

Design Project Continuous Emission Monitoring System

Customer: Georgian Industrial Group
Gazapkhuli Street 18
0177 Tbilisi, Georgia

Plant: Kutaisi Auto Mechanical Plant LLC
Avtomshenebeli Street 88
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0. General

Abbreviations:

GIG: Georgian Industrial Group

KAMP: Kutaisi Auto Mechanical Parts LLC

At the site of KAMP in Kutaisi (Georgia), a casting workshop is installed and operated. The design project at hand covers the concept of a continuous emission monitoring system (CEMS) for the above-mentioned plant.

All specifications relevant to the design are listed below. The contractor is responsible for meeting the mentioned requirements. Contradictories must be announced to KAMP by the contractor.

The contractor's scope of delivery includes a full planning of the listed scope of delivery about consistent functionality, feasibility, completeness and compliance with the respective applicable standards and regulations according to the documents and the detailed specifications listed below.

1. Basis of design

The CEMS to be installed in the above-mentioned plant must comply with the legislation of The Government of Georgia in the field of environmental protection, including:

- (1) Resolution of the Government of Georgia No. 192 of 04/27/2021 "On Approval of the Technical Regulations for Self-Monitoring and Reporting on Emissions from Stationary Pollution Sources"
- (2) 2014/35/EU *Low Voltage Directive*
- (3) 2014/30/EU *EMC directives*
- (4) EN 61010 *Part 1 Safety requirements*
- (5) EN 14181 *Quality assurance for automatic measuring equipment*
- (6) EN 15267 *Certification of automatic measuring equipment*
- (7) EN 15259 *Air quality - Measurement of stationary source emissions*

All equipment used must have the appropriate approvals and suitability. QAL 1 and MCERTS approval are prerequisites. Furthermore, the system must comply to the technical specifications mentioned in this design project.

2. Design stage

The design of the system must comply with the design project at hand and is furthermore to be agreed on between KAMP and the contractor. The contractor is in charge of requesting all necessary information for the design of the CEMS within the design stage.

Following documents shall be provided to the customer for approval before the manufacturing process of the CEMS:

- (1) Nozzle arrangement
- (2) Circuit diagram
- (3) Dimensioned drawings
- (4) Signal exchange list
- (5) List of mediums

a. Technical and economic characteristics and indicators of the object

The main technical and economic indicators are determined in the design documentation, in accordance with the below following Design Specifications.

The characteristics of the designed object in accordance with information on the composition and indicators of emissions from a stationary source of emissions to be equipped with automatic measuring instruments.

3. Initial Data

The initial data for the basic engineering for the contractor to provide a sufficient offer is shown in the design project at hand. Initial data that are not reflected in this technical assignment are provided by KAMP at the written request of the contractor.

a. Customer

<i>Company:</i>	<i>Kutaissi Auto Mechanical Parts LLC</i>
<i>Postal Address:</i>	<i>Avtomshenebeli Street 88 4600 Kutaissi, Georgia</i>
<i>Contact:</i>	<i>Shalva Gogoladze shgogoladze@gig.ge</i>

b. Schedule

<i>Offer submission until:</i>	<i>.... calendar week</i>
<i>Date of award:</i>	<i>.... calendar week</i>
<i>Arrangement of sampling nozzles with indication of dimensions:</i>	<i>.... calendar week</i>
<i>Signal list to DCS</i>	<i>.... calendar week</i>
<i>Circuit Diagrams for approval</i>	<i>.... calendar week</i>
<i>Delivery of instruments</i>	<i>.... calendar week</i>
<i>Commissioning</i>	<i>.... calendar week</i>

4. General requirements

a. Requirements for quality, competitiveness and environmental parameters of products

The projected technologies, construction solutions, organization of production and labor must comply with the current standards and norms of Georgia for quality, environmental requirements, industrial safety, fire and gas safety, labor protection. Ensuring the use of the best available technologies that correspond to the international level.

b. Requirements for architectural planning, structural and engineering solutions

Using prefabricated, block structures and equipment. Apply layout and technical solutions that minimize technogenic impact on the natural environment.

