



Liberty steel Galati  
Project department  
No. 7400 / /



## TECHNICAL SPECIFICATION FOR QUOTATION

**Overhead ladle Crane 152 replacement**  
**275 / 65 x 15,5m**  
**Rev 00**

Contracted work:

**Engineering, software, manufacturing, equipment supply, supervision & erection,  
tests & commissioning**

Date	Established by	Signature	Verified by	Signature
06 Mar 2023	Mircea Niculescu		Alin IACOB	
			Lucian LUPU	
			Catalin VERES	
			Stefan Radu	
			Catalin Zuzu	
			Catalin Busila	
			Ovidiu Glagia	
			Laurentiu Filer	
			Daniel Balaes	
			Liviu Trotusanu	

Project monitored by: Mircea Niculescu Phone: +40 722 373 495  
Email : mircea.niculescu@libertysteelgroup.com

**Summary**

<b>1. OBJECT OF CONTRACTED WORK.....</b>	<b>4</b>
<b>2. CHARACTERISTICS OF THE INSTALLATION INTERFACING WITH THE CONTRACTED WORK AND LOCATIONS FOR THE EXECUTION OF CONTRACTED WORK .....</b>	<b>6</b>
2.1 LOCATION	6
2.2 OVERHEAD LADLE CRANE 152 TECHNICAL DATA	7
2.3 PROCESS OVERVIEW	9
2.4 SITE CONSTRAINTS	9
2.4.1 CONSTRAINTS SPECIFIC TO THE WORKING ENVIRONMENT OF THE EQUIPMENT	9
2.5 INSTALLATION & ACTIVITIES INTERFACING WITH THE CONTRACTED WORK	10
2.6 CHARACTERISTICS OF TRANSPORTED PRODUCTS	10
2.7 TOPOGRAPHY – SITUATION OF LOCATIONS – VERIFICATION OF GENERAL LAYOUTS OF THE COMPANY	11
<b>3. DESCRIPTION OF CONTRACTED WORK.....</b>	<b>11</b>
3.1 SPLITTING OF CONTRACTED WORK INTO FUNCTIONAL POSTS	11
3.2 FUNCTIONAL DESCRIPTION OF POSTS	11
3.2.1 POST 1 COMPLETE ENGINEERING	11
3.2.2 METALLIC CONSTRUCTION:	13
3.2.3 CRANE TRAVELLING	15
3.2.4 TROLLEY (CRAB) TRAVELLING	16
3.2.5 LIFTING MECHANISM	19
3.2.6 ELECTRICAL INSTALLATION	22
3.2.7 DISTRIBUTION	23
3.2.8 POWER	25
3.2.9 POST 2 MANUFACTURING & TESTING IN WORKSHOP	26
3.2.10 POST 3 TRANSPORT AND DELIVERY ON SITE	29
3.2.11 POST 4 ERECTION AND INDUSTRIAL COMMISSIONING	29
<b>4. RESULTS, PERFORMANCES &amp; MEASUREMENTS TO BE ACHIEVED.....</b>	<b>30</b>
4.1 PRODUCTION & EXPLOITATION	30
4.2 RELIABILITY, MAINTENANCE, AVAILABILITY	30
4.2.1 OPERATIONAL RATE – AVAILABILITY RATE	31
4.3 OTHER RESULTS & PERFORMANCES TO BE OBTAINED	31
4.3.1 SAFETY	31
4.3.2 EXTRA WORKS	31
4.3.3 MAINTENANCE	32
4.3.4 PERFORMANCES RELATED TO PLANNING	32
<b>5. STUDIES .....</b>	<b>32</b>
5.1 MECHANICAL, PNEUMATIC, HYDRAULIC & HTV STUDIES	32
5.2 FUNCTIONAL STUDIES	33
5.2.1 DETAILED FUNCTIONAL ANALYSIS	33
5.3 ELECTRICAL & AUTOMATION STUDIES	33
5.3.1 GENERAL AND DETAILED ORGANIC ANALYSIS	33
5.3.2 STUDIES FOR INTEGRATED FACTORY ACCEPTANCE TEST (FAT)	34
5.4 RELIABILITY STUDY	34
5.5 STUDY FOR SAFETY DURING CONCEPTION	34
5.6 STUDIES FOR THE EXECUTION AND IMPLEMENTATION OF CONTRACTED WORK WITHIN EXISTING INSTALLATION	34
5.7 WCM/TPM	35
5.7.1 PARTICULAR SPECIFICATIONS REGARDING TPM/WCM	35
5.7.2 REQUESTS RELATED TO CLEANING	35
5.7.3 REQUESTS RELATED TO PROTECTION	36
5.7.4 REQUESTS RELATED TO ACCESS	36



<b>6.</b>	<b>SPARE PARTS .....</b>	<b>38</b>
6.1.1	AVAILABILITY OF SPARE PARTS	38
6.1.2	DETAILS REGARDING SPARE PARTS	38
<b>7.</b>	<b>POSSIBLE EVOLUTION OF THE INSTALLATION IN THE FUTURE.....</b>	<b>39</b>
<b>8.</b>	<b>LIFETIME &amp; WARRANTIES .....</b>	<b>39</b>
8.1	LIFETIME	39
8.2	WARRANTIES	39
8.3	METHODS TO VERIFY THE RESULTS & PERFORMANCES TO BE ACHIEVED	39
8.3.1	MEASUREMENT OF NON-AVAILABILITY AND AVAILABILITY RATES	40
<b>9.</b>	<b>SAFETY &amp; ENVIRONMENT .....</b>	<b>40</b>
9.1	SAFETY SPECIFICATIONS TO BE CONSIDERED	40
9.2	PARTICULAR SPECIFICATIONS REGARDING THE SAFETY OF THE WORKSITE	40
9.3	PARTICULAR SPECIFICATIONS REGARDING THE ENVIRONMENT	40
<b>10.</b>	<b>TECHNICAL RULES, NORMS, PRESCRIPTIONS AND LAWS FOR DESIGN, ERECTION, MOUNTING, COMMISSIONING.....</b>	<b>41</b>
10.1	SPECIFIC RULES	41
10.1.1	PAINTING & CORROSION PROTECTION STANDARDS	42
10.1.2	WELDING PROCEDURE AND STANDARD	43
10.1.3	LEGAL STANDARDS AND NORMS FOR MANUFACTURING, ERECTION AND TESTS	44
<b>ISO 286-1:2010 .....</b>	<b>44</b>	
10.1.4	SPECIFIC RULES AND REQUEST FOR MECHANICAL, HYDRAULIC AND HTV	44
10.1.5	SPECIFIC RULES FOR ELECTRICAL AND INSTRUMENTATION	44
10.1.6	SPECIFIC LAWS, RULES, NORMS AND PRESCRIPTIONS FOR AUTOMATION AND L3	45
10.1.7	OTHER SPECIFIC RULES	45
10.1.8	SPECIFIC LAWS, RULES, NORMS AND PRESCRIPTIONS CONCERNING THE SAFETY AND SAFETY FOR FIRE PREVENTION AND SUPPRESSION	46
10.1.9	SPECIFIC RULES FOR CIVIL WORKS	46
<b>11.</b>	<b>INTERFACES WITH THE CONTRACTED WORK.....</b>	<b>47</b>
11.1	INTERFACES	47
11.2	WORKSITE	47
<b>12.</b>	<b>TESTS - COMMISSIONING – RECEPTION.....</b>	<b>47</b>
12.1	SHOP TEST ASSEMBLY – TECHNICAL ACCEPTANCES, SIMULATIONS, WORKSHOP TESTS	47
12.2	ON SITE TESTS	47
12.2.1	DESCRIPTION OF AUTOMATION TESTS SPECIFIC TO THE CONTRACTED WORK	48
12.3	CONFORMITY OF THE EQUIPMENT, OBJECT OF CONTRACTED WORK	48
12.4	PRE-COMMISSIONING & COMMISSIONING	48
12.4.1	STAND-BY & INTERVENTION	49
12.5	TRAINING	49
12.5.2	LOCATION FOR THE TRAINING	50
12.5.3	TIME SCHEDULE OF THE TRAINING	50
12.6	RECEPTION	50
<b>13.</b>	<b>DOCUMENTS TO BE SUPPLIED.....</b>	<b>50</b>
13.1	LIST OF DOCUMENTS TO BE SUPPLIED (NON-EXHAUSTIVE LIST)	50
13.2	DIFFUSION METHODS OF DRAWINGS/DOCUMENTS	52
<b>14.</b>	<b>PROJECT MANAGEMENT.....</b>	<b>53</b>
14.1	PROCEDURE FOR QUALITY CONTROL	53
<b>15.</b>	<b>PRESENTATION OF THE OFFER .....</b>	<b>54</b>



<b>15.1 PRESENTATION OF THE TECHNICAL OFFER</b>	<b>54</b>
<b>15.2. PRICE BREAKDOWN</b>	<b>54</b>
<b><u>16. ANNEXES.....</u></b>	<b><u>54</u></b>

## FOREWORD

Liberty Steel Galati plant is called hereinafter, the **COMPANY** and the **PROVIDER** of equipment and services is named hereafter **PROVIDER**

In this technical specification, the installations represent the overhead ladle crane 152 from Steel Melting Shop no.1, as well as the complete connected installations and the equipment that represents a part of the installation.

The **COMPANY**, within its project aims to ensure the transfer of the ladle with liquid steel between converters and ladle furnace targeting to:

- Revamp the E-F casting bay (including the railway and roof)
- Replace the overhead ladle crane 152

This project is a part of the sustainability program of the **COMPANY** aiming to achieve the continuation of production under safety working conditions. For these considerations, the performance of the crane must be anticipately adapted accordingly (capacity, reliability, speed, number of manoeuvres)

This technical specification refers only to the first step and that is to **replace the overhead ladle crane 152**

**PROVIDER'S** compliance with this technical specification represents a commitment for results and performances as requested by the **COMPANY**.

The **PROVIDER**, within his commitment for results and performance, will ensure that the object of his work, all the materials, equipment and documents delivered by him, comply perfectly with enforced Romanian laws, decrees and standards, especially regarding health and safety and environment protection, technical as well as with internal regulations of the **COMPANY**.

Within the contracted work, the **PROVIDER** will strictly comply with IT DP 045 "General rules to be applied by LIBERTY GALATI contractors" as well as with all the policies and objectives of the latter.

## 1. Object of contracted work

Within the project for transfer of the ladle with liquid steel between converters and ladle furnace this technical specification refers the replace the overhead ladle crane 152

By replacing the actual overhead crane 152 by a new crane of bigger capacity the **COMPANY** expects an improvement from the last technologies in terms of health and safety, energy efficiency, productivity increase and maintainability.

The object of work executed by the **PROVIDER** will include in particular:

- Data collection from existing documentation, site surveys and technical discussion
- On-site verification of all drawings & data provided by the **COMPANY**
- On-site verification of all features of the existing installations/equipment that could influence the results & performances to be delivered by the **PROVIDER**
- On-site verification of any pre-conditions needed for the results & performances to be delivered by the **PROVIDER**
- Conception of equipment, installation and components including preliminary functionality description including HIRA (Hazard Identification and Risk Assessment)



- Basic engineering B.E. (all drawings & documents containing all required data for D.E. development) , including the means to LOCK OUT/TAG OUT energies
- Detailed engineering D.E. (the design activities providing all the necessary information for the equipment and material procurement, manufacturing, installation/erection, operation, and maintenance) including the means to LOCK OUT/TAG OUT energies
- Commissioning engineering (the design activities providing all information for the equipment verification, tests, cold commissioning, and hot commissioning)
- Pre-commissioning and commissioning manual
- As build drawings
- Standard software & software platform for application development, including all licenses;
- Software process application, including source code
- Supply & provision including the LOTO elements (devices which prevent the transmission or release of energy by Locking it Out through a mechanical element or mechanism)
- Manufacturing in the **PROVIDER'S** workshop including energy LOTO elements
- Manufacturing verifications & assemblies tests in **PROVIDER'S** own workshop
- Erection & mounting verifications
- Integrated Factory Acceptance Test (FAT) including the verification of energy LOTO elements
- Site Acceptance Tests (S.A.T.)
- Technical acceptances, intermediary & end phase acceptances
- Sequence of warehouse entry for proper take out in scope of mounting/erection on site
- Packing, loading, transport, dispatching, unloading, delivery on site and O.P.I. (open package inspections)
- Execution, erection, dismantling, mounting, and erection including all the site adjustments,
- Performing of cold tests and hot tests, as well as performance tests
- Perform the entire commissioning (industrial Commissioning until reaching contractual performances)
- Any other legal tests and or documents as per Romanian laws
- Management & coordination of all tests in **PROVIDER'S** workshop, all tests to be done with the **COMPANY'S** representatives including simulation for energy LOTO on the new equipment/ installation.
- Management & coordination of all tests on site, by considering all constraints (operational, any other projects or activities developed in parallel) including simulation for energy LOTO on the new equipment/ installation.
- Assistance starting with the Industrial Commissioning until reaching of all contractual performances
- Training of **COMPANY'S** personnel
- Complete documentation, in Romanian and English languages, necessary for start up, operation, energy Lock Out/Tag Out/Try Out and maintenance of the supplied equipment
- CE certificate, incorporation manual, declaration of incorporation for CE and all other legal documents corresponding to the scope of supply
- Risk assessment file for design, manufacturing, execution, and commissioning
- Spare parts for commissioning and spares parts for 2 year of operation

**All supplies of parts, materials and matters, all transports, all loading and unloading operations, all equipping (nacelles, scaffoldings, movable cranes etc.), all servicing equipment (crane operator to be provided by the PROVIDER), all protection equipment, all works, drawings and compliances related to the object of this technical specification and to the achievement of results expected by the COMPANY are exclusively in the scope of the PROVIDER.**



**The PROVIDER will use for scaffoldings from Rohrer or Hunnebeck that are companies agreed already to perform such activities inside COMPANY'S premises.**

**The PROVIDER will receive all contact details of the above companies in order to receive support for scaffolding evaluation after he confirms the participation to tendering.**

**The PROVIDER has the obligation to include within its offer the following:**

**Type and m<sup>2</sup> of the required scaffolding including the level of the working platforms and the need of personnel from scaffolding company to supervise and/or make modification. The normal schedule to mount/dismount scaffoldings is between 6:30 – 14:30.**

**The scaffolding supplementary quantities that are not estimated within the technical offer will be financially supported by the PROVIDER**

**The PROVIDER is the sole responsible for the solutions implemented in order to guarantee the proper operation of his installation and to obtain the results, performances and functionalities expected by the COMPANY.**

The PROVIDER will execute in his workshop the maximum of required pre-fabrications.

