Section 5a. Annex 1 to the Terms of Reference

Technical Specification for Equipment

Purpose of the equipment

The equipment is intended for illumination of city streets and highways with the installation of luminaires on a rigid mounting arm and street lighting control cabinets (see the layout of lighting towers in Annex 2, the current inventory of street lighting fixtures in Annex 3, a list of existing lighting control cabinets in Annex 4, and the general layout plan in Annex 5).

Composition of equipment to be purchased for replacement of the existing mercury discharge luminaires with the implementation of a street lighting control system

1. Outdoor LED luminaire (max power 55 W) – 147 sets
2. Outdoor LED luminaire (max power 130 W) – 253 sets
3. Street lighting control system, including software – 1 set

1. Outdoor LED luminaire (max power 55 W) – 147 sets

##	Parameter	Value
1.	Light source type	LED (Light Emitting Diode)
2.	Material of the protective glass of the luminaire	Tempered glass
3.	Material of the housing of the luminaire	Die-cast aluminium; all components of the luminaire housing, including the mounting bracket, must have a powder coated finish
4.	Ingress Protection rating of the luminaire (IP), not less than	IP65
5.	Impact Protection rating of the luminaire (IK), not less than	IK08
6.	Weight of luminaire (kg), not more than	10 kg
7.	Compatibility of the luminaire with the support or console diameter	∅ (diameter) 40÷60 mm, possibility of installation on a standard console
8.	Ability to adjust the tilt angle of the luminaire relative to the horizontal illuminated plane	+/-15°
9.	Operating temperatures range	-40°C - +45°C
10.	Colour temperature, K	4000 +/-250K (neutral white)
11.	Type of luminaire mounting kit	With stainless steel screws
12.	Efficacy of the luminaire, not less than	109 lm/W
13.	Total luminous flux, including losses in the optics, not less than	6000 lm
14.	Colour Rendering Index (CRI)	>70
15.	Electrical safety class according to EN 60598	I (first)
16.	Overvoltage protection, not less than	6 kV
17	The luminaire is equipped with a lightning protection device built into the luminaire housing, with the following parameters:	• rated discharge current, not less than 5 kA; • maximum discharge current, not less than 10 kA
18.	Total power consumption, no more than	55 W
19.	Protection from light pollution, not worse than	Luminous flux 0 candelas above 90° plane of the light emitting surface of the luminaire
20.	Useful lifetime of the luminaire - the operating time, during which the luminous flux is 80% of	50 000 hours

	the initial value (L80), not less than	
21.	Warranty period, not less than	5 years
22.	Technical requirements for the power supply unit of the luminaire	• a programmable power supply unit with the output power and feed current setting function; • data reading from the luminaire driver using 1-10V, DALI or DALI 2 protocols

2. Outdoor LED luminaire (max power 130 W) – 253 sets

##	Parameter	Value
1.	Light source type	LED (Light Emitting Diode)
2.	Material of the protective glass of the luminaire	Tempered glass
3.	Material of the housing of the luminaire	Die-cast aluminium; all components of the luminaire housing, including the mounting bracket, must have a powder coated finish
4.	Ingress Protection rating of the luminaire (IP), not less than	IP65
5.	Impact Protection rating of the luminaire (IK), not less than	IK08
6.	Weight of luminaire (kg), not more than	10 kg
7.	Compatibility of the luminaire with the support or console diameter	∅ (diameter) 40÷60 mm, possibility of installation on a standard console
8.	Ability to adjust the tilt angle of the luminaire relative to the horizontal illuminated plane	+/-15°
9.	Operating temperatures range	-40°C - +45°C
10.	Colour temperature, K	4000 +/-250K (neutral white)
11.	Type of luminaire mounting kit	With stainless steel screws
12.	Efficacy of the luminaire, not less than	110 lm/W
13.	Total luminous flux, including losses in the optics, not less than	14400 lm
14.	Colour Rendering Index (CRI)	>70
15.	Electrical safety class according to EN 60598	I (first)
16.	Overvoltage protection, not less than	6 kV
17	The luminaire is equipped with a lightning protection device built into the luminaire housing, with the following parameters:	• rated discharge current, not less than 5 kA; • maximum discharge current, not less than 10 kA
18.	Total power consumption, no more than	130 W
19.	Protection from light pollution, not worse than	Luminous flux 0 candelas above 90° plane of the light emitting surface of the luminaire
20.	Useful lifetime of the luminaire - the operating time, during which the luminous flux is 80% of the initial value (L80), not less than	50 000 hours
21.	Warranty period, not less than	5 years
22.	Technical requirements for the power supply unit of the luminaire	• a programmable power supply unit with the output power and feed current setting function; • data reading from the luminaire driver using 1-10V, DALI or DALI 2 protocols

3 Street lighting control system

The street lighting control system is designed to control the 400 luminaires to be purchased under the Terms of Reference, as well as for the currently used stock of luminaires specified in Annex 3 and includes the following basic equipment:

1. Controller integrated into the luminaire housing for remote control using PLC or GSM technology
2. Segment controller installed in the street lighting control cabinet
3. Centralized control software for the street lighting system
4. Street lighting control cabinets

