control circuits at 220 V DC voltage level, callbacks on LV at 48 V DC.
- Local control cabinets are required for selected equipment that requires on-site monitoring of operation and response to commands for operational or service reasons.
- The specification of motors and servomotors for which local control will be implemented will be determined by the OB 2 CONTRACTOR with regard to the possible needs:
 - working procedures for troubleshooting possible operational faults, where a direct visual inspection of the equipment is desirable when the fault is removed (fuel conveyor cave-in, etc.),
 - procedures for service work.
- An automatic power switch, e.g. ABB, will be incorporated into the substations to facilitate switching between substation feeders.
- At the entrances to LV substations (main switchgears) analysers will be installed on the feeders.

3.4 Concept of control of HV switchgears

- Control and signalling will be specified in the design so that the number of control and signalling points is minimised. OB 2 CONTRACTOR's proposed control and signal locations shall meet the requirements of the CLIENT, local practices, standards, and other codes.
- The control of the power supply to the HV switchgears will be controlled locally by means of the control elements on the HV switchgears and remotely from the superior control system of the substation.
- The control of the HV substations will be at 220 V DC.
- The control of the outlets of the actuators from the control system of the heating plant (now Procontrol) will be solved as follows:
 - commands - the command relay will be located in the LV superstructure of the HV switchgear, its coil will be supplied with a binary output signal at the voltage level 24VDC from the control system,
 - the feedback of the switching elements of the control system is received at 48 V DC.
- In addition to the above commands, the control system will also record the current and voltage measurements in the substations (U, I, P, Q) at least on the substation feeders and the states of the main switching elements, the control then depends on the specific drive. Current must also be transmitted from each outlet, voltage is sufficient from the busbar, P and Q from the inlets only.
- In HV substations, the substitution will be solved by means of electrical HV protection.

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- HV fields that will be supplemented with new outlets will be modified (switch etc.). Reserve fields will have to be fully retrofitted.

3.5 Socket cabinets

The socket cabinet will contain at least:

- 2 pcs - flange socket 230V, 16A, 3P (2P + PE),
- 1 pc - flange socket 400V, 16A, 5P (3P + N + PE),
- 1 pc - flange socket 400V, 32A, 5P (3P + N + PE),
- 1 pc - flange socket 24VAC, 6A, 3P (2P + PE).

It is required to provide at least a minimum number of cabinets with 63A outlets (on new buildings). To be defined during the development of the PD including the location. To be specified during delivery of individual technological units. Will be required in each substation.

The socket cabinet will contain a 230V/24V transformer connected via a flanged switch to supply the 24VAC socket.

An example of the type wiring of a socket cabinet is given in Annex A112.03-Typical_wiring_of_the_socket_cabinet. The final type wiring of the socket cabinet shall be agreed by the CLIENT.

3.6 Building electrical installations

3.6.1 Power supply for building electrical installations

- The power supply for the operational lighting is required from the lighting switchgears.
- Emergency lighting power supply is required for new buildings by connecting to the new CBS or to the existing UPS system. The new CBS will be included in the "total stop" and „central stop“ system. In justified cases, where it is technically unfeasible to provide power from the emergency lighting switchgear, emergency luminaires with their own battery source may be used with the agreement of the CLIENT.

3.6.2 Emergency lighting requirements

- Minimum illumination time of emergency escape lighting - 1 hour, the minimum illumination time of this lighting should be 1 hour, with 50% of the required illuminance to be achieved within 5 seconds after switching on, 100% within 60 seconds.
- As the technical standard for emergency and safety luminaires is the use of LED light source with a minimum design life of 50,000 hours, it is not recommended to use general lighting luminaires as emergency luminaires at the same time.
- When using luminaires with their own battery, the minimum technical standard will be an automatic luminaire testing function, controlled by a built-in timing and testing module with indication of the luminaire status via signal LEDs. It is not allowed to fit new luminaires with a NiCd battery.
- For all new or reconstructed buildings where more than 40 emergency and safety luminaires will be used, the use of a central battery power supply in accordance with EN 50171 with the possibility of remote monitoring and management via Ethernet is recommended to reduce operating costs and maintenance/operational control costs.
- When a central battery system is used, communication between individual luminaires and the battery unit will be via the power line with the option of programmed control of selected luminaire modes via the battery unit or a higher-level computer/system

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- Anti-panic lighting must be installed in areas where there are no designated escape routes (halls, areas greater than 60 m²) or in smaller areas where there is an additional risk.
- Emergency lighting for high-risk areas must be installed in areas where the safety of people involved in potentially hazardous processes or situations (e.g. control rooms) must be ensured.
- Suitable provisions shall be installed to ensure that if any part of the normal lighting supply fails, emergency lighting is activated.
- The EL must be activated not only in the event of a complete failure of the normal lighting supply, but also in the event of a limited fault, such as a fault in the terminal circuit.
- Emergency lighting is a fire safety device according to Decree No. 246/2001.
- Emergency lighting must comply with EN 1838. The design and operation of emergency and safety lighting systems shall comply with the applicable technical standards, in particular EN 1838, EN 50172 and EN 60598-2-22 as amended.
- Emergency lighting must comply with EN 1838.
- Cable routes shall be designed to be able to withstand the effects of fire for a specified period of time without interrupting the electrical circuits supplying the fire safety equipment.
- Requirements for the functional integrity of cable routes used to supply fire safety equipment must be part of the fire safety design of the building.
- Exit lighting must be installed:
 - at every escape door,
 - near the stairs (each row of stairs must be directly illuminated),
 - near any change in ground level,
 - at the prescribed emergency exits,
 - for every change of direction,
 - at each corridor (hall) junction,
 - outside and near every last exit,
 - near any fire extinguishing device (hydrant, fire extinguisher, or fire alarm),
 - near first aid stations.
- Escape route lighting shall be installed at least 2m above the ground if the installation site permits.

4 TECHNOLOGICAL CONNECTIONS

4.1 Description of the current state

For the purposes of this tender documentation, the description of the existing situation will be limited to:

- selected outlets for new switchgears in HV substations 80,90BBA at the level of 0,0 m in building E1A,
- selected outlets for new switchgears in LV substations 80,90BFB at the level of 4.65 m in building E1A,
- existing cabling and cable routes,
- K80/90 building wiring.

