**GC – Prototype system to feed RDF to Kiln 1 burner**

**Electrical Standards**

# Electrical Design

1. The scope includes documentation for Building Permit (PB), detailed engineering (PW) and As-Built engineering. The As-Built documentation shall include all changes introduced during the installation and commissioning of the Prototype system to feed RDF to Kiln 1 burner.
2. The **electrical design** shall include the following:
3. Energy Balance for the departmental power distribution station which will feed new process control and lighting switchgear.
4. Upgrade/modification of the Main LV Power Distribution Station [LV PDS] to include all necessary modifications and upgrades connected with power supply to the new process control and lighting cabinets. The scope should take into account also changes and modifications related to power supply to LV PDS (if any), e.g. adjustment of protective settings in transformer fields at the Plant’s Main Power Supply Station.
5. Electrical power switchgear for process control
6. A new fiber optic cabinet located in the server room at the Central Control, made with fiber optic and copper cables.

The new Fiber optic cabinet design should be based on the existing cabinet S0X01 and should have patchpanels (24 pigtails type ST).
7. Steady power supply (UPS) to individual cabinets.
8. Adoption of the existing switchgear to incorporate a new design engineering.
9. Lighting and non-process cabinets.
10. Fire detection system (the existing infrastructure to be taken into account)
11. Design of main fire circuit breakers
12. CCTV system
13. Electrical installation for dozing oil to the kiln burner (cut-off valve, regulation valve, flowmeter, pressure gauge) and compressed air (cut off solenoid valve, pressure gauge).
14. Description of the project design shall comprise, among others:
15. Inventory of the existing state,
16. Compliance with applicable Directives and standards,
17. Power Balance,
18. Information on earthing, grounding and fire protection systems.
19. Short-circuit calculations (short-circuit power, short circuit current, thermal current),
20. Calculation of the effectiveness of the protection against electric shock (selection of protection, single-phase short-circuit current
21. Cable selection calculations (the lowest possible cross-section of a cable, cable cross-section selection, calculation receiver current, cables’ long term current carrying capacity, selection of overload protections).
22. Selection of cross sections due to allowable voltage drop
23. Selection of settings
24. Arrangement drawings for specific equipment (cabinets, electrical boxes.).
25. Cable routes drawings
26. Specification of installation materials and prefabricates,
27. List of Health & Safety and fire protection equipment as required for electrical rooms by applicable regulations.
28. Electrical design shall incorporate all applicable Gorazdze Cement standards, both, for process control installations as well as lighting and non-process systems.
29. Each electrical drive, solenoid valve, filter controller shall be equipped with local maintenance switch disconnector with start/stop buttons (Gorazdze standard).
30. The design of a new electrical room shall take into account some space for additional cabinets (cabinet sizing 1200x600mm).
31. Electrical room design should include design for HVAC services and emergency heating system. Air conditioning must be of industrial type. A slight negative pressure should be in the electric room (protection against dustload)
32. Diagrams for the technological system covered by this Purchase Order:
33. Start-up sequence diagram,
34. Stop sequence,
35. Interfaces diagram,
36. Regulation loop diagram.

The above diagrams to be provided in editable form.

It is not acceptable to make replace those diagrams with descriptions.

1. Electrical designs must be agreed upon and approved by the Investor.
2. The design to be made in Eplan Electric P8 (a proof for Eplan licence to be presented to Investor).
3. The complete design must be submitted both, in three (3) hard copies and on CDs (4 copies). On CDs there will be Eplan designs and drawings (LV MPS on CDs, as well as dwg Materials placed on CDs shall be in Eplan (design projects) dwg format (all electrical design and drawings).
4. **Control and visualisation**
5. The scope of work:
6. PLC control program
7. Visualisation on operators’ panels (start screen, process screen, diagnostic screen)
8. Exchange of signals between PLCs via Ethernet (incl. interfaces between departments/ process control systems ),
9. Start up of ProfibusDP communication between PLCs and peripherals (ET200M modules)
10. Checking all I/O signals
11. Conduct cold start-up,
12. Conduct hot start-up (commissioning)
13. Optimisation of the process control system and introducing changes suggested by equipment suppliers and/or Process Engineer.
14. Process Control System and Visualisation shall be made on the FLSmidth platform:
15. ECS SDR 7.9
16. ACESYS ver 7.0.4
17. Process Control System to be made with Siemens S7-400 PLCs:
18. CFC V5.2
19. Step 7 V5.1
20. S7-SCL V5.1
21. In order to ensure complete readability and easiness of moving across PLCs and visualisation system the Contractor must take care in descriptions of specific signals, DB blocks, CFC blocks and visualisation elements introduced to the system.
22. **Electrical installation**
23. Electrical installation shall be made in compliance with the Gorazdze Cement standards.
24. Guidance on electrical engineering for operational equipment
* All support structures, cable routes, and cable access to be made with hot galvanized material, manufacturer: EL-PUK or BAKS.
* Local maintenance switch disconnectors, pre-start signals and safety switches to be mounted on galvanized sheet panels with roof.
* Local maintenance boxes to be grounded/earthed to the structure with yellow-and- green PE line.
* In the areas where there is a high dustload, the cable routes should run vertically.
* Cable junction boxes shall not be mounted directly on the equipment or structures but on a dedicated sheet metal plates.
1. Rules for laying electrical cables:
2. Cables on the cable routes should be mounted with cable holders
3. Power and control cables to be laid on separate cable ladders. The control cable ladder shall have also measurement and communication cables.
4. Electrical MCC room

Electrical room shall be equipped with and comply with the following:

1. Technical floor on the whole electrical room surface.
2. Cable entries to be sealed with fireproof wool and painted with fire resistant paint (certificate).
3. Supply and install an adequate Health&Safety and fire equipment.
4. Supply a table and two chairs to the e-room.
5. Proper signage on the e-room door as well as information signs.
6. Air conditioning equipment allowed in industrial version only.
7. Make measurements and acceptance tests in compliance with the standard PN-IEC 60364-6-61 „Electrical installation of civil structures. Acceptance testing”.
8. **Gorazdze electrical standards to be applied**
9. **Switchgear for process control**
10. Power supply field (Rittal manufacturer, TS8 cabinet, 800x600x2200mm)
11. Output field (Rittal manufacturer, TS8 cabinet 1200x600x2200mm)

Installation system for electrical equipment as well as cable ways to be applied on the basis of Lutze profiles system LSC.