The customer, upon written requests of the Contractor, issues technical conditions / requirements for the placement of production sites, equipment and structures, for connection to existing communications, to power supply, communications, sewage system.

c. Energy Saving Requirements

Use of energy efficient devices, where applicable and possible, is an obligation. The system shall be designed in a way to ensure the fewest possible energy consumption.

d. Requirements for industrial safety, labor protection and hygiene

Design documentation in the field of industrial safety, technical regulation, should be developed in accordance with current regulatory legal acts and local regulatory documents of KAMP.

The adopted technologies, equipment, construction solutions, organization of construction and operation of the facility must comply with the requirements of the current norms and rules in the field of industrial safety.

Ensure the use of the latest materials and technologies that ensure reliable operation of all materials and equipment, taking into account the efficiency and economy of construction and operation.

Technological processes of production should be automated as much as possible, taking into account the requirements of the company in the field of process control systems.

Equipment (technical devices) included in the design (working) documentation must have (if specific equipment is not indicated in the documentation, appropriate equipment requirements must be provided) one of the following sets of documents:

- (1) Documents confirming compliance (certificate or declaration) with the requirements of technical standards
- (2) A set of operational documentation in Georgian and English.
- (3) Additional requirements for thermal automation and measuring instruments: A separate list of instruments must be prepared.

Equipment design and layout should provide with the possibility of inspection during operation, free and safe access to units and parts for the purpose of maintenance, repair, technical and metrological examination (diagnostics).

e. Requirements for assimilation of production

The maximum use of existing buildings, structures, overpasses, utilities of existing facilities. The ability to use should be confirmed by calculations.

f. Requirements for security systems and protection of facilities

For automation and communication nodes (ACS, I&C, etc.) developing a section "Information Security" taking into account the requirements of the local regulatory documents of the company.

g. Documentation requirements

The customer should be provided with design and working documentation on paper in the amount of 4 copies and 2 copies in electronic form in Georgian and English, in the format:

- MS Office files (specifications for equipment and materials in MS Excel format, text documents in MS Word format).
- AutoCAD files (graphic part).
- The electronic version of the documentation set transferred on a CD-R disc (s) produced by the developer of the documentation (original-disc). It is allowed to use CD-RW, DVD-R, DVD-RW media.
 - On the front surface of the disc there must be a printed marking indicating: the name of the design (and working) documentation, the customer, the contractor, the date of preparation of the electronic version, the serial number of the disc. The disc must be packed in a plastic box, on the front surface of which the corresponding marking is also made.
 - There must be a content text file in the directory of the disk.
 - The composition and content of the disc must correspond to the set of documentation. Each physical section of the set (volume, book, album of drawings, etc.) must be represented in a separate directory of the disk by a file (group of files) of an electronic document. The name of the directory must match the title of the section.

Files should normally open in view mode using Windows 7/2000 / XP / Vista.