The PROVIDER, in the scope of his work will have to strictly comply with the following principles:

- Define, conceive, supply and commission the assembly of equipment described in this specification, to guarantee a perfect restart of the full installation and making sure that there is a full integration with the existing systems, structures and equipment.
- Conceive the mounting and execution process and its organization, in order to guarantee the health and safety and environment protection and to minimize the execution difficulties of his work,
- Obtain the results and performances expected and defined by the COMPANY
- Improve the reliability, availability, maintainability of equipment which were modified, adapted, replaced and / or related with the execution of contracted work
- Integrate the contracted work in the planning of the COMPANY
- Inform and consult with COMPANY, on regular basis, about achieved results.

## **2. Characteristics of the installation Interfacing with the contracted work and locations for the execution of contracted work**

### **2.1 Location**

The installation is located in the steel shop with the COMPANY premises, in Galati, Romania.

The actual overhead ladle crane 152 is located E-F casting bay .

The bay E-F has an opening of 18 m and a length of 219 m

The entire height is of 31,80 m and 33.64 at top

This crane has more than 55 years of service. The last expertise performed by a local company named BUTAN Group, in Aug 2013, confirmed the load of 250 / 80 / 16 t.



## 2.2 Overhead ladle crane 152 technical data

Item	U.M		
		Min value	Max value
Commissioning year:	Year	1968	
Fabrication number:	No	685815/1968, nr ISCIR G 857	
The average number of cycles per day	cycles/day	45	
Crane capacity main	tf	250	na
Crane capacity auxiliary	tf	80	na
Crane capacity maintenance	tf	16	na
Crane is for maintenance or process?	na	process	
Structural classification	na	A7	
Mechanical classification- hoist main	na	M7	
Mechanical classification- hoist auxiliary	na	M7	
Mechanical classification- hoist maintenance	na	M7	
Mechanical Classification- translation trolley main	na	M7	
Mechanical Classification- translation trolley auxiliary	na	M7	
Mechanical Classification- crane travel	na	M7	
Operation class	na	C	
Lifetime	Years	25	na
Overhead crane inside or outdoor?	na	inside	
Ambient working temperature-Under the crane girders	C	25	180
Ambient working temperature-in the bay	C	-20	60 (casual can reach 80 C)
Ambient working temperature at the ladle surface	C	1550	1650
Ambient working temperature under lifting girders	C	650	800
Operator cabin or/and remote control	na	Operator cabin	
Mobile cabin	Y/N	N	
Beam type (single/double/multiple- no.)		4 beams	
Beam with hook	Y/N	y	
No. of hooks main	no	2	
Lifting capacity per each hook/load	t	125 (2 hooks= 250 t)/80/16	
No. of hook auxiliary	no	2	
Lifting capacity per each hook auxiliary	to/hook	16	80
Hook maintenance	Y/N	Y	
No. of maintenance hooks	no	1	
Lifting capacity per each maintenance hooks	to/hook	16	
Maxim load on wheel	to	52	
Lifting height	m	10	
Type of railway	na	KP 120	
Length of the railway	m	225	
Height of the railway	m	16,5	
Type of material of wheels	NA	Casted with forged contact surface	





Item	U.M		
		Min value	Max value
Wheels hardness	HB	400	420
Wheels lateral guiding	Y/N	Y	
Crane wheels diameter	mm	800	
Span	m	19,6	na
Trolley wheels diameter	mm	800	
Railway type for trolley	na	KP100	
Crane gauge	m	15.5	
Crane wheelbase	m	12.1	
Main trolley gauge	m	6.5	
Auxiliary trolley gauge	m	2.25	
Main Trolley wheelbase	m	4.4 (± 4 mm)	
Hook type and material	na	Metallic construction for 80 t/125 t Casted for 16 t	
Main lifting speed	m/min	4.2	
Auxiliary lifting speed	m/min	8.3	
Maintenance lifting speed	m/min	16.3	
Travel speed for crane	m/min	82	
Travel speed for main trolley	m/min	24 .7	
Travel speed for auxiliary trolley	m/min	39,5	
Type of gearbox for main lifting	na	?	
Type of work brake for main lifting	TYPE	FC 630	
Type of service brake for main lifting	TYPE	FC 630	
Type of safety brake for main lifting	TYPE	SHC 251	
Anti-wire overlapping system (Y/N)	Y/N	N	
Gearbox for main lifting load		1 (one) planetary gearbox	
Gearbox for auxiliary lifting load		1 (one) horizontal gearbox	
Gearbox for maintenance lifting load		1 (one) horizontal gearbox	
Gearbox for main trolley travelling		2 (two) vertical gearboxes with central operation	
Gearbox for auxiliary trolley travelling		1 (one) gearbox with central operation	
Gearbox for crane travelling		2 (two) vertical gearboxes with central operation per each girder	
Brake for auxiliary work lifting load	TYPE	FC710	
Brake for maintenance lifting load	TYPE	FC400	



Item	U.M		
		Min value	Max value
Brake for crane travelling	TYPE	2XFC400	
Brake for main trolley travelling	TYPE	FC320	
Brake for auxiliary trolley travelling	TYPE	FC320	
Steel lifting cable	TYPE	stratoplast D34	
Semi- automation? (Y/N)		N	
Full automation? (Y/N)		N	
Energy saving converters. (Y/N)		N	
PLC included? (Y/N)		N	
Electrical Anti-sway incl. (Y/N)		N	
Anti-twist cable system	Y/N	Y	
Motor classification (for production class F)	Class	F	
Electric drive with frequency type?	Hz	50	na
Uninterruptible Power System UPS	Y/N	N	
Overload limitation system	TYPE	sensy	

In the same bay there are 2 overhead cranes that have the same characteristics and same age.

### 2.3 Process overview

Mainly, the crane 152 insures the transfer of the ladles of liquid steel between BOF converters – ladle furnace (LF) – RH (and their empty return)

Additional operations carried out by the P152 crane:

- Handled steel pots for demolition of masonry.
- Handled steel pots for positioning pots on dryers.
- Manipulated steel transfer for maintenance programs.
- Handled the coils of Ferrous alloys . To supply the cutting machines Al.

### 2.4 Site constraints

The **PROVIDER** must design, conceive, supply, execute, mount and commission all the services, materials, equipment, and documents delivered by him, object of this technical specification, to comply perfectly with the constraints and risks present on the site of the **COMPANY** and as he also identified during the site survey. The **PROVIDER** must also respect the IT DP 045 "General rules to be applied by LSG **PROVIDER'S**

#### 2.4.1 Constraints specific to the working environment of the equipment

The **PROVIDER**, during the execution of work, will also take into consideration the following specific constraints:

General environment data:

- Outdoor temperature \*
- Relative humidity \*
- Last earthquake observed in the area:: - 30.08.1986 = 7, 1° Richter, 30.05.1990 = 6, 9° Richter, 31.05.1990 = 6, 4 ° Richter, 27.10.2004 = 6 ° Richter



- Galati is in Earthquake Risk Zone Level VII on Mercalli scale.
- Wind and Snow conditions\*:
  - Reference wind speed: 32m/s,
  - Reference wind pressure: 0,5 kPa,
  - Snow load: 250 kg/m<sup>2</sup> at ground level

(\*) : values to be confirmed by the **PROVIDER** based on the meteorological station near the Braila airport, for the execution period of concerned works, see at:

<http://www.weatherbase.com/weather/weather.php3?s=1351&refer=&cityname=Galati-Romania>

Specific site data:

- Installation is located indoors Inside the Bay E-F (the **PROVIDER** must check the documentation for detail layout)
- The installation is subject to heat radiated by the surface of the liquid steel or by the empty ladle itself. The temperature at the ladle surface can reach 1650°C
- Under the girder temperatures reach 180°C and under the hooks cross beam (lifting beam) up to to 800°C.
- The installation is subject to dust, 10 mg/m<sup>3</sup>
- High temperature inside the bay with variations between the range of - 20 up to + 60° C (the temperature nearby the entire crane – except below girders- can reach sometimes + 80 C)
- Ambient temperature with moisture variations
- Noise – 88.8 Db
- Behaviour during standard power line disturbances (amplitude – 30% U duration 300 ms)
- Existing means and elements for Lock Out/Tag Out of energies to be explained during site survey
- Location and means available for stocking only at the central warehouse, limited space for stocking near the execution area. The supply can be received and unloaded from Monday until Friday. The **PROVIDER** must announce by e-mail within 5 days in advance any delivery to the **COMPANY**.
- Under voltage installations nearby

When designing the final solution, the **PROVIDER** must take into consideration the working environment conditions, available space as stated in this technical specification and also as observed during the site survey.

**2.5 Installation & activities Interfacing with the contracted work**

Equipment present in area	Interfacing [y/n]
Overhead crane	yes
Casual flow of materials and process activities	yes
Other projects in the area	Yes

**2.6 Characteristics of transported products**

- Liquid steel ladles with steel at approximately 1650°C
- Handled steel pots for demolition of masonry.
- Handled steel pots for positioning pots on dryers.
- Manipulated steel transfer for maintenance programs.
- Handled the coils of FE alloys . To supply the cutting machines Al

## 2.7 Topography – situation of locations – verification of general layouts of the COMPANY

The **PROVIDER**, prior to sending the final offer will conduct one or several surveys of concerned locations in order to specifically verify, measure the accuracy of layouts of existing installation as well as all existing interferences and risks.

The **PROVIDER** is allowed to bring on site for this survey any specialists that are required for a better understanding of the existing situation.

The **PROVIDER** must define, conceive, supply and commission the assembly of equipment described in this specification the object of contracted work taking in consideration available space and any other site constraints.

All visits of locations will take place in the presence of a member of the **COMPANY**.

The design and final equipment supplied by the **PROVIDER** must be, in any case, compatible with existing structures, working conditions and process constraints rather than with the layouts of the **COMPANY**, if due to any reasons the latter will prove to be inaccurate.

The geometry of the structure, alignment of the wheels and the cross travel rail geometry will be verified by a **PROVIDER**

## 3. Description of contracted work

### 3.1 Splitting of contracted work into functional posts

In order to have clarity in the functional description of the contracted work, the **COMPANY** has hereinafter divided the contracted work into functional posts.

An activity noted by the **COMPANY** in this Technical Specification with **OPTIONAL** means that the activity, the equipment, the item, etc. respectively may or may not be contracted by the **COMPANY**, but the **PROVIDER** has the obligation to include it in their Offer, following that the final decision to be taken by **COMPANY** afterwards.

In the same idea, in order to clarify the global comprehension of the contracted work, the **PROVIDER** will comply with this splitting into posts, unless this splitting does not allow him to comply with his commitment for results.

1. Design and documentation
2. Manufacturing & testing in workshop
3. Transport and delivery on site
4. Erection and Industrial commissioning

### 3.2 Functional description of posts

#### 3.2.1 Post 1 Complete engineering

When designing the crane, the **PROVIDER** will aim to keep in mind a standardization of all the foreseen equipment that made up the proposed solution.

The **PROVIDER** must conceive its solution so that all equipment and components are available on the market from alternative **PROVIDERs** (at least 2) for the **COMPANY** to purchase at least for the next 15 years.

The **PROVIDER** will design and ensure only equipment resistant to the heat and soundly positioned (specific attention to instrumentation devices)

Calculations and dimensioning of all components will be performed based on transitory (starting off, breaking) and extreme (trials, degraded operation, cable or drive chain breakage, disequilibrium, impacts etc.) operational conditions.



The components must be able to bear the corresponding torque and power and withstand the shocks and impacts that might occur.

The design will aim to avoid load-bearing welds, to reduce fatigue stresses

Drums / pulleys / cables must be designed and dimensioned in order to obtain and guarantee a minimum lifetime for cables of 5 years.

