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## **PART I – FORMAL MATTERS**

### **1. Specification of the subject of the contract**

The subject of the contract is the preparation of the design, delivery, assembly and putting into service two complete electric rail mounted gantry (RMG) cranes with rated capacity of 37 tons under the spreader, equipped with devices enabling the installation of the automated container handling system, with remote operation station (ROS) comprising two workstations with the necessary equipment enabling the provision of reloading services in accordance with the following technical specification.

### **2. Definitions**

For the purposes of this procedure, the following definitions will apply:

**Ordering Party** the same as the recipient – METRANS (Polonia) sp. z o.o.

**Supplier** the same as the Contractor – entity with which a contract for the execution of the order will be concluded by tender procedure,

**RMG** gantry crane, gantry, crane – terms used interchangeably, identical,

**TOS** terminal operation system – individual system used by the Ordering Party to manage terminals (MIS). Ordering Party requires the systems used by Supplier must be compatible with the foregoing.

## **PART II – TECHNICAL SPECIFICATION**

### **1. General requirements**

The subject of the contract is the preparation of the design, delivery, assembly and putting into service two complete electric rail mounted gantry (RMG) cranes with rated capacity of 37 tons under the spreader, equipped with devices enabling the installation of the automated container handling system, with remote operation station (ROS) comprising two workstations with the necessary equipment enabling the provision of reloading services in accordance with the Specification of the Subject Matter of the Order.

#### **1.1. Overriding requirement concerning devices**

The Ordering Party's key requirement is that gantries must in every respect ensure safe, efficient and continuous operation under working conditions, for a period not shorter than three million (3,000,000) manipulations, for normal wear and tear (with absolute exclusion of any failures due to wear and tear) subject to routine maintenance procedures.

The number of manipulations will be understood as the quantity of handled individual containers from the locking of the twistlocks to the unlocking of the twistlocks with respect to the same manipulation operation related to one container.

For the purposes of this Specification and the Contract the acceptable routine maintenance of steel structures and related elements, accessories and additional elements is limited to the paint coating

maintenance. Reinforcement, cutting and/or replacement of corroded, worn or defective steel or its fastening elements, etc. constitutes repair works, and not maintenance works.

With respect to paint coating routine maintenance acceptable must include:

1. Preparation and painting of the existing painting system in the 10th year from the date of the final gantry acceptance report.
2. Removal of defective parts of the paint coating until cleaning of steel and replacement of the paint coating, but not exceeding the total area greater than 1% and 2% of the total area after 5 years and in the 10th year, from the date of the final gantry handover report.
3. Removal of the paint coating from steel and replacement of the paint coating in areas larger in the aggregate than the above percentage values of the total area of the painted part of the gantry constitutes repair works, and not maintenance works.

With respect to electrical and mechanical equipment elements, control elements, systems, components, accessories and fittings, the acceptable maintenance includes periodic and routine maintenance works usually performed on various parts, normally undertaken as activities performed by the Ordering Party. Any replacement of parts during the period of the warranty granted by Supplier will be included in the fee for a gantry.

The foregoing conditions 1-3 apply notwithstanding any contrary requirements or information included in the maintenance instruction provided by the Supplier or otherwise presented by the Supplier, and all such other contrary requirements or information will not constitute or become the basis for the Supplier to release itself from obligations, or to limit or reduce any obligations or liability of the Supplier arising from the Contract or otherwise, in particular with respect to defects.

## **1.2. Gantry type**

Container RMG cranes with a self-propelled bogie, cab and remote control system will have 2 operator stations together with the necessary devices (ROS) which the Supplier will install in the Ordering Party's office building.

Gantry drive and control must be fully implemented on AC inverters with fully digital control devices with PLC.

The power chamber will be made by the Ordering Party. The Ordering Party will hook up to the power chamber power cables and optical fibers which the Supplier will connect to gantries. Gantries will be connected by the Supplier to the power source in the existing gantry power chamber, including the installation of the necessary equipment – i.e. cable sockets and cable exits outside the chamber (funnel).

## **1.3. Types of containers handed by gantries**

Required type of loads to be handled by gantries:

1. Containers ISO 20', 30' and 40', including high-cube and flat-rack containers.
2. Other types of containers with top corner fittings in positions 20', 24', 30' or 40', such as tank containers in sizes from 20' to 30', containers bulk containers, containers 45' and others. Such containers may protrude from one or both sides from the frame lengthwise and/or widthwise, e.g., tank containers with a tank longer than their 20ft frame, refrigerated containers 45' with a protruding built-in power generator or extended containers 45' to 33' or 34' Euro-pallets, which can be seen on the move in Europe.
3. In exceptional situations, containers with damaged top corner fittings or preventing fastening with a spreader – using rope or chain slings fastened to a spreader.
4. Handling of semi-trailers, swap bodies and containers lifted from the bottom by piggyback arms on a spreader.

#### **1.4. Gantry control mode**

Gantries must be controlled by an operator from a gantry crane cab (manually) or through ROS delivered together with gantries (semi-automatic mode), provided that gantry crane operation is planned to be automated.

The Ordering Party intends to initially use the gantry in manual mode (controlled by the operator from a cab), in the interim period in semi-automatic mode (with remote control from the terminal building), and ultimately in automatic mode (autonomous).

Gantries must have all necessary devices and installations (i.e., electrical, optical, network, antenna outputs, wiring harnesses, cable routes, electric conduits, etc.) enabling installation of devices ensuring automatic operation in the future.

The remote control system will be located in one of the rooms of the Ordering Party's office building to which the Ordering Party brought cable ducts (electric conduits) from the gantry power chamber, prepared for installation.

#### **1.5. Power supply for gantry cranes**

Gantries must be electrically powered with MV alternating current **15 kV, 50 Hz**. Supplier will deliver each gantry with a cable drum, power cable with a length enabling gantry operation within the entire range of gantry track operation, in accordance with the attached design of crane beam constituting Schedule no. 4 "Design of crane track and crane track surface (crane beam)"

Electrical cables must be equipped with optical fibers, hermetic power and optic fiber junction boxes, gantry output element (funnel) from the chamber and other devices that are necessary do connect the gantry crane to power.

Supplier will make all necessary electrical and installation connections to transmit power and data (including fiber optic cables):

- the power chamber,
- the Ordering Party's server room,
- the room in which gantry remote control system elements and operator stations and as well ROS stations will be located,
- at the interface of the optic fiber delivered by Supplier, built in the gantry power cable with a power cable and optic fiber brought by the Ordering Party to the power chamber, and machining of all cable ends in the gantry power chamber, connected to the power chamber by the Ordering Party, with machining of all ends in the gantry power chamber.

Supplier will deliver necessary fiber optic equipment (switches), video servers, complete remote systems. The Ordering Party will lay a 24 multimode fiber optic cable from the server room in the building to the power chamber.

The design of the power chamber built by the Ordering Party is presented in schedule no. 5 to the Request for Proposal "Design of crane power chamber"

Supplier will carry out necessary electrical measurements and will deliver appropriate measurement reports on the gantry crane acceptance date.

The lift electrical systems must ensure sufficient power supply parameters for fast and precise moving of containers during continuous reloading operations, taking into account heavy loads and simultaneous driving against the wind.

Power supply for the main drives of winches, bogies, crane levers and auxiliary drivers should be in alternating current technology (AC). The main switchboard must be installed in the transformer room or e-house. The switchboard must control and supply all drives and their equipment, as well

as other smaller systems, such as the lighting and heating system. Supplier will take into consideration power compensation and appropriate filtering systems in order to obtain proper power factors and low noise level in accordance with the applicable EU standards. The whole electrical and electronic equipment must be protected against overvoltage. Electrical equipment, cables, schemes and drawings must comply with the relevant EU standards and directives.

All crane electrical devices must be placed in enclosures with anti-condensation heating and cooling.

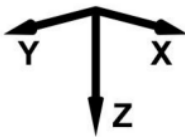
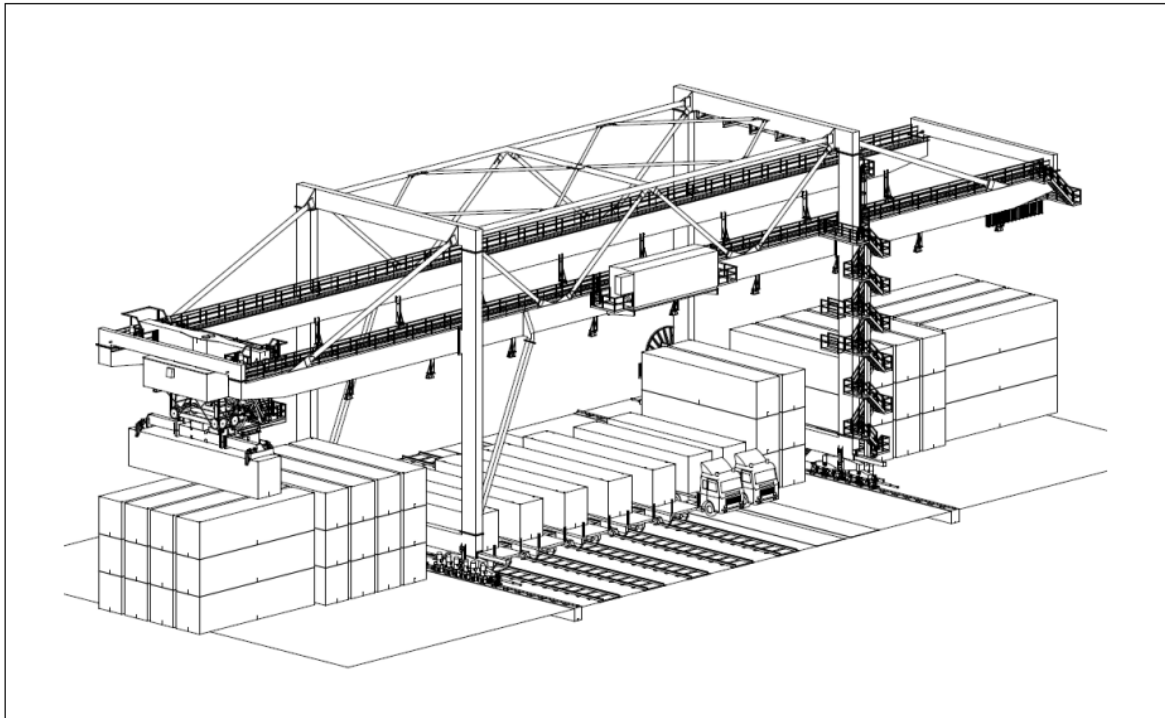
Gantry cranes must be:

- equipped with an automatic overvoltage shut-down system;
- supplied with power using a cable drum. Elements of the cable drum drive and slip sling must be protected by protective barriers ensuring easy and safe access for the authorized technical personnel and by locks to prevent unauthorized access. Lift electrical installation must be constructed in such a way as to ensure recovery of electrical energy recovered during the braking process (recuperation). Connection of a MV trailing cable in the power chamber must be ensured by a MV cable connector.

MV cables will be delivered by Supplier with appropriate cable winding equipment and cable connectors and connector for fiber optic cables. Supplier should ensure sufficient length for each gantry crane, to cover the gantry operating range on both sides of the central power supply point (power chamber). Supplier will bring the end of each crane trailing cable to the power chamber and make cable connections using an approved cable connector set. Cable connectors made on-site and MV wiring must meet control requirements, which will be confirmed by appropriate examinations and tests. Supplier will deliver MV trailing cables resistant to weather conditions such as sunlight, rain, frost, repeated winding and unwinding, deformations, ensuring uninterrupted power and data transmission in optical fiber. The cable must be round, flexible, suitable for supplying power to the gantry with integrated fiber optic cables for data transmission.