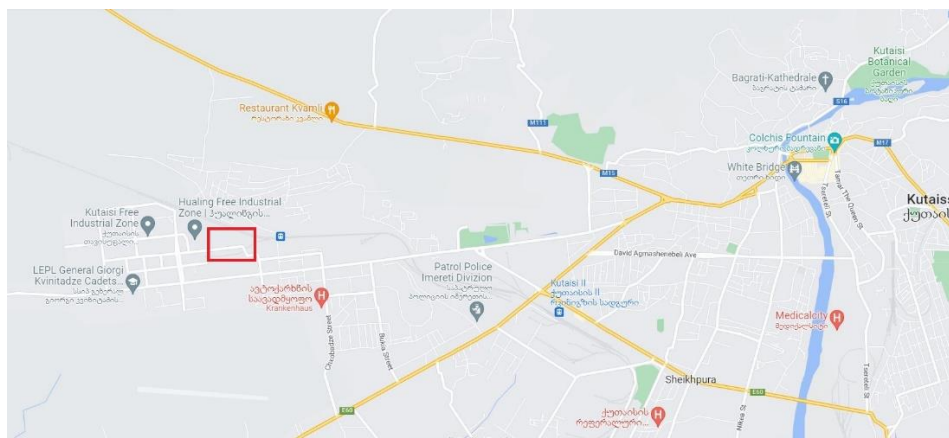
h. Special design requirements

The developed documentation must comply with the requirements of the current norms and rules on industrial safety, fire safety, the requirements of the State Law of Georgia and other regulatory documents. Designing according to foreign norms and rules is allowed only if it does not contradict the norms and rules in force on the territory of Georgia.

When developing technical documentation (if necessary and as agreed with the Customer), include the head of installation supervision and commissioning. All decisions on the development of design and working documentation must be agreed with the customer.

5. Location of the companies, buildings, structures, CEMS

The plant of KAMP is situated in an industrial compound in Kutaisi.



a. Plant configuration

The casting workshop consists of 2 induction furnaces for the melting process.

Type: 2x induction furnaces

Fuel: Electrical energy

Flue gas treatment: None



b. Stack

Material: Steel

Wall thickness 0,2 cm

Diameter - sample platform: 70 cm

Height: 11,5 m

Each induction furnace is equipped with a collector leading the emitted gases to a flue gas duct. Both ducts are merging in a common stack. The stack vertically leads through the ceiling where the flue gases are emitted into the air. The exhaust gases enter the stack at a temperature of 60 °C.



Collector above the furnace



2 flue gas ducts merging in common stack



Stack leading through the ceiling

6. Technical specifications

The objective of the project is to create a continuous emission monitoring system (CEMS) for KAMP. The technical specification listed below applies to the execution of the CEMS. If customer specifications, official protocols or notices are attached to the specification, these must be complied with. If the specifications are contradictory, GIG must be consulted.

Contradictories recognized by the contractor must be announced to the KAMP. Furthermore, KAMP will provide necessary information on request of the contractor, e.g. a drawing of the plant etc.

a. Requirements for technology, enterprise mode and basic equipment

The CEMS should include several components:

- (1) One automatic stationary monitoring station for emission sources
- (2) CEMS control should be carried out through the chimney of the technological unit
- (3) Center for the collection and processing of analytical information (CCPI) / Data acquisition and handling module (DAHS)

As part of the project documentation, it is necessary to develop basic technical solutions for connecting all system components into a single whole using software and network resources.

The operating mode of CEMS is daily, 24 hours. CEMS measurement system should be maximally automated.

Software program CEMS should operate both in automatic, as well as in manual (with the help of operator) operating modes, including:

- (1) Measurement of established parameters of emissions from stationary sources
- (2) Management of the operation of all systems of the measuring complex, measuring instruments, equipment and technical devices
- (3) Collection, archiving, processing, visualization and transmission of data on measurement results, operation of equipment and technical devices
- (4) Ensuring the collection, archiving, storage and processing of information received from CEMS on a single server of KAMP.
- (5) Provision of information to the Department of Environmental Supervision of Georgia on the results of measurements at CEMS in accordance with the legal requirements – Decree N192
- (6) Alarms for notification of violations in the operation of equipment, technical devices
- (7) Alarm for notification of power outage, communication

Technological and technical solutions shall lead to a decrease in capital investments and operating costs and corresponding to the international level. The design must provide energy-saving, environmentally friendly technologies and materials. Furthermore, shut-off and control valves, insulating coatings and pipe fittings, certified in accordance with the established procedure, permitted for use at hazardous production facilities must be provided.

b. Components to be measured

The CEMS must cover the measurement of the components listed below. These are to be measured and registered continuously. According to the measuring range and specifications of the flue gas treatment, a suitable monitoring method shall be chosen.

The components to be measured as well as the according limit values are defined by the authorities and provided by KAMP to the contractor.