The **PROVIDER** will ensure the complete technical documentation:

- Drawings and written documents (description),
- Basic information (BI) - The **PROVIDER** will provide all the basic information related to the main equipment. This information will be analyzed by the **COMPANY** in order to be improved or to be acknowledged. The **PROVIDER** will continue in the next design phase after receiving the acknowledgement of the **COMPANY** related to the basic information received.
- Basic engineering (BE) - The documentation related to the basic engineering will contain information related to all technical specialties (i.e. A.E.I, mechanical) but also non-technical subject (i.e. Safety) . The **PROVIDER** will supply within the same package of basic engineering also the first evaluation for risk and quality plan for the related phase.
- All the execution details (DDE) needed for the manufacturing of the new crane. Details for execution (DDE) of the crane will be provided in Romanian language (must include manufacturing details, treatment features of all the parts, etc.). Within this phase the **PROVIDER** will provide the:
  - Maintenance and operation manual,
    - Preventive interventions plan – PIP: Maintenance jobs TBM (time based maintenance) with a replacement frequency based on time
    - Greasing/ cleaning and greasing plan
    - Periodical revisions and adjustments
    - Periodical replacements of spares and materials
    - Inspection plan – PI: Maintenance jobs CBM (equipment condition-based maintenance) and PDM (Predictive maintenance) based on the equipment condition
    - Routine inspections (with operating machine)
    - Predictive inspections and checks (with the machine stopped) for the metallic building, mechanic machine, electric and automation instrumentation
    - Working instructions related to repair of the crane related equipment;
  - erection manual
  - safety risk analysis updated
  - quality plan for manufacturing in the workshop
  - quality plan for mounting on **COMPANY'S** site
  - Final list of spare parts for commissioning and for two years of operation



- All new designed cranes and important repairs projects will include collective protection solution provided by design.
- All documents needed to authorise the operation of the crane including obtaining the ISCIR authorization or any document required by the Romanian legislation for operating the crane.

The crane must be equipped with a lifeline and anchorage points.

On the crane the **PROVIDER** will design and provide lifting devices for maintenance.

The final versions of all documents, updated and accurate, will be submitted to the **COMPANY** prior to the Industrial Commissioning

The **PROVIDER** will follow the below stated design inputs:

	Utilization class	Load-spectrum class	Machine group
Whole of the structures	U8	Q4	A8
Framework	B8	P4	E8
Main hoisting mechanisms	T8	L4	M8
Auxiliary hoisting mechanisms	T8	L4	M8
Travelling mechanisms	T8	L4	M8
Steering mechanisms	T7	L4	M8
Auxiliary steering mechanisms	T7	L4	M8

### 3.2.2 Metallic construction:

#### 3.2.2.1 Overall assembly – whole structure

- The entire structure (including all assemblies) of the crane must be of maximum 675 tons (including the load of 275 tons)
- All crests and edges (axes, rings...) will be smoothed down, and appropriate bevelling will be considered.
- Crane structure will be adequately reinforced by gussets, diaphragms in the state-of-the-art engineering construction manner in order to comply with service criteria requested, on condition of estimated lifetime of crane of 25 years at minimum (see standards).
- The entire assembly will be fitted with surfaces ready for installing the hydraulic portable devices for lifting and any maintenance operations. The mentioned surfaces will be visually marked for easiness of identification

#### 3.2.2.2 Main, auxiliary, and intermediary girders

- 4 main beams with 2 different operational hoists: one hoist for 275 t, and one hoist for 65t
- Drawer beams with access inside the main beams
- Maximum load per each girder to be evenly distributed



- Main girders will be provided with inner lighting in case when driving units for crane travelling are designed to be in the beam structure. In this situation, appropriate openings must be designed to allow the easy dismantling and removal for maintenance purposes of any component of the driving unit, adequate opening dimensions must be considered for this purpose. All openings must be reinforced by surrounding steel sheet collar;
- The main girders will be provided with manholes for inspection. These manholes will be located on the side of the girder at level of the walkway, related access holes will be reinforced around entire whole by steel sheet collar plates oriented towards inside of girder. No manhole cover will be left unreinforced.

### 3.2.2.3 Main and auxiliary trolley

- The rails for main trolley (275 t) will be of type A 100 same for auxiliary trolley (65 t)
- Travelling on separate girders then the auxiliary trolley

### 3.2.2.4 Operator cabin

- Attachment of the operator cabin to crane structure will be made by bolted connections and not welded to crane structure, with intermediate damper elements and safety connections (e.g. chains) in case of failure of the main connecting systems ;
- The cabin must be positioned to have the best visibility for lifting the ladle (recommended see the position of the existing crane cabin PR152)
- No vibrations
- The operator shall have visibility both along the bay and under the cabin
- Noise and dust protection with efficient climatization (Norms) + windows resisting to metal liquid projections
- An ergonomic & visibility study will be made by **PROVIDER**. It will define the geometric characteristics of the cabin and interior fittings. The **PROVIDER** must supply a cabin adapted to the ambient temperature, all equipment locations, sizes, free spaces, working posts, travelling areas and stop to lift locations and interference with bay structure must be analyzed by **PROVIDER**.
- All the components installed must be supplied (buttons, manipulators, radio display panels etc.)
- Positioning of the cabin must be consistent with the access gangways (the responsibility of the **PROVIDER**).
- **PROVIDER** can consider own design & manufacture for cabin, provided the conditions required herein are met. The adjustments of the lead of the seat, of back incline and the suspension shall be manual.



- If the means of access to the crane or the location of the cabin do require modification of existing bay access, that will be the **PROVIDER'S** responsibility.
- Protection against projection of molten metal: the windows will have to be designed to resist to potential molten metal projection when the crane is over the top of the ladle carriers (bullet proof windows). Attention must be paid to water drop from air condition units regarding the contact with hot metal surface and associated risk.
- The whole of constraints imposed for the air-conditioning of the room or the electric girder must be considered for the air-conditioning of the driving cab. The temperature inside the operator cabin must be between 18° and 25°C, except during the degraded operation when prevalence is for maintaining micro-climate in the electric girder to continue functioning of electrical & electronic systems to allow travel of crane to parking area for troubleshooting.
- The crane operator should be able to wipe the cab windows

#### 3.2.2.5 Greasing system

- Greasing and lubing systems to be of manual type (not automatic), greasing feeding points to be located on the crane and trolley deck and grouped together on support flat bar in appropriate locations near greasing points to respective equipment ;
- Manual centralized by greasing pump

#### 3.2.2.6 Buffers

- The **PROVIDER** must check the existent buffers during site survey and determine the need to replace those or not. The final responsibility of the buffers and shock-absorbers is of the **PROVIDER**.
- The **COMPANY** is requesting to have the OLEO-dynamic, brand Jarret or equivalent.

#### 3.2.3 Crane travelling

- Travel speed 0+90 m/min per variable speed drive
- Acceleration time < 7 seconds
- Deceleration time < 5 seconds
- Mechanical braking distance < 5m (only brakes, emergency stop)
- Interaxial distance of wheels to be defined by the **PROVIDER**,
- Total travel approximately 220 m (length of rail in bay)
- Motor Brand ABB Siemens + VFC brand Siemens (with monitoring of their synchronous operation) and the power to be defined by the **PROVIDER**
- Start-up class 300 startups /h
- Stream factor 60 %
- Reduction unit recommended Brand SEW
- Service brake electromagnetic disk brake Sime type 45K or 5k, ventilated disc

##### 3.2.3.1 Wheels

- Number to be defined by the **PROVIDER**. Brand preferred: Valdunes with diameter D800





- Non-wearing type 500 Nickel, Chrome, Molybdenum Steel mass treated for Re > 800 MPa and Rm 1000-1100 MPa, binding and flanges treated at depth for HB 450-500 over 15 to 20 mm, type solid forged steel.
- The hardness will be applied on the rolling path and side bandages
- The wheels will have a diameter compatible with the standard dimensions
- To be dismantled as one subassembly without dismantling other parts of the crane.
- Guiding rolls placed on railway (lateral guiding for longer wheels lifetime)
- For each girder that supports the 275 t carriage, the end of the girder is with 2 bogies each with 2 wheels and 2 balance beams each with one wheel.
- For each girder that supports the 65 t carriage the end of girders is with 2 wheels.
- **Recommended 16 wheels** in total of D 800 mm diameter– please see drawing of the crane Annex 07
- Wheels designed for to be fitted for A150 rail with the condition of maximal wheel load is of 52 to considering that the main trolley (crab) is with full load and is in the nearby of the end carriage

### 3.2.3.2 Couplings

- Cardanic coupling with protection.
- Brand type rotex without maintenance

### 3.2.3.3 Brake

- Disk Brake 45 K per disc x30 for crane and trolley (crab) travelling
- Service brake, Breaks system and safety breaks with disc type SIME-STROMAG
- Service brake 2CA or 3CA
- Safety brake type SH 18, Sime only
- Security brake discs on drums must be removable with no need of drum dismantling

### 3.2.4 Trolley (crab) travelling

- The design shall aim to avoid welding electric arc to be discharged on the bearing.
- The trolley/crab will be fitted with rails cleaners
- The design shall aim to diminish fatigue stress.
- The trolley(s)/crab (s) shall be equipped with guardrails to avoid deviation of the trolley (crab) from the rails
- No openings in the deck greater than 200mm will be accepted, except at points where lifting cables pass through. All openings will be bordered with a skirting collar.
- Access will be provided to allow passage from one girder to the other by the trolley deck.
- If the height between the trolley floor plates and a low point of the building is lower than 2m:
  - Either the trolley will be covered by grillwork framing or a roof that can be easily removed or folded back without access from above (unit weight element <20kg).
  - And electrical protection device will be fitted.
- Return pulley block(s) to be located on the trolley deck as well as the dead end of ropes (balance beam) in such way as to have easy access for pulleys & ropes inspection and maintenance / change. Generally, all parts to be designed for easy maintenance and in case of dismantling, this action will not require dismantling of other parts or in any way will reduce at minimum such additional operations.
- Trolley will be provided with additional platforms (cherry-picker type ) on the inside of trolley at level of each bogie for any time easy access and maintenance of wheels from other side of gangway.



### 3.2.4.1 Overall assembly

- Independent movement in certain operations of the trolleys (crab) of 275 t respectively 65t
- No vibration
- Mechanical Classification- translation trolley main - M8
- Mechanical Classification- translation trolley auxiliary -M8

### 3.2.4.2 Wheels:

- To be dismantled as one subassembly without dismantling another parts of the crane. Railway steel brushes with easy dismantling or moving lateral or upper part
- Number to be defined by the **PROVIDER**. Brand preferred: Valdunnes, Diameter D800
- Non-wearing type 500 Nickel, Chrome, Molybdenum Steel mass treated for Re > 800 MPa and Rm 1000-1100 MPa, binding and flanges treated at depth for HB 450-500 over 15 to 20 mm, type solid forged steel.
- The wheels will have a diameter compatible with the standard dimensions

### 3.2.4.3 Gearboxes

- Gearboxes must be equipped with sampling valves for oil, install a minimum of 10 cm from the gearbox base different from flushing valves and air filtration systems, positioned at approx. .10 cm above the top cover gearbox
- Gearbox must be fitted with visual level oil indicator placed with a visible range
- Mechanically welded steel casing
- Parallel shafts (beveled gears are prohibited, gears in vertical arrangement to be avoided, could be accepted only for travelling units and based on reasonable justification by **PROVIDER**); Splicing plane of covers has to be in the mid axis of all gears, screw tighten and secured with Loctite " strong tight "
- The level oil check rolls to be included in the general arrangement drawing of the gear reducer, dimensioned for proper traceability of the oil level. All gear reducers to be provided with oil sampling placed between the inner bottom surface of the reducer and maximum oil level surface.
- The air breathers must be dimensioned considering the quantity of oil inside the reducer
- Footplate of gearbox has to be aligned and positioned by appropriate setting horizontal screws, the shim plates have to be face machined at required thickness, the theoretical alignment level will be provided by max. 10 mm thickness shims, welded on the support structure of equipment (reducers, bearing casings, motors,... )
- Gear reducer with gears carburized (CTR), case-hardened & rectified. The design arrangement must provide the retaining of oil in the bearing houses in such way that at restart of unit, the bearings will not start to turn on dry. Upper cover has to be provided with adequate number of manholes in such way as all gears to be clearly visible on entire contact surface. Gear reducers will be provided with identification plates with clear mark of gear type, weight, ratio, oil quantity and quality.
- All the seals will be mandatory, at least doubled. The sealing gaskets of shafts inlet and outlet of gear reducer will not have direct contact with the shaft surface itself, but, an intermediary dismountable sleeve will be installed, sleeve hardened material (CTR) for no wear of pinion shaft surface during operation. Fit-between sleeve and shaft will be

such as not to allow oil leakage between shaft and sleeve, neither rotation of the sleeve around shaft under contact with gasket.

- Gear reducers must consider the requirement of close loop mechanical cinematic chain (risk of stand to maximum torque by only one of reducers in case of breaking lifting kinematic chain of 275 t);
- Gear pinions in one piece with shaft, gear wheels on shaft by tight fit (shrinking 1/1000) not wedge or splined. Preferred forged material.
- Retention tanks to be placed under each gear reducer unit;
- Gear reducer interchangeable
- Calculation notes (according to ISO or Henriot 75), material characteristics, material certificates, machining reports, fit adjustment reports, etc... and complete set of detail drawings (including manufacturing drawings of parts) & maintenance / operational instructions will be provided by **PROVIDER** in printed copy and on CD (electronic format).
- All intermediary shaft ends or free will be externally protruding out of carters, will be provided with protection covers and easily accessible to be NDT checked by US;
- Shaft ends will be smooth;
- Breathers will be brand Pall size HC-7500-FS-UJ-4:H for gearboxes of capacity under 150 liters of oil and size HC-7500-FS-UJ-8 H for oil capacity over 150 liters.