#### **1.6. Rail and gantry wheels loads**

Gantry cranes must ensure load transfer to the crane track rail (including cargo) not exceeding the following values:



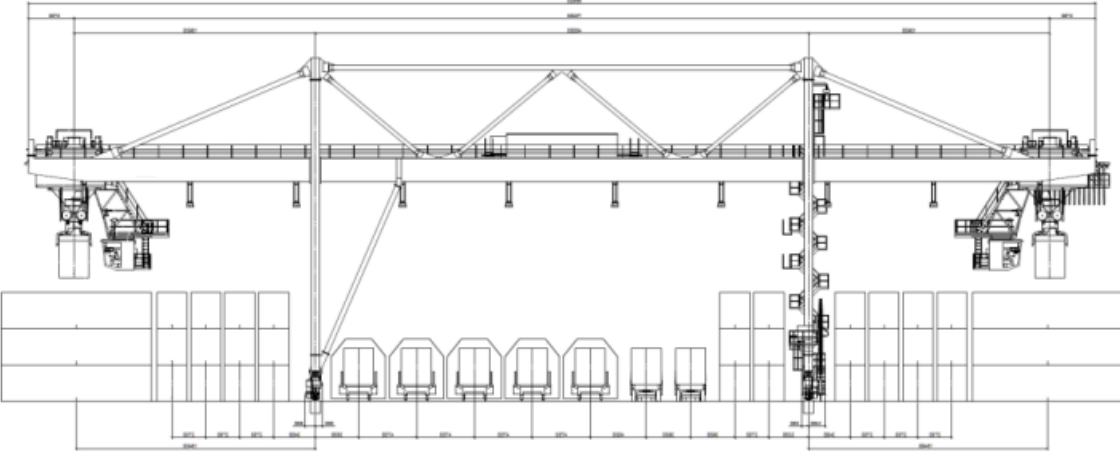
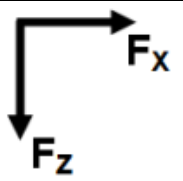
x...kierunek jazdy wózka – prostopadle do szyny suwnicy

y...kierunek jazdy suwnicy – wzdłuż szyny suwnicy

z...kierunek pionowy / wciągnik – pionowo do szyny

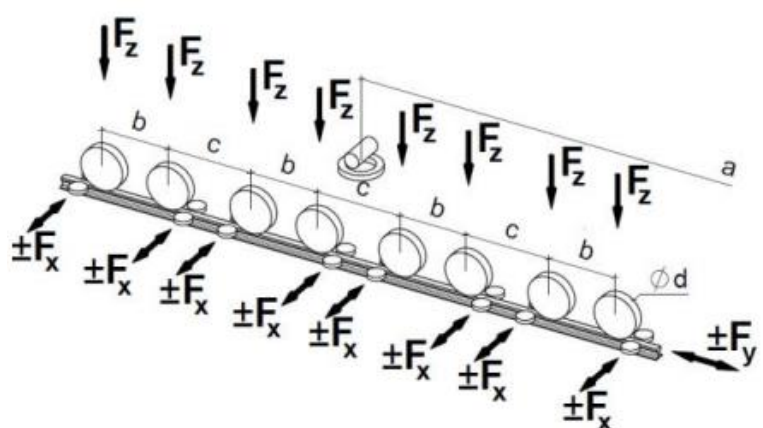
Lifting capacity	37 t
Rail span	40.00 m
Climb to the Fixed Post (FP) usable bracket length	19.60 m
Climb to the hinged post (HP) usable bracket length	19.60 m
Lifting height over the rail top	12.60 m

No.	Load combinations	Fixed post			Hinged post			Notes
		Components of gravity [kN]			Components of gravity [kN]			
		F <sub>x</sub>	F <sub>y</sub>	F <sub>z</sub>	F <sub>x</sub>	F <sub>y</sub>	F <sub>z</sub>	
1	max. in case A	±15	±95	230	±10	±95	235	
2	max. in case B (+ wind in operation)	±25	±225	245	±15	±225	250	
3	max. in case C III (wind out of operation)	±20	±280	150	±15	±310	195	a)
4	max. in case C IV (test load)	N/A	N/A	230	N/A	N/A	235	
5	max. in case C V (buffer)	N/A	N/A	270	N/A	N/A	275	b)
a) F <sub>y</sub> acts over the fastening/clamp of a rail on a rail, or through a locking pin on a locking bracket b) F <sub>y</sub> acts on the end stop								

N/A... not applicable	
Fixed post	Hinged post
	
	<p><math>F_x</math>... Force per wheel in the direction of travel of the bogie – perpendicularly to the gantry crane</p> <p><math>F_y</math>... Force per rail in the direction of travel of the gantry crane – along the gantry rail</p> <p><math>F_z</math>... Force per wheel in vertical direction / hoist – vertically to the rail</p>
<b>Tolerance of <math>\pm 5\%</math> applies to all values!</b>	

Where:

- Distribution of forces on the fixed post bogie:

Number of wheels per corner	8	
Wheelbase a	16.4 m	
Distance b	0.80 m	
Distance c	1.00 m	
Wheel diameter	500 mm	
Rail type	PRI 85 R	

- Distribution of forces on the hinged post bogie:

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Number of wheels per bogie	8	
Wheelbase a	16.4 m	
Distance b	0.80 m	
Distance c	1.00 m	
Wheel diameter	500 mm	
Rail type	PRI 85 R	

- Load combinations

Calculations of wheel load are based on loads, load combinations and dynamic factors arising from DIN EN 1991-3:2010-12 - table 2.2 and EN 13001-2:2014-12 - table 12a. During operation of a container crane the following load combinations apply.

Loads	Load combinations						
	case A		case B		case B		
	max	min	max	min	max	max	max
<b>Gantry with curb weight</b>	$\phi_1$	1	$\phi_1$	1	1	$\phi_1$	1
<b>Rated load</b>	$\phi_2$	-	$\phi_2$	-	$\eta^1$	-	1
<b>Accelerating crane</b>	$\phi_5$	$\phi_5$	$\phi_5$	$\phi_5$	-	$\phi_5$	-
<b>Skew force gantry</b>	-	-	1	1	-	-	-
<b>Acceleration or deceleration of a bogie and hoist</b>	$\phi_5$	$\phi_5$	$\phi_5$	$\phi_5$	-	$\phi_5$	-
<b>Wind in operation</b>	-	-	1	1	-	-	-
<b>Wind excluded from operation</b>	-	-	-	-	1	-	-
<b>Test load</b>	-	-	-	-	-	$\phi_6$	-
<b>Buffer load</b>	-	-	-	-	-	-	$\phi_7$
<b>Tilt force</b>	-	-	-	-	-	-	1

<sup>1)</sup>  $\eta$  = applies only to lifting equipment (spreader and head block)

<b>Case A</b>	Regular loads according to EN 13001-2
<b>Case B</b>	Occasional loads according to EN 13001-2
<b>Case C</b>	Excessive loads in accordance with EN 13001-2

DIN EN 1991-3: 2010-12 standards specify which dynamic factors should be taken into account in static calculations, in order to reflect dynamic interactions. With respect to operation of a container crane the following dynamic factors apply.

**Schedule no. 1**  
**Detailed Technical Specification**

$\phi_1$	Vibrations on gantry structure resulting from lifting hoist load of the ground Applies to: dead weight of the crane excluding lifting devices (head block and spreader) and without hoist load.	1.,10
$\phi_2$	Dynamic action when lifting hoist load of the ground Applies to: hoist load (working load, lifting devices, and ropes)	1.15
$\phi_3$	Dynamic action resulting from sudden release of working load, when operating a magnet or clamshell bucket. This factor and associated load combinations does not apply for operating a container crane because it does not comply with standard operating conditions	-
$\phi_4$	Dynamic action resulting from travelling on uneven rail tracks or road ways. According to DIN EN 15011: 2014-09 chapter 5.2.1.3.3 this dynamic factor equals 1 for welded and grinded rail joints. Therefore this factor and associated load combinations do not need to be considered when operating a container crane.	1.00
$\phi_5$	Dynamic action arising from acceleration and deceleration Applies to: driving force	1.50
$\phi_6$	Dynamic action arising from dynamic test load Applies to: dynamic test load 110% capacity (on the spreader)	1.08
	Dynamic action arising from static test load Applies to: static test load 125% capacity (on the spreader)	1.00
$\phi_7$	Dynamic action arising from hitting the bumper Applies to: buffer forced	1.54

Supplier will make gantry cranes class S4 and load spectrum class Q2 in accordance with EN13001 standard.

Gantry cranes must have a system and brake enabling immobilization of the gantry during strong wind, preventing the device from working safely. Rail type used by the Ordering Party to MRS87A.

### **1.7. Electrical installations in the crane cab**

1. In the place of the radio or near it two wholes should be provided for installation of a coaxial cable which is connected with the antenna mounted outside. The wholes must be equipped with waterproof fastenings ready for a coaxial cable.
2. Supplier should deliver at least 6 power circuits with switches adjusted to appropriate voltage, connected to screw limit switches with negative connections and grounding system.
3. Supplier ensures sufficient quantity of power circuits to connect devices necessary for the operator's work (e.g. screens, radios, tablets, etc.) and all sockets, including those located outside the cab, necessary to power components.
4. Supplier will install at least two double sockets 230V/16A at the back of the cab and one double socket 230V/16A in the front of the cab, under the ceiling, to power the screen.
5. The crane cab must be connected to the Internet service connected with optical fibers in the power chamber: 2 Ethernet sockets connected to the telecommunication device with terminal operating system.
6. Supplier will also prepare plugged wire exits in the cab roof to connect an antenna and indicate a potential place for mounting the antenna. There must be a possibility of connecting a radio to the right joystick in the operator cab such that pressing of one of the buttons should enable communication with the terminal.

### **1.8. Weather conditions**

Gantry cranes must enable safe work in the following atmospheric conditions:

- temperature: from -30°C to +35°C,
- wind up to 22 m/sec. without any specific warning during operation,
- lightning storm,
- heavy snowfall, hail, fog.

Power circuits for crane fittings and operator cab equipment should be separated.

Gantry cranes must be equipped with a wind speed measurement devices informing on an ongoing basis of the possibility of conducting reloading and warning of severe weather. In the event of any extreme weather conditions posing a risk to work safety, the system should automatically prevent work from been carried out until the weather improves.

### **1.9. Safety in lifting loads and their stability**

1. Gantry cranes must have a solution which will ensure complete elimination of the risk that one end of a container will be lifted by one twist lock or two twistlocks. The gantry crane should immediately detect such condition and prevent the spreader from moving up, thereby allowing only for the lowering thereof while maintaining safety procedures.
2. Materials from which the gantry crane is built cannot show signs of structural fatigue of the material in accordance with the applicable standards in this respect.
3. Activation of any of the brakes or safety systems (e.g. sudden braking) cannot cause any damage to the devices of the gantry crane, event under max. load.

**1.10. Noise**

1. Noise emissions measured outside the gantry cranes cannot exceed the parameters arising from the applicable standards.
2. The noise level inside the operator cab, while air-conditioning devices are switched on and doors and windows are closed, cannot exceed 75 dB

**1.11. Key components for operation**

1. Supplier will provide the Ordering Party with:
  - a) a time schedule of inspections and replacement of key elements as part of the scheduled maintenance of the gantry cranes as part of each of the Tasks for at least 20 years. The inspection schedules contain detailed instructions concerning parts subject to inspection, with the method and criteria for rejecting an inspection.
  - b) a time schedule of the planned servicing activities including their scope.
  - c) maintenance instructions and inspection instructions concerning key elements for operation (i.e., elements and structural connections the failure of which may have disastrous effects and other elements which are essential to maintain work continuity of the gantry crane).

**1.12. Formal requirements**

1. Electrical and electronic equipment, and crane mechanism must be designed for effective works and manufactured by world-renowned manufacturers in order to meet, in every respect, the requirements arising from all applicable statutory provisions and implementing rules, norms or other requirements or regulations in force in the country of operation of the gantry cranes and their availability.
2. Gantry cranes must be made in accordance with all statutory provisions and implementing rules, norms and other requirements in force in the country of installation and operation of gantry cranes on the date of execution of the contract.
3. Gantry cranes must meet all requirements necessary to obtain an occupancy permit issued by the Transport Technical Supervision Office.
4. Supplier will specify all standards, laws and regulations applied in the gantry design and will submit them to the Ordering Party with the gantry crane documentation at the latest.

