

## TECHNICAL DESCRIPTION JN 19/2024

**Note:** By signing this document, the tenderer must declare that he has carefully studied this attachment Nr. 2 »Technical description JN 19/2024« and that he is informed with all technical requirements and descriptions and that we fully agree with them. In case of possible deficiencies in the technical requirements and description of the order, the client must warn or ask a question by the public procurement portal [www.enarocanje.si](http://www.enarocanje.si).

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**Opomba:** S podpisom priloge 2 »Technical description JN 19/2024« (Tehnični opis JN 19/2024) ponudnik izjavlja, da je natančno preučil vsebino zadevne priloge in da je seznanjen z vsemi tehničnimi zahtevami in opisi ter da se z njimi v celoti strinja. V primeru morebitnih pomanjkljivosti v tehničnih zahtevah in opisu naročila mora ponudnik naročnika na to opozoriti ali postaviti vprašanje preko portala javnih naročil [www.enarocanje.si](http://www.enarocanje.si).

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## 1. GENERAL

### 1.1. *PRINCIPLE DUTY*

The electrified rubber tyre gantry crane (E-RTG) is required to have a lifting capacity of 41t under the spreader for and to be designed to handle ISO containers of 20 and 40 feet.

The crane must be designed to operate efficiently, uninterrupted, and safely.

The principal duty, for which the E-RTG's are intended, is to load and unload containers on a continuous basis from terminal tractor-trailers and road trailers to storage areas and vice versa.

### 1.2. *CLIMATE CONDITIONS*

The E-RTG shall be designed and so constructed for operation in a marine salt laden air environment and the following Site-specific environmental conditions:

Minimum temperature	- 12° C
Maximum temperature	+ 45° C
Maximum Relative Humidity	100 %
Maximum operational wind speed	25 m/s
Maximum out-of-service wind speed	44 m/s

### 1.3. *OVERRIDING REQUIREMENT OF THE PURCHASER*

The Purchaser's overriding requirement is for the Works to be suitable in all respects for safe, efficient and continuous use under actual operational conditions in a modern, large capacity, international container handling facility for a period of not less than twenty (20) years subject to fair wear and tear (excluding categorically any fatigue failure), and routine maintenance.

### 1.4. *PRINCIPAL PARTICULARS AND DIMENSION*

The Supplier shall satisfy himself that the particulars and dimensions of the E-RTG's are suitable for the design which he offers. The size and capacity of any parts of the E-RTG shall be, unless stated otherwise, in accordance with the requirements of FEM: Section 1.001" 3rd Edition.

## 2. GENERAL DESIGN CRITERIA

### 2.1. *TYPE OF THE CRANE*

The electrified rubber tyre gantry crane shall be a self-propelled 16 wheels rubber tyre Electric Gantry equipped with cable reel power supply, manual (1000 V) plugin system and auxiliary battery pack.

The crane shall have a rated capacity of 41t capable of lifting and transporting 20'/40' ISO containers across the span of seven standard ISO container rows plus one truck lane. The height of lift shall allow one 9ft 6" high container to be transported over the top of five 9ft 6" high containers stacked one on top of one another.

The spreader shall be a telescoping 20'/40' single lift, all electric spreader, with flippers.

The E-RTG shall be operated by a single operator from a totally enclosed cabin which shall be situated in a position such as that the load is always in view.

The manufacturer shall design and control the machine in an energy efficient manner

## **2.2. SAFETY OF MACHINERY**

### **2.2.1. STATUTORY REQUIREMENTS AND MINIMUM DESIGN STANDARD**

The Crane electrical, electronic equipment and its mechanism shall be designed and manufactured to comply in all aspects with the requirements of all latest, laws, ordinances, rules, orders, or other legal or regulatory institutes applicable in the Slovenia – Port of Koper.

Where items are not covered by local statutory requirements, the Crane and other Goods shall be designed and manufactured to at least the standards as specified in this Specification. For items which are not specified above, then to at least to the current applicable recommendations of the following organizations:

- EN – European Standard
- FEM – Federation Europeane de la Manutention

Other standards which must be considered:

- AWS – American Welding Society - Bridges and Dynamically Loaded Structures
- BSI – British Standards Institute
- DIN – Deutsche Industrie Normen
- OSHA – Occupational Safety & Health Administration
- IEC – International Electrotechnical Commission
- IEEE – Institute of Electrical and Electronic Engineers
- ISO – International Standards Organization
- UL – Underwriters Laboratory

The Contractor shall define all standards used in the design of the Crane.

### **2.2.2. CONFORMITY WITH THE EU MACHINERY DIRECTIVE**

The crane shall comply with the requirements of the European Machine Guidelines, particularly Machinery Directive 2006/42/EC, 2014/30/EU and 2014/53/EU. The cranes shall be provided with a declaration of conformity and the CE marking and symbol according to the relevant Appendixes of the Machinery Directive. The Supplier/ Contractor is solely and entirely responsible for all aspects of this conformity declaration and CE marking. A single electric power or malfunction shall not damage the crane or injure personnel. If possible, component failure or malfunction shall safely stop the crane operation. If this is not possible, a redundant system shall be supplied. The redundant system shall both safely stop the crane and prevent operation until maintenance personnel make corrections. A means shall be provided so the maintenance personnel may routinely check each redundant or backup system. The check procedure shall be included in the maintenance manual. No crane component shall change state because of a power failure. Powering or repowering the crane or any system within the crane shall not result in an unanticipated or potentially unsafe motion or condition.

## **2.3. MINIMUM CLASS OF THE CRANE**

Unless otherwise specified the whole and any part of the works shall comply in all respects with the requirements of F.E.M. 1.001 3rd Edition Booklets 1 to 8 and shall also comply in all relevant respects with local regulations.

The E-RTG G shall be designed to operate, up to a maximum of 24 hours a day under all Site weather conditions, and a total of 2.000.000 loading cycles.

For each individual mechanism 25.000 hours lifetime shall be considered.

Notwithstanding the requirements of F.E.M. 1.001 3rd Ed. Section 1 the following classifications shall be used during design.

### Structures

Class utilisation: U7  
 State of loading: Q2  
 Group classification: A7

### Mechanisms

	<b>Hoist</b>	<b>Gantry</b>	<b>Trolley</b>
Class of utilization	T7	T7	T7
State of loading	L2	L2	L2
Group classification	M7	M7	M7

## 2.4. GENERAL DESIGN CRITERIA

Major dimensions, clearances, and performance requirements

All calculations and labelling on the crane in SI-Units (Except spreader size).

Rated load under spreader: 41 metric tones  
 Container type: ISO 20'/40' containers with ISO corner fittings at 20'/40' position  
 Spreader: 20'/40' telescopic fully electric type, with 4 electrical corner flippers used separately one by one  
 Rail gage (Span): 25,5 m  
 Lift height: One over five 9'-6" high containers  
 Over-all crane width: max 29 m (including stairs fences)  
 Over-all crane length: max 12,5 m  
 Clearance inside span min 24 m

### Speeds

Hoisting/lowering with rated load: Min 30 m/min  
 Acceleration **max** – 3 s from 0 to full speed  
 Hoisting/lowering with empty spreader: Min 60 m/min  
 Acceleration **max** – 2 s from 0 to full speed  
 Trolley travel speed: Min 70 m/min  
 Acceleration **max** – 4 s from 0 to full speed (reduced in high wind operation)  
 Gantry with empty spreader: Min 135 m/**max**

Acceleration **max** – 8 s from 0 to full speed (reduced in high wind operation)

Note: Deceleration times must be the same as acceleration times. The above speeds must be achieved for crane operation under a sustained 25 m/s wind condition.