See A112.01_JEPS_OB2-K20, A112.08_JEPS_OB2- new

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4.1.1 Electrical equipment at HV level

Currently, the following selected electrical equipment is located in the substations HV 80BBA and 90BBA at the 0.0 m level in the E1A building:

- reserve pins No.12 in HV 80,90BBA.

The location of individual switchgears in the substations is shown in the site layout (see Annex A112.02_OB2_main_cable_routes_el)

4.1.1.1 HV substation 80,90BBA at 0,0 m level in building E1A

The 80,90BBA HV switchgears are powered from two independent sources. The 80,90BBA switchgears are at 6 kV voltage level, each has 12 fields and the following devices will be powered from it (for ARB there is a special independent device from ABB SUE3000 reacting to a fault condition in the main supply, replacing 80BBA and 00BCA and similarly 90BBA and 00BCB):

- 80BBA, reserve field No. 12: outlet for transformer 1 for K20,
- 90BBA, reserve field No. 12: outlet for transformer 2 for K20.

More information regarding the interface between the HV switchgear 80,90BBA and the control system is given in the Technical Specification Annex A4.3 of the I&C. More detailed information about the 80,90BBA switchgear can be found in Annex A112.01_JEPS_OB2-K20.

The control system of the heating plant CS 800xA is powered from a secured voltage of 220 V DC / 24 V DC (UPS). The control system of the heating plant provides measurement, control of switches:

- 80,90BBA,
- and other switchgears.

More detailed information is given in the technical specification Annex A4.3 of the I&C and in the existing drawing documentation (see Annex A112.01_JEPS_OB2-K20).

4.1.2 Electrical equipment at LV level

Currently, the following selected electrical equipment is located in LV substations:

- spare outlet in LV distribution switchgear of boiler K80,90 No.80,90BFB.

The location of the individual switchgears in the substations is shown in the site layout (see Annex A112.02_OB2_main_cable_routes_el)

4.1.3 Electrical equipment at LV level

4.1.3.1 Distribution LV switchgear for boiler K80,90 80,90BFB at 4,65 m level in building E1A

Distribution switchgears 80,90BFB at voltage level 400V have 13 fields are of modular (plug-in) type. All fields are single-sided. The switchgear is fed from transformers 80,90BFT01 (6/0,725/0,4kV 4100 kVA). The 80,90BFT01 transformers are located outside the existing HV/LV substation and are fed via cables from the 8th field of the 80BBA HV switchgear (80BFT01) and from the 5th field of the 90BBA HV switchgear (90BFT01).

The LV switchgear 80,90BFB supplies the appliances for the boilers K80/90.

More information regarding the interface between LV switchgear and controlgear is given in the Technical Specification Annex A4.3 of the I&C. More detailed information about the 80,90BFB switchgear is given in the existing switchgear documentation (see Annex A112.01_JEPS_OB2-K20).

4.1.3.2 Electrical equipment at LV level

Currently, the following selected electrical equipment is located in LV substations:

- spare outlet in LV distribution switchgear of boiler K80,90 No.80,90BFB.

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4.1.4 Wiring and cable routes for the K80/90 boiler

Outlet and inlet cables are routed from the switchgears underneath into the cable compartment. From the cable compartment the cables can lead further:

- to the boiler room for K80/90 boilers via a cable riser and then in the troughs along the walls of the K80/90 boiler,
- to the technology outside the boiler room through a cable duct under the existing boiler K80/90,
- to other areas of the engine room and boiler room via cable riser and longer in troughs along the wall.

The cable room, boiler room K80/90 and cable duct contain existing welded trays and are fire separated.

4.2 Delivery limits

The boundaries of the electrical supply will be formed in the direction of:

- to power sources:
 - Newly armed switchgear fields 80,90BBA – a cable to the new K20 switching station within the scope of the OB 6 order,
 - terminals of technological switchgear 00BHD, 00BHE, 00BUA, 00BHC and new armed modules (sockets):
 - newly armed outlets with all equipment to existing substations,
- on Control System Technology:
 - control terminals of HV/LV switchgears:
 - cabling between the control system of the technology and HV/LV switchgear is in the scope of the I&C,
 - terminals (or LV switchgear) are in the scope of the Electrical part,
- to control the substations:
 - Control terminals of HV/LV switchgear supply fields:
 - cabling between the substation control system and HV/LV switchgear is within the scope of the I&C,
 - terminals (or LV switchgear) are in the scope of the Electrical part,
- on technology:
 - terminals of electrical appliances:
 - the terminals of electrical appliances are in the scope of the Machinery section,
 - cables are in the range of the Electro part,

The supply boundaries are shown schematically in Annex A112.01_JEPS_OB2-K20.

The new supply cables for OB 2 technologies, which will be laid between the buildings, will be part of OB 6- IO 307 Electrical relocations and new connections, see drawing no. OB6_A112.02- Main cable routes and OB2_A112.08- OB2 - Single pole diagram- new.

5 BUILDING ELECTRICAL CONNECTIONS

5.1 Description of the current state

For the purposes of this tender documentation, the description of the existing situation will be limited to:

- selected outlets for new switchgears in LV substations 80,90BFB at the level of 4.65 m in building E1A,

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- existing cabling and cable routes,
- building wiring K80/90.

5.1.1 Electrical equipment at LV level

Currently, the following selected electrical equipment is located in LV substations:

- Spare outlet in LV lighting switchgear No.00BHE.

The location of individual switchgears in the substations is shown in the site layout (see Annex A112.02_OB 6_main_cable_routes_el)

5.1.1.1 Main light switchgears 00BHE and 00BHF, emergency lighting

Two main 230 V AC light switchgears 00BHE and 00BHF located in the E1A building at +4.65 m in the LV self-consumption substation room are used to connect the operational lighting. Switchgear 00BHE is connected from 00BHT01, but 00BHF is supplied from 00BHT02. The longitudinal coupling is normally open. The switchgears are 3 and 2 pole.

The emergency lighting is supplied directly from the 80BUA and 90BUA (220 V DC) switchgears located in the E1A building at +4.65 m in the LV self-consumption room.

5.1.2 Wiring and cable routes for the K80/90 boiler

Outlet and inlet cables are routed from the switchgears underneath to the cable compartment through the double floor (or through the intermediate floor space). From the cable compartment, the cables can lead further:

- to the boiler room for K80/90 boilers via a cable riser and then in the troughs along the walls of the K80/90 boiler,
- to outlets no. 12 from BBA, or even to all lower 220V outlets,
- to other areas of the engine room and boiler room via cable riser and longer in troughs along the wall.