All emission limit values are to be calculated at a temperature of 273.15K, a pressure of 101.3kPa, after deduction of the water vapor content of the exhaust gas at a reference oxygen content.

Following components are to be monitored continuously:

<i>Parameter / Substance</i>	<i>Limit value</i>	<i>Measuring range</i>	<i>Monitoring method</i>	<i>Comment</i>
Dust	300 mg/m ³	0 – 3000 mg/m ³	Light extinguishing or diffusion, triboelectric method	
Oxygen (O ₂)	--	0 – 25 Vol.%	Electrochemical Cell	
Velocity	--	0 – 30 m/s	Differential Pressure	

The table of measurable components are estimations to be specified and completed by the Department of Environmental Protection. The final measuring ranges will be agreed on after the customers purchase order to the contractor within the kick-off of the project.

Due to the fining structure of the Georgian Government, calculating the fines depended on the level of limit exceedance, the measuring range shall be 10x the emission limit. Due to the unusually high measuring range, the variety of suitable devices is limited. Discussions between customer, authorities and contractor shall take place in order to find a reasonable solution.

An oxygen measurement shall be included in the offer as an option to be prepared for changing legal requirements in future and in accordance to Annex 6 of the Decree N192 footnote (1), referring to a standard oxygen concentration.

Furthermore, a velocity monitor shall be included in the offer as an option, as the authorities might require an actual measurement to calculate the amount of harmful substances released in the air. The customer will clarify his obligations with the legal authorities in charge and might agree on an alternative solution to determine the velocity. E.g., via the frequency of the flue gas fan or the gas input.

c. Sampling platform

An existing platform in approx. **+10 m (please check!!)** height shall be used as sampling stage for the CEMS. The status quo does not comply with DIN EN 15259. The sampling stage is currently hard to access. The flooring needs a refurbishment in order to ensure safe accessibility. The customer will take care of this issue. The contractor must provide a dimensioned drawing of a sufficient sampling stage complying to the above-mentioned norm. The customer will ensure compliance with the drawing and the norm. The customer will furthermore ensure safe accessibility to the measuring stage as well as the safety of the stage itself.

d. Sample gas extraction / Nozzles

The sample gas extraction / sampling nozzles are installed in the stack at approx. **+11,5 m (please check)** on the pressure side of the flue gas fan. The inlet of the flue gas flow into the stack is at approx. +2,00 m. The inside diameter of the stack is around **600 mm (please check)**.

The arrangement of the required nozzles for the individual measurements as well as the test nozzles according to DIN EN 15259 shall be shown by the contractor in a drawing with dimensions and the required installations position. All nozzles shall be provided by the contractor.

The customer or a third-party company commissioned by the customer shall carry out the installation of the nozzles in the stack. All necessary drilling and welding works will be executed by the customer.



Stack left side with measuring platform



Measuring platform from below

e. Cable trays

The customer takes care of a suitable solution to lay cables and sample gas line between sampling stage and control cabinet. The cables are to be installed on dedicated cable trays with separation of power supply and signal cables. However, in accordance with the requirements mentioned above, the customer might use existing structures to install the cables on. The installation shall be carried out by the customer or a third-party company commissioned by the customer.

f. Analysis measurement

The measuring equipment consists of all components necessary for the measurement of the listed components. Beside the dust monitor, a control cabinet shall be included in the system in order to distribute the power supply and the signals. Furthermore, the DAHS shall be installed in the cabinet. The emission evaluation PC shall be installed in the same room.

If an oxygen monitor is to be implemented, all components necessary for the measurement such as heated sampling tube, heated sampling probe, heated sample gas line, sample gas conditioning, analyzer system and cabinet, etc. shall be included.

All binary signals (e.g., status, operating and fault messages) must be recorded in the cabinet and displayed from there directly on the cabinet and forwarded to the emission computer and the PLC (if applicable).