#### 3.2.4.4 Greasing system

- Greasing and lubing systems to be of manual type (not automatic), greasing feeding points to be located on the crane and trolley deck and grouped together on support flat bar in appropriate locations near greasing points to respective equipment;
- Manual centralized by greasing pump

#### 3.2.4.5 Electric motors

- Motor brand ABB + VFC brand Siemens with continuous monitoring of their synchronous operation
- They will be of asynchronous type with casing & with reinforced bearings. The protection insulation is IP 55.
- The frame will be in cast iron type GS or steel.
- The shaft ends will be smooth.
- All the bearings of all motors will be provided with lubrication devices accessible without mechanical dismantling.
- The hoist (main and auxiliary) motors will be provided with encoder. The encoders will be of the hollow shaft type. The encoders will have suspended mounting. All the Encoders will be connected in electrical girder.
- The nominal linear speed of movement must be obtained at the nominal speed of the motors
- All the motors will be equipped with 3 type PT 100 temperature probes
- All motors that are connected to on VFC must have individual thermal protection
- The cable festoon (no cable chain) must be designed in such way as when a damage on one cable occurs, the worst result will be passing to degraded movement.



- The order of the movements will be carried out by order controllers with coder 4-20mA of brand Spohn and Burhardt or Gessman with stem of a length of 110mm, springiness n°10 and bellows out of leather. For fast change of a controller, the wiring of coders and contacts will be brought back on Harting cards associated with fast connectors laid out in the control boards.
- The controllers for crane operator to have the possibility to set the direction of moving the crane and percentage of pressing on the HMI.
- If a system based on offset input /output is proposed, the **PROVIDER** must install, on the outside of the electrical girder, a redundant cabling network with loop circuit or quick connections on to the reserve cable.
- **PROVIDER** will analyze & provide a cleaning system for the power line (i.e. by blowers).
- All brakes: next each brake will be installed a box with LED indicating the Open / Close position of the brake.

### 3.2.5 Lifting mechanism

#### 3.2.5.1 Overall assembly

- Speed type-continuous variation
- No vibration
- 2 Hooks for 137.5 t load each + 1 hook of 65 t load
- The provider will verify if the auxiliary mechanism of 65 t, will be able to tilt the full ladle.
- For each hook we ensure the design type (what we have in use). The **PROVIDER** will study, update and propose the final drawing for manufacturing to the **COMPANY** for acknowledged.
- The load cables for all mechanics must be provided stratoplast type (recommended manufacturer Casar)
- Drawer beams with access inside the beams

#### 3.2.5.2 Main hook

- There are 2 main hooks each one of 137.5 t
- Each must be lamellar design
- The inter-axial dimension of the lamellar hooks will be 4400mm
- The plate hook total thickness is 232mm
- Implantation of the hooks on the bar must follow the plans of the existing configuration of the steel ladle (annex 2)
- The protection must be provided so that the preliminary wearing of the hook is achieved.
- Both the hooks are mounted on a traversal beam
- The hook joint to the traversal beam must allow the joint possibility to move/shift on both directions given the load movement. This is to prevent blocking the ladle on the hook, deforming the hook or breaking part of ladle system. The lamellar hooks will have enough length to allow the ladle to be tilted
- The hooks will be long enough, to implement the take-up of ladle safely, compatible with the handling required. Ladle tilting will face towards WEST side, to be considered for hooks orientation.
- The traversal beam must also have thermal protection
- The traversal beam must be fitted with maintenance supports that are used to ensure space between ground (level 0) and the traversal beam when this is on level 0. Appropriate access to be considered for climbing on the lifting beam when posed on support.



### 3.2.5.3 Pulley

- The pulleys protection must be fitted with openings that allow dust to fall off
- The pulleys shall comply with COMPANY'S standards, by meeting the following requirements: mass-treated non-wearing Nickel Chrome Molybdenum Steel (Rm1000-1100 MPa, Re>or =800 Mpa, groove hardened at depth for HRC 58 to 62 over 4 to 5mm), type forged steel.
- The pulley axes must not be cantilevered. An independent lubrication point will be provided for each pulley.
- The flanges of the first driving pulley of the lower block must have a total opening angle of 60° to 70°. This angle will be 45° for the others.
- The groove bottom diameter must be at least equal to 1.06 times the rated diameter of the cable.
- The pulley assembling shall be made on an intermediate sleeve in order to facilitate the handling operations.

### 3.2.5.4 Load cable

- The load cables for all mechanics must be provided stratoplast type (recommended manufacturer Casar).
- The load cable must be of 34 mm in diameter
- Anti-twist cable system

### 3.2.5.5 Main drum

- Under the drum, safety cradles shall be provided. These shall be provided with pressure screws to maintain the drum. 200 mm minimum are required between the flange and the cradle for adjustment.
- The assemblies usually used in the COMPANY are:
  - Assembly on driving drum coupling type MALMEDIE and at the opposite side supported on a steel bearing support.
  - Assembly with channeled shaft on floating gearbox
- Concerning the design of the drum, it is required:
  - A post weld treatment after welding and thus before machining (the manufacturing report and a certificate of treatment shall be transmitted)
  - A ultrasonic control (US) or a radiographic control of welding at 100%
  - Supply of the material and NDT certificates of steel sheet for drum rolling and mechanical parts
  - Supply of a document containing the dimensions of the fitting parts, before tight fit assembly.
  - Drum surface to be cable channeled on the entire length, superficial hardness to be at 160 HB minimum;
  - We require to provide 2 survey holes to 180° on the flange on the shaft side with a diameter of 100 to 120 mm to see if, during the greasing of the drive coupling, the grease does not fill the drum when the sealing joint is leaking;
- To provide a blocking drum system for the control of the couplings and replacement of the brakes (rotation blocking system ) ;
- To consider 3 additional clamps on the drum that will be useful for the adjustment of the ropes during balancing. The whole of the clamps (of fixing and adjustment) are located to the maximum on ½ a diameter.
- Security brake discs on drums must be removable with no need of drum dismantling;
- Drums will be provided with system of detection of rope slack and anti overlap, these devices do have to stop the lift up movement in case failure detected but to permit release cable by downward movement ;



- Appropriate devices for rope, drum bearings & drum maintenance to be considered by **PROVIDER** and included in offer ;
- Dimensioning of drums will consider the following criteria :
  - Rope dead end will remain at 3 rounds at cable limit unwinding in any case, except when a pulley block is to be changed where admitted 1 round of dead-end cable on drum ;
  - At hook limit up, one more turn of drum should remain possible (appropriate rope channel free space for one turn more to be considered)
- The drum will be fitted with safety disks breaks

#### **3.2.5.6 Safety and service brakes (on the drum)**

- The recommended manufacturer is SIME-STROMAG, type SH18 x2200

#### **3.2.5.7 Coupling**

As described in previous chapter

#### **3.2.5.8 Main gearbox**

As described in previous chapter

#### **3.2.5.9 Electrical motor**

As described in previous chapter

#### **3.2.5.10 Synchronization shaft**

- The synchronization shaft must be provided with a device to ensure the synchronization and visual warning in case of deviation. Also, in case of deviation the system must stop the movement

#### **3.2.5.11 Weighting system (under drum)**

- A weighting device will be installed on the main trolley to weight only the 275 t load. The 65 t load will not be supplied with weighting system.
- This device will be of brand Schenck and will be installed on the crane, will provide the weighing of ladles (arrive in the area, exit of the area, after tilting, partial and complete empty ladle).
- The device required is a device on the main hoist trolley in double chassis construction with compression load cells between the two frames of the chassis.
- Measurement parameters:
  - Measurement range: 0 to 275 t (able to indicate until 275 t)
  - Resolution: steps of 100 kg
  - Precision: + / - 0.1% given by compression cells
- The system will consist of :
  - A display for the operator in the cabin with function to inform the crane operator instantly of the weights (gross, net, partial weights, empty ladle), preferred size of screen numbers and indications at 15 mm size, easy legible by crane operator;
  - A connection with the steel plant automated systems for storing and validations of weighting.
  - A link with the programmable control device to transmit information on the weight to the automatic systems:
    - Gross
    - Net



- Partial loads, including empty ladle
- The capability of the weighting system (weighting conditions, mechanical mounting, sensors, measurement processing ...) must be guaranteed based on calculations to be acknowledged by **COMPANY**.
- The weighting system must be calibrated before start of operation (procedure to be proposed by the **PROVIDER** and **acknowledged** by **COMPANY**). Calibration of the weighting system will be conducted using the supervision device delivered by **PROVIDER**.
- Same display need to be interactive with crane driver in order to allow to introduce in the system dates related to :
  - Number of ladle
  - Number of converter
  - Heat number
- It will taking account that, as per ISCIR Technical Prescriptions (PT R1 – 2010) it will be done two kind of load tests:
  - static test - static coefficient 1.25
  - dynamic test - dynamic coefficient 1.1

#### 3.2.5.12 Weighting system – load limitation

- The two loads will have a load limitation function (processing of the weighting signal). A warning system must be set in place.
- To carry out replacement of the hook ropes, provision must be made for setting the hooks down on the ground with rope slack detection by load limitation systems. Upward and downward speed limitation must be provided when rope slack is detected.

#### 3.2.6 Electrical installation

- In general, dust-sensitive electrical equipment will be installed inside a girder, the so-called electrical girder. This electric room will be perfectly sealed, with attention paid to means of access (for example by an airlock with automatic closure). A slight overpressure could be allowed, for a full guarantee against dust infiltration into the girder. The access doors will be provided with anti-panic lock and standard lock barrels for steelworks crane type.
- The **PROVIDER** will ensure the climate control and increased pressure within the girders so that temperature is allowing the operation of electrical system is achieved and dust free area
- The arrival of dust from the outside must be practically zero to reduce clogging of the air filters. The maintenance period will be of over 1 year.
- The doors must not, in any circumstances, be able to remain open. They will be equipped with full closure devices with indicators in the crane driver's cabin and above each door. The sensitive equipment located outside the electrical unit will be installed in double-skinned casing.
- The keys to the box and cupboard locks (out of the emergency stops which will be with no keys) will be trilateral type.
- The study for installation inside the girder and likewise for the access for the equipment must be conducted to allow fitting of electrical boxes or frames with standard manufacturers' dimensions. The fitting and support systems will be studied jointly between electricians and mechanics. A place will be set aside for fixing of possible anti-harmonic filters.
- The **SUPPLIER** will ensure all needed equipment to provide remote maintenance, end a distance connection with all the other process applications. The supplier will ensure the Wi-Fi equipment and radiotelephony.

Both PLC and operator pannels should be from SIEMENS and operator pannels should be SIMATIC HMI Unified type..

The communication network between PLC and converters should be PROFINET type.

- Fitting of the electrical installations must follow the regulations and standards in force, notably C15100, UTE and AFNOR standards, CEM, decrees concerning machines.
- **PROVIDER** will have the conformity of the electrical equipment and of its installation checked at its own cost. It is the responsibility of **PROVIDER** to build up reserve stock, at own expenses.
- The boards will be tropicalized with double varnishing (2 sides) and protection for connections.
- In case of micro-cuts of the electricity supply, the equipment must be able to remain in safety. All the components must be insensitive to micro-cuts less than or equal to 300 ms.
- The electrical system will be determined by means of calculation notes. They will be transmitted to **COMPANY**.
- The temperature of the girder will be monitored by at least 2 suitably placed PT100 probes, following fitting of the equipment.

### 3.2.7 Distribution

#### 3.2.7.1 Supply to the crane

- The existing supply network is 400 Volts AC triphasic with a tolerance  $\pm 10\%$ , located on the E axis inner face of the crane runways, 3 angle steel aerial conductors. The **COMPANY** will implement a 4<sup>th</sup> aerial conductor
- The general power supply line of the crane exists. The **PROVIDER** shall consider the characteristics of this power supply line. The technical proposal shall be carried out so that no modification will be necessary to the power line for the correct operation of the crane.
- An IT neutral regime is imposed, and the control circuits are provided with a permanent insulation tester.
- Command control voltage: 220V~
- Signal voltage: 24 Vcc or Vca
- Voltage input automatic system: 24 Vcc or Vca
- All the transformers will be of circuit separation type.
- A low-tension distribution will allow each movement to be switched off separately in order to perform the maintenance / troubleshooting on it independently.
- The supplier will ensure of two set of pantographs of twin contacts, for the mobile connection to the main power feeding. Each pantograph set is composed by three pantographs (one for each phase) and one pantograph for earthing.
- Possibility to connect to the crane from the office and a laptop for maintenance.

#### 3.2.7.2 Auxiliary circuits

- The supply panel for the auxiliary circuits will be installed in the electrical girder. It will be equipped with a head cut-off switch and departures necessary for ease of repair.
- An external socket will be provided for power supply next to PLC at 220 V in order to have power supply to the supply panel during maintenance work on the crane, from the electrical circuit, also power plug on trolley(s) in case of general switch-off of trolleys from the supply. Locking mechanisms will be provided in order to make safe this function (do not feed the trolleys from the external plant network).