Spreader adjustment

Skew adjustment: Min +/-5°

Trim adjustment: Min +/-5°

Fine positioning: Min +/-250mm in both positions simultaneously **with empty spreader and Min +/-150mm with rated load** (without moving trolley or gantry)

## **2.5. GROUND INTERFACE**

The RTG is to run on asphalt pavement.

Maximum operating wheel load shall not exceed 19 metric tonnes per wheel and the ground pressure not to exceed 9,5 kg/cm<sup>2</sup>.

## **2.6. GENERAL DESIGN REQUIREMENTS**

The E-RTG shall be designed for reliability and ease of maintenance, due regard being given to the need for safe access from permanent platforms or from ground level for adjustment, lubrication, inspection, maintenance, and repair. All major components and sub-assemblies shall be provided with suitably rated, integral lifting points to facilitate correct handling.

Only components which have been well tried and proven to have given service over an extended period of years under similar conditions shall be incorporated into the E-RTG. The Supplier shall have a minimum ten years' experience and track record of E-RTG manufacturing.

## **2.7. MACHINERY UNITS**

The E-RTGs shall be provided with independent machinery units for the hoisting, traversing, gantry travel each being operated by their own motor or motors and capable of three simultaneous movements with 100% speed.

Wherever practicable the units shall be mounted on separate bedplates to facilitate their removal for maintenance purposes. All components requiring maintenance shall be safely accessible.

Hydraulic systems are not accepted on the E-RTG.

## **2.8. HOIST MACHINERIES**

The hoist machinery consists of one or more identical electrically synchronized machinery units mounted on the trolley frame.

The hoisting machinery shall be through an AC electric motor(s) driving a reducer(s) and fitted with disc brake. Electrical motors are preferable flange mounted type.

Coupling(s) which connect the hoist gearbox to the hoist drum shall be manufactured by an internationally recognized manufacturer of this type of component. Wear indication marks shall be provided in a

convenient place for viewing without dismantling of any components.

The four main hoist ropes are reeved without s-curves from the rope drums to the sheaves mounted on the head block and then back to the trolley frame to their fixing points. The fixed ends of all four hoist ropes shall be provided with load cells, which are used for load indication and overload protection.

The hoist ropes shall be securely fastened to the hoist drum by clamp type fittings with at least one round of rope underneath each clamp fitting.

The hoist drum diameter shall be minimum 25 times the hoist rope diameter. The grooves shall be free of sharp edges.

Main hoist service brakes shall be external and effective disc type manufactured by Pintch Bubenzer, or equivalent approved by buyer. Discs must remain corrosion free. The hoist brakes, pads and disc shall be protected from the weather with an easily removable or accessible enclosure, so designed to allow access to all components for maintenance.

The hoist motor(s) shall be fitted with external cooling fan and protected by over speed, over-heating safety devices and absolute encoder for position detection. Space heater shall be provided to prevent risks of humidity condensation during long term standstill conditions.

All sheaves shall be similar and interchangeable for spare part and maintenance requirements.

## **2.9. ROPE SHEAVES AND WIRE ROPES**

All steel wire ropes shall be made in one piece. All four main hoist ropes must be same length. Rope selection shall be based on F.E.M. 1.001 3rd Ed. All ropes shall be Warrington-Seale type or equivalent with steel core and have an ultimate tensile strength of 1960N/mm<sup>2</sup>. Manufacturer's test certificate of the quality and breaking strength of each rope shall be provided.

Main hoist wire ropes shall have a minimum safety factor of 6.0 with a concentric load and 5.0 with an eccentric load.

The ratio of the sheave pitch diameter to the wire rope diameter shall be a minimum of 30:1.

The main hoist rope sheaves shall be of cast or welded construction with machined grooves.

Sheaves are to be provided with rope guards to prevent slack rope coming off the sheave. The gap between the sheaves and guards shall be minimized to avoid ropes coming off the sheaves.

All sheaves shall be designed with easy access and with ample space for maintenance and repair. The clamp and retainer shall be fitted opposite to the wire rope pulling force direction. Clamp and retainer bracket shall easily be removed for sheave replacement.

## **2.10. TROLLEY, TROLLEY DRIVE**

The trolley shall be fabricated structural frame mounted on four steel wheels providing adequate support for all items of machinery equipment mounted on the trolley (hoisting machineries, trolley traverse machineries, and operator's cabin). On the energy chain site there must be mounted two pairs of side guide



stell wheels. Wheels on energy chain side must be flanged, wheels on other side of energy chain must be non-flanged.

The trolley shall be provided with service platforms to provide safe and easy access to all those components, which require to be maintained and replaced from time to time. The access to all such components is from the top of the trolley structure.

The trolley wheel assemblies need be removed from their mountings as complete units without the need to remove shafts and bearings from the wheel.

Access onto the trolley and to the operator's cabin shall be provided by ladders or stairs with suitable guards. In addition to the ground level access, there shall be a second access from the cabin onto the trolley which can be used during emergency or breakdown of the machinery at outside the normal parking position.

The trolley shall be carried upon four free running solid forged steel wheels sized per F.E.M. 1.001 3<sup>rd</sup> ed.

All four trolley wheels shall be driven. Trolley must be driven directly by trolley wheels. Ropes or chain/gear are not allowed to accelerate or decelerate trolley.

Trolley design shall incorporate safety devices (drop blocks) that will ensure the trolley will not be separated from the girder structure in the event of wheel / shaft failure. Falling prevention clamps around the rails shall also be provided.

Jacking points shall be provided at suitable locations to enable the trolley to be jacked up for maintenance purposes such as replacing the wheels.

Energy absorption buffers at both ends of the trolley runway are to be provided to prevent collisions between the trolley structure and the main structure.

## **2.11. E-RTG GANTRY TRAVEL SYSTEM**

The E-RTG shall be carried upon 16 tyres mounted on four bogie assemblies.

Sixteen wheels, two at each portal side diagonally positioned, shall be provided with the appropriate transmission designed to drive the RTG.

Gantry travel system must be directly driven. Drive chain or hydraulic drive is not acceptable.

The motor size and torque capacity shall allow the E-RTG to travel on 2% gradient at maximum operating wind condition with rated full load.

Electric powered wheel turning shall be provided to enable each axle to be rotated 90° about the vertical axis so that the E-RTG may be travelled transverse to the operating direction when it is required to be transferred to the other container stacks. It is preferred to use same machineries for gantry travel and wheel turning.

Each corner assembly shall consist of an equalizer beam which carries two pivoted wheel assemblies. Wheels shall be fitted with slewing rings so that each wheel assembly can pivot 90° rotation. The design shall allow the machine to be turned by carousel drive around E-RTG's centre. The wheels shall also be able to be turned to the parking position and be able to withstand loads from storm wind.