The position of the cabinet is determined in an existing room in approx. 35 m distance to the sampling stage – indicated with the red box in the following picture. The cable lead-through will be installed by the customer.



g. Sample gas line & cables

The specification and delivery of the sample gas line (in case oxygen measurement is to be implemented) and cables is included in the scope of delivery of the contractor. The laying of the sample gas line and cables is carried out by the customer or a third-party company commissioned by the customer. Technical details for the laying are to be provided by the contractor.

The length of the heated sample gas line and cables shall be assumed approx. 35 m.

h. Design of analysis / control cabinet

The cabinet is designed using conventional surface-mounting technology. At the time of installation, the cabinet must be designed and tested in accordance with the last applicable standards and regulation at the installation site. The test report must be available to the customer.

The respective tests (protective conductor test, insulation resistance test, high-voltage test, visual inspection) must be documented with measurement tables, which must be supplied. A declaration of conformity (CE) must be submitted for the cabinets. The test report and the declaration of conformity must be available to the customer. sent directly to the customer in the original and not with the delivery of the cabinets. The protocols shall be issued in English.

All components of the analytical measurement must be integrated in the cabinet. This applies both to the power supply for all measuring equipment and to signal acquisition and forwarding to the emission computer.

A power supply of 380 VAC (3x L, N, PE) is provided for the analytical measuring equipment. The distribution of the voltage to supply the sampling equipment is done internally by the contractor.

i. Data Acquisition and Handling System (DAHS) for emission evaluation

A PC-based solution shall be implemented, by means of which the visualization, archiving and transfer of the values to the authorities in accordance with Decree N192 is done. Neither the higher-level automation nor the control system takes over the functions of a possibly required raw value recorder or emission computer.

All raw values and status signals such as warnings and faults, etc. are to be transmitted to the higher-level automation system of the power plant (DCS). For this purpose, signal duplicators or isolating amplifiers shall be used. The signal transmission is to be designed hard-wired.

The emission computer consists of all components necessary for the emission monitoring or visualization.

- (1) Display, mouse, keyboard and operating software (Windows in multiple languages)
- (2) Analog and digital inputs and outputs (if applicable)
- (3) Interface to the higher-level boiler control system (hard-wired)
- (4) Internet access for remote maintenance purposes and data transfer to authorities
- (5) Installation and parameterization

The software must provide:

- (1) Configure system operation mode
- (2) System management
- (3) Compiling reports
- (4) Display of current concentrations
- (5) Display flow parameter information
- (6) Display all information in digital and graphic images in real time
- (7) Data transmission in digital and analog form
- (8) Programmable measurement units (ppm, mg/m³, %, g/sec)
- (9) Programmable output signal scale
- (10) Constant control of emergency and warning signals

The language of the user interface is to be realized in at least English language.

An according system shall be included in the offer.

j. Spare parts

Spare parts shall be available for the next 10 years. Common spare parts for a period of 2 years must be included in the offer as an option.

k. Cable connections

All connections to the plant (power supply of the analysis cabinet, signal cables, internet connection etc.) are provided by the customer and led into the cabinet. The provision and the installation of the cables are done by the customer.

The cable manufacturer shall be Lapp Holding AG.

The cables necessary for the CEMS internal power supply, signal transfer and network are provided by the contractor. However, these cables are to be installed by the customer.

Following cables are within the scope of supply of the customer:

- (1) Power supply 380 VAV (3x L, N, PE)
- (2) Signal cables between DCS and CEMS cabinet
- (3) Internet connection

Following cables are within the scope of supply of the contractor:

- (1) Internal power supply and signal cables within the cabinet
- (2) Internal power supply and signal cables between cabinet and sampling platform
- (3) Internal network connection cables

I. Power supply

The system is fed by a 380 V power supply (3x L, N, PE). The supply of the sampling equipment is done internally by the contractor.

The cable into the cabinet (especially diameter and technical specification of the cables) will be determined together with the customer after the order has been placed.