**1.13. Safety of devices and compliance with the EU machine directive**

Gantry cranes must meet the requirements of the European guidelines concerning machines, in particular the Machinery Directive 2006/42/EC. They must be equipped with certificates of compliance, CE markings and symbols in accordance with the relevant schedules to the Machinery Directive. The Supplier will be exclusively and fully liable for all aspects of this declaration of compliance and CE marking. No individual failure or breakdown of any electrical, control or hydraulic element may cause any damage to the lift or personal injury. If possible, any failure or malfunction of any element should result in safe discontinuation of the gantry crane operation. Supplier will equip the gantry cranes with appropriate redundancy systems in order to ensure safety, including safe immobilization of the gantry crane. The gantry crane must be equipped with the system making work impossible during the execution of any maintenance works by the gantry maintenance staff. The maintenance staff should be provided with measures enabling it to carry out routine inspections of all redundant or backup systems. The inspection procedure should be included in the lift maintenance instruction. No element of the gantry crane may change its condition as a result of power failure. Any activation or reactivation of the gantry crane or any other lift system cannot cause any unpredicted or potentially dangerous movement or risk. Gantry cranes should meet all requirements necessary to obtain a Polish permission to use issued by the Transport Technical

Supervision Office. Gantry cranes should be designed in a way facilitating maintenance. All gear boxes and drives must be easily accessible for the purposes of oil change and/or servicing. All descriptions and warnings on control panels and within maintenance areas should be in Polish.

## **2. Gantry crane structural specification**

### **2.1 General requirements**

1. Parts must be connected with one another by welding or high-strength screw connections, protected against automatic unscrewing.
2. Deformations or vibrations of the structure cannot affect the gantry crane operation (in particular the spreader positioning ability).
3. Girders must be designed such that in case of any hazard the operator should be able to get out of the operator cab and get to the aisle at any point along the bogie route.

### **2.2 Projekt**

1. Support beams, arms and girders and cantilever beams must create a continuous rigid frame. Connections between such elements must be bolted or welded and resistant to all forces.
2. The material used for longitudinal structural stiffeners should meet the same requirements as those specified in point 1 above.
3. The design of gantry cranes must be prepared by specialized and experienced structure designs having appropriate qualifications and permissions.

#### **2.2.1 Main structure equipment and materials**

The following will comprise the main gantry crane structure:

1. Drive units of gantry, bogie, hoist
2. Gantry crane bumpers (buffers) – hydraulic
3. Wheel brakes of the gantry crane with limit switches
4. Cable drum (cable reel with a cable guide and limit switches)
5. Winch pulleys
6. Rail tongs
7. Storm brake

#### **2.2.2 Additional fittings on the main structure (accessories)**

The following fittings will be additionally installed to the main gantry structure:

1. Passageways, stairs, pavements, platforms, ladders,
2. Lighting system necessary for operation of the gantry crane and lighting of passageways, stairs, ladders, pavements, platforms,
3. Weather station (vane anemometer), resistant to own vibrations of the gantry crane emitted by its own structure during operation,
4. Radio/intercom,
5. Visual and audible signaling device during gantry crane operation,
6. Two loudspeakers mounted at the site level on each side directed inwards,
7. Service sockets,
8. Emergency stop buttons,
9. Fire extinguishers,
10. Bumpers and anti-collision devices

### **2.2.3 Calculations and description of the gantry crane design**

Supplier will provide the Ordering Party with detailed calculations: wheel loads, stability, braking ability, drive power for all movements, peak power consumption before the commencement of preparation of the detailed design. The Ordering Party has the right to review the remaining elements of the design and calculations at each phase of execution of the order.

The structure design will be calculated using the methods and procedures specified in the recognized international design standards. Calculations must be prepared and presented in a clear and precise format, and present all methods and assumptions used in each element of the design.

### **2.2.4 Drawings**

Supplier will deliver copies of drawings and electronic documentation in .pdf and .dwg format, presenting the structural details in order to enable supervision over execution and construction by the Ordering Party's representatives and experts.

Drawings forming part of the design packages submitted to audit must be in .pdf and .dwg format and at least A1 format, so that they can be reproduced clearly after the receipt thereof in order to enable thorough examination and assessment.

The Ordering Party, staff acting on behalf of the Ordering Party and third parties acting on behalf of the Ordering Party undertake to keep trade secret with respect to the supplied drawings and will use them exclusively for the purposes of assessing the design and for gantry crane maintenance.

## **2.3 Materials**

All materials used in a gantry crane should be brand new and suitable for their intended use. Quality certificates and production certificates should be obtained from the factory. Supplier should conduct strict production control. Steel materials for all of the above-mentioned elements should be selected from among materials whose parameters enable operation and repairs in the environment with a temperature from -30 to +35°C.

### **2.3.1 Steel**

Steel used for production of a gantry crane should be of top quality and consistent with the currently applicable international norms and regulations. Supplier will deliver the required welding certificates which will certify the fulfillment of all regulations concerning the assessment and verification of performance properties described in the following standards: EN 3834, EN 1090-1 and EN 1090-2 for steel and machinery.

### **2.3.2 Metal part finishes**

All edges and finishes must be smooth, free from sharp shapes, unevenness and burr. All welding drops should be removed from the structure surface.

Metal surfaces should be cleaned and treated in the manner specified in subpoint 3.26 "Protection against corrosion" of this specification.

### **2.3.3 Drainage of the structure**

The steel structure and mechanisms should be designed so as to ensure effective water drainage. The drainage water cannot affect deformations, safety of operation or maintenance works during heavy rain. The siphon cannot be located in any part of the gantry crane.

### **2.4 Stiffness of the gantry structure**

Deformations or vibrations of the structure should not affect the gantry crane operation (in particular the spreader positioning ability).

Any horizontal displacement at the girder level caused by full acceleration or deceleration of a bogie with rated load or full acceleration or deceleration of a bogie, when the rated load is suspended in the max. upper position, cannot exceed the permissible deflections arising from the applicable norm, statutory provisions and implementing rules.

The main structure cannot be damaged in case of puncture of any element.

The main girders must be designed with sufficient convexity, such that the main girders should be horizontal under load conditions.

The structure of beams and supports of the gantry crane must be made of tightly welded steel elements. The main beam of the gantry must ensure stiffness and keep stress to a minimum.

### **2.5 Quality requirements**

During the entire process of production and assembly of the structure of the gantry cranes the Contractor will conduct strict production and quality control. The Contractor will ensure throughout the entire process of execution of the order professional and experienced staff having the required permissions, licenses, certificates and equipment.

Welded elements must be subject to strict control. Welders and persons engaged in the process of combining elements must have permissions to produce materials, carry out processes, welding type and operations performed. Qualification certificates for each welder will be provided by the Supplier in the as-built documentation. Any joints installed using any unqualified procedures or welds made by uncertified welders will have to be dismantled and redone by the Supplier at its expense. Alternatively, the Supplier should have a structure welding system implemented in accordance with the requirements the applicable standards, confirmed by the obtainment of a certificate, and meeting the requirements arising from EN and ISO standards concerning quality requirements applicable to welding of metal materials, also confirmed by the obtainment of a certificate. Both certificates must be valid throughout the duration of the order/contract. Two weeks before the technical acceptance of each gantry crane the Supplier will deliver to the Recipient a document issued by a European Welding Engineer, confirming that all welding works related to the respective gantry crane have been performed correctly.

The Contractor will keep accurate records of qualified welders carrying out the subject of the order. The records will be reviewed by the Ordering Party or a representative of the Ordering Party on a case-by-case basis at the installation place.

Contractor will ensure that all proper welding procedures will be strictly followed by the welding personnel. All welding works considered to be inconsistent with the adopted procedures should be immediately discontinued and recorded in the non-compliance report. In such case welding may be resumed upon consent of the representative of the Ordering Party.

Contractor will ensure that all welding works performer in low temperatures should be carried out, as far as possible, in a closed and sheltered room, in order to ensure controlled environment.

The application of correct heating procedures in welding processes is necessary and is strictly monitored by the Supplier and may be subject to inspection carried out by a representative of the Ordering Party.

In order to ensure the compliance with all provisions of law, regulations and requirements applicable in the country of assembly of the gantry crane, the Supplier will check all requirements of the Transport Technical Supervision Office in Poland [TDT – Transportowy Dozór Techniczny] which will approve gantry cranes. If required, the Supplier will submit complete welding documentation at the express request of the Transport Technical Supervision Office or the Ordering Party.

#### **2.5.1 Checking of welds**

All welds will be subject to the Supplier's inspection. **The Ordering Party expects the provision of an inspection report concerning 100% of welds, signed by a person being a qualified European Welding Engineer.**

Welds and their execution class should meet the requirements structures periodically loaded in accordance with the applicable standards, including EN 1090 and must match the gantry crane load and the service life of the structure specified in the Specification.

#### **2.5.2 Production control**

1. Phases of production and assembly throughout the entire process of implementation of the subject of the order should be subject to quality control carried out by the Supplier. The Supplier will implement a written quality control program, to be provided to the Ordering Party for review within 1 months from the execution of the delivery contract. The quality assurance program contains also a supplier inspection and testing specification.
2. The quality assurance program must contain information on the general quality assurance principles and organization in the design, procurement, production and construction periods, with specification of specific requirements and deadlines.
3. The quality assurance program also contains drawings and the time schedule of inspections which the Ordering Party is supposed to carry out during production, delivery and handover of the gantry crane to the Ordering Party, with proposed inspections and tests.
4. The inspection program must encompass the following areas:
  - Inventory of the delivered materials, consumables, components and machines,
  - Materials traceability procedures with identification codes, which are to be issued in series and indexed to the controlled production procedures,
  - Cutting, fastening, welding, forming and dimensioning of structural elements,
  - Welding and inspection procedures which clearly identify the type and dimension of non-destructive tests carried out on the gantry structure,
  - Qualifications and certification of welding and inspection personnel,
  - Maintenance and calibration of welding, processing, measurement and control devices,
  - Surface finishing, tensioning procedures,
  - Non-conformities reporting procedures (NCR), punch lists (PL) and defect removal,
  - Control and procedures concerning the design and production drawings and inspections, updates and re-releases of drawings,
  - Material cleaning, preparation, cleansing and painting procedures,
5. The quality control program must comply with the applicable requirements, statutory provisions and implementing rules.

### **3. Functional devices and gantry equipment**

Each element of the gantry equipment must be described in detail and identifiable on the date of delivery.

### **3.1. Main lift – winch**

1. Wear indicators must be located in a place convenient for viewing, without dismantling any part.
2. Calculation of the compliance of brakes per specified load is carried out by the brake manufacturer who includes such calculations in the design documentation.
3. Acceleration from zero to maximum speed or deceleration to zero must be smooth and continuous for all load combinations.
4. Rotating mechanism. The total rotation angle of the spreader should amount to at least 300°.
5. Slewing ring with ball bearing, with anti-swing control and an internal gear must be designed and performed as a rotating ring between the undercarriage frame and the rotating frame of the lifting mechanism.
6. Slewing ring with ball bearing to be placed in such manner that the clearance of the slewing ring with ball bearing may be checked in the mechanism frame casing.
7. Bearings from world-renowned manufacturers which ensure high quality and durability must be used.
8. The rotating mechanism to be powered by two asynchronous engines collected with one inverter, and activation should be performed by a PLC driver. Mechanical rotating drive should be integrated with the brake.
9. Rotating mechanism with flange-type motors should be installed in such manner that the clearance between the pinion of the rotating mechanism of the gantry crane and the internal gear wheel of the rotating ring with ball bearing may be exactly adjusted.
10. Extension of the drive units of rotating mechanisms upwards with a chain hoist should be envisaged for maintenance purposes.

#### **3.1.1. Swing control**

Spreader operations must be supported by an effective anti-swing system which should be electronic and/or performed using the rope tensioning system and pulley. Such system prevents swinging, but not adjustment.