The gantry system shall be designed such that in the event of a tire failure (flat tire), no damage occurs to the E-RTG.

### **Wheels and Tyres**

The E-RTG shall be mounted on 16 heavy-duty appropriate size tyres. The tyres shall be mounted upon heavy duty tubeless rims.

Each wheel shall have local jacking pads to allow it to be lifted clear of the ground for maintenance purposes.

The E-RTG shall be fitted with an appropriate amount of wheel guards.

The tyres must be equipped with tyre pressure monitoring system.

### **2.12. GEAR REDUCERS**

All gear reducers shall be arranged to fully enclose the necessary gearing for the respective motion in a dust and weatherproof oil-tight enclosure.

Reducer cases shall be split along the shaft centerline for easy of servicing and maintenance. Inspection covers, oil level check and breather holes shall be incorporated in the design. Adjacent to each oil filling point shall be a permanently fixed label indicating the type of oil to be used. Each reducer shall have a lockable drain valve, easy access for filling, draining, level check, filter replacement.

All gearing shall be machine cut and shall comply with the appropriate ISO 6336 Standards.

The gearboxes shall be designed to allow easy replacement of gear or gear shafts without removing the whole gearbox assembly from its mounting base.

### **2.13. OPERATOR'S CABIN**

The crane is to be provided with a totally enclosed, weather tight and insulated operator's cab fixed permanently to the trolley.

The operator's cab shall have all controllers needed for container handling operation, swivelling type armchair with appropriate adjustment possibilities, ergonomic and capable of rotating.

The cab connection to the trolley shall include anti-vibration mounts to reduce impact and vibration to the operator.

Noise level in the cabin during operation shall not exceed **70 dBA**.

All windows must have the possibility to clean it from inside and outside using mounted platform (without using additional lifting devices).

Joystick must be linear type and work with increasing and reducing without steps. The functions of joystick must be with the same functions and locations as on existing RTG's.

Cab windows shall provide as much view as possible including lower rear view. It shall protect the operator from the glare of the sun with fine screen type roll up sunshade on upper front, side and rear windows which have characteristics to allow vision through it. Window glass shall be scratch resistant meeting the requirements of BS6206 class A safety glass with both surfaces being flat, parallel, and fine polished, giving clear undistorted vision. The front and bottom window shall be laid out symmetrically about the Crane centreline in left and right direction. Operator Cab access shall be from a hinged door on one side of the cab. The door shall be self-closing, with a latch to keep the door in the open position

Cabin must be equipped at least with:

- Electrically operated wipers and washers to ensure the view angle required for operation on front, bottom, left and right window.
- Communication equipment – preferred Motorola DM 4600E UHF low power – outside antenna (channel spacing 12,5/25kHz, range 430/470MHz)
- Internal lightning
- Interactive operator's panel, for displaying crane data and for control functions.
- Armchair with all commands and linear joystick (increase without steps), layout of buttons and joystick must be the same as we have on existing cranes
- Air conditioning (industrial type – electrically integrated to crane PLC)
- Support for data terminal – holder (power supply DC 24V and 12V)
- Coat hook
- Electrical heater (min 1000 Watts)
- Container load indicator – numeric on operator panel
- Waste bin
- Fire extinguisher
- Vacuum cleaner
- Signal horn
- Anemometer for wind speed – Thiese or equivalent approved by buyer
- Second foldable training seat
- Radio with MP3/USB player and stereo speakers
- Sun blinds
- Floor panel – spreader lights status
- Tinted anti-glare safety glass on front and side windows.

## **2.14. LUBRICATION**

All the moving parts shall be effectively lubricated. Details of lubrication system to be included in offer package.

Unless approved by the Purchaser, the lubrication points shall be fitted in reasonable groups, to a group battery plate mounted in a convenient position with the nipples etc.

Filling and drainage arrangements of all reducers shall be easily accessible from the fixed platforms.

At manual lubrication points it must be possible to carry out lubrication from a gangway, stairway or landing without removing the guard or inserting the hand into the guarding. Access to all lubrication points must be possible without harness.

All the lubricants specified by the Contractor shall be locally available in the country of operation and manufactured to the latest appropriate API service classifications. The lubricants initially filled in manufacturer's shops shall be pre-approved by the Purchaser for their compatibilities with those lubricants

used by the Purchaser. Type of lubricants must be specified by manufacturers. It must be allowed to use 3rd party supplier of lubricants.

Any excess lubricant shall be trapped in removable trays or receivers accessible for cleaning.

All grease points shall be clearly indicated, and colour coded in order that all grease points requiring the same lubricant can be readily identifiable.

### **2.15. SPREADER & HEADBLOCK**

The telescopic spreader shall be designed to meet the heavy demands of the container handling industry, rated spreader capacity 41t. All motions of the spreader including telescopic movement shall be controlled from the operator's cabin. The spreaders shall be capable of picking up ISO 20' and 40' containers. The spreader shall be designed to handle the rated load of the mentioned containers.

The spreader shall be connected to the head block by manually released **twistlocks**.

All motions of the spreader shall be electrically actuated.

Spreader is to be equipped with light indicator for twistlock open/close and spreader landing indication. Indicator must be well visible from operator cabin.

Twist locks shall be ISO "floating" type.

Twist locks shall be floating type and fitted with sleeve type twist lock guides. Greasing nipples shall be fitted suitable positions on the sleeve guide so that grease can be injected into the sleeve for lubrication between the sleeve and twist lock shank.

Spreader must be fully electric and have four separately operating electrical corner flippers. All the electrical parts shall be protected from the weather.

The spreader shall be 'All Electric' type with no hydraulic power. The main electrical panel shall be stainless steel, NEMA 4X standard easily accessible and provided with hinged door and robust 'stay'.

The crane shall be provided with a mechanism to skew and trim the spreader about vertical axis minimum  $\pm 5^\circ$ . This mechanism shall be provided with an automatic centering function. Crane shall be also provided with anti-sway system and fine positioning (please see below chapter).

The head block shall consist of a structural frame with hoist blocks and sheaves which are permanently reeved into the main hoist.

All mechanical, and electrical components fitted on the spreader shall be protected from frequent impact and vibration of operation. All related fasteners shall be anti-loosening type.

Design of connections shall be submitted to the Purchaser.

A cable basket shall be mounted on the head block to store the spreader supply cable when hoisting and lowering takes place.

LED indicating lights shall be fitted to the upper section of the main frame or on the head-block. The lights shall be clearly visible in all lighting conditions and shall be unobstructed from the operator's field of vision. The lights shall follow the colour code:

- Yellow – Landed
- Red – Twistlock Unlocked
- Green – Twistlock Locked

## **2.16. ANTI-SWAY SYSTEM AND FINE POSITIONING**

The Crane shall be provided with electrical anti-sway dampening.

Anti-sway system shall function independently without moving trolley or gantry motions. System prevents the sway of container, not only stopping the start of swaying.

Control of the lifting beam and lifted container against swaying during loading and unloading operations shall be accomplished electrically. Particular attention shall be given to prevention of skew while trolleying and hoisting simultaneously. Load shall not make more than two complete oscillations from center line before oscillation is brought to a virtual rest (within capture ability of spreader gathering arms).