- The girders will be equipped with emergency lighting with the equipment necessary for statutory tests and inspections Floodlights and fluorescent tubes correctly protected against dust, heat and radiation will be installed to obtain satisfactory lighting of:
  - the crane working areas: 200 lux
  - the crane as a whole: access, passages, stairs and equipment installed: 200 lux
  - the electrical girder: 400 lux
  - the mechanical girders: 200 lux
  - the crane structures for maintenance operations: 200 lux (motors, reducer groups, greasing points, control point...)
  - a flashing light, 24 V single-phase AC will be installed to warn of ongoing maintenance on the crane. This light must be visible from the plant shop floor and from the opposite crane.
- Lighting of the working area will be arranged as follows:
  - Spotlights will be placed under the trolley. These lights must be accessible from the trolley.
  - Spotlights will be fixed under the girders, adapted to the ambient conditions and accessible from the crane. Attachment of these lights must be made safe. They will be provided with anti-falling security devices. In the event of the breakdown of spotlights, the lighting must remain enough for working.
  - Work lighting should be with LEDs from manufacturers such as Philips or equivalent.
  - Independent lighting will be provided in the access area to trolleys gangways.
  - Laser/safety lights mount on the crane to show on the ground the area of the crane.
- Electricity outlets for ~~380~~ 400V 50Hz 32A triphasic, 220V 50Hz 16A single-phase, individually protected by differential circuit-breaker switches, will be set out on the crane. These outlets will serve in maintenance and upkeep of the crane.
- Electrical plugs for ~~380~~ 400 V / 50 Hz, 32A triphasic, 220V/50Hz, 16A single phase, individually protected by differential circuit-breaker switches, will be set out on the crane. These plugs will serve for maintenance (see also above) and upkeep of the crane.
- Cabling for the auxiliary circuits will be coloured orange. Apparatus still live (powered on) during consignment (switch-off ) of the main supply to the crane will be identified by label on the circuit boxes and frames.

### 3.2.7.3 Uninterruptible power supply

- In order to avoid loss of data during consignment manoeuvres (cut-off < 15 minutes), a system of uninterrupted supply with voltage regulator will be provided for supply of the whole of PC continuous functioning.
- The brands of UPS will be ABB, Siemens or equivalent, according to the power of the chosen UPS.
- Its reliability must not affect the crane availability rate. It will include an automatic by-pass system. When the autonomy of UPS is near the limit, the UPS unit must trigger and guarantee the automatic and correct close-down of PC-s. This UPS must switch on the control PC when the crane circuit is switched on again.
- The UPS circuit will also supply the interphone system and continue of supply it for 10 minutes in case the general supply to the crane is switched on.

## 3.2.8 Power

### 3.2.8.1 Frequency converters

- The whole movements of the crane will be driven by asynchronous triphasic AC motors with squirrel cages linked with variable speed drives with vectorial control of recuperation flows by recuperation on the circuit which will adjust the motor speed (regenerative drives).
- The brand of the variable speed drives will be Siemens.
- Where design and installation of the electrical equipment is done by the manufacturer, or by a subcontractor other than the **PROVIDER** of the equipment; the design, installation and operation of the electrical appliances must be validated by the **PROVIDER** of the electrical equipment (ex: audit).

### 3.2.8.2 Safe mode or degraded operation of equipment

- The change-over to degraded operation of the movement concerned must be semi- automatic. After turning the isolating switch of the defective unit (variable speed drive, supply to the continuous-current bus, motor, air conditioner); the PLC being informed of the state of all the switches, changes to adjustments and controls will be automatic with no other intervention on the equipment.
- The switch-over is made by means of a contactor for the power part and by connectors type rapid connectors for the signals (or gold low-level contact relays).
- The change-over must be done quickly to keep the impact on the process to a minimum (maximum time of 30 min).
- All the movements can be simultaneous.
- Degraded operation is also to be provided for the motors and brake caliper.  
Degraded operation of movements:
- In case of malfunction of part of the drive (motor, variable speed drive, etc...) a degraded operation will be proposed for each movement so that the crane can continue working.
- Degraded speed of the horizontal movements could be adjusted according to the characteristics of the drives. However, it will not be able to be lower than half of the nominal speed. The degraded operation of the horizontal movements is to be proposed.
- If the potentiometer of a joystick is out of service, the movement must be possible to continue with fixed speed reference values given by 3 contacts ( for each sense ) of the joystick

#### Safety operation of the vertical movements:

- In the event of failure of a part of the drive (motor, variator, etc...) a spare operation will be proposed for each vertical movement so that the crane can continue its mission. In the event of a proposal of redundant variator, it will be also considered the associated resistance of braking.
- Spare operation of the vertical movements is to be proposed.

#### Degraded or safe operation of brakes:

- In the event of failure of brake, a degraded operation will be proposed for each movement so that the crane can continue its mission. For the hoisting movement, the spare operation shall be considered.
- Any movement must permit to continue the normal operation when one service brake is out of service.

- The main and secondary hoists do have to be able to continue to be operational in case of one safety brake is out of service.
- The degraded operation of the grips of brakes is to be proposed.
- The passage into spare or degraded operation of the movement or of the grip of concerned brake must be semi-automatic. After opening of the switch of insulation of the failing item (drives, motors, air-conditioner, grip of brake) by the operators of maintenance, the PLC is informed of the state of all the switches, the modifications in the adjustments and the orders will be automatic without any other intervention on the equipment.
- The swing is carried out using a contactor for the power part and thanks to fast connectors for the signals (or of relay with low contact gold level).
- The swing will have to be fast in order to limit the impact on the process (maximal duration: 30min).
- Contact line to be provided with protective null of copper provided with an average cell voltage, power transformer substation and to ensure the safe operation of the two cranes capacity of 275 tons each.
- The contact line must be backed-up by a second contact line (redundancy) in order to ensure crane safe operation in case of power failure
- Instrumentation the transducers with Hart Protocol;
- Possibility to show on HMI maintenance operation such as Start/end rope replacement main hoist and auxiliary hoist;
- Possibility of operation in a single power line module from two existing from electric box;

### 3.2.9 Post 2 Manufacturing & testing in workshop

The **PROVIDER** will ensure the complete manufacturing of the crane.

Adjustment shims must be from machined face parts and with minimum thickness of 10 mm, must be used for all the seat surfaces of major component units (motors, gear reducers, bearing blocks, brakes, etc).

The entire crane will be measured by the **PROVIDER** and will result a measurement sheet for the **COMPANY'S** acknowledgment

The **PROVIDER** will ensure the development of the verifications and considering proving to the **COMPANY** the performances of each mechanisms as listed below:

Mechanism	Item	Requested performances	UM	Min Value	Max value	
Metallic construction	Overall assembly	Maximum weight of the crane with the load 275 t in hooks	t	-	600	
		Maximum length of crane	m	20		
	Main girders	deflection	mm	15.5 +/- 15%		
	Auxiliary girders	deflection	mm	15.5 +/- 15%		
	End girders	measurement sheet	na	na		
	Main trolley					
	Auxiliary trolley					
	Thermal protection	Fitted to withstand the ladle temperature of	C	1625		
	Buffers	As per standards and design	na			
	Operator cabin	heat, noise and dust protection with efficient climatization (Norms) + windows resisting to metal liquid projections				



Mechanism	Item	Requested performances	UM	Min Value	Max value
Crane travelling	Overall assembly	Maximum pressure on the wheel and equal distribution of weight	T	-	52
		Speed	m/min	0	90
		Acceleration time	s	0	7
		Deceleration time	s	0	5
		Travelling speed		m/min	0
	Drive wheels	hardness on the rolling path and side bandages	HB	450	500
	Drive wheels	Lifetime	Years	5	
	Free wheel	Lifetime	Years	5	
	Free wheel	hardness on the rolling path and side bandages	HB	450	500
	Greasing system	No leakages	na	Na	Na
Guiding rolls nearby railway		Ensure full alignment between end gliders and railway	na	na	
		hardness on the rolling path and side bandages	HB	380	420
		Lifetime	Years	10	
Main trolley travelling (for 275 tf load)	Overall assembly	Fully comply with the measurements sheet	Na	Na	Na
		Speed	m/min	0	30
	Drive wheels	Lifetime	Years	5	
	Drive wheels	hardness on the rolling path and side bandages	HB	450	500
	Free wheel	Lifetime	Years	5	
	Free wheel	hardness on the rolling path and side bandages	HB	450	500
Greasing system	No leakages	na	na		
Auxiliary trolley travelling (for 65 tf load)	Overall assembly	Fully comply with the measurements sheet	Na	Na	Na
		Speed	m/min	0	45
	Drive wheels	Lifetime	Years	5	
	Drive wheels	hardness on the rolling path and side bandages	HB	450	500
	Free wheel	Lifetime	Years	5	
	Free wheel	hardness on the rolling path and side bandages	HB	450	500
Greasing system	No leakages	na	na		
Main lifting mechanism	Overall assembly	Lifting capacity	tf	0	275
		Speed	m/min	0	8
		Acceleration time	s	0	2.9
		Deceleration time	s	0	1.9
	Safety brakes (on the drum)	overspeed brake distance	mm	0	150



Mechanism	Item	Requested performances	UM	Min Value	Max value
	Service brakes	overspeed brake distance	mm	0	150
	Operation brakes	Upward mechanical breaking distance	mm	150	200
		Downward mechanical breaking distance	mm	150	200
	Cleaning system	No dust	na	na	na
Auxiliary lifting mechanism	Overall assembly	Lifting capacity	tf	0	65
		Speed	m/min	0	8
		Acceleration time	s	0	2.9
		Deceleration time	s	0	1.9
	Safety brakes (on the drum)	overspeed brake distance	mm	0	150
	Service brakes	overspeed brake distance	mm	0	150
	Operation brakes	Upward mechanical breaking distance	mm	150	200
		Downward mechanical breaking distance	mm	150	200
	Cleaning system	No dust	na	na	na
Electrical installation	All consumers	Tension voltage fluctuation protection	V	370	440
Automation system	UPS	Uninterruptible Power System UPS	V	400	
			Hz	50	
			KW	As installed on crane	
			min	15	
Monitoring	Video cameras	Perfect vision type monitoring all functionalities of the crane (see Annex 24- Camera recommendation)	na	na	
Safety	Anti-collision mechanism	Reduce speed with 50 % when the detected obstacle is at	m	30	
		Stop the crane when the detected obstacle is at	m	5	
	Ground marking with lasers		na	Na	

The **COMPANY** intends to perform a performance test with 302.5 t conf PT ISCIR R1- 2010.

The **PROVIDER** will list within his technical offer all the verifications & test they can be done inside its own workshop.

The **PROVIDER** will ensure all the tools and logistics needed to perform all the verification & tests and will inform with at least 2 weeks in advance the **COMPANY** related to the readiness of performing the verification and tests.

The **PROVIDER** will follow the quality manufacturing plan that was submitted to the **COMPANY** during the design phase.



The **PROVIDER** will provide also to the **COMPANY** prior to starting the manufacturing process the full schedule containing also milestones related to verifications & tests.

### 3.2.10 Post 3 Transport and delivery on site

The **PROVIDER** will start packing the components of the crane after the written acknowledgment received from the **COMPANY'S** representative regarding the verifications and tests performed in the workshop.

The **PROVIDER** will provide to the **COMPANY** details related to packing including the procedure to manipulate and lift the packages.

The **PROVIDER** is obliged to send in advance to the **COMPANY** a full list containing all packages dimension and weight.

The **PROVIDER** will provide a team to participate at the open package inspection.

During the open package inspection if any part is damaged the **PROVIDER** has the responsibility to replace the damaged item without affecting the contractual schedule.

All transport is in the scope of the **PROVIDER** from where the crane is made until where it will be erected.

The unloading at **COMPANY** is also in the scope of the **PROVIDER**

The temporary warehouse for pre-mounting will defined by the **COMPANY**.

### 3.2.11 Post 4 Erection and Industrial commissioning

First filling with oil, grease and all consumables are in the scope of the **PROVIDER**.

The **PROVIDER** will start the erection works on site based on an erection manual provided well in advance during DE phase to the **COMPANY** and acknowledged by the **COMPANY**.

During mounting and erection, the **PROVIDER** will ensure all logistics (slings, cables, etc) needed for the works.

The **PROVIDER** will ensure full supervision they each specialty.

The works on site will always be supervised by the **PROVIDER'S** nominated representatives.

The **PROVIDER** will provide the quality plan for erection & mounting prior to starting this activity during the design phase (DE)

The **PROVIDER** will provide all logistics tools needed to perform the verifications and tests on site within **COMPANIES** premises.

The **PROVIDER** will provide all authorizations, certifications and any legal documents prior starting the erection works, including the ones for his own personnel that is appointed/nominated to perform or supervise siteworks.

The **COMPANY** takes the right to perform audits at the **PROVIDER'S** subcontractors in order to verify the alignment with the standards and the regulations imposed and agreed by both parties during contract.

All site organization, bungalows and any other related facilities (toilets, water connection, electrical connection to the bungalow, etc) are in the scope of the **PROVIDER**.

The **PROVIDER** will assure transportation of all energy fluids from the existing takeover points.

**PROVIDER** will not execute adaptation, modification and correction resulted from a manufacturing error on the supplied equipment inside the **COMPANY** site without the official approval of the **COMPANY**. After receiving the written approval of the **COMPANY** to perform adaptation, modification of the correction the **PROVIDER** will also update the drawings keeping as a reference the correction. When the **PROVIDER** with submits to the **COMPANY** the as build drawings he will also submit the drawings containing the corrections done on site for modification.

The **PROVIDER** is in charge of performing the entire erection and mounting on site which includes all the modifications required for the crane to be mounted in the designated area (including roof opening and remediation after the works, if that is imposed by the technology proposed by the **PROVIDER**)



The **PROVIDER** is in charge of performing the entire industrial commissioning until reaching the contractual performances thus includes cold tests, hot tests and follow up of the performances until reaching contractual performances.

#### 4. Results, performances & measurements to be achieved

The **PROVIDER** studies, defines and executes the contracted work as well as the equipment object of the contracted work to achieve the results and performances defined below, as well as in IT DP 045 "General rules to be applied by LG **PROVIDER'S**"

The **PROVIDER** must take in consideration the working environment (i.e. temperature, corrosion, steam etc) when designing and executes the contracted work and equipment.