1. Anti-swing/anti-tilt device or swing/tilt reduction system must be effective in movement at short distances, also after stopping after complete deceleration. The operation of the system cannot change the spreader lifting height, with or without load, at the required height.
2. An effective anti-swing system with a proven structure should be ensured.
3. The swing control system should stop the spreader when the bogie is completely decelerated from the full speed, and working load at half lift is measured at bottom corners of the container 40' or at twistlocks of unloaded spreader. The system must be able to stop the spreader within 2.5 rocking cycles. Fading (trade) rocking elements, if any, during 2.5 cycles, are allowed if they do not stop or prevent other activities related to moving.
4. Braking while working must be performed electrically and in a continuous manner.
5. Ropes from internationally renowned manufacturers which ensure high quality and durability should be used for lifting.
6. Lifting mechanisms and engines from internally recognized manufacturers which ensure high quality and durability are used.
7. All gear wheels and gear wheels of the lifting mechanism should work in an oil bath and be placed in a closed gear box. Gear boxes should ensure the possibility of aeration, be equipped with an oil gauge and cocking cam, to enable oil change.
8. The rope drum should be made of welded hot rolled sheet metal and should be grooved.

9. In the lowest lowering position the rope drum should have at least 2 additional safety windings.
10. The hoisting winch must be equipped with two single disc brakes with an electro-hydraulic retarder from renowned manufacturers, with parameters chosen by the brake manufacturer, which may safely decelerate the load in case of emergency stoppage.
11. Limit switches and an emergency limit switch for the highest position of the lifting mechanism should be ensured.
12. Load measuring elements should be built in on torque transmission handles of lifting mechanisms in order to automatically cut-off excessive and unevenly distributed loads.
13. The overload system must be equipped with special tensometric sensors or devices to measure total load.
14. The system consists of:
  - monitoring system ensuring prevention of lifting in case of a breakdown of the measuring device,
  - tare weight adjustment,
  - loose rope monitoring system,
  - overload warning on the lifting system,
  - warning when the load is close to the max. lift load – stopping work when overload is detected (warning sound and light),
15. The overload system must be equipped with a bypass protected against unauthorized use. The bypass should enable lifting loads at the level of 110% and 125% during the required tests carried out by the Transport Technical Supervision Office.

### **3.2. Bogie**

#### **3.2.1. Bogie frame**

1. The bogie frame must be equipped with main lifting devices, drive units, trim device, operator cab and bumpers (or bumpers) for collision movement forwards and backward. Bumpers must be able to absorb and disperse the impact arising from collision with the rated load at full speed.
2. The bogie frame must be equipped with drop-stop safety barricades which support the bogie in case of any damage to wheels or axis.
3. The bogie frame must have marked lifting points for replacement of wheels bogie and bearings. Enclosures must be divided so as to enable easy dismantling of wheels and axes.
4. The bogie frame must ensure safe emergency access from the operator cab to the girder passage at any point of the bogie route.
5. The bogie frame must be placed on a safe service platform and access to all of its components and maintenance equipment must be ensured.
6. A recording camera which must be resistant to weather conditions will be installed to help the operator monitor the further side of the lifted container from the bottom of the bogie frame.
7. Two pairs of high-resistance side guide rollers 250 mm should be installed on both sides of the bogie frame, at the front and at the back, in order to ensure even and smooth bogie wheel guidance .

#### **3.2.2. Service lift**

1. In the top part of the gantry crane an auxiliary electrical winch should be envisaged for the purposes of service works performed on a bogie and for transportation of replacement parts and components from the ground level to the beam bridge, with a lifting capacity not less than 250 kg.

2. Since the hoist is exposed to precipitation, it must be encased in waterproof material. Supplier is obliged to prepare documentation in order to obtain an approval from the Transport Technical Supervision Office in accordance with the requirements arising from the Polish statutory provisions and implementing rules for the hoist which is treated by the authority as a unit independent from RTG, subject to registration and mandatory inspections.

### **3.2.3. Bogie drive**

1. **Bogie drive systems** must be installed directly on the bogie. Four electric motors must be equipped with speed controller and safety brake. The bogie drive system as well as the wheel, shaft and bearing systems must be designed so as to enable easy and fast replacement of parts at any place of the bogie. The replacement of bogie wheels should not take more than 1 hours for 2 people. The Ordering Party does not accept a chain drive in the bogie.
2. **Bogie gear** The bogie gears should be equipped with spur gears (hardened), which ensure high degree of accuracy and quiet operation. Gears should be completed closed sets with oil batch lubrication.
3. **Bogie brakes** The bogie system must have the number of brakes equal to the number of motors. Each sudden braking is activated electromagnetically. Further, devices for manual unblocking should also be installed.
4. **Bogie bumpers** On the main beam on the ends of the bogie span four bumpers should be installed on each bogie corner.
5. **Lifting system** Winches should be put on the bogie, in a sheltered place and equipped with at least 1 electric drive and gears with appropriate power. The transmission shaft should be equipped with an appropriate brake which will do well with a system of eight ropes.
6. **Rope drums of the winch** should be equipped with spiral grooves for correct positioning of the rope, sufficient for the total length of the rope with an appropriate spare rope.
7. **Ropes** Standard ropes which are easily available on the market are used. Ropes should be adjusted to resilience of 1960 N/mm<sup>2</sup> and minimum tensile strength of 550 kN.
8. **Pulleys** Winch pulleys should be made of strong and hard polyamide (Lamigamid) or equivalent material.

### **3.2.4. Power supply to the bogie**

Power supply to the bogie should be brought through a cable festoon track system.

### **3.3. Gantry**

Drives of the winch, bogie and gantry crane must be variable-frequency AC drives, stepless adjustable, prepared specifically for RMG.

1. The drive motors of the gantries and the brake system must ensure sufficient heat capacity, torque and traction under all operating conditions, including in continuous mode at full load.
2. Acceleration and deceleration forces cannot result wheel loads exceeding the limit values specified in specification.
3. The drives of the gantry crane must be able to accelerate and decelerate the gantry crane and its elements both under wind load and under the influence of wind, without unfavorable heating of any elements.
4. Brakes for operation of the gantry crane should include spring disc brakes with mechanical drive installed on each lift drive. The dynamic factor must be greater than 100 % of the max. engine torque, but not greater than 150 % of the max. engine torque. The brake heat capacity must be sufficient to stop the gantry crane from its rated speed in accordance with the direction of max. wind force without suffering any damage, even if the emergency stop button is pressed without

the help of the wheel or rail clamps. Each brake must be equipped with a strong light snap-in rainproof casing. Brakes are activated after the regulated opóźnieniu czasowym bezczynności dźwigu. Calculations and selection of the brake structure are subject to formal acceptance by the brake manufacturer, and the approval will be provided to the Ordering Party by the Supplier.

5. Supplier will equip the gantry cranes with storm brakes enabling the attachment of the gantry crane to the track in each position. Storm brakes will not require the Ordering Party to prepare any equipment such as: anchors, sockets on the gantry track infrastructure.
6. The gantry drive must be independent in the drive bogie and transmitted by completely closed oil lubricated bevel and/or spur gear with one motor and one engine driving one wheel. The engine must be installed by a flange coupling to the reducer.
7. The lift elements must be protected by proper placement or ensuring significant protective functions in order to prevent damage caused by movement.
8. Crane bogies must be equipped with bogie protection in case of any damage to wheels or wheel shaft.
9. Each bogie and balance beam must be equipped with appropriate lifting points to facilitate lifting for the purposes of easy disassembly of any wheel without dismantling the bogie or balance beam. Load and lifting position should be selected so as to prevent overloading of the surface structure.
10. Wheels and drives must be equipped with solid security measures.
11. Rail covers muszą must be placed in front of the external wheel at each corner.
12. Hydraulic bumpers should be installed in 4 corners of the gantry.
13. Gantries must be equipped with limit switches in order to prevent the gantry from moving after the activation of the storm brake.

### **3.3.1. MV cable drum**

The gantry crane must be equipped with a single spiral cable drum. The drum is powered by an electric motor directly connected with the gear box. The drive must ensure sufficient torque and speed to lift the cable from the ground and prevent it from slipping out under any working conditions.

The cable drum must be adjusted to sufficiently large speeds of winding/unwinding, large distances and great tensile forces. The expansion range will be appropriately selected by the Supplier - 400 m in each direction + a necessary spare cable determined by the Supplier. It must also be equipped with fiber optic cables which are free from data transmission disruptions and control signals.

The winding system must prevent winding/unwinding when the drive is not powered. Cable must unwind vertically downwards to the roller guides which will put it in a cable tray. The cabinet in which the slip ring system will be located, should be resistance to weather conditions (IP min. 65) and equipped with heating devices.

1. Cable drum must be mounted on one of the posts on the northern side. The cable drum drive control system must be controlled in order to minimize sudden activation, braking and excessive loosening/tightening of the cable during gantry operation, in particular during passing the power chamber point.

Sensors/switches for detecting the above conditions should be ensured.

2. Cable drum must be fully made of stainless steel or galvanized after the completion of the production and processing.
3. The guide must be set such that MV cable is close to the ground level. The cable will be unrolled on a cable ladder, installed on the terminal by the Ordering Party.

4. The system must be well protected against weather conditions, in particular near MV slip sling elements, and the slip sling enclosure should be made of stainless steel.
5. The cable drum drive equipment and the slip sling area must be fenced in order to enable access thereto only to the authorized personnel. High voltage warning sign must be placed by the Supplier at the entrance to the fenced part of the gantry crane.
6. In the slip sling enclosure a heater with an appropriate size must be placed.
7. Limit switches should be installed to control the gantry movement near the sliding limit (limited by the length). Manual control elements for operation of the drum at the ground level must be provided.
8. Switches must be placed in a lockable box resistance to weather conditions, installed at the ground level, near the cable system in order to ensure traffic control forward and backward and bypass of loose cables.
9. Cable drums by world-renowned manufacturers which ensure high quality and durability must be used.
10. The Supplier of the gantry will deliver a power point splitter and relief drum (drum with a funnel), and the Ordering Party will deliver cable trays/ladders and power chamber in which a cable connection will be performed by the Supplier. Terminal box and/or socket connector for the power cable will be delivered by the Supplier.
11. Supplier will ensure short circuit and overload protection of the cable guide.

### **3.3.2. MV power cable**

MV cable delivered by the Supplier:

1. round, with the number of wires required for proper power supply and built-in fiber optics for data transmission. Cable of sufficient length should be installed to ensure full length of the radius of the crane movement, three "dead" coils on a reel plus one protective coil along the whole length, passage from the ground and at least 2 wraps on the relief drum in the cable box,
2. composite cable must contain at least 6 single- mode low-loss optic fiber cables,
3. cable drums mechanisms must contain low-loss connecting devices which make it possible to use the whole fiber optic cable with simultaneous connection of devices on the gantry to an external device.
4. Supplier will bring the end of the power cable of the gantry to the power chamber and make appropriate electrical connections, including fiber optic connections.

Connection of MV cable to the cable manhole must be performed using a MV cable box made by a world-renowned manufacturer and delivered by the Supplier. Supplier must carry out the required electrical measurements. Supplier of cranes will also deliver equipment through which it will connect optic fibers inside the cable box. The Ordering Party will hook up MV and fiber optic cables to the cable chamber from an external network. Supplier is obliged to carry out necessary tests and electrical measurements and provide appropriate measurement reports. The power cable should be unrolled on a cable stand prepared by the Ordering Party.

### **3.3.3. Gantry anti-collision system**

1. The gantry must be equipped with two separate and independently operating anti-collision systems which automatically decelerate, warn and ultimately stop the device in dangerous situation such as:
  - when getting close to the end of the runway,
  - when devices come close to each other,
  - if there is an obstacle (or person) on the runway;

In each of the four corners of the gantry crane one needs to install reliable laser and radar devices or other devices with similar parameters and efficiency of detection under difficult weather conditions in order to prevent collision with an adjacent crane, vehicle, container and other objects. The system must operate without interruptions under any weather conditions (heavy rain, snow, darkness, fog, etc.).