The anti-sway system shall be capable of damping the spreader after the trolley and gantry has stopped with full deceleration at any operational speed with any operational load, to within 150mm of lateral displacement after 2.5 cycles of sway, without any additional trolley and gantry movement for dampening the spreader. The same criteria will apply to the yawing motion following the trolley stopping from any operational speed with full deceleration, or after the end of the skew motion command. The system shall meet the above criteria measured at the spreader in the 40' position between 4.5 meters above the ground level.

## **2.17. SAFETY GUARDS**

Guards shall be provided to machinery wherever necessary for the protection of personnel. These guards shall be designed so that they can be removed to permit maintenance and overhaul of the equipment without interference with other parts of the E-RTG.

## **2.18. FIRE EXTINGUISHERS AND FIRE SUPPRESSION SYSTEM**

At least 5 fire extinguishers must be provided in the following locations:

- (1) inside operator's cabin
- (1) in electrical room
- (1) on traverse trolley platform
- (2) at ground level (one close to the battery pack and one at the opposite sill beam)

Only extinguishers suitable for and marked as being suitable for dealing with fires in electrical equipment shall be located close to such apparatus.

All fire extinguishers shall be placed in a properly designed holder so that they are firmly secured and easily accessible.

Electric room must be equipped with fire suppression system. The system must work on gas which is not leaving residue.

### **2.19. ANTI-COLLISION AND VIDEO CAMERAS**

An anti-collision system shall be provided to prevent collision between E-RTG's working on the same track, and collision with objects on the tracks.

The system shall be designed to automatically prevent damage if the E-RTG is travelling into possible collision situation.

Laser sensors should be installed to avoid accidents or collisions with external elements or persons during gantry driving.

Digital cameras shall be installed at the four corners, directed along the runways to provide visibility of runway obstructions. A monitor in the cabin shall provide a split-screen view of the two cameras pointed in the direction of travel when the gantry drives are energized.

Four mechanical limit switches should be installed at the internal side of the gantry to prevent collisions with containers and tracks.

Additionally, two cameras installed at sill beam and camera monitor in cabin are to be provided to give view for the operator on truck lane operations.

### **2.20. BALANCE OF THE CRANE**

Transformer house and the electrical house shall be in the opposite of the truck lane side (=access side) of the E-RTG providing optimal weight distribution. Full size Generator set shall be located under the truck lane side sill beam.

Wheel loads, stability analysis and duty-cycle calculations showing the weight distribution during normal crane operation shall be submitted with the offer.

### **2.21. MAINTENANCE HOIST**

An electric maintenance hoist with capacity at least 500kg mounted on a manual swivel jib is required on the trolley platform.

The hoist must raise each electromotor mounted on the trolley platform.

### **2.22. CRANE IDENTIFICATION NUMBERS**

Crane identification number with required dimensions should be installed on the top of the crane both sides. As well around the four corners, additional labels should be installed to be able identification from the floor level.

Customer logo shall be installed on outside of both main girders, Logo size and colour to be provided and approved by customer.

## **3. STRUCTURAL SPECIFICATION**

### **3.1. DESIGN - GENERAL**

Configuration of the structural steelwork shall meet the stated dimensional characteristics. The structural design shall consider the most adverse loading combinations at rated capacity, maximum hoist, trolley, and gantry speeds, simultaneous operations with 100% speeds shall be considered.

Structural calculations shall be prepared using S.I. Units.

The calculations shall be based on the various conditions of the E-RTG working loads, superimposed loads, fatigue loads, inertia loads and wind loads, in conjunction with the dead loads on the structure.

The structural design shall consider the stiffness (sway) of the E-RTG and relative deflection of main structural components. The design shall minimize sway in the trolley and gantry travel directions and its effect on the operator under normal operating and E-stop conditions.

### **3.2. WIND LOADING**

The operating and out-of-service wind pressure shall be as noted herein and applied based on F.E.M. 1.001 3rd Ed. requirements.

The entire Crane structure with all of its machineries, components, fittings, or accessories shall be designed and constructed to withstand following wind loading conditions:

- For Operation: Allow for wind loading of sustained wind speed of 25 m/s for safe load handling operation of the crane.
- For the stowed condition of the crane: A wind loading of wind speed up to 44 m/s shall be allowed for the condition that the crane is out of service and stationary without any tie downs and wheels chocked. The Stability Safety Factor under this condition shall meet FEM requirements.

### **3.3. FATIGUE LOADING**

The structure shall be designed for the maximum fatigue conditions which can occur based on the eccentric load conditions of all possible combinations under the spreader beam with 41 t below the spreader in accordance with F.E.M. 1.001 3<sup>rd</sup> Ed requirements. The Supplier shall provide with the offer the proposed E-RTG load spectrum based upon 2.000.000 cycles.

For fatigue load design 30t concentric load, including impact effects shall be considered and the impact factor is 1.15 for calculation of structures and mechanisms.

### **3.4. ECCENTRIC LOADING**

The design of the E-RTG shall consider an eccentric load of 41t under the spreader beam, with a maximum eccentricity of 1.22m longitudinally (gantry direction) and 0.3m transversely (trolley direction) measured from the plan centre of the container.

The eccentricity of the container shall not cause any horizontal drift of the container during hoisting/lowering motion.

### **3.5. CRANE GANTRY STRUCTURES AND TROLLEY RAIL**

Main girders, legs and connection beams shall be of fabricated box construction. Material used for structural stiffeners shall be the same material as the plate to which it is attached.

All exterior welds in the main structure shall be continuous seal welds.

The connections between the legs and main girder beams are of bolted type. Pin joints are preferred between the legs and sill beams. Bolted joint design shall conform to the FEM. All bolted joints shall have the threads excluded from the shear planes.

The minimum thickness for load carrying structural plates, angles, flat bars and rolled sections shall be 8mm, including platform supports.

The crane structure is to be constructed such that water pockets are not formed in any member or at the intersection of members, and there are no unsealed blind areas where paint cannot be applied. Adequate drainage holes are to be provided where there is a tendency for water to collect.

The trolley rails shall be accurately aligned according to the requirements of F.E.M. 1.001 3rd Ed.

Rails shall be welded type on the upper flange of both main girder beams.

Access from the operator's cabin to the girder sections shall be such that it offers the operator alternative safe access to the operator's cabin at any position of trolley travel.

### **3.6. STAIRS, ACCESS PLATFORMS AND LADDERS**

All stairs, ladders, rungs and platforms have to meet EN 13586 crane access standard and F.E.M. rules.

All stairs, ladders, rungs and platforms must be hot dip galvanized.

Access to the cabin from the ground level shall be by ladder to the sill beam level followed by a stairway where the cabin platform and the final platform shall be at the same level.

Walkways, stairways and platforms shall be designed to avoid tripping, skidding, ducking or crawling. Clear headroom of 2.1m shall be maintained throughout the walkways, stairways and platforms. Special non-skidding treatment shall be applied for flat structural surface if used as walkways.

If parts of Walkways, Platforms, ladders, movable and foldable pieces could obstruct moving parts or surroundings (e.g. the trolley travelling path) then they should be monitored by a limit switch and interlocked with the drive.

Walkways, stairways and platforms shall be designed without need of harness.