The **PROVIDER** must also check the site status and existing design for proper adaptation to observed situation.

##### 4.1 Production & exploitation

The work executed by the **PROVIDER**, as well as the Equipment object of contracted work, must achieve the following results and performances in terms of exploitation:

Number lifts per day = 276

Number translation per day = 276

Distance per day = 12 km

Number of cycles per day = 58

Lifetime = 25 years

##### 4.2 Reliability, maintenance, availability

The work executed by the **PROVIDER**, as well as the equipment object of contracted work, has to comply strictly with the recommendations regarding maintenance and reliability of installations, detailed in the document « Annex no 05 -IT DP 046 WCM Specification for **PROVIDERs** Rev.0 » and «Annex no 19 – TPM development & specification for **PROVIDERs** » attached to the RFQ.

**The non-availability of the overall equipment object of the work executed by the PROVIDER must not exceed the limits indicated in the following matrix of criticality.**

The cases considered as acceptable are marked by "A"

The cases considered as unacceptable are marked by "I"

Breakdown = non-availability or faulty operation of the function

BREAKDOWN	VERY FREQUENT 1 breakdown per month Fmax = 12 / year	FREQUENT 1 breakdown per semester Fmax = 2 / year	LESS FREQUENT 1 breakdown per year Fmax = 1 / year	IMPROBABLE 1 breakdown every 5 years Fmax = 0.2 / year
<b>CATASTROPHIC</b> Stoppage > 8 h	I	I	I	I
<b>CRITICAL</b> 2h < Stoppage <= 8 h average = 5 h	I	I	I	A
<b>MAJOR</b> 1h < Stoppage <= 2 h average = 1.5 h	I	I	A	A
<b>MINOR</b> Stoppage < 1 h Average = 0.5 h	I	A	A	A



The definition of the calculation of the operational rate and the availability rate of the WORK EQUIPMENT made by the PROVIDER can be done as follows:

The above matrix allows the determination of the accepted stand-by time:

Catastrophic stationary:	0 h / year
Critical stoppage:	$0,2 \times 5 = 1$ h / year
Major stoppage:	$1 \times 1,5 = 1,5$ h / year
Minor stoppage:	$2 \times 0,5 = 1$ h / year

Thus:

Accidental stationary time is:

T Accidental stationary = 3,5 h / year

The plant operates 365 days a year in 3x8 h or 8760 h / year.

Planned maintenance stops are rated at: T = 300 h / year

The operational rate is calculated by integrating the stops planned:

Operational rate =  $(8760 - T \text{ planned stops} - T \text{ accidental stationary}) / (8760)$

The availability rate is calculated excluding plant maintenance stops, or as:

Availability rate =  $(8760 - T \text{ planned stops} - T \text{ accidental stationary}) / (8760 - T \text{ planned stops})$

#### 4.2.1 Operational rate – availability rate

The Equipment object of the work executed by the PROVIDER must achieve the following results and performances:

Operating rate = 96,53%

Availability rate = 99,96%

The assembly of the installation must be conceived in order to achieve the above defined operational rate and availability rate, especially with the possibility to diagnose and replace immediately a faulty mechanism and the availability of necessary spare parts.

Generally, to be maximized the uniformity for mechanical and electrical parts, frequency converters, etc....to reduce the diversity of spare parts and optimize the related stock ;

#### 4.3 Other results & performances to be obtained

##### 4.3.1 Safety

Ensure fire detectors in the operator cabin. Provide fire extinguisher (manual) in the operator cabin.

All equipment must be design for a temperature 60 (casual can reach 80 C)

Ensure fire detection and extinguishing (automated) in all electrical rooms.

PROVIDER must provide anchorage points on the crane to ensure the maintenance and operation activities.

##### 4.3.2 Extra works

The PROVIDER, within his commitment for results and performance, will ensure from the design phase that the supplied solution is adapted to the existing situation and not generate extra works (i.e. consolidation of the existing foundation or of the metallic structure, etc)

If for any reason the PROVIDER cannot respect this requirement, he must forecasts and details into his offer all the implications (extra works, extra supply, adaptations, etc).



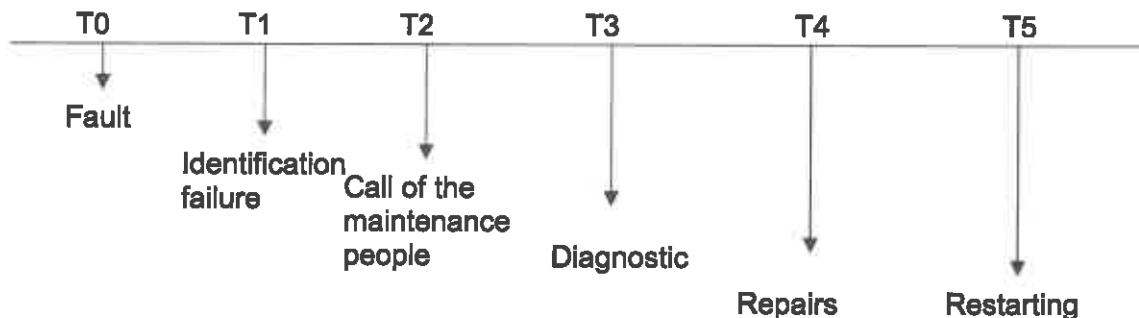
### 4.3.3 Maintenance

#### 4.3.3.1 Time

For automation one important parameter is MTTR (time for maintenance).

Control devices and sensors must be installed on all equipment in order to facilitate fault-finding and maintenance of running conditions. For example: bearing, oil and casing temperatures; vibrations, noise; pressure, output; stresses, play and clearances, wear and so on.

The following maintenance protocol in case of a fault must be applied with the new automation:



The **PROVIDER** is in charge to ensure  $T1 - T0 = 5$  minutes.

In order to ensure this time, it is necessary to run the auto diagnostic task which will include the following activities made in automatically mode:

- module identification.
- location identification.
- error type.

The **PROVIDER** will help the **COMPANY** to reduce  $T5 - T1$  to 25 minutes with a proper software program for diagnosis, training, and the spare parts list.

#### 4.3.3.2 Consumables & standardization

The **COMPANY** is aiming to maintain the existing level of stock diversity and prefers to future use of grease mobile LBZ low viscosity

The **PROVIDER** should aim to design all systems taking in consideration **COMPANY'S** recommendation without generating additional scope.

#### 4.3.4 Performances related to planning

The **PROVIDER** must respect of planning with 0% deviation from initial agreed planning

### 5. Studies

All definition and conception documentation listed hereinafter in a functional and non-limited manner, as well as the basic and detail engineering are in the scope of the **PROVIDER**, including HIRA, the means to Lock Out energies and the definition of LOTO elements.

#### 5.1 Mechanical, pneumatic, hydraulic & HTV studies

The **PROVIDER** is in charge of establishing all documents required for the management, manufacturing, execution and commissioning of the project, respectively:

- Definition layouts

- General assembly layouts
- Assembly layout for mechanical / hydraulic / pneumatic LOTO points and elements
- Draw up the mounting /execution drawings and documentation (i.e. erection and mounting manual)
- Detailed sub-assembly drawings
- Calculation sheets, diagrams, and charts
- Reliability study
- Study of interferences with the existing installation
- On site verification and validation of existing installation, equipment and dimensions
- Access and protections
- Detail drawings of any other part related
- Drawings in AUTOCAD 2009

## 5.2 Functional studies

### 5.2.1 Detailed functional analysis

The **COMPANY** expresses its requirements in functional terms.

The **PROVIDER**:

- Provides the operational instructions
- Elaborates the functional analysis jointly with the **COMPANY**
- Elaborates the form for the functional requirement.
- Verifies the correlation of this functional requirement with the requirements of the **COMPANY**
- Specifies the interfaces and interlocks

## 5.3 Electrical & automation studies

### 5.3.1 General and detailed organic analysis

The **PROVIDER** must:

- Develop and draw up the single line diagram, electrical circuit diagram, bloc diagrams, external wiring diagram, cabling diagrams, **equipment list with code of manufacturer**, electric cabinet layout, bill of material, List of spare parts for 2 years, etc...
- Develop and draw up the hardware system configuration, rack configuration, network layout and configuration, etc
- Draw up the assembly layout for electrical LOTO points and elements
- PID diagram with electrical tag of devices;
- Draw up the erection drawings: cabling diagram (block diagram with all equipment and cables between them), cable list (with type, length, source and destination, number of wires, section), layout of equipment and cable route;
- Software application description
- Determine the organization and the constituents of the system
- Determine the commissioning of each constituent
- Structure the treatment for each constituent.
- E-plan and/or AutoCAD

In order to structure the conception and the execution of sub-assemblies for automations, the **PROVIDER** must use a library of standard programming modules, unless there is a properly justified exception. He must supply the documentation and the applied standard programming modules.

The conception of automation sub-assemblies must ensure the safety and the rapidity in installing, diagnosing and troubleshooting them.

### 5.3.2 Studies for Integrated Factory Acceptance Test (FAT)

The **PROVIDER** must:

- Prepare the detailed description of the FAT procedure and obtain validation from the **COMPANY**
- Define the configuration and make available the platform for simulations
- Supply a list of necessary materials and tools for the platform and simulations
- Prepare the job list for technical acceptances and simulation
- Ensure the validation of the platform by an authorized organization
- The test will be performed at the **PROVIDER** workshop and will contain also crane movements

The **PROVIDER** is in charge with ensuring the energy LOTOTO procedure and instruction during the performance of Factory Acceptance Tests.

### 5.4 Reliability study

The **PROVIDER** has to:

- Submit to **COMPANY** the list of references for past improvements done
- Submit a FMEA with the aim to show all improvements taken in consideration from design phase
- Analyse the all causes for unreliability by root cause analysis (respecting **COMPANY's** template and methodology)
- Assess the probability of occurrence,
- Identify the corrective actions in order to comply with requested availability constraints.

### 5.5 Study for safety during conception

The **PROVIDER** must:

- Identify the risks linked to his supply during design, implementation, operation and maintenances phases
- Identify and implement actions to eliminate/reduce/replace identified risks
- List these risks and measures in a synthesis document (as table)
- List in a synthesis document called "LOTOTO" the following: energy Lock Out points, energy Lock Out elements, Lock Out possibilities, energy Lock Out/Tag Out/Try Out instructions.

### 5.6 Studies for the execution and implementation of contracted work within existing installation

All definition and conception documentation listed hereinafter in a functional and non-limited manner, as well as the basic and detail engineering are in the scope of the **PROVIDER**, including HIRA, the means to Lock Out energies and the definition of LOTO elements.

The **PROVIDER** has to:

- Verify the existing installations (existing piping, anchorage, cabling...)
- Study the interfaces with existing installations
- Study the existing logistics (cranes, lifting systems, ...)
- Make the studies for the integration of the system
- Make the execution and mounting drawings and define full documentation (erection manual and mounting instruction)

The **PROVIDER** must optimize, within the contracted work, the operations to be performed on site in order to minimize the shutdown time for integration, as well as the number and duration of necessary initial stoppages. In this respect he will define



- Erection and mounting manual and instructions
- Dismantling manual
- Operational grid,
- Details on the equipment and tools for erection works and adjustments,
- Maintenance equipment,
- Additional equipment for the exploitation of the machine or installation.
- Prepare the technology of works on phases of execution as per standardised template of Projects Department (annex to this Technical Specification).

## 5.7 WCM/TPM

The PROVIDER will comply with IT DP 045 "General rules to be applied by LIBERTY GALATI contractors" and the IT DP 046 «WCM Job List for Suppliers». Dismantling of each of the mechanisms must be made possible without dismantling other components in order to keep alignment operations to a minimum.

The PROVIDER will provide a document under the form of a table, listing the actions and measures applied in order to comply with the TPM/WCM concept within the execution of contracted work.

### 5.7.1 Particular specifications regarding TPM/WCM

The following points will be considered by the PROVIDER:

- Lighting
- Cleanliness
- Tidiness
- Maintainability
- Numbering system: the system will take into consideration the actual identification tag for each equipment. For a proper identification, the same tag will be used in all documentation mechanical drawings, electrical circuit diagram, PID diagram, bill list, layout, cable tray, PLC application program, HMI application.
- All the equipment must be supplied with visual management and clear warnings (POKA Yoke system to be implemented)
- 

### 5.7.2 Requests related to cleaning

A system for cleaning the dust must be set up for the whole of the crane by means of a network to be designed according to the crane architecture and comprising the following minimum configuration:

- The periphery of the quadrilateral crane frame will be surrounded by a tube of diameter 150mm with minimum thickness 5mm
- pipe elbows will be reinforced to avoid piercing due to abrasion
- 12 connections will be fixed on this pipe duct network
- each connection will be closed off with a movable plug secured with chain.
- Piping of the same diameter will be installed all around the main trolley. This will have 8 identical connections with plugs.
- Downward piping of identical diameter will be fixed down to operator's cabin and platform it will be equipped with 1 connection with plug.

An independent fixed industrial vacuum cleaner will be installed in the bay and addition pipes will be mounted with fast connections. On the crane the PROVIDER will design, supply and mount piping, sockets and flexible tubing so that the entire crane area can be vacuumed including inside girders. The vacuum installation must work with existing big bags that are provided by the COMPANY.