The street lighting control equipment installed in street lighting control cabinets, as well as the incorporated software, should provide for

- The possibility of real-time monitoring of the main parameters of input and output electric power lines (voltage, frequency, current load monitoring);
- The possibility of real-time monitoring of the status of individual functional units in the control cabinet, storing information about the monitored parameters for a certain period of time, regardless of the presence of external supply voltages, and transferring this information to the main PC-based dispatcher workstation via communication channels;
- The possibility of operating in an automatic mode according to a pre-set street lighting system operating schedule;
- The possibility of local (manual) and remote (using the main PC-based dispatcher workstation) control;
- Switching on, switching off operating modes, monitoring of the technical condition of street lighting control cabinet units;
- Switching on/off and/or adjusting the power consumption of each phase separately according to a pre-set schedule;
- Timely signalling of technical malfunctions and emergency situations arising during the operation of the street lighting control system.

3.1. Controller integrated into the luminaire housing for remote control using PLC or GSM technology

Quantity - 400 units

Technical requirements for the controller

- Built-in automatic positioning (GPS) function to determine the position of the connected luminaire. In the case of the delivery of the luminaire with a controller without this function, the Contractor shall ensure in manual mode that all luminaires are accurately addressed and adjust addressing on the control system software cards during the installation and programming of the street lighting control system;
- The luminaire controller shall provide for brightness adjustment from 10 to 100% with a brightness adjustment increment of 10%;
- The luminaire controller shall support at least one interface for monitoring various types of power supply units of the connected luminaire: 1-10 V, DALI, DALI2;
- The luminaire controller shall ensure readout of the following data from the luminaire driver: total operation hours of the driver; current supplied to the LED array of the luminaire, mA; voltage supplied to the LED array of the luminaire, V; operating temperature on the LED array of the luminaire, °C; operating temperature of the luminaire driver, °C; total power consumption of the luminaire (kWh);
- The luminaire controller shall use CENELEC B standard (95-125 kHz) for communication with the segment controller;
- Current frequency 50 +/ - 1 Hz;
- Operating temperature range of the luminaire controller, from -40°C to + 70°C;
- Overvoltage protection, at least 3 kW;
- Total consumption of the luminaire controller in the operating mode, no more than 10 W;
- The proposed luminaire controller must meet the standards, at a minimum:
  - EN 301 489-1 (1.9.2) & 7 (1.3.1) - Electromagnetic compatibility and radio spectrum matters;

- EN 55015: 2013 - Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment;
- EN 61547: 2009 - Equipment for general lighting purposes. EMC immunity requirements;
- EN 61347-2-11 and EN 61347-1 - Lamp Control gear.

3.2 Segment controller installed in the street lighting control cabinet

The quantity is determined by the Bidder based on the number of offered control cabinets to ensure the operation:
1) 400 LED luminaires purchased under this Terms of Reference,
2) 772 existing LED luminaires, specified in the Annex 3 to the Terms of Reference;
3) 653 existing DNaT type sodium discharge luminaires, specified in the Annex 3 to the Terms of Reference;
4) 354 existing DRL type mercury discharge luminaires, specified in the Annex 3 to the Terms of Reference.

Technical requirements for the segment controller

- Segment controller shall ensure the transfer of data and commands to at least 200 luminaire controllers centralized in a real-time mode with a time shift of less than 1 minute;
- Segment controller shall provide for sending and receiving a minimum data to/from the centralized control software:
  - relay status in any phase (ON/OFF);
  - voltage level in any phase (V);
  - current level in any phase (A);
  - power factor level in any phase (cos ϕ);
  - data from the connected luminaire controller(s);
  - relay operation schedule in case of communication failure;
  - PIN-codes for access of technical personnel;
- Segment controller shall be able to communicate with the central control software via a secure TCP/IP protocol;
- Segment controller shall communicate with the central control software no more often than every 10 minutes and no less that once every 30 minutes;
- Segment controller shall support at least two communication channels (automatic switching) for communication with the central control software: Ethernet (LAN), 3G, LTE, Wi-Fi, etc.;
- Segment controller shall be able to communicate with the luminaires via a power line using secure encryption;
- Segment controller shall have a built-in real-time clock with a backup battery and astronomical calendar support. The clock shall be synchronized from the central control software at least once a day;
- Segment controller shall be able to send notifications to the centralized control software in the event of a complete loss of power;
- Automatic updating of firmware and settings of remote equipment, programming shall be provided;
- Segment controller shall have a minimum of interfaces in the main unit:
  - RS-485 interface for connecting additional equipment;
  - two or more optically separated digital inputs;
  - at least three voltage measurement inputs with the accuracy of +/- 1%;
  - at least three current transformer inputs;
  - at least three relay inputs;
  - at least one antenna connector for PLC or GSM equipment;
  - 12 VDC output for connecting an external siren;
- Segment controller should have built-in backup memory for operation without communication with the central control software for at least for 365 days;

- Rated voltage of segment controller, 230W -15 %.. + 10%;
- Current frequency, 50 +/- 1 Hz;
- Operating temperature range of segment controller, from -40°C to + 70°C;
- Overvoltage protection, at least 6 kW;
- Total power consumption of segment controller in the operating mode, no more than 50 W;
- The proposed segment controller must meet the standards, at a minimum:
  - EN 301 489-1 (1.9.2) & 7 (1.3.1) - Electromagnetic compatibility and Radio spectrum Matters;
  - EN 55015: 2013 - Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment;
  - EN 61547: 2009 - Equipment for general lighting purposes. EMC immunity requirements.