Stairs shall be provided to allow ample and safe access to all sheaves, pins, wheels, carriers, ropes, machineries, switches and control equipment, etc., where preventive maintenance is necessary. At least 0,6m clear passage around any machinery shall be provided.

The height of handrails shall be 1,1m and an intermediate rail height 0,6m for a level walkway. The height shall be increased as necessary to ensure safety of passage. The handrail shall be constructed with pipe, all



welded joints finished smooth to same diameter as the pipe, and continuous along walkways platforms and stairways. Adequate safety straps or bars shall be installed between the lowest safety hoop of a vertical ladder and handrail for landing wherever there is a wide clearance which may allow a person to fall.

On the side of cable reel and electric house the crane must be equipped with emergency ladder from the top of sill beam to the roof of electric house.

### **3.7. DEFORMATIONS**

Deformations of the structure must be limited in such a way that there is no influence on travelling of the E-RTG; wear of the tyres shall not be unequal.

Deformation of members supporting mechanisms may not have an influence on the lifetime of the relevant mechanism.

## **4. ELECTRICAL SPECIFICATION**

### **4.1. SCOPE OF ELECTRICAL WORKS**

The contract includes the provision of cable reel type electric power supply, battery pack, all electrical systems, equipment, controls, materials, works and things of all kinds, as necessary for efficient completion, safe operation, and minimal maintenance.

### **4.2. GENERAL**

All electrical equipment used on the E-RTG shall be of current design and will be selected to meet the arduous conditions imposed by all-weather marine environment.

All drives, control equipment and wiring installations shall be adequately rated to meet the duties imposed by the specified operating parameters. Protection against overloads, malfunction or misuse shall be provided.

Particular attention shall be made to the safety and comfort of operating and maintenance personnel and to the ease of access to all parts requiring routine servicing by maintenance personnel.

Where possible and practicable, units requiring removal for maintenance will be designed on a modular or "plug-in" basis.

### **Main Power Equipment**

The main power drives, hoist, trolley and gantry travel shall be powered by cable reel.

The drive-in system shall be supplied complete with the cable reel unit.

Cable reel supply voltage is 1000V, 3 phase, 50Hz, TN-C and the travel distance for the crane +/- 250 meters (if possible +/-275m).

The cranes shall be equipped with manual plugin system so that the cable plug can be manually connected and disconnected when changing the stack.

Electrical devices shall be installed as required by applicable IEC and EN codes.

As back up for operations, gantry travel between stacks and for maintenance purposes, a battery pack system shall be provided.

#### **4.3. MAIN CONTROL EQUIPMENT**

Main control equipment shall be fully digital, microprocessor based and programmable.

The control system shall include, but not necessarily limited to, the following:

Main control:

- Fully digital, microprocessor based, programmable control.
- PLC for all sequencing and interlocking functions. Emergency protection functions shall be hard-wired.
- User-friendly status monitoring and fault diagnostic systems. Displays shall be provided in operator's cabin and in electrical equipment house.

Main drives (Hoist, Gantry, Trolley and Slewing):

- Digital frequency inverters for adjustable (4-quadrant) speed AC-drive: Siemens or equivalent
- Vector control with speed feedback in each drive
- Solid state controllers for regenerative braking resistor systems

Providers shall clearly specify the number of inverters used in their design.

The frequency inverters for the control of the main drives, braking units, control relays, protection and distribution equipment shall be housed in an insulated, fabricated walk-in type electrical equipment house.

Inverters shall be designed for control of hoist, gantry, trolley and slewing motions.

With Cable reel supply operation mode, the generated electricity during descending action of the crane the braking energy shall be fed back into the supply system. When the crane is operated in battery pack, the braking energy is supplied to braking resistor banks located on the crane. When the power source is the battery pack, a signal will be sent from the switchgear to the crane in order to use this resistor.

#### **4.4. MAIN DRIVE SYSTEM**

##### **Main Hoist Mechanism**

The hoist drive motion shall be driven by an AC motor, the speed of which shall be controlled by a frequency inverter. The controller shall allow the motor to run above base speed under light load conditions.

Drives shall be vector controlled with speed feedback by digital pulse encoders.

Deceleration shall be achieved by re-generative braking which slows down the drive to almost standstill condition prior to the holding brake being applied.

##### **Trolley Travel Mechanism**

The trolley travel mechanism motion shall be driven by an AC motor using a separate frequency inverter and control principle similar to that used on the hoist motion. Acceleration and deceleration shall be further controlled by processing the inverter control signals such as to introduce a ramp function.

Limits of travel shall be controlled by slow down and stop limit switches.

#### **4.5. LIMIT SWITCHES**

##### **General**

Limit switches shall be utilized for safety over-travel applications and shall be easily and quickly accessible for adjustment and maintenance. All limit switches shall be mounted on a uni-strut (C-rail) – non-corrosive material.

Special attention is drawn to the twist lock ‘Locked’ and ‘Unlocked’ signals from the proximity switches, which shall be ‘fail-to-safe’. In order to avoid damage to the spreader and the container by lifting one end only, the proximity switches for ‘Locked’ and ‘Unlocked’ signal shall be individually connected to the PLC through an I/O module. When the PLC detects a short-circuited proximity switch on ‘Locked’ or ‘Unlocked’ the hoisting motion shall be immediately stopped. Further motion will be restricted to lowering only.

Alternatively, lever type limit switches may be used, two locked in series and two unlocked signals in series (NC-contact) wire to PLC.

##### **Hoist Motion**

The hoist motion shall incorporate the following safety functions:

- overhoist limit switch (up and down)
- hoist limit switch (up and down)
- overspeed protection
- overload protection

PLC shall be used to “smart” slowdown the hoist to up position and to down position. The intention of the limit switches shall be to ensure safe operation.

##### **Trolley Traverse Motion**

The trolley traverse motion shall incorporate a slow and stop limit switches for the extremes of travel. The deceleration and limits of travel shall be controlled by limit switches located on the trolley. PLC shall be used to “smart” slowdown the trolley at both ends of travel. The intention of the limit switches shall be to ensure safe operation. Absolute position encoder must be installed.

#### **4.6. ELECTRICAL HOUSE**

The power supply, PLC and control gear are housed in a totally enclosed weatherproof, thermally insulated (floor, walls and roof), floor electrically insulated, air-conditioned and heated walk-in electrical house. All electrical equipment inside electrical house is preferred to be installed in an open frame (IP00), provided with touch guards as necessary or main drives shall be located in closed cabinets with openable hinged doors.

The frame of the electrical room is of steel construction.

The electrical house is mounted on the sill beam at the same side as the transformer room.

A hinged, outward opening, steel door of weatherproof construction shall be provided at one end of the electrical house for general access, fitted with heavy duty door handle and padlock. The top of the door shall be provided with glass window. A drip list is to be provided over the door.

One tinted safety glass window shall be provided in long side of the house to provide clear sight of the trolley, spreader and opposite side gantry bogies as well as to give natural lighting inside the house.

The electrical house is air conditioned to enable a temperature of 25-30 degrees C to be maintained at the specified ambient temperatures and relative humidity. In case of overheat, alarm for the operator must be provided.

#### **4.7. MOTORS**

All exterior mounted motors shall have IP55 ratings. Main drive motors shall be AC squirrel cage motors. All motors shall be fitted with anti-condensation heaters and excess temperature detection.