2. Supplier will deliver high quality anti-collision system between gantries, based on long distance laser communication, configured to detect neighboring RMGs.
3. In the operator cab and at the remote gantry staff workstation a sound warning of a gantry coming close to an obstacle must be ensured, and emergency deceleration/ stop functions must be activated automatically in a logical sequence in the direction of travel.

#### **3.3.4. CCTV**

The gantry crane must be equipped with IP HD CCTV mounted on the external gantry posts, ensuring high fidelity view in both directions of the gantry movement on the running tracks. The purpose of the system is to ensure additional visibility to the operator in order to detect personnel or obstacles which may be located outside his field of vision. Screens must also form part of the equipment of the remote gantry staff workstation.

CCTV screens must be placed in the top corner of the operator cab such that they should not limit visibility from the operator's seat. In case of the remote control workstation screens should be placed ergonomically in order to ensure visibility necessary to operate the gantry crane.

CCTV camera recorders should be placed on the crane in the manner not interfering with the normal operation or maintenance. The place of installation of recording cameras, angle of view, focal length and other parameters should be selected so as to ensure full visibility of the areas around the gantry at the ground level on both sides of the container pile. An additional recording camera will ensure a view from the top on the operation of the gantry from the operator cab. Cameras should be mounted such that they should be accessible for the purpose of maintenance works, with as little necessity to use elevators as possible. The system will allow to see live view from the operator cab, both during the day and at night.

Recording cameras must be adjusted to environmental conditions prevailing at the place of installation, as specified in the Specification.

#### **3.4. E-house**

##### **3.4.1. General structure**

1. E-house should be equipped with a complete set of air-conditioners, electric heaters and fans. Air-conditioning and heating must be maintained at temperature of approx. 20°C and humidity of 50% and will ensure appropriate air exchange and circulation. Air-conditioners and heaters must be duplicated in case of failure of any of them in order to enable the use of the crane until it is repaired.
2. The control room floor must be fully equipped with a rubber gum matt ensuring antistatic protection 1000 V. In the control room one should ensure sufficient space for all devices for the Gantry Management System.
3. All devices and electrical cables installed under the floor must be easily accessible.
4. Access doors must be equipped with corrosion resistant high-strength locks, safety windows in the top panels with a drainage system will constitute sliding doors with non-corrosive locks. Doors will be located at each end of the control room and will have door closers. An anti-drip cover must be placed over the door.

##### **3.4.2. Fittings and objects places in the e-house**

1. Push button switches for the main control circuit, main power source and lighting switches.
2. Main high voltage switch and remote control switches.

3. Control panels of the main drive for hoist, bogie, crane, cabin movements, etc.
4. Transformer
5. Auxiliary power source panels.
6. Control panels.
7. LED lighting system, ensuring even illumination of the working area with illuminance not less than 150 lux.
8. Intercom.
9. Appropriate meters.
10. Fire extinguishers odpowiednie do installations elektrycznych.
11. Service sockets.
12. Central dashboard for gantry lighting system.
13. Harmonic supressor.
14. Power factor controller.
15. If required, two (2) heaters / air-conditioners adapted for continuous operation. Provided that the operation of air-conditioners when the gantry is not working cannot lead to a detrimental impact on the power factor. (POWER FACTOR).
16. The emergency lighting system with maintenance of power supply to the safety lamp for at least 2 hours. Lamps turn on automatically in case of any interruption in power supply to the gantry. Spare batteries are charged automatically by appropriate devices.
17. An additional air-conditioner built-in as a spare one in case of failure or maintenance.
18. An automatic fire detection system in the e-house, equipped with a smoke detectors in each single e-house panel near sensitive elements, such as transformers or switches. Information on fire should be sent to the operator in accordance with the adopted procedure which will ultimately lead to automatic and safe turning off the gantry crane if critical conditions are reached.
19. In the control room there should be one button with a key which switches standard operations into "creeping flow" for maintenance and servicing purposes. In the "creeping" mode all max. speeds should be reduced to 1–10 % of the standardowych max. speeds.

#### **3.4.3. Electric current connection to gantry cranes**

The Ordering Party will make a power chamber to which it has brought the following power installation: 2 cable lines type 3xYHAKXS 1x70/25 mm<sup>2</sup> 12/20 kV laid directly in the ground under green areas and under hardened surfaces in HDPE protective pipes with a diameter of 160 mm.

- a) As part of the contract the Supplier of lifts will deliver complete power cables and cable connectors with a connection in the underground cable box of the gantry crane and will deliver a cable drum for each and a funnel-shaped element to a cable box, and will prepare and deliver electrical elements and make a connection of flexible lift delivered by the Supplier with the grounding system prepared by the Ordering Party.
- b) Supplier of the gantry cranes will equip gantries wigh necessary power system protections in order to ensure proper and faultless operation of the gantries and install elements compensating reactive power, if the gantry causes it emission (Active Power Factor Correction System).
- c) List of additional elements which the Supplier is to deliver under the contract is included in chapter no. 4 of this document.
- d) Supplier will also deliver electrical boxes for a cable bos and make a connection in the underground box and server room. **After the completion of works the Supplier will deliver a complete set of electrical measurements** required by Polish law.

#### **3.4.4. Electrical equipment**

Electrical equipment must comply with the currently applicable quality and safety standards.

### **3.4.5. Switches**

1. Supplier will ensure one main switch of each gantry in the e-house control room for all drives and controllers and one switch for auxiliary devices (lighting, heating, sockets, etc.). Both switches must be made as power switches. The Ordering Party requires each gantry crane to have two independent electrical circuits.
2. Fire safety devices.
3. Gantries must be equipped with fire extinguishers in accordance with the applicable laws and regulations, e.g. in the control room and cabin, and with an automatic fire detection system.
4. Emergency stop and transition buttons
  - a) All gates between moving and fixed platforms must be equipped with a gravity closure, with a high quality electric lock resistant to weather conditions. Opening of any passage gate must cause bogie movement to stop immediately.
  - b) All limit switches must be adjusted to weather conditions prevailing at the place of assembly of each gantry and have a degree of protection of IP65. Each limit switch must form part of a monitored circuit checked by PLC controller in terms of correctness and recorded error data.
  - c) Activated buttons are displayed in the error message system.
  - d) Standard emergency switches
  - e) After pressing the safety switch the emergency stop switch disconnects the power from all drives of the gantry and stops the current operation of the gantry. Power should be disconnected, when brakes are turned on.
5. Safety switches used for emergency stop purposes must be installed in the following places:
  - a) E-house control room x 1
  - b) Switchgear on the bogie x 1
  - c) Console in the operator cab x 1
  - d) Corners of the drive mechanism of the gantry x 4
  - e) Corners of the top beam x 2
  - f) Spreader x 1
  - g) Entrance to the winch area x 1
  - h) Gate passage from the portal to the cabin x 1
  - i) Winding area x 1
6. Lifting winch
  - a) Emergency limit switch for the highest load position (switches on the emergency stop circuit), including bypass switch for testing purposes
  - b) Limit switch for operation above (using a sensor)
  - c) Limit switch for operation below (using a sensor)
  - d) Overload blocking device, complete and for each lifting mechanism (key switch or bypass switch). Load measuring shafts should be installed on the torque transmission anchorages of the gear box or on the ends of the rope.
  - e) Overspeed switch – field weakening control (switches on the emergency stop circuit)
  - f) Switch if the spreader attached a container only on one side
  - g) Initial disconnection is carried out irrespective of the rotation speed to guarantee smooth availability of the limit switch.
7. Drive mechanism of the gantry
  - Limit switch in front and at the back

8. Drive mechanism of the gantry
  - Limit switch on the left and on the right side

### **3.5. Transformer**

Supplier will deliver a low voltage transformer dedicated to this type of devices, hermetically closed, equipped with appropriate electrical protections. The transformer must be installed in a place resistant to weather conditions and ventilated on each gantry. The transformer must be equipped with a monitoring and alarm system which is activated in case of occurrence of any undesirable event. Access to the transformer and other MV devices must be well protected against unauthorized persons, and low voltage devices which must be accessible to personnel must be located in a separate place.

### **3.6. Switchgear**

Switchgear must be installed in a safe dedicated tight place and delivered by a leading manufacturer. Switchgear must ensure max. electrical protection of the transformer, electrical circuits and particular elements equipment and prevent overload, short current circuits and damage to insulation. Switchgear must be equipped with a monitoring and alarm system which is activated in case of occurrence of any undesirable event.

### **3.7. Gantry crane wheels**

1. Supplier of RMGs will adjust solutions for RMG to be delivered with respect to static and dynamic loads, taking into consideration the parameters of the gantry foundation (track).
2. The Ordering Party will not accept flanged wheels. Wheels without a rim flange (plain) with guide rollers will only be used.
3. The gantry crane wheels must be connected with drives using a Hirth joint gear.
4. Wheels should be made of hardened steel alloy with high tensile strength. Material 42CrMo4 or equivalent, i.e., material meeting the requirements concerning mechanical properties of materials exposed to mechanical stress, simultaneously meeting safety requirements.
5. Wheels must be constructed mechanically in such manner that they should require adjustment.
6. Drives will be synchronized such that both sides of the gantry will move at the same speed.
7. In order to ensure safety of the gantry crane during storm, the gantry must be equipped with self-blocking rail clamps, in order to protect it in any position on the track.

### **3.8. Access to gantry crane**

1. Stairs, ladders and landings must be made of galvanized and anti-slip materials. Each ladder placed above the ground level must be equipped with a safety cage, in accordance with the applicable statutory provisions and implementing rules.
2. At the level of the gantry cabin and its fastenings platforms enabling access to the bogie and cabin should be ensured.
3. All pavements must be equipped with self-closing doors protected against unintended opening. The applicable legal regulations in this respect should be taken into consideration.
4. The main beams of the gantry must be equipped with galvanized Bridges enabling access for pedestrians and finished with anti-slip finishes.

### **3.9. Drive mechanism**

1. Gantry crane moves along the crane tracks with rail profile MRS87 (in accordance with the design of the crane track and the surface of the crane track (crane beam) constituting schedule

no. 4 to the Request for Proposal “Design of the crane tracks and surface of the crane tracks (crane beam)”

2. Assembly and disassembly of wheels installed using rolling-element bearings should be easy.
3. Gantry must ensure safe driving and operation at the rated speed under wind load conditions of up to 22 m/s. Gantry protected by rail clamps/rail tongs must withstand wind speed of up to 42 m/s without moving.
4. The gantry propulsion must be carried out using electric gear motors equipped with disc brakes with a mechanical drive. Connection of the gear box with the clutch shaft should be made in such manner that it should be possible to easily unscrew it, even after many years of operation. Engines are selected taking into consideration the assumed energy performance.
5. Engines from world-renowned manufacturers which ensure high quality and durability should be used.
6. All 4 corners of the gantry chassis must be equipped with hydraulic bumpers and protective barriers.

Limit switches on the crane tracks must be installed in such manner that the crane will stop in the final position before bumpers.

### **3.10. Spreader/gripper**

Spreader must be hydraulic, controlled from the operator cab or from a remote workstation, made of high quality steel, equipped with electrically controlled operation system (four fins), automatically adjusted to handling containers 20', 24", 30' and 40'.

1. Spreader must be equipped:
  - a) with the PIGGYBACK LEGS SYSTEM - four fully foldable piggyback legs for handling trailers, with cameras and safety signaling system.
  - b) with handles for lifting loads if at least 4x10 tons each, with a durable cable basket for power cable. Cable should be easy to replace and have simple connection points on the spreader and bogie.
  - c) with the height monitoring system in order to ensure safety by signaling to the operator when approaching the top part of the tank
2. Electrical fittings and cable guide system must be well protected in the main frame of the spreader. All elements must be easily accessible for the purpose of conducting servicing and maintenance works.