Cable room, boiler room K80/90 and cable duct contain existing welded trays and are fire separated

5.2 Delivery limits

The boundaries of the electrical supply will be formed in the direction of:

- to power sources:
- on the building wiring:
 - The building wiring (lighting and sockets) is fully in the scope of the Electro part.

The supply boundaries are shown schematically in Annex A112.01_JEPS_OB02.

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6 TECHNICAL SPECIFICATION AND DESCRIPTION OF POSSIBLE TECHNICAL SOLUTION

6.1 General

A possible technical solution is proposed in the framework of the tender documentation. The proposed technical solution represents the minimum technical requirements for the Electrical part and is strongly linked to the technological solution of the UNIT. The BIDDER may offer just such a way to make LOT OB 2 more technically advanced and more efficient for the CLIENT and to meet the requirements specified in the tender documents. The BIDDER shall indicate the items that differ in the deviation list.

Furthermore, the BIDDER is obliged to supplement the technical solution with such items that are not specified but are necessary for the proper execution, commissioning and ensuring reliable and safe operation of the OB 2.

The design of the possible technical solution of the Electro part must be modified by the OB 2 CONTRACTOR according to the offered technological solution of the UNIT.

For clarity and purposes of this tender documentation, the existing names of LV switchgear, HV switchgear and control cabinets will be used.

6.2 Dismantling

Dismantling works mean the removal of all unused cables from the appliance to the switchgear pins. The dismantling works will also include the dismantling of complete switchgears that will not be further used.

6.2.1 LV electrical equipment

6.2.1.1 LV switchgears 80/90BBA and 80,90BFB and 80/90BFA

- The LV and control cabling will be gradually disconnected from the LV switchgear 80.90BFB to the following outlets:

The existing control air compressors + dryers on floor +7.5 m will be gradually dismantled and replaced by new compressors in another location (on K20) and will be fed from another substation (on LV in SO201).

Selected cabling that is connected to the 80.90BFB distribution panelboard will be disconnected:

- internal carbonization - redlers including rotary feeders,
- system of carbonization in the boiler room - in the bunker construction,
- ash transport system for boilers,
- Existing air compressor station (2x) - 4x compressors, (from E1A bay #10. in 80/90BBA substation, two transport air compressors and two control air compressors from 80/90BFA will be dismantled and removed. The new ones will be placed in K20, 3 in total). The supply to the existing control air compressor will be removed from the 80/90BFA (2x90kW).
- The drives of the limestone farm will remain intact and functional, and the operation of this technology is planned for the future.

The existing armament of the aforementioned outlets will remain and the outlets will become armed reserves.

6.2.2 Wiring and cable routes for the K80/90 boiler

All wiring supplying or controlling the dismantled appliances for the K80.90 boiler and its accessories will be disconnected and dismantled with the following scope specification.

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- HV and control cabling, from the HV switchgear 80,90BBA in the field No. 10 in its entire range (i.e. up to the terminals of appliances and hence the control system).
- LV cabling from the existing distribution switchgear 80,90BFB to the existing technologies of the boiler K80,90 and its accessories (i.e. to the terminals of the appliances). New 3 fields (5200x2200x600) of modular design will be added.
- The LV cabling will be disconnected from the existing 80,90BFB distribution switchgear of the existing K80,90 boiler technology and its accessories. Site modifications will be made for K80/90. Everything affected will be dismantled and checked for functionality and after reinstallation of the technology will be fitted with new electrical wiring and cabling or the existing functional one checked will be used.
- LV cabling that connects the existing 80,90BFB distribution switchgear and the 800xA control system of the heating plant in its entirety (i.e. from the 80,90BFB switchgear terminals to the 800xA control system terminals).
- control cabling that connects the LV/HV switchgear and the control panel of the respective technology. More detailed information is given in the technical specification Annex A4.3 of the I&C.
- LV cabling from the existing light switchgears 08UHA10GP001 and 08UHA10GP002 in the boiler room K80/90 to the operational lighting and possibly to the sockets of the boiler K80,90, which will be dismantled in connection with the reconstruction - in its entirety (i.e. up to the terminals of the appliances). The other cables will remain connected and will not be dismantled.
- LV cabling from the existing switchgears 80,90BUA (220V DC) to the emergency lighting of the boiler K80/90, which will be dismantled in connection with the reconstruction.

The OB 2 CONTRACTOR shall inspect the condition of the cable routes required for the completion of LOT OB 2. The cable routes shall be maintained to the maximum extent possible. Portions of the cable routes shall be removed or modified in the following cases:

- the technical condition of the cable routes will be insufficient,
- Technological, mechanical or construction dismantling is required,

The OB 2 CONTRACTOR shall ensure that disconnected wiring to be reconnected in the future is protected against damage during disassembly and installation.

6.2.3 Partial dismantling of light circuits on K80,90

From the existing light switchgears 08UHA10GP001 and 08UHA10GP002, which are fed from switchgears 00BHE and 00BHF, selected cabling leading to the outlets for service lighting at the site of the extension will be disconnected, according to the new drawing documentation (or for sockets) of the boiler K80,90 and its adjacent areas, which will be dismantled. The other cables will remain connected. The existing local light switchgears 08UHA10GP001 and 08UHA10GP002 located directly in the SO 203 building will remain as well as switchgears 00BHE and 00BHF located in the E1A building at +4,65 m in the 0,4 kV self-consumption room. Then the light switchgears, located in different locations in the plant, are connected from it.

The extent of the extension site is elaborated in the DSP drawings 0404T21-DS203-407 to 0404T21-DS203-412.

The OB 2 CONTRACTOR shall map or verify on site the outlets for the K80/90 boiler and its adjacent spaces to be removed.

6.3 Proposal for a solution

The part deals with the connection of technological equipment in the building SO 201, 202, 203 and SO 204.

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In the new building SO 202 there will be a new substation for two dry transformers and an LV substation for switchgear RM_SO201 (16 fields, 2500A, 65kA, dimensions 9840 x2200x600mm, l x h x d).

For the building SO 203 7 new fields will be installed on A112.01_JEPS_OB2-K20 points marked as NB ELE 30 and NB ELE 31, which will extend the existing switchgear 80BFB and 90BFB (7 fields, 630A, 65kA, dimensions 5240x2200x600mm, l x h x d).

The part deals with the connection of the building wiring in the building SO 201-204.