Motors must be sized both for peak torque, duty cycle requirements and according to FEM 3rd edition, booklet 5 – Electrical Equipment. The minimum rating and duty of the motors must be designated according to IEC 34-1 standard.

All motors must be special designed and constructed for outdoor use in marine salt laden air environment.

All motors must be designed and build to prevent water intrusion into the motors and on the other hand to allow moisture to come out of the motors.

The motors must be powered through inverters. The thermal rating of the motors must be suitable for continuous container handling operation.

#### **4.8. FIXED CABLE SYSTEMS**

All cables shall be of a type suitable for their location and adequate in rating and other electrical and mechanical characteristics for the duty expected of them.

The wiring size will be based on EN regulations.

The Contractor shall ensure that all heavy current low voltage power cables are sized to include suitable de-rating for the temperature and space factor. The mixing of control wires and power wires shall not be acceptable.

All the wires shall be run in trunking, conduit or stainless steel or hot dip galvanized cable trays with cover except those wires used in moving application. Any other way of protection shall be approved by buyer. Excess / slack cables shall be provided at all bend points of the cable installation to allow for expansion / contraction of the cable trays. All the wire run through holes and openings of structure shall be protected from insulation damages due to mechanical contact with structures. Control and signal wires (including encoder cables) shall be separated from power wires and routed through flexible conduit to avoid any

interference causing false signals. Multi-core cables may be run on cable trays or raceways with adequate cable clamps, and covered with sunshield and mechanical protection covers.

All conductors shall be numbered with numbers or colour coded.

Cable cores must be terminated with appropriate purpose made lugs and fixtures and identified with purpose made isolated ferrules. Each wire shall be fitted with terminal lugs and marked at both ends with ferrule with number corresponding to the number in schematic diagram.

All cables shall be permanently marked or numbered to agree with the cable schedules and circuit diagrams and conductors' sizes shall be adequately rated for their intended duty and protection devices, all wiring and electrical practices shall be to European Wiring Regulations or other internationally recognised Standards.

Wiring on the trolley, head-block and spreader shall be designed to withstand continuous vibration and impact.

#### **4.9. ENERGY CHAIN AND SPREADER CABLE**

##### **Energy Chain**

Supplies to the moving trolley shall be by energy chain system so positioned to avoid contact with the E-RTG structure and trolley under any circumstance. Acceptable suppliers for the energy chain system is Igus.

There shall be a minimum number of cable sizes and 10% of cores.

Energy chain must be equipped with fiber optics.

##### **Spreader cable**

Supplies of the spreader shall be by means of a multi core cable arranged to coil and uncoil in a cable tub in accordance with the cable manufacturer's specifications. A minimum of 10% spare cores shall be provided. The cable provided must be suitable for operation in design operating wind conditions.

The spreader cable must be equipped with fiber optics.

#### **4.10. OPERATORS CONTROLS**

The controls shall be arranged to enable the operator to always maintain efficient and safe control through a joystick controller and conveniently placed levers and selector switches.

Step less control shall be provided in each direction from the joystick controller and movement to a central position shall give a neutral condition to all circuits. A mushroom head emergency stop button shall be provided in the operator's console so connected to stop all motions.

The general arrangement of the operator's controls shall be to the approval of the Purchaser.

#### **4.11. MISCELLANEOUS ELECTRICAL EQUIPMENT**

Load indication system shall be provided in operator's panel in the cabin.

Audible alarms Brigade BBS 107 white sound smart reversing alarm and flashing yellow LED lights shall be installed at all four corners of the E-RTG to operate whenever the gantry motion is in use.

A loudspeaker system between the cabin and the roadside sill beam shall be provided.

Auxiliary power supply sockets 230V AC should be available at the cabin.

Purchaser communication system and operations computer terminal will be installed at the cabin, auxiliary power supply 24V DC and 12 V DC. Provisions for mounting shall be available for such equipment.

#### **4.12. EMERGENCY STOPS**

Emergency stop buttons shall be provided where necessary to shut the E-RTG down and set all mechanical brakes to safeguard personnel and protect the E-RTG. As a minimum this should include the trolley, the electrical house, operator's console, both sides of the E-RTG at ground level, cable reel system, and at the Genset.

#### **4.13. LIGHTING**

Lighting system for the E-RTG shall be designed to provide sufficient illumination to all work areas (min 100 Lux) of the E-RTG. Preferred producer is Nanhua, Phoenix or equivalent approved by buyer. The colour temperature must be maximum 3000K, CRI $\geq$ 80, IP65. All the lighting system must be in accordance with the regulation of light pollution in Slovenia.

E-RTG lighting shall consists of LED floodlights (150/300 Watts) mounted to the main girder sections and trolley, plus to the driver's cabin and general lighting of the walkways and access providing at least 100 Lux on ground level under E-RTG.

For maintenance purposes all light fittings shall be fully accessible from walkways or access platforms.

Light switches shall be gathered in several convenient locations to allow centralized control. Two (2) - On-off control switches for all the operational lights and walkway lights shall be located at near the panel house where close to the operator's passage and in operator's cab to allow switching from either location.

#### **4.14. PLC AND CRANE MANAGEMENT SYSTEM (CMS)**

Programmable Logic Controller (PLC) shall be used to perform the logic function on the E-RTG. Major drive controls for main hoist, trolley traverse and gantry travel shall be full digital control and performed by PLC.

PLC and control system

- Access to PLC source code must be provided
- Logging of Messages for lifetime
- Logging of each Overload with weight and drive positions for lifetime
- Should there be a Load counter / Fatigue monitoring
- Black Box / Trace tool / Post mortem analysis tool
- Supply of Service / Programming laptop with all required **SW with** licences

- PC Keyboards must be Slovenian language

Crane Management System computer (CMS) shall be installed in electrical house on the E-RTG working in conjunction with the PLC. This shall provide continuous monitoring, diagnostics, data collection and alarm history on the crane. Displays for monitoring and diagnostics shall be provided in operator's cabin.

All texts appearing in operator's displays should be written in local language (Slovenia) and English (operator can choose which language he will use). Modification and redesigns of the operator messages and screens will be adequate to the understandable level of operators after commissioning period.

Following functionalities and data shall be available in operator's panel in the cabin:

- General information and status of the cranes
  - Weight of the load
  - Distance of spreader from ground level
  - Position of the trolley; distance from the parking position or relative distance from any given position
  - Spreader trim
  - Spreader skew position and fine positioning status
  - Drive status (may also be in CMS in the E-House)
- Instructions to operators
- Event, Alarm and fault messages
- Maintenance and service information interface
- Information of production (moved containers...) (may also be in TOS/CMS)
- Bypass functionalities (Bypass is password protected) (may also be in CMS in the E-House)
  - Hoist load cells
  - Hoist Overload
  - Limit switches (Trolley gates, Ladders, Shore power)
  - Anti-collision – laser scanners in front of the bogies.
  - Motors (gantry and trolley) – brake supervision
  - Bogie encoders

CMS computer in the E-room must have following functionalities:

- All functionalities from operators panel in the cabin
- Installed all necessary Software with the licenses for monitoring and programming all equipment installed on E-RTG (PLC, frequency inverters...)
- On CMS computer all alarms, events and bypasses must be recorded.
- CMS computer must have the possibility to check the history of all alarms, event and bypasses.
- CMS computer must have the reporting functionality including.
  - Energy measurement
  - Maintenance and production counters
  - All energy measurement data from RCMS shall be saved in SQL database and integrated in the energy efficiency system ENIS of Port of Koper

#### **4.15. REMOTE CRANE MANAGEMENT SYSTEM (RCMS)**

Remote crane management system shall be included, installed in office building with online connection to E-RTG.