- Minimum suction pressure: -800 mmCE
- Minimum rate: 100 m<sup>3</sup>/h



- Maximum sound level: 83 dB at 1m

Fixed piping (in non-inflammable, fireproof materials) with appropriate diameter will run the length of the girder.

Self-sealing sockets will be provided near each cabinet.

To be provided for system with ventilator for blow-cleaning of rails.

The **COMPANY** recommends fans (4 pieces) per each end of girders.

For rail the **COMPANY** recommends brushes.

On the crane the **PROVIDER** will design, supply and mount a compressed air system so that the maintenance activities (i.e. cleaning filters) is possible. The **PROVIDER** will ensure the

connection on the entire crane area so that maintenance can be performed in all places needed.

The **PROVIDER** will ensure a dust free environment in the electrical cabinet and girders by installing a counter pressure equipment.

### 5.7.3 Requests related to protection

Appropriate protection must be incorporated for all moving parts (turning/swivelling).

Protection systems must have a unit weight of < 30 kg and a lift height < 1m for removal.

These protection systems will be equipped with suitably positioned hatches for checking and inspection. These hatches must be easily detachable and lockable.

The protection arrangements must not impede safe cleaning of structures, accesses and equipment

The possible protection of girders against heat radiation must be included in the offer

Under the main beams, truck beams and the trolley, support brackets will be provided for heat protection covers and marked off for the position adjustment later, during assembly stage

Handrails with blocking devices.

Anchoring points for lifeline.

The **PROVIDER** will provide 800 C thermal protection for travers hook overall assembly.

For the whole structure the calculations for thermal protection and insulation are the responsibility of the **PROVIDER**.

### 5.7.4 Requests related to access

The design of the different equipment, corresponding attachments and connections will have to consider the easiness of dismantling, including after several years of service.

Dismantling tools and inspection hatches must be provided for all equipment that might not be directly accessible or easily inspected. Manholes on gear reducers must provide clear view over all gears inside, on all length of gear.

Access platform with handrails around the cabin for maintenance

Pulley blocks for return pulleys will be in easy access positions such as on trolley deck; areas under deck, under hoist drum, other difficult access areas to be avoided.

Cable ends at fixed points (others than on drum) will be of type wedge socket with self-locking for cables for easy access and easy handling for maintenance. Threaded ends are prohibited.

Protection of cables in pulley blocks to be designed by simple rod bars rather than half-covers in order to avoid accumulation of grease and dust in the area between ropes, pulley channels and protections.

Any need to dismantle of parts or components must not require any dismantling of adjacent parts, all accesses for dismantling to be free and easily accessible.

Access inside the girders must be allowed to all inside their length (access openings for the auxiliary girders) by access doors / openings at each end. In addition, they will give access to girder / truck beams connections so that these can be checked.

For girders with side walkway, the openings & doors will be located at level of walkway on the web of girder (side access), meanwhile, for the girders with no side walkway ( if applicable ), openings will be made on the upper flange of girder. All openings in girders will be reinforced all-around by flat bar collar, protruding inside girder, no opening will remain just cut on steel sheet with no reinforcement.



All openings will be covered & sealed either by doors or by covers, all lockable.

Each truck beam will be provided with side access from the runways, access provided with anti-falling system, on each corner, located in such way as not to interfere with trolley(s) & bay structure.

Each access to the crane will be equipped with a safety switch to stop the travel movement of crane in case of unauthorized access, operator will have a warning in the cabin for this purpose Request for access will be made by a push button fitted near each access point.

On the same control panel, a red and a green indicator light will show authorization given by the crane operator from the control cabin.

Access to crane will be provided: from the crane runways mainly for maintenance purposes to maintenance team and occasionally to crane operator, access by all four corners of the crane (two by each truck beam).

The main trolley will have access points on each of the main beams and from each of truck beams ( when trolley located at end cross travel position ).

Walking and access on to the whole of the crane framework must be made easy and safe. Access gates to be of self-closing type, by counterweight.

The ergonomics of all means of access must be particularly well studied and optimized. Generally, vertical access ladders to be avoided.

The different levels must be made the same and have anti-skid surfaces: access and circulation (risks of tripping upon trapping feet), access around the equipment and machines (interior and exterior).

Safe access and enough space for inspection, maintenance, replacement and adjustment of all the equipment (electrical and mechanical) and sensors must be provided.

Access points for maintenance will be on the same level at working height.

Access will be provided under the drums, with additional working platform (cherry picker type ), for arranging the sheave pulleys ( recommended : to be avoided sheaves under drum ) and checking of cables.

Safety cages, ladders, rungs and hatches are to be avoided; inclined stairs and doors will be installed.

Doors will have automatic closing by counterweight.

Cabin access must be compatible with existing gangways and means of access.

Enough clearances will be arranged to avoid interference and risks of accident. Special adapted arrangements will be studied, considering positioning margins, and applied to avoid risks of falling and of shearing.

Circulation inside the girders must be possible without any obstacle at the diaphragms and around the equipment, with height kept at 2150 mm. The structures, equipment or lighting have not to diminish this clearance.

A clear passage of 1000 mm width and 2150 mm height left in all parts of the crane, its annexes and their means of access (exceptions may only be granted after properly reasoned discussion with the **PROVIDER**).

No equipment, ducts, protection arrangement, lighting, cable lines or support structures may restrict these clearance dimensions.

The free height of the access gangway / walkway in the power / electrical room must also to be kept strictly at 2150 mm.

Guardrails will be installed on either side of each of the access and maintenance areas: truck beams, girders, trolleys, hoisting bar, gangways, ... as well as in front of all uncovered mobile or turning/swivelling element (e.g.: drums).

The toe-plates of the guardrails (handrails) made of flat bar with at least 100mm size and must not be obstructed by frame working, supports or cable trays.

Access walkways will be provided for inspection and maintenance of all the mechanisms, and those involving horizontal and lifting movements (including cable inspection)

Means of access, guardrails, floor plates, stairways etc. must be designed and constructed in compliance with COMPANY'S standards and instructions. They will be developed to avoid any possibility of objects passing through. They will be fitted with fine-mesh grillwork to avoid risk of

objects falling, but this grillwork must have parts that can easily be opened with a common tool to obtain easy access to equipment.

The guardrails near to the electrical cabling must give protection all-around the cable with smooth sheet metal instead of grillwork to minimize wear of the electrical cables in the event of occasional mechanical contacts.

Floor plates and stairs will be in metal grating wherever possible, to avoid dust accumulation. Additional protection with tough fine-mesh grillwork will be installed to prevent objects or parts to fall to the ground.

Skirtings and flooring: to prevent objects or parts from falling, no space greater than 10 mm is permitted under the skirting or between flooring elements.

The most external parts of the crane or its trolleys which can be positioned or arrive near the component units of the crane or the building will have guardrails with grillwork raised to 2 m height to avoid the risk of shear. These protective features will also be extended over a distance of 1 metre beyond the corners or access limits.

The crane components (girders, truck beams, hoisting bar) not fitted with a double guardrail (on both sides) throughout their length will be equipped with lifelines allowing safety harnesses to be hooked on.

As on the track sides guardrails cannot be fitted, special care must be taken those free spaces between the travelling bogies do not expose personnel to the danger of falling.

The safety spaces to be considered for the minimum and maximum access values, are according to the parts of the body concerned ( foot, full body, hand, etc...).

- The vertical ladders to be avoided in favour of inclined stairs. Access gates ( folding or self-closing gates ) to be easily accessible and not to put in peril the access safety.

- Access on the crane structure to be possible from one girder to the other by passing on the trolley deck, not by passing from crane to the bay structure and climb back to the other girder. Access on crane from the bay gangway by a security alarm to the operator & stop of crane and trolley travel to secure the access and avoid the travel movements of crane during / in case of climbing on the crane structure.

- The flooring will be made by gratings to avoid dust accumulation. The floor plates will consist of 20X20 mesh reinforced galvanized grating. The admissible load on the gangways is 450kg/m<sup>2</sup> (in compliance with LG standard)

## 6. Spare parts

### 6.1.1 Availability of spare parts

Generally, to be maximized the uniformity for mechanical and electrical parts, frequency converters, etc. to reduce the diversity of spare parts and optimize the related stock.

The spares for commissioning are in scope of **PROVIDER**.

The critical spares will be detailed in the technical offer, the reasoning of this list be supplied also (criticality analysis).

The spare parts list for 2 years of operation, the reasoning of this list is to be supplied.

The following proposal may be considered and analysed:

- The spare parts remain the property of the **PROVIDER** and invoiced to the **COMPANY** when they are consumed:
  - ▶ Spare stock of the **PROVIDER** advanced in the **COMPANY** premises.
- Spare parts purchased by the **COMPANY**:
  - ▶ At the end of the guarantee period, one year after reception,
  - ▶ Afterwards, within the time frame of the option negotiated to the main order.

### 6.1.2 Details regarding spare parts

It will be included in **PROVIDER** scope of supply as priority spares at least the following:



### 6.1.2.1 Automation

- Computers ( 1 pcs operator station, 1 pcs engineering station, 1 pcs server) with OS and software preinstalled
- For PLC: 1 CPU for each type, communication modules, at least 10% for each type of I/O module.
- Weight modules 10%.

## 7. Possible evolution of the installation in the future

The crane must be able to sustain the future needs of the plant and the capacity of the ladle transportation.

## 8. Lifetime & warranties

### 8.1 Lifetime

The **PROVIDER** must design the supplied solution and equipment so that the lifetime is of 25 years. The **PROVIDER** must deliver the reference list with the observed lifetime all supply.

### 8.2 Warranties

The minim warranted for supply and all the scope of contracted work must be 24 months or as per GCCP (General Conditions for Purchasing) accepted form.

All the supply and equipment must be available for purchase for minim period of 10 years after the commissioning.

All breakdown must be approached and solved within the acceptable breakdown time.

Afterword the warranty time for the specific item/equipment will be restarted.

### 8.3 Methods to verify the results & performances to be achieved

- Reference list with details related to observed lifetime
- Workshop pre-inspections on the supply manufacturing/assembly intermediary phases
- Final supply inspection in the workshop before delivery
- Automation inspections on the manufacturing/software development intermediary phases
- Integrated FAT
- Erection and mounting works inspections during intermediary phases
- Final erection and mounting checking
- Cold commissioning on site
- Hot commissioning on site
- Industrial commissioning
- Performance and reliability tests on site

The **PROVIDER** must propose during early engineering phases all the details related to the smart acceptable criteria of the tests as well as a full description of those tests.





### 8.3.1 Measurement of non-availability and availability rates

The Non-availability as well as the Availability rate of the Equipment object of contracted work will be verified and measured between the end of hot commission phase and the end of the guarantee period.

## 9. Safety & environment

**THE COMPANY UNDERSTANDS THAT THE SAFETY OF EQUIPMENTS AND WORKS EXECUTED ON-SITE IS OPTIMUM AND WORKS ARE EXECUTED IN PERFECT SAFETY CONDITIONS.**

The **PROVIDER** will comply strictly with IT DP 045 "General rules to be applied by **LG PROVIDERS**" and IT DP 044 General safety instructions for External Companies that work on the beneficiary's sites.

The **PROVIDER** will inform the **COMPANY** about all the specificities of the equipment in terms of environment and safety.

Considering the environment in which the Equipment will be installed, since the conception phase of the respective equipment, the **PROVIDER** will comply with the following prescriptions, regarding the safety of the equipment and that of the worksite

The **PROVIDER** must attach to the Technical Offer, the filled-in template F.DP.087 H&S Management Questionnaire V0, (annex to this Technical Specification).

### 9.1 Safety specifications to be considered

All actions to eliminate / reduce / replace identified risks resulting from HIRA, described in chapter 3.4.6 – Study for safety during design/conception, of this document are considered as part of the **PROVIDER** supply – design, manufacturing, delivery, erection, notably all the energy Lock out elements.

General health & safety instructions for all external companies working on sites belonging to **COMPANY** (annexes no.3 and 4) are not exhaustive and are general. Services **PROVIDERS** and their sub**PROVIDERS** are bound to observe and apply entirely all national laws regarding Health & Safety, even if they are not stipulated in annexes

### 9.2 Particular specifications regarding the safety of the worksite

Special attention has to be provided for the safety of the worksite, especially regarding:

- Superposed works
- Interfaces between worksites – **PROVIDERS**

**CONTRATOR** has to provide at least the following:

- Risk assessment to be performed by **PROVIDER**
- Implementation of safety concept, to be delivered separate safety system - Safety PLC or Emergency relays SIL, SIL devices (limit switches, emergency push buttons, etc ) according with risk assessment and safety design);
- Safety interlocks (software and hardware).
- System availability as per the required performances, including the HMI servers

### 9.3 Particular specifications regarding the environment

The **PROVIDER** will comply with all laws, norms, rules, and regulations applicable in Romania. All the management related to waste are in the scope of the **PROVIDER**.

The **PROVIDER** based on site survey as well as existing laws, standards and norms must assess the corrosive of the environment to which the structure, parts and equipment will be exposed and



in implement appropriate coating and surface protection. The specifications will be submitted to **COMPANY** for review from early design phase.

## 10. Technical rules, norms, prescriptions and laws for design, erection, mounting, commissioning

The **PROVIDER** will comply strictly with IT DP 045 "General rules to be applied by LG **PROVIDERs**" along with all the laws, regulations, norms and standards of required in Romania.

According to the evolution of standards and norms, if there are any contradictions between the recommendations and prescriptions of the **COMPANY** and enforced regulations: the **PROVIDER** has the obligation to inform the **COMPANY** with minimum 30 days in advance. The final solution will be chosen by mutual agreement of the two parties.