In the building SO 202 there will be a new LV substation for lighting switchgear RS_SO201 (1 pole, 100A, 30kA, dimensions 3200x2000x600mm, l x h x d).

Operational data:

Voltage systems
3~6kV, 50Hz/IT(r) ¹
3 PEN ~ 400 / 230V, 50 Hz / TN-C-S
3 NPE ~ 400 / 230V, 50 Hz / TN-S
2PE =, 220V /IT

¹ The IT system will be up to 20 A of capacitive current.

- Protection against electric shock for HV:
 - protection against dangerous contact with inanimate and animate parts will be carried out in accordance with ČSN EN 61936-1, ČSN EN 50522 and all related standards,
 - protection against dangerous contact will be made under normal conditions by insulating/covering live parts or barriers,
 - protection against dangerous contact will be provided by earthing in the IT network.
- Protection against electric shock for LV systems:
 - protection against dangerous contact with inanimate and animate parts will be carried out in accordance with ČSN 33 2000-4-41 ed. 3 and ČSN EN 61140 ed. 3,
 - as a rule, protection against dangerous contact will be made under normal conditions by insulating/covering live parts or barriers,
 - protection against dangerous contact will be carried out by earthing in the TN and IT network.
- Calculation of short-circuit currents:
 - Maximum three-phase shock and surge short-circuit currents were calculated for the DSP project in order to select and price the equipment.
- Electrical protection:
 - electrical protection automatically selectively switches off the affected sections of the network (equipment) in the shortest possible time (without damaging any part of the network (equipment)). The protections will be at least in accordance with ČSN 33 3051 and

¹ The IT system will be up to 20 A of capacitive current. In the case of higher capacitive current above 10 A, a resistor will be placed in the block transformer dungeon to the zero point at 6.3 kV or to an artificially created point, i.e. IT(r).

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ČSN 38 1120. The use of surge arresters shall be in accordance with the applicable regulations for buildings of the nature of a power plant,

- protections will be SIEMENS SIPROTEC series 5 or newer series (due to the uniformity of the set of these protections within the heating plant).
- Degree of power supply:
 - The stages of power supply will be in accordance with ČSN 341610 and ČSN 381120 for power/heat plants,
 - ABB SUE 3000 synchronized substitute responding to a fault condition in the main supply is installed:
 - between the main supply of the 6 kV switchgear - 80BBA05 and the backup supply of the 6 kV switchgear - 80BBA07 (connected from 00BCA05),
 - between the main supply 90BBA06 and the spare 90BBA08 (connected from 00BCB05).
 - In the event of a fault condition of the main supply for the entire heating plant (when both the generator and the block transformer are switched off), the switchover to the backup supply will occur. The power supply is therefore secured in stage 2. The new main LV switchgear will also be provided with stage 2 power supply, it will have two feeders with manual override, it is not necessary to provide automatic back-up for the fuel supply technologies.
 - LV switchgears that are powered by DG or battery systems are in power supply No. 1,
 - Sub-distribution boards that have only one power supply will be in supply stage 3.

6.3.1 Backup power supplies LV

Two existing stand-alone power supplies will be used as backup power sources, a 1MW diesel generator at 400V AC (if necessary) and a 220V DC battery pack. The total battery capacity is divided into two equal units. The dieselgenerator will be used for backing up higher power appliances where a short-term outage (up to 10 seconds) is possible. These sources will form power supply stage 1.

The 220 V DC battery pack is expected to back up emergency lighting, control systems, control of new HV and LV substations and others according to the technology requirements.

The CBS with visualization is expected to back up emergency lighting, and from the existing batter source also control systems, control of new HV and LV substations and others according to the technology requirements.

Distance, fire sections, connection to the "total stop" and "central stop" system, needs of fire functional routes will be considered.

6.3.2 Energy balance technology

for boiler K20: $P_i = 2\,224\text{ kW}$, $P_p = 1\,417\text{ kW}$

Design current LV = 2 500 A

total annual consumption 4 610 MWh

for boiler K80/90: $P_i = 500\text{ kW}$, $P_p = 350\text{ kW}$

Design current LV = 505 A

total annual consumption 931 MWh

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Device designation	Voltage system	Power input [kVA]	Description
Switchgear RM_SO201 for new objects SO 201, SO 202	3PEN~50Hz 400V/TN-C-S	Approximately 2200kW	Inlet from transformer
Switchgear SO203 - New appliances on boiler K80,90	3PEN~50Hz 400V/TN-C-S	Approximately 500kW	Supply from 7 new arrays that will extend the existing 80BFB and 90BFB switchgear

The main self-consumption facilities are:

K20 (PS 210):

modification of existing switchgears:

- modification and retrofitting of reserve field No. 12 of the existing 80BBA, 6 kV, 2000 A, 40 kA / 1 s- (ELE 01),
- modification and retrofitting of the reserve field No. 12 of the existing 90BBA, 6 kV, 2000 A, 40 kA / 1 s (ELE 02),

New substation SO 202:

- two dry-type HV/LV double-circuit transformers for the connection of LV substations K20 (SO 202) 2500kVA, 6/0.42 kV for the connection of LV substations for K20 (SO 202).,
- main LV 0.4 kV switchgears for K20 in SO 202.

6.3.3 LV switchgear RM_SO201

The LV switchgear RM_SO201 on boiler K20 will be located in the new substation in building SO 202. The RM_SO201 process switchgear will have two inlets. Two redundant feeders from HV/LV transformers are fed into the 1st field, on which blocking against simultaneous switching of both feeders is made by means of APSS (automatic power switch). The selection of the feed breaker and its switching is manual or via APSS. From the 2nd to the 4th field the appliances for the boiler K20 and the adjacent premises are supplied. One backup power supply from 00BHD is fed to field 5 (see appendix A112.01_JEPS_OB2-K20). EL from the CBS backup power.

The power supply system of the new switchgear will be similar to the existing distribution switchgear 80,90BFB for K80,90. The main circuit breaker will be 2500A. The switchgear will be fed from a new xxBFTxx HV/LV transformer (6/0,4kV 2500 kVA). The HV/LV transformer will be connected via new busbars to the 1st bay of the new switchgear. The supply circuit breakers will be of the slide-out design. In standard operation, a coupling will connect the two parts of the switchgear and the switchgear will be fed from the HV/LV transformer from 80BBA. In the event of a power failure from the HV/LV transformer, the automatic APSS will switch the power supply to the entire switchgear from the 90BBA transformer.