Remote CMS shall have overall terminal map view and crane locations are shown in this map. Individual crane CMS can be accessed thru the RCMS.

Remote CMS shall have same functionalities and reporting available as in on-board CMS. Also following functionalities must be included:

- crane statistic (working hours, number of containers picked up and down, energy consumption...)
- creating reports for different time and date and different criteria like energy consumption, number of containers...
- all this data must be stored and available on RCMS also if E-RTG is not working.

#### **4.16. AUTO STEERING, AUTO STOP AND CONTAINER POSITIONING SYSTEM**

Automatic gantry steering system shall be provided with each RTG. The system shall eliminate the need for the operator to steer the machine: however, the system shall allow the operator to "take over" the controls as he may require. The system shall require no ground civil works and shall guarantee a maximum  $\pm 10$  cm lateral deviation from the runway axis with automatic shutdown occurring at predetermined distance from the runway axis.

A Container position detecting system shall be provided. The system shall be capable of detecting gantry, trolley and spreader positions accurately in order to support establishment of container location with a maximum error of  $\pm 15$  cm when spreader twistlocks are activated. It shall also be able to interface the Tideworks TOS system.

An autostop system shall be provided. The system shall be capable of stopping the gantry and/or trolley position accurately in order to eliminate the need for the operator to move back and forth for final positioning. It shall also be able to interface the Tideworks TOS system.

The autosteering, autostop and container positioning system shall be fully compatible with terminal existing system.

#### **4.17. STACK COLLISION PREVENTION SYSTEM**

Stack collision prevention system shall be provided to reduce the risk of collision with containers. The system shall constantly monitor the distance between the spreader and the stacked containers in the direction of trolley movement. When the distance between the trolley and the container stack goes below a predefined safe distance, the E-RTG will reduce the trolley speed to try to avoid the collision.

Laser scanners shall be installed on the trolley, and they constantly read the stack profile as the trolley moves. The system shall detect both 20ft, 40ft and 45ft containers in the same stack. The stack collision prevention system must be approved by buyer.

### **5. MANUFACTURING, TESTING AND ACCEPTANCE**

#### **5.1. PROJECT PROGRAM**

Supplier shall submit complete project management program covering all aspects of design, manufacturing and quality assurance programs of the parts and the full project. Project program shall indicate details of work breakdown.



Bidders shall submit all copies of their ISO-9001 or equivalent certificates of the facility in which the proposed E-RTG's shall be fabricated, manufactured, assembled and tested.

### **5.2. INSPECTION AND TESTING DURING MANUFACTURE**

The tests to be carried out during manufacture shall be in accordance with the requirements of the manufacturer, relevant F.E.M. Statutory requirements and approved by the Purchaser.

### **5.3. MATERIAL**

The whole of the materials and articles incorporated in the Work shall be new and unused and to the satisfaction of the Purchaser. All materials shall be of current design and of recent manufacture.

The Supplier shall maintain material traceability for all structural members from the mill source through all manufacturing processes. Original mill test reports, showing conformance to all specified requirements, shall be furnished for all material.

Materials will be chosen in accordance with the specifications and the relevant rules of FEM.

Material used for structural stiffeners shall be the same material as the plate to which it is attached.

The minimum thickness for load carrying structural plates, angles, flat bars and rolled sections shall be 8mm, including platform supports.

### **5.4. STANDARD SPECIFICATION**

Unless otherwise specified herein, any materials or articles to which F.E.M. 1.001 3rd Ed. specifications can apply shall be supplied in accordance with the provisions of all such standards and their addenda and any modifications thereof.

### **5.5. PLATES BARS AND CASTINGS**

All plates, bars and sections shall be well and cleanly rolled to the full sections, free from cracks, surface flaws, laminations, roughness and other defects. All forgings and castings shall be sound, clean, fair, and free from flaws and blowholes. All steel castings shall be properly annealed.

### **5.6. DESCRIPTIVE PLATES**

All description plates attached to the E-RTG's shall be written in Slovenian language.

In addition to the description plates, E-RTG's shall carry all plates and indications as requested by the CE Machinery Directive.

### **5.7. WELDING**

All welding shall be carried out by qualified welders EN 287-1, AWS D1.1 or other Purchaser approved welding codes.

All welders shall be EN or AWS certified by an independent testing laboratory for the material, process and type of weld being performed. Copies of the testing procedures, welders' qualification certificates and welding procedures shall be made available to the Purchaser on demand.

Welds installed using unqualified procedures or welding performed by non-certified welders will be subject to removal at the Supplier's expense.

All welds shall be of sound construction and of the dimensions shown on the drawings or specified. They shall be free from porosity, slag inclusions, undercutting and other defects and shall be of clean and regular appearance throughout, and the execution shall be such as to ensure that the parts connected are properly aligned and positioned, free from distortion and so fixed together as to produce a homogeneous section of the correct dimensions.

### **5.8. NON-DESTRUCTIVE TESTING OF WELDS**

The Supplier shall be responsible for carrying out of non-destructive testing of welds on completed members and joints per the applicable EN, AWS or other Purchaser approved welding codes for dynamically loaded structures.

All welding deficiencies shall be repaired per the applicable welding codes for dynamically loaded structures.

### **5.9. PROTECTIVE COATS**

The Protective coats procedure to be carried out in accordance standard SIS 05 59 00 -1967, with the requirements of the manufacturer, statutory requirements and approved by the Purchaser with following criteria.

The work includes the requirements to provide the coating with all pre-finishing work, accessories, auxiliary materials, and equipment required to finish the surfaces.

Metallic surfaces of the Crane shall be painted or corrosion protected except for nameplates, marine corrosion-resistant stainless steel and wearing or internal surfaces of mechanical parts.

#### **Exterior paint system - exterior surfaces**

Coat	Type	Thickness
First Coat	Zinc Rich Epoxy	40my - 60my
Intermediate Coat	Epoxy Primer	140my -150my
Third Coat	Polyurethane paint	50my - 70my
Total dry film thickness (nominal)		Min. 250my

#### **Sealed members**

Interior surfaces of sealed members will not be painted.

#### **Surface treatment of walkways, ladders and platforms**

All walkways, ladders and platforms will be hot dipped galvanized. The galvanization must be done according to ISO 1461.

**Standard buyout components**

For standard buyout components, the manufacturer's standard paint system will be used, if he can demonstrate that the paint system used is compatible with the specified marine environment.

**Field painting**

Field painting shall consist of touch-up work only. Special attention need to be given to areas where burning or welding has damaged the shop paint. Areas requiring touch-up will be those scuffed, chipped, burned, or otherwise damaged during shop disassembly, shipping and field assembly. Paint will be feathered to blend colour and will match without noticeable difference in shade.