Electrical systems must at all times monitor the spreader operating condition. Control devices must warn the operator when the spreader is improperly placed, blocked or unblocked. Each signal must be a condition for activation of protective functions of the spreader (activation of twistlocks, unfolding the telescope).

3. Electric cabinet must be mounted on the spreader frame using special dampers in order to minimize any damage to electrical elements when moving. Cabinet waterproof rating: IP66.
4. Spreader parameters
  - **Load capacity:** 37 tons
  - **Slings:** 4 x 10 t
  - **Telescope unfolding speed:** od 20 'do 40': not more than 20 seconds
  - **Flippers:** hydraulic
  - **Twistlocks:** service life: min. 100 000 cycles, fast replaceable, so-called floating twistlocks, which enable movement in all lateral directions in order to ensure effective positioning in corner castings of the container, turning force: 250 Nm.

**Schedule no. 1**  
**Detailed Technical Specification**

5. The Spreader weight must be chosen optimally to match the required type and parameters of gantry cranes.
6. Container bolts should comply with ISO standards and should be installed on swivel bearings. Locks must be located near rotary locks and must be blocked automatically, provided that they are not placed on the tank. Lift signal loss alert is transmitted directly by proximity sensors.
7. The movement of container bolts from the "unblocked" position to the "blocked" position must be protected mechanically and electrically until all 4 twist locks are completely fitted in the corners of the container, and the entire Spreader will be placed on the container. Unblocking twistlocks from the "blocked" position to the "unblocked" position will be impossible during lifting or when the container has not been fully set aside.
8. Spreader automatically adjusts to positions 20', 24, 30' and 40' after the operator chooses the required dimension.
9. The first three seconds of the change of the container position and the last three seconds is performed with reduced movement in order to minimize the impact.
10. In order to enable lifting damaged containers or specially shaped loads, in the four corners of the Spreader, near bolts, mounting brackets should be installed in order to enable installation of slings.
11. All mechanical and electrical elements, including those attached to the Spreader or operating near the Spreader must be protected against the consequences of frequent strokes and vibrations during operation. All connecting elements must be self-blocking and resistant to loosening.
12. Power cables, connecting moving parts of the spreader must be protected against mechanical damage.
13. Spreader control must be integrated with the crane management system (CMS). Functions must appear in the CMS as single messages.
14. Signaling lights (yellow, red, green) must be in the form of LED diodes on the black background. Duplicated lights are preferable. Light must be visible in all lighting conditions. Spreader must be fully resistant to weather conditions.
15. Spreader must withstand at least 2 million cycles.
16. Spreader must be equipped with an operation counter.

All mechanical and electrical elements, including those attached to the Spreader or operating near the Spreader must be protected against consequences of frequent strokes and vibrations during operation. All switches must be self-blocking and resistant to loosening.

17. Spreader power supply

The spreader power cable should be placed in a cable basket located on the Spreader frame. The spreader power cable should be shielded and insulated (PVC) with an appropriate load. Its durability must be adjusted to weather conditions, operation intensity and dynamic loads existing during all types of reloading operations. The cable must be fitted with a plug at the end enabling fast disconnection.

### **3.11. Operator cab**

The operator cab must be equipped with a complete air-conditioning system, electrical heaters, fans and windows defrosting and demisting system.

The air-conditioning and heating system must allow to maintain a temperature of approx. 20°C and humidity of 50% and will ensure appropriate air exchange and circulation, adjustable +/- 3°C.

The operator cab must ensure safety and work ergonomics. The cabin must be installed under the bogie and will ensure that the operator will have a great view on the area of operation. The cab manufacturer will deliver a diagram showing the operator's view in order to demonstrate proper positioning of the cabin, as well as its size and shape. The cabin must be made of a stiff welded steel structure with effective acoustic insulation, vibration isolation and thermal insulation. The cabin must be largely glazed with using reinforced tempered or laminated glass, tinted on the sides and at the back and transparent in the front and on the floor plate. Foot grilles should be installed above the lower window.

The gantry control panel must be operated from the operator's seat. On both sides of the seat there must be two consoles with two joysticks characterized by industrial strength. The joystick on the right side must operate as a controller for raising/lowering and blocking/unblocking of twistlocks. The joystick on the left side must control the bogie drive and gantry travel.

1. The cab must be :
  - installed on the gantry crane and move together with it.
  - movable in the horizontal direction from the initial position to the front position (closer to the spreader) in order to ensure better visibility.
  - mounted to the gantry crane using vibration isolation systems in order to reduce shocks and vibrations of the operator.
  - for safety reasons, equipped with hooks or shackles protecting the cab from falling
  - LED illuminated, air-conditioning/heating system with window defrosting and demisting under any conditions, microphone + button with loudspeakers outside, acoustic signal, adjustable shutters on the cab roof and on lateral windows effectively reducing sun exposure and preventing direct overheating, handle for TOS device.
  - be designed in accordance with the regulations in force in Poland, with respect to the gantry operator cab structure and work ergonomics.
  - designed as a fully glazed cabin with tinted safety glass. Security windows must consist of safe laminated glass. The cabin windows must be made of scratch-resistant glass in order to ensure undisturbed visibility.
2. The cab mounting system must be designed in such manner that it must be able to withstand the cabin weight with the operator and equipment
3. The entrance doors must be equipped with a window and lock. The front and back part of the roof must be equipped with gutters, and the whole cabin must be tight and adapted to work under conditions specified in the specification, in particular during heavy rain
4. The windows defrosting and demisting system must ensure glass transparency under any conditions. Vents of the air-conditioning and heating system should be located as low as possible above the floor.
5. The adjustable operator's footrest must ensure good visibility.
6. Cabin doors must open in a safe and collision-free manner.
7. The lower panel must consist of safe laminated glass and be openable. The top front window must be split, and the top lateral windows on the right side and left side should be sliding windows. The top front window, the top windows of the right and left lateral panel and the

- window in the door must be equipped with shutters. For safety reasons, window cannot be wide open, possibly only to the extent that allows ventilation.
8. If the internal cladding is made of steel sheet, the Ordering Party accepts the thermal insulation of the cabin with mineral wool boards or other certified and non-flammable material.
  9. The cabin structure must enable the operator to safely clean the cab windows from the outside.
  10. The cab must be equipped with a control panel. The console with the operator's seat must ensure an ergonomic workplace for the operator in order to minimize fatigue. The seat must have adjustable height, front and rear and must be profiled so as to enable visibility through the lower window (between the operator's legs).
  11. The cab must be equipped with the following signaling system: ready to attach a container (yellow), fastening the container (green), unfastening of the container (red), wind warning (blue), wind warning (red). Pilot lamps are placed on the operator's panel, and in case of auxiliary lamps (concerning wind strength) alternative solutions are acceptable, to be confirmed by the Ordering Party.
  12. In the cabin safety handrails protecting the operator and maintenance staff from falling should also be installed.
  13. Further, the Supplier will also equip the cabin with:
    - a. Telephone connection with other areas of the gantry crane
    - b. Microphone and loudspeaker system
    - c. Warning signal (horn)
    - d. LED headlights
    - e. Emergency light
    - f. Air-conditioning and heating devices with window defrosting and demisting system
    - g. Shutters as described in point 13
    - h. Cabinet for the operator
    - i. 6 sockets 230V/16A (2 in the top corners and one on the left and on the right side of the seat) on separate electrical circuits
    - j. Radio
    - k. Tablet/ TOS terminal holders
    - l. CCTV system – control and display
    - m. Windshield wipers, side and roof wipers with sprinklers
  14. In the cab there must be an ergonomically placed digital monitor touch ensuring good visibility under any lighting conditions and displaying on a continuous basis at least the following data:
    - a. Fault/alarm indication
    - b. Load
    - c. Spreader height
    - d. Bogie and gantry driving position
    - e. Current wind speed
    - f. Status of bolts/twistlocks (unblocked, ready to turn, blocked)
  15. Galvanized platform consisting of anti-slip hot-dip galvanized grilles, the handrail height: 1100 mm.
  16. Color of the cab interior: RAL 7015 (anti-reflective coating) or equivalent.
  17. Other equipment: fire extinguisher, 2 places/holders for TOS screens to be supplied by the Supplier.

**Schedule no. 1**  
**Detailed Technical Specification**

18. All labels, instructions and hazard notices should be in Polish and in accordance with the applicable occupational health and safety regulations in force in Poland.
19. Heating and air-conditioning systems with vents and a fan (installed above the floor) must be designed for the minimum cabin temperature amounting to 20°C, irrespective of the ambient temperature and insolation.
20. Moisture resistant LED lights installed on the cab ceiling in order to ensure appropriate level and lighting arrangement. Light switch for cabin and door lights.
21. The cabin must be equipped with electrical wipers and sprinklers. Wipers must ensure the operator seating at his seat good visibility within the entire operation area. They will be installed both on the windshield and on the side windows.
22. The operator cabin must be ultimately equipped with a transceiver for communication with the terminal. It must be possible to connect a radio to the right joystick in the operator cab such that the pressing of one of the buttons should enable communication with the terminal.
23. Supplier will ensure the possibility to safely leave the cabin through the cabin guide and chassis frame in all positions of the gantry crane and cabin.
24. Supplier must use a system which eliminates or limits the possibility of splashing, e.g., grease from spreader ropes, on cabin windows.
25. The seat must be appropriately and ergonomically designed, electrically adjustable forward and backward, up and down, must be also able to rotate. The seat backrest must have different reclining positions and adjustable lumbar support. The seat must be equipped with two-point seat belt. Designed for operators who weigh up to 150 kg
26. The communication system should enable communication from the operator cab with people on the ground near the crane and should consist of a microphone, amplifier and loudspeaker. Loudspeakers are placed at least in the following spots:
  - a. 1 x loudspeaker in the operator cab
  - b. 4 loudspeakers on the inner legs – one loudspeaker per leg /support
33. A telephone system should be installed on the gantry crane with its own independent power supply. The system covers at least the following locations:
  - a. Earphones with a slot and power cord in the e-house and operator cab
  - b. Earphones with a power cord at the ground level near the main entrance and on the bogie near the switchgear
34. Earphones, plugs and other equipment must be appropriately protected against weather conditions

### **3.11.1. Remote operation station (ROS)**

Notwithstanding the fact that gantry cranes will be equipped with operator cabs, they should be prepared for being controlled through remote operation stations (ROS) provided by the Supplier and located in the Ordering Party's building, enabling the control of the gantry cranes. Supplier will ensure to fully equipped operator stations enabling remote control of each gantry crane (ROS). The stations must be complete and equipped with devices, software and solutions necessary to operate the gantry crane. In particular, within the Remote Operation Station the following must be ensured among others: a video server and redundant video server as well as all devices and their connection ensuring communication and data transmission between the gantry crane, servers and service use terms. The operator's workstation must ensure safety and work ergonomics. The set of screens used in the provided station will ensure the operator a great view on the area on which he works and carries out reloading operations.

Crane control at the remote stations must be carried out by an operator working in a seating position. Gantry crane control is carried out using ergonomic consoles with industrial solid joysticks and other control devices selected by the Supplier.

The workstation must be designed in accordance with the applicable directives and regulations concerning works ergonomics and must meet the requirements applicable in Poland.

The operator's station must be equipped with the following signaling system: ready to connect (yellow), locking (green), unblocking (red), wind warning (blue), wind alert (red). The signaling system is placed on the operator's screen, and in case of auxiliary lighting (related to wind strength) alternative solutions which will be confirmed by the Ordering Party are admissible.

The whole system must be equipped with protection against movement of the gantry crane from the remote workstation with operator or technical workers.