The PS104-106 appliances will be connected with a cable supplied by OB 1.

This switchgear will supply all the secondary switchgears for the K20 boiler and its accessories (abbreviated as K20 boiler), appliances of the K20 boiler with higher outputs.

The control of the supply fields from the HV/LV transformers will be provided from the site. The 800xA heat plant control system will be modified to provide the required operation of the new switchgear supply. The control of the outlets to the actuators is provided by the new control gear of the respective

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technology. More information regarding the interface between the LV switchgear and the control gear is provided in Technical Specification Annex A4.3 of the I&C.

The cabling running between the new distribution switchgear and the HV/LV transformer and between the transformer and the existing 80,90BBA substations will be new. The new transformer will be located in the new K20 substation at +0.0 m level.

The power and control cabling that connects the new distribution switchgear to:

- new appliances for the K20 boiler and its associated plants,
- new electrical switchgears for the K20 boiler and its associated plants,
- new control system technology,
- with the existing 800xA control system of the heating plant.

will be redesigned, delivered, laid and wired.

Within the proposed solution, the following new appliances will be supplied from the switchgear in addition to the existing outlets:

- FC for primary air fan,
- FC for secondary air fan,
- FC for flue gas fan (additional equipment for existing retrofit fans is also required),
- transport air compressor,
- two transformers in SO 201 at 2500kVA
- Two 75-90kW 1+1 control air compressors will be fed from the new K20 switchgear.
- or other sub-distributors of larger capacity, see A112.05_SKOE_List_of_appliances

The layout of the new distribution switchgear RM_SO201 in the LV substation is shown in the layout of the substation (see Annex A112.04_SKOE_Substation layout_lv+6.75m).

6.3.4 LV switchgear RM_SO203

The LV switchgear RM_SO203 on the boiler K80/90 will be located in the existing switchgear 80,90BFB in building E1A at +4,65 m. The new switchgears (I assume there will be two - separate for K80 and K90) are likely to be in the same rooms as the 80,90BFB rooms, with spare positions in the middle of these rooms for the addition of the new switchgears. The connection of these new cabinets to the 80,90BFB would be by cable.

The PS104-106 appliances will be connected with a cable supplied by OB 1.

Technological switchgear RM_SO203 will be divided into two parts, it will have two inlets. Two feeders from the HV/LV transformer are fed into the 1st field, on which a blocking is made against simultaneous switching of both feeders. The selection of the supply circuit breaker and its switching is manual. From the 2nd to the 4th field the appliances for the boiler K20 and the adjacent premises are supplied. One backup power supply from 00BHC, 00BHD is supplied to the 5th field.

The main circuit breaker will be 630A. The new switchgear RM_SO203 will be connected to the existing technological switchgear 80,90BFB for K80/90.

The supply of FM for the gas flue fan is required as a part of the delivery.

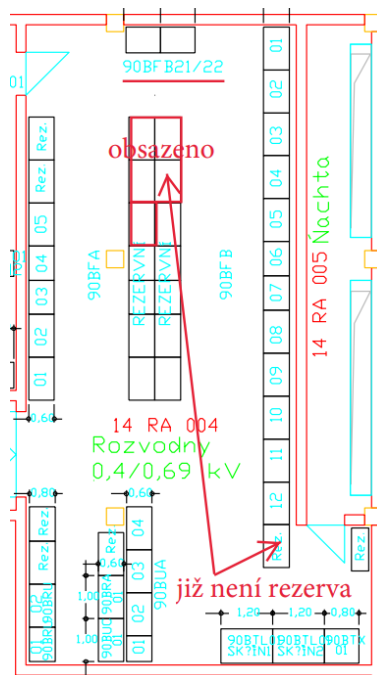
The layout of the new distribution switchgear RM_SO203 is shown in Annex A112.02_OB2_main_cable_routes_el.

6.3.5 LV switchgear of the building SO203

The LV switchgear of the building SO203 on the boiler K80/90 will be solved by installing 7 new fields which will extend the existing switchgear 80BFB and 90BFB in the building E1A to +4.65 m.

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The switchgear of the building SO203 will be divided into two parts, it will have two inlets. Two feeders from the HV/LV transformer are brought to the 1st field, where blocking is made against simultaneous switching of both feeders. The selection of the supply circuit breaker and its switching is manual. From the 2nd to the 4th field the appliances for the boiler K20 and the adjacent premises are supplied. One backup power supply from 00BHC, 00BHD is supplied to the 5th field.



The main circuit breaker will be 630A. The switchgear of the building SO203 will be connected to the existing technological switchgear 80,90BFB for K80/90.

The layout of the new distribution switchgear of the building SO203 is shown in Annex A112.02_OB2_main_cable_routes_el.

6.3.6 Heating plant control system 800xA

The part of the control system 800xA, which is related to the switchgear for the new boiler K20, will be modified to meet the requirements for the new method of controlling the power supply to the switchgear in the HV/LV substation at the level of 0.0 m.

Other parts of the control system that are not related to the K20 boiler remain unchanged.

More detailed information is given in the technical specification Annex A4.3 of the I&C.

6.3.7 Construction-related equipment:

The electrical wiring of the construction parts will include power supply for all operational and emergency lighting, socket wiring, HVAC, cranes, lifts, all wiring not related to the delivery of technology.

Furthermore, earthing and lightning conductors will be included in the construction part.

In SO203-205 facilities, there will be one lighting switchgear in each SO building and they will be fed from the existing main lighting switchgears 00BHE/00BHF (ELE 03) in building E1A via the new main building switchgears.

marking of the connection point	Voltage	switchgear / field	Notes
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NB ELE 03	400 V / 50 Hz	00BHE / 00BHF	Assumption of the arming of the outlet up to 63 A (compact circuit breaker)
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The main emergency switchgear 00BHD will be used to supply electricity to the fire systems, which is powered by the existing diesel generator 00BRV - 1000 kVA in case of main power failure. Switchgear 00BHD is located in EA1.

marking of the connection point	Voltage	switchgear / field	Notes
NB ELE 05	400 V / 50 Hz	00BHD / xx	Assumption of the arming of the outlet up to 63 A (compact circuit breaker)
NB ELE 06	400 kV / 50 Hz	00BHD / xx	Assumption of the arming of the outlet up to 63 A (compact circuit breaker)

To power the emergency lighting, main control system and local control units, the existing battery system and its main switchgear of backup voltage 80BUA and 90BUA will be used.