3.3. Centralized control software for the street lighting system

Technical requirements of the incorporated software

- The centralized control software for the street lighting system shall provide for at least two-level user access;
- The centralized control software shall support determination of access rights and access restrictions;
- The centralized control software shall visualize all segment controllers, luminaire controllers and the location of gauges and sensors on a map (GIS);
- The maps visualization shall support interactive functions, such as scaling, selecting, adding, deleting and moving objects;
- The maps visualization should provide status information about the luminaire and the cabinet: malfunctions, on/off, dimming level, type, group membership;
- The centralized control software shall allow for configuring and changing the switching and dimming profiles depending on the time of day and outdoor lighting;
- The centralized control software shall allow for configuring and setting the dimming and switching parameters on either a single controller or a group of objects;
- The centralized control software shall support online control system data visualization and equipment operation;
- The centralized control software shall allow for assigning sensors to luminaire controllers and the corresponding luminaires.
- The user reporting function of the centralized control software for the street lighting system shall envisage the following:
  - a possibility to select: period (year, month, day, week, day of the week, time), luminaires parameters, objects (segment controllers, luminaire controllers), groups and separate system elements;
  - all reports shall be available in html, pdf, xls formats;
  - the server management software shall provide notifications via SMS and e-mail based on user selection criteria;
  - the server management software shall be based on web interfaces and support various browsers with an easy-to-read design;
  - the server management software shall have an interface in the Russian or Belarusian languages with the ability to add new languages (English).

3.4. Street lighting control cabinets

The quantity is determined by the Bidder to ensure the operation:

1) 400 LED luminaires purchased under this Terms of Reference,
2) 772 existing LED luminaires, specified in the Annex 3 to the Terms of Reference;
3) 653 existing DNaT type sodium discharge luminaires, specified in the Annex 3 to the Terms of Reference;

4) 354 existing DRL type mercury discharge luminaires, specified in the Annex 3 to the Terms of Reference.

Requirements for the lighting control system

1. Requirements for reliability.
The LED indication of the status of each control channel of the pulse contactor unit and the LED indication of the status of each control channel of the outgoing lines shall be provided.
Elements of lightning protection, short-circuit protection, LED indication elements, signal transformations for control lines of starters and control lines for outgoing voltage should be able to be replaced in case of failure of the element base for each line separately, modularly.

2. Requirements for safety.
A remote control lock shall be provided in case of the work performance in the control cabinets by operating personnel.
The supply of microprocessor devices shall be provided by an uninterrupted power supply for each device.

3. Requirements for installation, pre-commissioning, operation, maintenance, repair and storage of system components.
Installation and pre-commissioning of the street lighting control cabinet, in the case of installation and pre-commissioning of individual sections of the control system, should be carried out with the uninterrupted operation of the control system sections that have been pre-commissioned.
The system should be designed for round-the-clock continuous operation. The supply voltage deviations must not exceed the limits from the normal value of + 10% and -15%; frequency of current is 50 +/- 1 Hz, the maximum coefficient of higher harmonics is -5%.

4. *Requirements for protection from the effect of external influences*.
• equipment installed in the head and end points shall be in lockable control cabinets and operated at an ambient temperature of -40 to +70 °C;
• humidity is 95 -/+3% at a temperature of 35 °C (without condensation of moisture);
• atmospheric pressure is 60 - 106.7 kPa.

All technical facilities of the system should be provided with a convenient approach, as well as protection from unauthorized interference in their work by unauthorized persons by installing a door sensor.

List of equipment of control cabinets
• Housing
The dimensions and placement of the housing should not prevent the maintenance of the cabinet (s) to be installed in the room).
The Bidder shall specify the overall dimensions of the housing, which are optimal for the placement of components provided for in this Technical Specification for equipment and the technical solution of the Bidder, as well as taking into account the conditions for the placement of control cabinets and the convenience of their further maintenance. The overall dimensions of the cabinet housings can be changed by the Contractor at the stage of preparation of design specifications and estimates for the purpose of optimizing the placement / servicing of cabinets, without changing the declared cost for the control cabinets in the tender proposal.
• Segment controller
• Power supply with support for the uninterruptible power supply of the controller from the battery
• Battery
• Control station
• Set of protective automation of input and output lines
• Block of impulse contactors
• Lightning protection for each incoming control power line
• Door sensor (end sensor) (included in the power cabinet set)
• Antenna
• Cables, patch cords, corrugated tubes, mounting materials
• Other equipment and materials required to perform the functions of the proposed street lighting control system