1. **Lighting and non-process power**: Rittal TS8 Cabinets 1200x600x2200mm.

Installation system to mount electrical equipment and conduct wires to be used: Lutze profiles LSC.

1. **Local maintenance disconnectors (isolators)**

Each electric drive, solenoid valve, filter controller shall be equipped with a local disconnector box with maintenance/repair switch off (selected with consideration of nominal current of load) and start/stop buttons. Local maintenance boxes made with Rittal / Lappkabel / Eaton / Socomec subassemblies. Local maintenance disconnectors to be installed on the galvanized steel plates (2mm) with a protective collar.

1. **Labelling of electrical equipment**

Maintenance boxes shall have Weidmuller Logi Mark holders for description plates.

Description plates (Nameplates) to be engraved: black letters, white background

1. **Pre-start signalling**

Pre-start signalling must include a warning lamp (Famor OB4177-07), buzzer (Famor HB3551-01) and junction box.

Whole pre-start set must be mounted on galvanized 2mm plates with a protective collar.

1. **Safety switches**

As safety switches, the Siemens (3SB3801-0EF3) devices to be applied.

Safety switches to be mounted on galvanized plates, in galvanized enclosures with a protective collar .

1. **Cable junction boxes**

For this project we use Hensel cable junction boxes

1. **Electrical apparatus**

Our standards are as follows:

1. Eaton apparatus for switching and protecting electrical circuits
2. Releco relays C7 (C7-A20DX/24VDC, C7-A20X/230VAC)
3. ABB Frequency Converters series ACS880 with additional option for extended warranty
4. WDU connectors: Weidmuller
5. Knick analogue input isolators
6. **Subassemblies of PLC system**

Basic cards/modules of control system are:

1. Communication module ET200M - 6ES7 153-1AA03-0XB0
2. DI card - 6ES7 321-1BH02-0AA0
3. DO card - 6ES7 322-1BH01-0AA0
4. AI card - 6ES7 331-7KF02-0AB0
5. AO card - 6ES7 332-5HD01-0AB0
6. ProfibusDP modul - 6GK1 503-3CB00
7. **Temperature measurements**

Temperature measurements are made with temperature transmitters installed in electrical cubicles placed in electrical rooms. We use PRelectronics transmitters series 4114, 9116B (version Ex) and display modules 4501.

Pt100 sensors are connected with transmitter with 3 or 4 –core cables, whereas for connections with thermocouples type K compensation cables are used.

1. **Speed control**

Belt conveyors, screw conveyors, airlock feeders are equipped with IFM inductive sensors of type II5436 (II-2015FRKG) for speed control.

Due to a cycle time of PLC, the inductive sensor should have appropriate width to ensure adequate duration of the puls (too short pulses can be disregarded by PLC).

1. **Pull rope emergency stop switch and belt drift switch**

Belt conveyors must have KIEPE pull rope emergency stop switch HEN001 and belt drift switch HES011.

1. **Fibre Optic cable**

ProfibusDP communication between S7-400 PLC and peripherals (ET200M) located in individual switchgear is performed on the basis of multi mode fibre optic [FO] cables 12G 62,5/125. Cables to be laid between FO Cabinet at Central Control Room and local FO cabinets in electrical rooms. FO cabinets should be dustproof (door sealing,FO cable glands, elestice patchcord entries) and possibility to install 24 pigtails of ST type. All fibres of FO cable in the cabinet and FO cubicle should be ended with ST pigtails. Connections between FO cable (both at Central Control Room and in switch-room) and OLM modules (equipped with two FO ducts) should be made with double ST patchcords.

1. **Elevated floor in electrical room**

Technical floor is to be made of Wappex plates 600x600 type W38BS-P with anti-static PVC Gerflor Mipolam – Michigan floor tiles. There should be maximum possible space provided for installation of cabinets (applicable regulations to be taken into account). Space not covered with cabinets must have PVC floor plates.

1. **Control cables**

Control circuits shall have YoKSLYekwf cables with green sleeve. Cables with core diameter 1mm2 are allowed with core number and colours as below:

1. 3 cores: black, grey, red
2. 4 cores: black, grey, red, blue
3. 7 cores: black, grey, red, blue, brown, white, purple
4. 10 and more: numbered cores
5. **Power cables**

Between cabinets and local maintenance isolators (disconnectors) we use cables of NYY-J type, with minimum core diameter 2.5mm2.

Between local disconnectors and drives, the cables H07RN-F are used.

For FC drives we use shielded cables with symmetrically split PE core.

1. **Cable ways**

All support structures, cable routes, cable access shall be made with EL-PUK or BAKS systems. Only hot galvanized accessories are allowed.

1. **Earthing system**

For earthing system we use FeCU steel bonding with 0.070mm copper coating

1. **Lighting circuits**

Lighting to be made with Beghelli LED luminaires or other well known manufacturer agreed upon with the Investor.

1. **Repair sockets**

Sets of repair sockets with Bals Catalogue number 516980 to be used.

1. **Final remarks**