marking of the connection point	Voltage	switchgear / field	Notes
NB ELE 07 (21)	220 V / DC	80BUA / xx	Assumption of the arming of the outlet up to 63 A (compact circuit breaker)
NB ELE 08 (22)	220 V / DC	90BUA / xx	Assumption of the outlet arming up to 63 A (compact circuit breaker)

6.3.8 Building wiring in building SO 201 and SO 202 for boiler K20

Energy balance

Device designation	Voltage system	Power input	Description
Switchgear RS_SO201	3PEN~50Hz 400V/TN-C-S	Approximately 570kW	Inlet from 00BHE/00BHF

- 3PEN~50Hz 400V/TN-C-S
- For the new boiler K20 (SO201-204): $P_i = 570 \text{ kW}$, $P_p = 400 \text{ kW}$
- Design current LV = 570 A
- Total annual consumption 1063 MWh
- Inlet from RM_SO201
- Short circuit resistance 30kA

In the building SO 202 there will be a new LV substation at the level of 6.75m for the boiler K20, in which a new switchgear RS_SO201 will be placed for the building electrical installation. The new switchgear RS_SO201 will be connected to RM_SO201.

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This part will deal with the RS_SO201 building wiring switchgear, internal lighting, socket circuits and emergency lighting.

The emergency lighting will be solved by luminaires powered (220 DC) from the new CBS field located in the SO 202 substation in the substation room at the level of +6,75m and EL will be without batteries. The new CBS array is fed from RM_SO201.

The project will also address a new lightning conductor and new earthing.

The outdoor cooling units on the façade are supplied with an electrical backup power supply with a shutdown function in case of fire.

All emergency and operational lighting for the new K20 boiler and associated plant will be newly designed supplied and installed.

Lighting:

The wiring will be made with CYKY cables with a conductor cross-section of 1.5mm². The luminaires are designed industrial LED, IP54. The number and location of luminaires in individual rooms will be designed so that the illuminance and other light-technical parameters comply with the applicable standards. The lighting control is solved by local switches. The circuits of the new luminaires will be connected from the new switchgear RS_SO201 located on floor +6,75m.

Lighting levels:

No. of the object	No. of rooms	Calculation of lighting	Room	Lighting
SO201	1.01	1.1	Boiler room K20 +0,0m	100 lx
SO201	2.01	1.2	Boiler room K20 +6,75m	100 lx
SO201	3.01	1.3	Boiler room K20 +11,2m	100 lx
SO201	4.01	1.4	Boiler room K20 +18,0m	100 lx
SO201	5.01	1.5	Boiler room K20 +23,6m	100 lx
SO201	6.01	1.6	Boiler room K20 +28,0m	100 lx
SO201	7.01	1.7	Boiler room K20 +33,7m	100 lx
SO201	8.01	1.8	Boiler room K20 +38,8m	100 lx
SO202	1.03	1.1	Batch behind the boiler K 20 - flue gas cleaning	100 lx
SO202	1.04	2.1	compressor room	200 lx
SO202	1.05	2.2	FC room	200 lx
SO202	1.02	2.3	substations	200 lx
SO202	2.04	3.1	Main technical room	200 lx
SO202	2.03	3.2	Roof of the compressor room	100 lx
SO202	2.05	3.3	LV substation	200 lx
SO202	2.02	3.4	Platform +6,75m	100 lx
SO202	3.03	4.1	Substation ASR +11,2m	200 lx
SO202	3.02	4.2	Platform +11,2m	100 lx
SO202	4.01	5 .1	Platform +18m	100 lx
SO202	5.01	6 .1	Platform +23,6m	100 lx
SO202	8.01	7 .1	Platform +38,6m	100 lx

Emergency lighting:

The wiring will have increased resistance against spreading of flames, the functional capacities of the wiring system in accordance with ZP 27/2008, STN 92-0205, DIN 4102 Conductor cross section 1,5mm². The luminaires are designed with the IPxx cover in accordance with the given premises. The luminaires will be addressable. The functioning of the system will be monitored by remote surveillance. The number and positioning of luminaires in each space will be designed so that emergency lighting is anti-panic and illuminates escape routes and high-risk areas. Other lighting and technical parameters shall comply with the applicable standards.

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Socket circuits:

New socket circuits in the building SO 201, 202 will be made with sockets. The socket circuit wiring will be made with CYKY cables with a conductor cross section of 6mm². Connection of socket boxes will be from technological switchgears RM_SO201 located on floor +6,75m. The socket circuits for the socket outlets to be used by laymen (persons without electrical qualifications) and intended for general use will be connected via a current protector with an inrush fault current of 30mA.

Outdoor lighting on the facade:

The lamps on the facade (4 pcs) will be supplied by the contractor OB 2 and will be connected with a new CYKY 3x2.5mm² cable (in the delivery of OB 2) to a separate outlet to the new switchboard RS_SO201.

The delivery of OB 2 will also include an optical sensor, which will be placed on one lamp on the facade.

6.3.8.1 New light switchgear RS_SO201

Light switchgear RS_SO201:

- 3PEN~50Hz 400V/TN-C-S
- for SO201: $P_i = 20 \text{ kW}$, $P_p = 14 \text{ kW}$,
- LV rated current = 20 A,
- total annual consumption of 37 MWh,
- inlet from 00BHE, 00BHF,
- feed from RM-SO201,
- short circuit resistance 30kA

The RS_SO201 light switchgear will have 4 fields (100A, 30kA, dimensions 3200x2000x600mm, l x h x d) and will be used to supply the building wiring SO201, 202. There is one feed into the 1st field from 00BHE (depending on where the reserves are) and a second feed from the 220V DC secured voltage for the emergency lights. The 2nd field mainly supplies the operational lighting circuits for the K20 boiler and adjacent spaces. The emergency lighting is fed (220V DC) from a new CBS array located in the SO 202 substation in the substation room at +6.75m level.

The design of operational and emergency lighting will be in accordance with the applicable standards of ČSN EN and the PBR. The cabling that provides power and control circuits for operational and emergency lighting will be redesigned, supplied, laid and wired.

6.3.8.2 External lightning protection - lightning conductor, earthing for SO 201,202

The project deals with a new lightning conductor and a new earthing system for the building SO 201,202, which will be connected to the existing earthing system of the Škoda Auto premises.