Further, the Supplier will equip the station with:

- Safety system preventing unauthorized use of the crane. At the operator's workstation there must be an access point enabling to start and operate the gantry crane only after the operator inserts a magnetic card in the reader. The system records card numbers and recognizes the name of the operator assigned to the given card number; it is recommended as an open system RFID 125 kHz enabling the Ordering Party to program access cards/locks, including adding already used ones to ensure access to other devices.
- Telephone connection with other areas of the gantry crane.
- Microphone and loudspeaker system
- Warning signal (horn)
- Radio
- Additional screen dedicated to TOS
- CCTV – control and display

The station must be equipped with ergonomically placed digital screens in the cabin, ensuring good visibility under all lighting conditions and continuously displaying at least the following data:

- Fault/alarm signaling
- Current load
- Spreader height
- Bogie and crane driving position
- Current wind speed
- Twistlock status (unblocked, ready to turn, blocked)
- View from loading and movement aid cameras

The seat must be properly and ergonomically designed, electrically adjustable forward and backward, up and down, must be also able to rotate. The seat backrest must have different reclining positions and adjustable lumbar support. Designed for women and men of weight of up to 150 kg. the upholstery should be made of leather. 2 seat cover sets (easily replaceable) to be provided.

The communication system (intercom) must enable one-way communication of the operator with people on the ground near the crane and should consist of a microphone, amplifier and loudspeaker.

Loudspeakers are mounted at least in the following places:

- 4 loudspeakers on internal legs – one per leg/support
- A telephone system with own independent power supply should be installed on the crane. The system covers at least the following locations:
- Earphones with socket and power cable in the e-house and operator cab and on remote operation stations (ROS)
- Earphones with power cord at the ground level near the main entrance and on the bogie next to switchgear

Earphones, plugs, and other equipment must be properly protected against weather conditions.

### **3.11.2. Equipment and wiring between the server room and ROS room.**

As part of the start-up of remote operation stations (ROS) Supplier will ensure delivery, installation and connection of the whole infrastructure necessary for their operation (including components such as e.g. servers, video servers, switches and other). Ordering Party will do the wiring between the server room and the room in which remote operation stations will be located. The wiring will be done by the Ordering Party before the delivery of the gantry crane, in accordance with detailed guidelines provided to the Ordering Party pisemnie by the Supplier, within 2 months from the execution of the agreement.

Work performed by the Supplier includes termination and connection of optical fibers brought by the Ordering Party to the server room to the system elements delivered by the Supplier and installed in the Ordering Party's server room, assembly of such elements, connection of components in the server room to the remote operation station, and termination and connection to ROS in the operator room, and configuration and start-up of the whole system. Servers and switches required for system operation should be placed in a standard lockable cabinet (e.g. full height 42U) in accordance with the Supplier's guidelines.

Parameters concerning the cabinet and power demand of the devices which the Supplier is planning to instal in the server room will be provided to the Ordering Party in writing within 2 months from the execution of the agreement.

If any additional components, e.g. NTP time server, are required for system operation they are also covered by the scope of the delivery on the side of the Supplier. Video servers record images from cameras on the gantry crane for inspection purposes for 45 days.

### **3.12. Equipment of gantry cranes with devices enabling installation of an automated container handling system**

The delivered gantry cranes must be suitable for installation of devices enabling fully automated container handling operations in the storage and train and truck loading area, i.e., must have appropriate cable outputs and data links and equipment elements, enabling their expansion with such functionality.

### **3.13. Electrical installations and switchgear**

1. Electrical cables must be laid in galvanized ducts, grated cable trays and cable shelves, in vertically mounted cable reel holders, to be attached using stainless steel claims with neoprene pads.

2. Devices with low electromagnetic resistance (BUS interfaces, incremental encoders, anemometer, etc.) are connected through shielded or separately laid cables or optic fibers.
3. All power supply systems must be permanently marked with a number on both sides.
4. PLC and frequency converter should be installed centrally in the e-house.
5. Junction boxes / distribution boxes / control panels mounted outside of the gantry cranes should be made of stainless steel with min. protection IP65, equipped with hinged doors and anti-condensation heaters. All elements must be properly grounded.
6. All electrical switchboards installed on the crane should be of appropriate industrial type and consist of standard electrical elements.
7. LV control circuits cannot have more than three devices under one switch.
8. Electrical switchboards should be fully assembled, and the whole wiring connected.
9. Before the delivery they must undergo all tests at the manufacturer's plant in order to confirm correct wiring, functionalities and no errors.
10. Gantry cranes must have standard built-in electricity meters.

#### **3.14. Electrical cables**

1. Each crane electrical cable must be permanently marked on both ends for easy identification and should be appropriately marked on the electrical diagram.
2. Power supply for alternating current drives/engines with variable frequency must be delivered by special engine cables.
3. Wiring with insulation of at least 1000 VA.
4. Expansion power cable must be shielded and insulated PVC with an appropriately selected load. Its resistance must be adapted to weather conditions, operation intensity and dynamic loads during all types of reloading activities. The cable must be ended with a plug IP65 enabling quick disconnection.
5. All cables should be placed on cable holders and in cable ducts and protected with plastic bands resistant to UV radiation with double lock.
6. All cables transmitting digital or control signals should be shielded and ended with clamps that properly protect against electromagnetic interference.
7. Shields must be installed at regular and appropriate intervals, in order to ensure appropriate strength and durability.
8. Cable entries must be made from the bottom of electrical cabinets or, if not possible, appropriate cable loops should be made to do it outside the cabinet.

#### **3.15. PLC**

Fully digital control based on a microprocess and programmable logic controller.

Controlled units are connected via Profibus or Profinet.

#### **3.16. Drives**

1. Gantry cranes must be equipped with devices do synchronizacji mechanismsu jezdnego gantry.
2. All drives with frequency converters must be protected against overload using sensors. All drive systems with frequency converters must be designed with increased insulation resistance. Frequency converters of internationally renowned manufacturers which ensure high quality and durability are used.

#### **3.17. Sound generator and horn**

Supplier will install warning light and sound generators in all four corners of the crane driving structure.

1. Warnings must be triggered automatically, when the crane is in motion.
2. Supplier will ensure the possibility of adjusting the warning generator volume.
3. Gantry must be equipped with a horn to be honked by the crane operator.

### **3.18. Lighting**

All lighting circuits must be divided into individual branches.

Each branch should be protected by its own switch with earth-fault protection in the e-house. Failure of any branch cannot cause of power loss for more than 50% of all lights in the same group. Lighting fixtures must be installed so they withstand vibrations generated by the crane and minimize light reflections in the operator cab.

The location of lights must enable easy repair and replacement.

#### **3.18.1. Upper beam lighting**

Type: LED. It will ensure lighting intensity of approx. 100 luksów at the ground, winch / bogie level.

#### **3.18.2. Bogie lighting**

Type: LED. At least two flash lights must be mounted at the bogie bottom to properly illuminate the spreader and the container attached to it.

#### **3.18.3. Lower beam lighting**

Type: LED. At least one flash light to illuminate the runway at each crane corner.

Additional flashlights on the lower level for proper backlighting of container pins on the means of transport used to transport containers being the subject of reloading activities.

#### **3.18.4. Entrance lighting**

Each ladder, stairs, landing and pavement must be appropriately illuminated by LED flash lights will lighting intensive of at least 50 lux.

Lighting is controlled automatically using a photocell.

#### **3.18.5. Cabin lighting**

The lighting level of the operator cab cannot be lower than 200 lux (without shadow)

#### **3.18.6. E-house lighting**

The source of light must be located overhead and consist of at least 2 LED lightsources which ensure fully sufficient illumination to carry out maintenance works. Inside the e-house lightsources should be installed overhead and ensure illumination of the working area with light intensity of not less than 150 lux.

#### **3.18.7. Warning lighting**

In each corner of the gantry crane an unfallible orange warning lighth resistant to weather conditions should be installed. Signaling lights and sound signals should be connected to the power supply for the crane drive and work continuously while driving. Adjustable volume and remote management at night.

#### **3.18.8. Emergency lighting**

As a minimum requirement, an emergency lighting system should be installed at pedestrian crossings, in the operator cab and in the e-house.

### **3.19. Plug-in sockets**

Socket sets:

Min. Level of equipment:

- 2 CEE 5x32A,
- 2 230V (type E 16A),
- 1 CEE 5x63A,
- switches mounted near lower electrical cabinets located between the gantry crane legs on the north and south

Sockets 230V type E - 16A:

- 1 in all control cabinets
- 3 (double) in the cabin

### **3.20. Heating**

1. Anti-condensation heating of bogie engines, crane and lifting mechanism.
2. Heating in each electrical cabinet located outside.

### **3.21. Recuperation**

Gantry cranes must be equipped with a system for recovering energy (recuperation) from braking the gantry crane, winches and bogie. The Ordering Party, with the Supplier's support, will obtain a permit for feeding energy into the grid or modify the gantry cranes being in possession already before the final handover.

### **3.22. Simultaneous assembly operation**

The delivered gantry cranes must allow for simultaneous work of the gantry drive, bogie movement and lifting/opuszczanie spredera.

### **3.23. Crane management system and remote maintenance**

1. Gantry crane management system and remote connection through the Internet in order to carry out maintenance activities must include at least:
  - Gantry crane diagram
  - Gantry crane position display
  - Alarm and failure management
  - Statistical analyses and reports
  - Operating hours counter for all container bolt drives, etc.
  - Reloading activities counter
  - Operation manual along with the electrical diagram
  - Service modules
  - Work stations: 1x crane cabin 1x e-house

The crane management system monitors and records faults/failures and current working conditions which are essential for loading activities.

2. The system must make it possible for examining all electrical and electronic circuit, simulating boot sequences and checking motor supply current.
3. Detection and monitoring of defects to be controlled by PLC.

4. PLC will monitor on an ongoing basis the status of all switchboards and electrical elements. If any irregularities are detected, information thereof must be conveyed and displayed on the screen in the cabin and in the e-house.
5. The system must make it possible to direct the displayed error/alarm directly to the specified point on the electrical diagram of the crane.
6. The system will ensure the minimum display area for the following data:
  - working hours (winch),
  - bogie movement,
  - crane movement,
  - twistlock turn (number of movements),
  - power consumption,
  - gantry crane position,
  - control systems alarm and warnings.

The system also records and ensures remote reading of voltage, current, kVar, kWh, power factor, Hz.

7. The system must allow for preparing and recording reports showing total power consumption in a given month with hours worked. There must be a possibility of choosing any time slot to create reports with hours worked by all drives, stoppages and downtimes.
8. All of the above data must be stored in the gantry crane memory in the form of date and time records.
9. The system will operate with high speed to monitor all critical tasks. It is organized in a clear, logical and understandable manner, even for non-technical staff.
10. The system must enable ongoing energy consumption reading.
11. The system is installed and operated from a computer in the operator cab and in the e-house.
12. The system also displays data in graphical form enabling their choice and tracking.
13. The crane management system must be available through a reliable connection on the designated (max. 3) terminals for review and must ensure availability of all data, including warning alarms and current statuses.
14. Supplier will ensure a communication channel enabling collection of data in real time from the central crane unit, and removal access to the lifting system by service personnel.

#### **3.24. Black box recorder**

A register in the form of diary of all signals and operator commands will be kept for at least 30 days of work 24 hours a day, 7 days a week. The register must contain all signals, load weight, twistlock turn counter, hour counter, crane startup timer, electricity meter, winch, crane and bogie driving time, etc. All data must also be available via a remote connection with the SMF.

#### **3.25. Integration with the terminal operating system**

1. Gantry cranes will ensure two-way transfer of data to /from the terminal operating system (TOS). There must be a possibility of transmitting data from the gantry cranes to the TOS in a structured manner. Supplier of the cranes will provide the Ordering Party with the data structure and specify information which may be transmitted by gantry cranes, to be used, in the Service Use Terms.
2. The Ordering Party shall require remote control /administrative access to the crane management system. Direct access to the crane PLC must be ensured; a heavy-duty laptop with system and service software will be included in the scope of the delivery as part of each of the Tasks. Access/service codes for PLC settings will be provided to the Ordering Party by the Supplier after the lapse of the standard warranty period.