**5.10. COMMISSIONING TESTS AND REPORTS**

The Supplier shall carry out at the Purchaser's site full commissioning tests to verify that the E-RTG's are fit to operate. These tests, shall include, but not be limited to the following:

The testing procedure is be approved and monitored by the Purchaser:

- pre-operational inspection and testing
- No-load operation and testing
- Load testing
- Endurance Test

After the above tests are completed, the E-RTG shall be put into intensive use in actual container operation or in simulation with E-RTG handling rated load for a continuous period of 8 hours. Entire test shall be breakdown free where the operator or a technician is not called upon to reset any fault.

**Reports**

Accurate and complete reports of all testing shall be prepared. Such reports shall record all the information checked during the test.

**5.11. TEST RESULTS**

All results recorded during the testing shall be collated and put into a form of protocol

**5.12. TESTS REQUIRED BY LOCAL STATUTORY BODIES**

Supplier shall familiarise itself with the requirements of local crane regulations. Supplier shall provide details of tests carried out to satisfy such requirements.

**5.13. SUBMISSION OF TECHNICAL DATA****5.13.1. DRAWINGS**

The following drawings, calculations and data shall be provided by the Supplier for approval by the Purchaser.

General arrangement drawings of subassemblies

- steel structures
- trolley
- bogies

- all mechanisms
- head block
- spreader
- Layout drawings
- operator's cab
- electrical equipment room
- diesel alternator and enclosure
- walkways and platforms
- lubrication points
- Rope diagram
- Nameplates
- Assembly drawings
- Drawings showing clearances and wheel loadings
- Electrical drawings
  - electrical equipment layout drawings
  - circuit diagrams, wiring diagrams and schematic diagrams including interconnecting diagrams for all equipment
  - drawings of cabling
  - layout drawings of electrical equipment in the operator's cab, electrical room, diesel alternator enclosure, trolley, gantry and bogies, including the routing of all cables
  - limit switches and miscellaneous electrical devices
  - PLC documentation

The information supplied shall, when read in conjunction with the maintenance manuals, enable the technician to undertake all necessary repairs, disassembly, reassembly, fault finding procedures and any other maintenance or repair procedures to be undertaken without reference to further documentation.

#### 5.13.2. PROJECT SCHEDULE

The program to be submitted shall be structured in such form and detail as to enable the Buyer to monitor the progress of the delivery project of the E-RTG. The program shall show in detail each manufacturing and erection operation related to a Contract calendar.

#### 5.13.3. OPERATING AND MAINTENANCE MANUALS

Operator manual is to be established in Slovenian and English language and Maintenance manual in English language. One copy shall be provided with each E-RTG.

Operating Manual shall detail step by step all actions necessary to place the E-RTG into operation. Where necessary illustrated drawings and photographs shall be shown.

The Maintenance Manual shall clearly specify each and every recommended routine maintenance procedure set either against a daily, weekly or monthly time basis or set against actual operational time as measured by the "hours-run" meters.

A comprehensive lubrication program shall be included in the Maintenance Manual. The number of different lubricants shall be kept to a practical minimum and shall, if possible, be restricted to the products of a single manufacturer. Details of alternative equivalent lubricants from at least two other manufacturers shall be given.

Both the Operating and the Maintenance Manuals shall give due regard to correct procedures and shall place full emphasis on all aspects of safety.

Maintenance instructions for electrical fault diagnosis and correction shall include block diagrams, signal flow charts to enable a fault in an inverter or associated control system to be rapidly traced to a replaceable component or sub-assembly.

Each Manual shall contain a fully detailed up-to-date spare parts list complete with ordering references or as a separate spare part catalogue.

One copy of each manual shall be provided with each E-RTG.

#### **5.14. OPERATOR AND MAINTENANCE TRAINING**

After the E-RTG's are delivered at Supplier's site and are being commissioned, there will be a training period for the Purchaser's maintenance and operating personnel. The program for this training will be drawn up by the Supplier and approved by the Purchaser.

During this training period the personnel shall be instructed in all aspects of maintenance and fault finding procedures. The use of any special purpose tools, equipment, analytical or programming accessories shall be fully explained and demonstrated.

Special training time shall be scheduled for the PLC system.

The driver's instructions will include all instructions, directions, and explanations to ensure a proper and safe utilisation of the machines during operations.

Bidders are required to provide with their bid submission their planned program for training indicating clearly duration for training for each topic and expertise of the trainer.

#### **5.15. WARRANTY DURING THE DEFECTS LIABILITY PERIOD**

Warranty period on all components shall not be as follows:

- General (Mech. and Elec.) – Min 2 years
- Steel structure – Min 5 years
- Coating System – Min 8 years

During the Defects Liability period, the Purchaser requires the Supplier to carry out warranty repairs, free of all charges, by competent personnel.

Bidders shall detail how they plan to cover their obligations under the warranty clause. It is expected that Bidders will have experienced personnel from their own plant based at the vicinity of the Site during the warranty.

#### **5.16. CRITICAL SPARE PARTS LIST**

The bidder shall provide a critical spare parts list with prices for eventual delivery together with the E-RTG's

## **6. DELIVERY TO SITE**

Bidders are to quote for the units to be delivered in dismantled units with erection and commissioning on site or fully erected method.

Thirty days prior to shipment from the manufacturing site, the Supplier shall submit to the Purchaser for approval his requirements for unloading, commissioning and storage areas and full details of any lifting gear, loads and procedures to be used; the data shall be entirely sufficient for the Purchaser to check all out rigger, wheel or other loads to be imposed on the surface.

In case of fully erected shipment satisfactory pretesting to be carried out at supplier's erection premises. Notice for pretesting shall be send to Purchaser thirty days prior testing.

## **7. FINAL SITE**

### **7.1. SUPPLIER'S AREA**

Materials, temporary structures or Supplier's equipment shall not be placed elsewhere, other than the allocated area. The Supplier shall include with the Offer, the required area and schedule for offloading, final assembly and commissioning of the E-RTG's.

### **7.2. SITE OFFICE**

The Supplier shall, for his own account, arrange the Site office for his engineers and /or representative(s) to carry out the work as well as power and water supplies.

### **7.3. ELECTRICITY SUPPLY**

All temporary electricity supply installations shall be installed by the Supplier and in accordance with the requirements of the Purchaser.

The Supplier shall comply with the provisions of local electrical statutory regulations.

### **7.4. SITE WORKING CONDITIONS**

Any spoil and debris from the Works shall be removed by the Supplier. The Supplier shall comply with the Purchaser's requirements and the local regulations.

The Supplier shall ensure that his work area is kept clean and orderly.

### **7.5. RULES AND REGULATIONS**

All works shall comply in every respect with local safety rules and regulations.

The Supplier shall acquaint himself of all the above requirements.

**Statement**

By signing this document, we declare that before submitting the offer, we have studied in detail this Attachment Nr. 2 »Technical description JN 19/2024«, so that we are informed with all the technical requirements and descriptions and that we fully agree with them. In the event of potential deficiencies in the technical requirements and description of the order, we have warned the purchaser. We will not make any subsequent claims from this title.

Place: \_\_\_\_\_, date: \_\_\_\_\_

Name and Surname: \_\_\_\_\_

Stamp and signature: \_\_\_\_\_