Earthing, protective bonding

Lightning protection system measures LPS class III. Max. sufficient distance 88cm.

During the foundation of the building, it is necessary to build a foundation ground in the perimeter foundations of the new buildings. It will consist of a strip of FeZn 30x4mm embedded in concrete foundations with overhead "earthing leads" (according to ČSN). All joints made in the concrete foundation will be non-destructible and must be provided with anti-corrosion protection (e.g. asphalt grout). The earthing leads shall be routed where the lightning conductor leads are proposed. Another earthing lead will be brought out and connected to the equipotential busbar of the main protective connection (MPC). A Kopus KO 250/L box with EPS2 terminal box is proposed, connected with FeZn $\phi 10$ wire to the protective conductor of the network in the junction box. In addition, the connection of any

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conductive utilities entering the building and other well-conducting mass and technology of the building will be connected to the main protective connection (MPC) with CY10 conductors.

The resistance of the earthing system should not be more than 10 Ohms. A new inspection report shall be made after implementation.

Lightning rod

The lightning conductor should protect the building from fire or the mechanical effects of lightning current and also protect persons inside or next to the building from injury or death due to the passage of lightning current. The functions of external protection are as follows:

- ☐ interception of a direct lightning strike to the object by the arresting system,
- ☐ safe lightning current discharge to the earthing system of the system of leads,
- ☐ distribution of lightning current in the ground through the grounding system.

All metal parts on the roof and cladding of the building encroaching into the interior spaces must be within the lightning protection area and must not be connected to the lightning protection system's lightning arrestor lines. Leads should be routed as close as possible to the edge of the roof edge and may be fixed to metal eaves pipes. In case the plumbing elements are made of copper material, the ridge arrestor system will be made of AlMgSi Ø 8 mm, also the leads up to the test clamps will be made of this wire, or wire (FeZn) Ø 8 mm will be used and all connections to the copper material will be made via cupal plates.

From the test terminals, a 10 mm Ø FeZn wire will be routed and connected to the earthing. This earthing will be made of a 30x4 mm FeZn earthing strip, laid in the foundation slab and further in the ground at a depth of at least 70 cm. For the internal earthing, a main protective earth connection (MPC) busbar will be placed in the building area, which will be earthed via a test clamp to the FeZn 30x4mm foundation earthing strip. At the time of construction, it is necessary to prepare the foundation slabs including the outlets for the grounding line leads. Copper material cannot be combined (bonded) with aluminium material and hot-dip galvanized steel. The connection must only be made using stainless steel clamps or Al/Cu cup inserts. The earthing leads shall be routed at the points of the leads on the equipotential busbar of the MPC building.

Location of lines and leads

The lines and leads should be as straight as possible without unnecessary curves. Leads to earth electrodes shall be as short as possible and shall be a natural continuation of the earthing equipment. It is recommended that, if possible, the conductors of the earthing line should continue as leads (to the test terminals) without interruption.

Test clamps

The lead conductor is connected to the earthing pin (the so-called earth lead) in an accessible place with a disconnecting screw connection, allowing easy disconnection and reconnection, usually with a standardized test clamp. For external leads, the test clamp shall be mounted at a height of 1,8 to 2,0 m above the ground and shall be at a sufficient distance from both the line support on the lead and the protective angle bracket to enable the clamp to be disconnected.

Mechanical protection of leakage lines

Conductors of lines and leads in places where they are exposed to the risk of damage (on flat roof walkways, introduction of the lead into the ground, etc.) must be protected against damage or made of a sufficiently mechanically strong material (e.g. profile steel, thick steel rod, etc.).

The intake above ground (up to a height of at least 1.6 m) must be protected from damage by a protective angle, while for buildings with profiled plinths pipes may be used instead of an angle. This pipe shall be sealed against water leakage (e.g. with a suitable conductive seal) and conductively connected to the lead wire at both ends; this conductive connection between the pipe and the lead wire shall be durable.

Protection of lines and leads against corrosion

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Conductors and terminals must be made in such a way that under the given conditions the conductors and the components used are sufficiently resistant to the corrosive effects of the environment, nor can corrosion of the contacting conductors and components be caused by the action of moisture (water)

6.3.9 Building wiring in building SO 203 for modifications of boiler room K80/K90.

In the building SO 203, the building wiring in the designed rooms will be completed.

This section addresses interior lighting and emergency lighting.

Emergency lighting will be solved by using the existing battery power supply.

The project also addresses the addition of the existing lightning conductor, grounding is existing.

The project was prepared on the basis of documents provided by the main designer of the construction and documents from the designers of individual professions involved in the event.

The protocol for determining externalities is existing.

6.3.9.1 Existing light switchgear for K80/K90

From the existing light switchgears 08UHA10GP001 and 08UHA10GP002, which are located directly in the building SO 203 and which are fed from switchgears 00BHE and 00BHF, new outlets for the supplemented building part of the boiler K80,90 will be fed.

- **Lighting levels:**

object no.	No rooms	Calculation of lighting	Room	Lighting level
SO203	-	+7,5m	Platform +7.5m	100 lx
SO203	-	+12m	Platform +12m	100 lx
SO203	-	+18m	Platform +18m	100 lx
SO203	-	+36m	Platform +36m	100 lx
SO203	-	+40,3m	Platform +40,3m	100 lx
SO203	-	+44,25m	Platform +44,25m	100 lx

6.3.9.2 External lightning protection - lightning conductor for SO 203

The existing lightning conductor for building SO 203, which will have a new roof, will be completed. The added elements will be connected to the existing lightning conductor and the existing grounding system of the Škoda Auto premises.

6.3.10 Building wiring in object SO 204,205

In SO204-205 the wiring of platform lighting, measuring point, sockets, emergency lighting in the conveyor bridge will be carried out.

Furthermore, a new lightning conductor (the lead will be made by its own steel construction) and a new earthing.

6.3.10.1 New light switchgear RS_SO204,205

Device designation	Voltage system	Power input	Description
Switchgear RS_SO204	3PEN~50Hz 400V/TN-C-S	Approximately 5kW	Input from RS_SO201, alternatively 00BHD, 00BHF

Energy balance:

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For SO204 - 205: $P_i = 5 \text{ kW}$, $P_p = 3,5 \text{ kW}$

Design current LV = 5 A

Total annual consumption 10 MWh.

6.3.11 Wiring and cable routes for boiler K20, K80 and K90

All cabling feeding or controlling the new appliances for the new K20 boiler and its accessories will be redesigned, supplied, laid and wired. Specific details of the scope are given in the text of the chapter as it progresses 6.3 Solution design.