### **3.26. Crane paint coating - colors**

1. Paint coating should consist of at least 2 layers: primer and paint. Painting should be commenced immediately after shot-blasting. Total dry paint coating thickness should be at least 240 microns.
2. The Ordering Party stipulates that metal elements of the structure will be painted RAL 7042 (subject to special requirements concerning marking of special zones).
3. Spots for placing the logo of the Supplier and the logo of METTRANS on selected elements (e.g. main beam) to be agreed.
4. Further, for safety reasons, Supplier should paint yellow (RAL 1023) sensitive elements such as bumpers, handrails, protective elements, ladders.
5. The floor of the operator cab and e-house should be green (RAL 7042), e-house interior must be white (RAL 9016).

### **3.27. Corrosion protection**

The surface of all steel materials must be prepared in an automatic surface treatment plant or in a specialist manual blasting hall. The quality of the cleaned surface should comply with EN - ISO 8501-1:2008, "Preparation of steel substrates". All steel profiles must be completely cleaned in order to restore the surface quality in accordance with class SA 2.5 before applying the paint coating.

The steel structure of the crane must be protected against corrosion in accordance with EN ISO 12944 (varnish, paint, steel structure corrosion protection)

- 1x min 40 µm primer layer (two-component epoxy-zinc coating HS)
- 1x min 60 µm topcoat - polisiloksan or poliuretan w kolorach z palety RAL
- Min. 240 µm total thickness of all paints.

It is allowed to use paints/varnishes which guarantee long color durability and stability and meeting the warranty period requirements. Supplier will recommend to the Ordering Party, for its approval, the type of paint coating in the crane maintenance manual.

### **Corrosion class of at least C4**

### **3.28. Crane assemblies**

All bogie, lift and gantry crane bearings and gantry crane and bogie wheels must meet the minimum requirements at max. load of **20,000 working hours**.

1. Bearing housings must be removable to enable quick and easy access for inspection and replacement purposes. All movable parts of the gantry crane which require lubrication must be equipped with an effective lubrication system with easy access for inspection and maintenance purposes.
2. The lubrication plan delivered by the Supplier should indicate the places and frequency of lubrication incl. materials to be used.
3. List of materials must indicate products available in Poland or indicate products in accordance with appropriate API classification.
4. All areas that require lubrication must have pavements and landings with necessary protective handrails. Lubrication places must be clearly marked in accordance with color codes. One code corresponds to one type of lubricant.
5. All hoisting systems must be correctly and clearly described and marked (both outside and inside), both ends reaching panels should be marked with foil with a description consistent with the set of system diagrams to be prepared by the Supplier and delivered to the Ordering Party. All external electrical installations must meet the minimum protection level IP55, and internal electrical installations - IP41.

### **3.29. Warning signs and notes**

Warning signs should be placed by the manufacturer in accordance with the currently applicable provisions prawa, all EU requirements and requirements of the Polish Transport Technical Supervision Office. Warnings must be in Polish.

- S.W.L.: Two signs, one on each beam
- Frazowania: Safe working load of 41 tons
- Color of letters: Black on white background

## **4. Required technical documentation**

Supplier will prepare and deliver under the agreement full technical documentation of the devices and operation manuals for operators in Polish and English and maintenance instruction for technicians, in Polish and in English. All delivered components and assemblies must have necessary attestations and certificates required by Polish statutory provisions and implementing rules.

Additionally, with each gantry crane a heavy-duty laptop with licensed software in Polish or English, covering all connectors, wires and interfaces with service and diagnostic software and software for programming gantry cranes, with an operation manual.

Technical documentation must comply with the statutory provisions and implementing rules and meet the requirements of the Transport Technical Supervision Office.

Kompletna dokumentacja dla każdego Zadania zawiera w szczególności:

- a) SG operation manual
- b) RMG operation manual, including instructions concerning calibration of sensors and other devices to be adjusted on the gantry crane
- c) Certificate +CE
- d) CE certificate for the spreader
- e) Catalogue of all spare parts installed in the gantry crane
- f) All technical data cards with nominal dimensions, tolerances, permissible rail wear, wheel flanges and other necessary data
- g) Spreader operation and maintenance manual
- h) List of spare parts for the spreader
- i) Technical drawings
- j) Static calculations and steel structure drawings
- k) Diagrams
- l) Electrical installation instruction manual
- m) Documentation of PLC controller
- n) All passwords to PLC controllers and other electronic devices
- o) Post-sale report with measurements of the electrical installation and the performance of electrical and lightning protection
- p) Cybers-security certificate
- q) Further, the relevant parts of the documentation include:
- r) Technical descriptions
- s) Drawings
- t) Electrical, hydraulic and pneumatic diagrams, if they exist
- u) Rope drive system diagrams.

After the completion of the assembly works with respect to each gantry crane, Contractor will deliver a written confirmation that the installation was made in accordance with the applicable standards and the state of the art, as well as confirmation that all tests have been carried out, and will confirm the correctness of the subject of delivery and efficiency of the gantry crane.

The confirmation of compliance is signed by an authorized person coordinating installation works. Both the documentation and the devices must meet the requirements of Polish statutory provisions and implementing rules concerning close transport in quantitative, qualitative and regulatory terms. Drawings and diagrams should be delivered in PDF format and general assembly drawings of the gantry crane should be delivered both in readable PDF format and in readable DWG format. The documentation will be delivered in one English and one Polish copy in paper form + on two data carriers (e.g. two pendrives) no later than on the date of completion of the order.

#### **5. Bumpers and end of the crane track**

RMGs must be equipped with a system which automatically stops the gantry after detecting any obstacle on the track clearance line and slows down smoothly when approaching the crane track end or another gantry crane bumper.

Supplier will make sure that the staff will be able to program the system for detection of the crane track end and change the gantry stop point (in case of decision to extend or shorten the gantry crane operation area)

Supplier will make and deliver, along with the delivery of structural elements of the gantry crane, stops cooperating with bumpers installed on the gantry crane, which the Ordering Party will install in the gantry crane foundation.

#### **6. Foundation and crane track**

The Ordering Party informs that it constructs the foundation and crane track in accordance with the design constituting **schedule no. 4 to the Request for Proposal “Design of crane track and crane track surface (crane beam)”**. Supplier must ensure that running elements of the gantry crane located in the southern foundation do not conflict with the gantry crane foundation.

#### **7. Summary of technical requirements for gantry cranes**

Gantry cranes must handle container cargos with sizes from 20 to 45 feet including non-standard containers. The assumed load capacity of RMGs under the spreader amounts to 37 tons. The Ordering Party assumes that the gantry operate in the following working conditions:

- Temperatures ranging from -30°C to +35°C; humidity up to 95%.
- Maximum working wind speed 22 m/s.
- The height of the gantry must enable handling High Cube containers in a three-container block storage system with maneuvering space and a reserve above container blocks,
- Rotary bogie,
- Possible full rotation of a container 45' across the width of the gantry crane and between the gantry crane supports
- Effective, continuous, uninterrupted communication
- Monitoring – local and remote

Dimensions of the gantry crane:

**Schedule no. 1**  
**Detailed Technical Specification**

- 1) Crane track axle spacing (distance between rail axes of the crane track) 40.0 m, i.e., over five railway tracks of the terminal, in the truck lane and 2 + 1 (buffer) rows of containers/semi-trailers stored in parallel to the movement of the gantry cranes – between the crane supports;
- 2) Maximum height of the gantry crane arising from the provisions of the master zoning plan – 30 m above ground level.
- 3) 4 rows of containers stored in parallel to the movement of the gantry cranes + 1 row of containers stored perpendicularly to the movement of the gantry cranes over the fixed leg jib (south-western side);
- 4) 4 rows of containers stored in parallel to the movement of the gantry cranes + 1 row of containers stored perpendicularly to the movement of the gantry cranes with semi-trailer loading zones and scales and power chamber of the hinged leg (north-eastern side);
- 5) Along the crane track length 773.0 m with designed two gantry cranes and parking areas at the crane track ends.

The gantry crane diagram and loading and storage front in the gantry crane operation area constitutes Schedule no. 6 do Request for Proposal “Normal cross-section”

**8. Detailed technical data**

The Ordering Party assumes that the number of reloading activities performing using a RMG will amount to approx. 10,000 (± 3000) per month. Containers with various sizes and weight will be handled.

Gantry cranes must meet the following parameter:

<b>Position, parameter</b>	<b>Value</b>	<b>Unit</b>
Twistlock loading capacity	37	Ton
Lifting speed under load of 41 tons / full load	0 – min. 20	m/min
Lifting speed under load of up to 10 tons under the spreader / partial load	0 – min. 40	m/min
Crane driving speed; full and empty cargo	0- min. 120	m/min
Bogie driving speed / Transverse travel speed	0-100	m/min
Bogie rotation speed	0-1.5	Revolutions per minute U/min
Electrical connection	15 +/- 10%	Kv
Control voltage	230	V
Control voltage	24	V
<b>Equipment classificaton</b>		
Steel structures	S4	EN 15011
Spreader	S4	EN 15011

Mechanisms (according to STN ISO 4301 and FEM):

Mechanisms	Operating class	Loading status	Group classification
Hoist	Please see T8	L3	Please see M8
Bogie travel	Please see T8	L3	Please see M8

Sliding crane	Please see T8	L3	Please see M8
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## 9. Quality guarantee

The Ordering Party requires a quality guarantee:

1. 2 years warranty for the gantry crane, its assemblies and equipment delivered as part of this bidding procedure ("basic warranty"), covering all defects and failures which will occur in this period. The basic warranty period will be extended by the period in which operation of the gantry crane is impossible due to the detection of defect covered by the warranty.
2. 1 year warranty for parts repaired during the basic warranty period, not shorter however than the basic warranty period indicated in point 1.
3. 5 years warranty for the tightness of the paint coating of the gantry crane, covering all defects which will appear in this period.
4. 8 years warranty for color stability of the paint coating on the gantry crane structure.
5. 10 years warranty for steel structure of the gantry crane, covering all faults or failures during such period.

The period of each warranty will commence on the date of final acceptance of the devices by the Ordering Party, and in case of repairs – on the date of the gantry crane resuming work after the repair.

The scope of the granted warranties includes all defects, failures, damages, software errors, corrosion and other events resulting in malfunction, immobilization or unaesthetic appearance of the gantry crane, during the warranty period, except from those arising from reasons attributable to the Ordering Party.

## 10. Maintenance service

Supplier will ensure maintenance service throughout the warranty period. The maintenance service must ensure:

1. In case of occurrence of any problems with the gantry crane, technical support staff of the Ordering Party will report a defect to the e-mail address and/or hotline number indicated by the Supplier.
2. Supplier will ensure, as part of the maintenance activities, a hotline service in Polish and English, operating 24/7. Supplier's service technicians may also be contacted on non-working days, 24 hours a day. Remote technical support provided by Supplier's service technicians will be provided without undue delay after a fault is reported by telephone or e-mail.
3. Gantry cranes will be equipped with software enabling remote monitoring of their technical efficiency through a link between each gantry crane the Ordering Party's computer network. Supplier's service technicians should be able to remotely carry out ongoing inspections of the gantry crane and – if necessary – provide information and guidance to the Ordering Party's personnel. However, the foregoing does not release the Supplier from the obligation to ensure timely visits of professional technical personnel and to carry out an overall of the gantry cranes at the terminal. In case of any defect preventing the gantry crane from operating, which cannot be removed remotely or by simply instructing the Ordering Party's technical personnel, Supplier's qualified service technicians **will arrive at the terminal in order to remove the defect, no later than 48 hours after the problem is reported by the employees** of the Ordering Party. Practically, if a defect was reported in Friday at approx. 11:50 p.m., immediately on Friday or during the night hours from Friday to Saturday an e-mail/telephone consultation (attempt to solve the problem remotely) will be held, and if the problem is not solved technicians

**Schedule no. 1**  
**Detailed Technical Specification**

should arrive at the terminal not later than on the following business day. In case of any defects that do not prevent the gantry crane from operating, it is permissible to postpone the arrival of service technicians for up to **72 hours**.

4. Brak odpowiedzi serwisantów Supplier w wyznaczonym terminie stanowi podstawę do naliczenia kar umownych.

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