The connection for the power supply of the CEMS should be made in accordance with the TOR for power supply, provided by the customer at the request of the designer. The issued load calculations, the definition of the voltage class and the reliability category of the power receiving devices are the basis for the design of the connection.

The design borders of power supply are considered to be the points of connection inside the cabinet. The technical specifications for power supply, issued by the customer, including the development of the necessary cable routes and structures for open laying of supply cable lines from the points of connection to the designed facility is to be taken into consideration. Provision of cable routes for newly envisaged and existing cable racks - independent and combined with technological racks is within the scope of supply of the customer.

The design and development of working documentation in terms of power supply systems, electric lighting, grounding and lightning protection, should be carried out in accordance with the technical requirements for design, provided by the customer. The grounding and lightning protection is overseen by the customer.

7. Scope of delivery

All components of the emission measuring system shall be delivered in appropriate transport units on pallets or similar. Proper packaging, loading and transport to the installation site shall be included in the scope of delivery of the contractor. The unloading process is executed by the customer.

If required, the goods are to be stored protected from rain and snow until installation.

a. Documentation

The following documents are included in the scope of delivery from the contractor:

- (1) Circuit diagrams incl. cable list and terminal diagrams
- (2) Parts lists in Excel with make and type for the main components
- (3) Drawing of sampling platform incl. nozzle arrangement with arrangement of measuring devices as well as information about the connection pieces (dimensions, length, position, material, etc.)
- (4) Manuals of devices
- (5) Test protocols and declaration of conformity of the system
- (6) Signal list

After completion of commissioning, all changes and additions shall be incorporated into the planning documents by the contractor and "as built" status shall be handed over to the customer.

All documents shall be executed in English.

b. Hard- and software

All components described in the specification for the proper execution of the emission measuring system are included in the scope of delivery of the customer. The delivery is carried out in several parts (e.g. nozzle in advance), the individual dates are to be coordinated between KAMP and the contractor.

The system must consist of the following components:

- Dust monitor
- Control Cabinet
- Cables for supplying the devices installed on the stack (approx. 35 m)
- Data Acquisition and Handling System for the purpose of emission monitoring and evaluation incl. parameterization

Options:

- Velocity monitor
- Oxygen measurement system incl. necessary auxiliaries
- Spare parts for 2 years of operation

c. Commissioning and training

The scope of delivery of the contractor includes the complete commissioning of the delivered components. The contractor shall provide a sufficient number of qualified personnel for the commissioning period. The installation of the equipment is overseen by the customer.

The commissioning is divided into the following steps, the presence and execution is in the delivery of the contractor:

- (1) Mechanical check of installation works
- (2) Commissioning of all components
- (3) Signal test to DCS
- (4) Functional check and calibration (the gas cylinders with test gases for the commissioning calibration are supplied by the customer)
- (5) Measured values are to be checked for plausibility
- (6) Training of operating personnel

After completion of the commissioning, the end customer shall be instructed on the scope of delivery for the operation of the system.

The training documents as well as the operating manual of the entire scope of delivery shall be made available to the customer in English at latest by the commissioning of the system.

The safe accessibility incl scaffolding, cranes and the transport of the equipment is overseen by the customer. All installation works (laying cables and sample gas line and installation of devices) are executed by the customer or a third-party company commissioned by the customer.

8. Additional costs

Additional costs or additional expenses which exceed the lump sum order must be notified to the customer in writing with the expected costs. These will be checked at short notice and a statement will be made.

Additional costs, which are charged to the AG without approval, will not be accepted, unless there is imminent danger and these changes or expenses must be carried out immediately.

9. Contractor and Subcontracting

The contractor is to be determined in accordance with the local normative documentation of GIG. The subcontractor is to be determined by the Contractor in agreement with the Customer.

10. Work completion time

In accordance with the schedule of the contract.

11. Job expiration date

The job expiration date is to be specified in the contract.

12. The order of delivery of work

In accordance with the terms of this design assignment and the schedule of the contract.