The OB 2 CONTRACTOR shall inspect the condition of the cable routes required for the completion of LOT OB 2. The cable routes shall be maintained to the maximum extent possible. Portions of the cable routes shall be redesigned, supplied and installed as follows:

- the technical condition of the existing cable routes will be insufficient,
- Technological, mechanical or construction dismantling is required,
- existing routes will be overcrowded,
- the existing routes will lack a segregation group.

6.3.12 Consumers

The appliances that are envisaged in the possible solution of the electrical part are strongly connected with the proposed technological solution. The draft list of appliances must be adjusted by the OB 2 CONTRACTOR according to the proposed technological solution of the UNIT.

The BIDDER shall be obliged to modify the technical design in such a way as to ensure the proper execution, commissioning and ensuring the reliable and safe operation of the LOT OB 2.

The anticipated list of appliances based on the technological solution of LOT OB 2 is given in Annex A112.05_SKOE_List_of_appliances.

7 POSSIBLE LAYOUT

7.1 LV boiler substation K20 at the level of 6.5 m

The layout of the HV/LV substation at the level of 0.0 m and the LV substation of the K20 boiler at the level of 6.75 m will be new.

The new frequency converters will be located in the FC room at 0.0 m level.

The exact location of the new switchgears is shown in Annex A112.02_OB2_main_cable_routes_el.

7.2 Cable routes

In a possible technical solution, the following uses are envisaged:

- existing cable routes running in areas where no construction or technological dismantling will take place. These are, for example, cable spaces for the supply to the new substation, main vertical cable routes, cable duct leading to the anchorage, etc,
- new cable routes in areas with new technology. These cable routes will be routed according to the needs of the technology and the location of new appliances and field instrumentation.

7.3 Drawings and attachments

A112.01_ JEPS_OB2-K20

A112.02_OB1,2,4,6_ main_cable_routes_el.

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A112.03_Types_of_connection_of_closures

A112.04_SKOE_Substation location_lv +6,75m

A112.05_SKOE_List_of_appliances _OB2

A112.06_SKOE_Substation location +0,0m

A112.07_SKOE_Disposition of existing EA1 +4,65m

A112.08_ JEPS_OB2- new



Fig. Switch cabinet 90BBA (80BBA in the same design)

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Fig. Switchroom VN90 (last cabinet is 90BBA)



Fig. NN80 switchroom area

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Fig. NN90 switchroom area



Fig. Cabinets 90BUA

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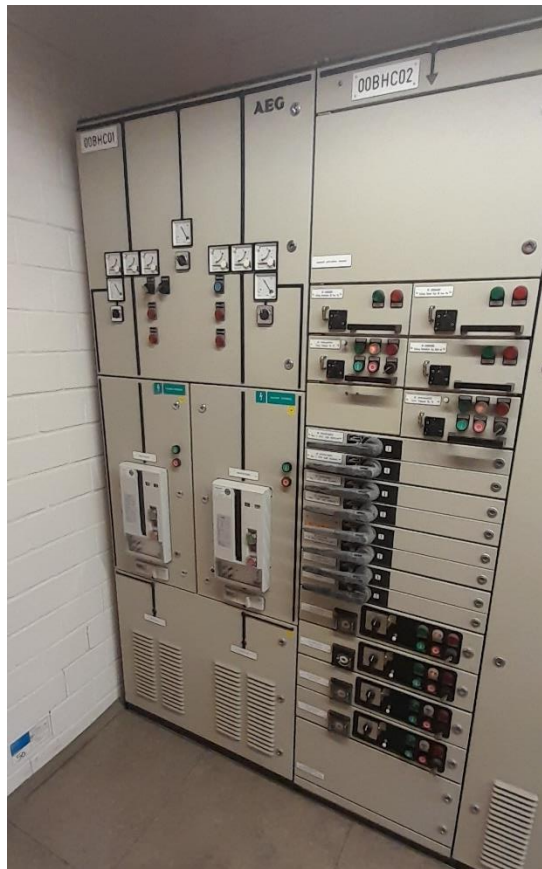


Fig. Cabinets 00BHC

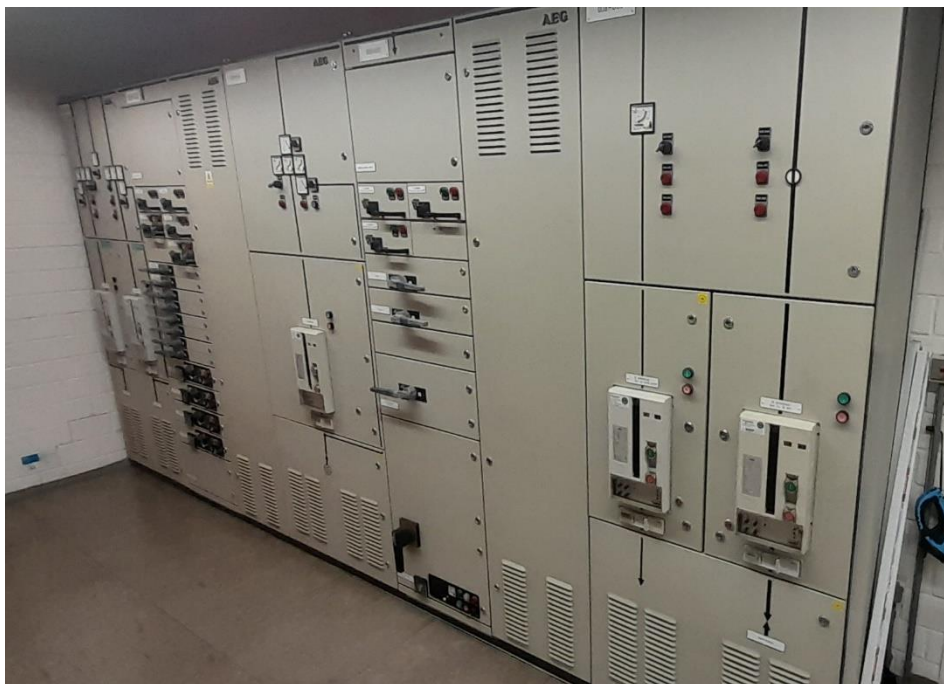


Fig. Cabinets 00BHD

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Fig. Cabinets 00BHF, 00BHE