### 10.1 Specific rules

Additionally to enforced Norms and Regulations, as well as to construction standards, instructions and rules of the **COMPANY**, the **PROVIDER** will comply with the below mentioned specific rules:

ISO 9001

ISO 14001

ISO 18001

Law 316/2006

IEC 81346

sr en 22768-1,2 mK

FEM 1. 001 3rd Edition revision 1998/10/01;

FEM 9.901 Calculation base for overhead crane equipment's;

Machining-ISO 2768/UNI EN 22768;

CEN-European Committee for Standardization;

CENELEC-European Committee for Electro technical Standardization;

ETSI-European Telecommunication Standard Institute;

ANSI/AGMA n. 2001, 6001 and related standards for gearboxes;

ISO/AWS for welding design and procedures;

IEC for electrical part;

DIN for forged hooks; forging according to EN 10254: 2001: steel closed die forgings;

SR 1944-1; SR 1944-2; SR 1944-3; SR 1944-4; - "Simple forged hooks with rod"

DIN 15018;

DIN 15020;

EN 349 : 1 994 + A1:2008 Safety of machinery-Minimum gaps to avoid crushing of parts of the humane body;

EN-ISO 5817:2007: Welding-Fusion welded joints in steel, nickel, titanium and their alloys (bean welding excluded)-Guidance on quality levels for imperfections-> Level B = Quality level : Stringent;

EN 13135-1 : 2003 + A1 : 2010 : Cranes-Equipment-Part 1 : Electro technical equipment;

EN 13135-2 : 2004 + A1 : 2010 : Cranes-Equipment-Part 2 : Non-electro technical equipment;

EN 13155;2003 + A2:2009: Cranes-Safety-Non-fixed load lifting attachments;

EN-ISO 13857 : 2008 : Safety of machinery -Safety distances to prevent hazard zones being reached by upper and lower limbs;

EN 15011 : 2011 : Cranes-Bridge and gantry cranes;

EN 1090-1 +2 : Execution of steel constructions & aluminium structures-Class to be determined during basic engineering.

Steel constructions

FEM 1. 001, edition 1998-Booklet 1 to 9;

Eurocode 0(EN 1990) : basis of design;

Eurocode 1 (EN1991) ; actions;

Eurocode 3 (EN 1993) : steel;



EN ISO 13849-1 Safety of machinery-Safety-related parts of control systems-  
Part 1 : General principals for design-performance levels;  
EN 13850 Safety of machinery-Emergency stop-Principles for design;  
EN 62061 Functional safety of safety-related electrical, electronic and programmable electronic control systems-Safety Integrity Levels;  
EN 954-1 Safety categories (replaced by EN ISO 13849-1 and EN 62061);  
EN 60204-1 Safety of Machinery Electrical Equipment of Machines  
Part 1 : General requirements (replaced by EN ISO 13849-1 and EN 62061);  
EN 60204-32 Safety of machinery-Electrical equipment of machines-  
Part 32 : Requirements for hoisting machines (replaced by EN ISO 13849-1 and EN 62061);  
EN-ISO 14121-1 Safety of machinery-Risk Assessment Safety of machinery-Risk assessment examples of methods;  
EN-ISO 14121-2 Safety of machinery-Risk assessment-Part 2 : Practical guidance and examples of methods;  
EN 14122-1 to 4 Access to work stations;  
EN ISO 12100-1 Safety of machinery-Basic concepts, general principles for design  
Part 1 : Basic terminology, methodology;  
EN ISO 12100-2 Safety of machinery-Basic concepts, general principles for design  
Part 2 : Technical principles;  
EN ISO 13857 Safety distances, dimensioning and screening;  
EN 953 Physical guards;  
EN 563 Safety of Machinery-Temperatures of touchable surfaces;  
EN ISO 13732-1 Ergonomics of the thermal environment-Methods for the assessment of human responses to contact with surfaces-Part 1 : Hot surfaces;  
IEC 61131 Programmable logic controllers (PLCs);  
EN 13135-1 Crane safety electromechanical equipment;  
EN 13135-2 Crane safety non-electromechanical equipment;  
EN 13557 Cranes. Controls and control stations;  
EN 13586 Cranes. Access;  
EN 12077-2 Cranes safety-Requirements-Part 2 : Limiting and indicating devices;  
EN 12644 Cranes -Information for use and testing-  
Part 1 : instructions;  
Part 2 : Marking;  
EN 60034 Rotating electrical machines;  
EN 60947 Low-voltage switchgear and control gear, General rule's;  
SR EN 12644-1+A1:2008 Lifting equipment. Information for use and testing. Part 1: Instructions  
SR EN 12644-2+A1:2008 Lifting equipment. Information for use and testing. Part 2: Marking  
SR EN 12385-1+A1; SR EN 12385-2+A1; SR EN 12385-3+A1; SR EN 12385-4+A1; - "Steel cables";  
Fire retardant or fire-resistant standards  
IEC 60332 Tests on electric and optical fiber cables under fire conditions;

### 10.1.1 Painting & corrosion protection standards

ISO 12944  
ISO 2409  
DIN 53209  
DIN 53210

The steel components (except commercial parts painted under manufacturer's own painting system of which crane manufacturer has to make proof of the respective lifetime) are subject to following surface protection procedure :

- Surface preparation of Sa 2 ½ (by sand or shot blasting );
- Immediate application of a 30 micron primary coat of paint.

In addition, all the materials must imperatively be coated in the workshop (no painting on site except for touch up).



The type of protection proposed must be indicated on return of the proposal and the certificates must be supplied before work commences.

**COMPANY** reserves the right to have inspections made.

Colours to be respected:

- girders, truck beams, Yellow RAL 1018
  - Handrails Yellow RAL 1018
  - Exterior cabin, hood Yellow RAL 1018
  - Trolley Orange RAL 2008
  - Floor plates Black
  - Rotating parts Red RAL 3020
  - Motors - RAL 5002
  - Greasing and hydraulic system - RAL 6022
  - Certain parts can be given a different colour depending on the results of the TPM study.
- Only touch-up will be done on site on any paintwork damaged during assembly or on-site welding and successive grinding
  - The interior of the girders will be painted with a light colour.
  - The paint must resist the temperature conditions stated in this technical specification and annexes .
  - A light-coloured anti-corrosion coating, will be applied inside the girders

### 10.1.2 Welding procedure and standard

All welds on the mechanical equipment must be stress relieved (e.g.: drums, gear reducer casings, special couplings, clamps, hooks, balancing rods, steel structure frames etc.)

The **PROVIDER** must comply with

C150-99 welding quality directive

EN ISO 13920- General tolerances for welded constructions: Dimensions for lengths and angles. Shape and position

sr en ISO 13920

In order to fulfil the conditions of traceability and quality the **PROVIDER** must provide all quality welding control documents and related documents for used materials and compile one file quality for each element (support, welded joint pipes, etc) respecting the minimum as follows:

1. Welding procedure (WPS) - specifications covering all type of welding joints (provided in drawings and / or specifications);
2. Document of approval of welding procedures (WPQR ) - records covering all type of welding joints (provided in drawings and / or specifications));
3. List of welders who worked on product (authorization of welders for type and thickness of the base material - including welding position);
5. Location map of welders punches (according to specification / drawings);
6. Control file (visual, LP, US, etc.- where appropriate - according to specification / drawings);
7. Quality certificate for semi finished products (sheets, profiles, pipes, etc.);
8. Quality certificate for filler materials (electrodes, wires, flux, etc.);
9. Document for dimensional measurements (where applicable);



### 10.1.3 Legal standards and norms for manufacturing, erection and tests

**HG 51/1996** – decision regarding the regulation of reception for machine montage, equipments, technological installations and their commissioning.

OG No. 95 from 30 August 1999

Law NO. 440 from 27 June 2002

EN 10204

EN 10204 - *Inspection Certificate according to EN 10204, type 3.1*

ISO 286-1:2010

EN 22768/1,2

### 10.1.4 Specific rules and request for mechanical, hydraulic and HTV

Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast) (Text with EEA relevance)

HG nr. 1029/2008,

**DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL** of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility

**PROVIDER** will assure the protection against corrosion using anti corrosive paintings on all parts that are subject to this risk.

The layout of the installation will be conceived to prevent accumulation of dust and drainage, spills of any kind.

### 10.1.5 Specific rules for electrical and Instrumentation

73/23/EEC	Low Voltage Directive
EN 60 204	Safety of machine, electrical equipment of machines
EN 50 178	Electrical equipment in electrical installation
EN 61 800-3	Variable-speed electric drive EMC product standard
EN 55 011	EMC Emission
EN 61 000-4-3	EMC Interference - Immunity
IEC 60 801-3	EMC Interference

**IEC 62337** Commissioning of Electrical, Instrumentation and Control Systems in the Process Industry

**IEC 62381** Activities during Factory Acceptance Test (FAT), Site Acceptance Test (SAT) and Site Integration (SIT) for Automation

**IEC 62382** Electrical and Instrumentation Loop Check

**DIRECTIVE 2006/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL** of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits

HG nr. 457/18.04.2003

HG nr. 982 from 22 august 2007

The list is not exhaustive. All EU electrical standards must be accomplished.

#### Romanian Norms

- NP 17-02 – norm for electric installations engineering and execution
- PE 107/98 – Norm for electric cable networks engineering and execution
- PE 102/86 – Norm for the engineering and execution of connecting and distribution installations with power up to 1000 V a.c.



### 10.1.6 Specific laws, rules, norms and prescriptions for automation and L3

See annexes

### 10.1.7 Other Specific Rules

All European standards must be respected.

The European and Romanian legislation in force, and with (list not exhaustive):

- national standards in force regarding pollution control, health and safety, calculations.
- HG 1029/2008 : "Lifting machines other than lifts and service lifts",
- SR EN 12644 – 1+A1:2008 Lifting machines other than elevators and service elevators
- SR EN 12644 – 1+A2:2008 Lifting machines other than elevators and service elevators
- PT R1 2003 Lifting machines other than elevators and service elevators
- General safety instructions for External Companies that work on the beneficiary's sites
- to law n° 91-1414 of 31.12.91 Heading II, provision ensuring the transposition of E.E.C.
- directives regarding the design of machines, appliances, tools, heavy plant, equipment and installations.
- decree 88-1056 of 14.11.88, and its appendices regarding the protection of workers against the dangers of electric current.
- decree 98-1084 of 02.12.98 regarding organization measures, conditions of setting in operation and the technical stipulations that govern use of equipment in the workplace.
- order of 18.12.92 regarding coefficients of utilization of lifting accessories.

Technical Documents & specifications :

- a) ASME NOG 1 - 2004 – Rules for manufacturing of cranes, overhead cranes, gantry cranes ( overhead multi-girder crane ), valid edition \*;
- b) AWS D1.1M - Welding code for structures – Steel, valid edition \*;
- c) AWS D14.1M –Welding specifications for industrial cranes and other lifting equipment, valid edition \*;
- d) ASTM A 36/A 36M, Specification for carbon steel for structures, valid edition\*;
- e) ASTM A 48/A 48M, Specification for Gray Cast Iron, valid edition\*;
- f) ASTM A 275/A 275M, Norm of testing methods for Magnetic particles examination of forged steel, valid edition\*;
- g) ASTM E 709, Standard Ghid pentru examinarea cu Particule Magnetice, editie aplicabila / Guide norm for examination with magnetic particles, valid edition\*;
- h) ASTM E 165, Norm of testing methods by penetrant liquids, valid edition\*;
- i) EPRI NP-5380, Visual control of welds acceptance criteria, valid edition\*;
- j) Recommended practice Nr. SNT-TC-1A, valid edition\*;
- k) SR EN ISO 12100-1:2004 –Equipment safety. Basic concepts, general design principles. 1st part : Basic terminology, methodology ;
- l) SR EN ISO 12100-2:2004 - Equipment safety. Basic concepts, general design principles. 2nd part : Technical principles;
- m) SR EN ISO 13857:2008 –Equipment safety. Safety distances to prevent the contact of risk areas with upper and lower parts ;
- n) SR EN 349:1996 –Equipment safety. Minimum distances to prevent the crash of human body parts;
- o) SR EN ISO 13850:2007 - Equipment safety. Emergency stop. Design criteria ;
- p) SR EN 614-1:2006 - Equipment safety. Design criteria for ergonomics. 1st part : Terminology and general principles ;
- q) SR EN ISO 14731:2007 – Welding process coordination. Duties and responsibilities ;



- r) SR EN 954-1:2000 - Equipment safety. Parts regarding the safety of the control systems. Part 1 : General design criteria ;
- s) SR EN 982:2001 - Equipment safety. Safety requirements related to hydraulic and compressed air commnad systems and their related parts. Hydraulics ;
- t) SR EN ISO 14121-1:2008 - Equipment safety. Risk assessment. Part 1 : Principles ;
- u) SR EN 12644-1:2003 – Lifting equipment. Information for use and test. Part 1 : Instructions ;
- v) SR EN 60204-1:2000 - Equipment safety. Electrical equipment. Part 1 : General requirements;
- w) SR EN 60529:1995 și A1:2003 – Protection level provided by covers ( Code IP ) ;
- x) SR EN 60947-5-1:2005 –Low voltage equipment. Part 5-1 : Equipment anc commuting elements for control circuits. Electromagnetic devices for control circuits ;
- y) SR EN 61000-6-4:2003 –Electromagnetic compatibility ( CEM ). Part 6-4 : Generic norms. Norm for emissions in industrial environment ;
- z) SR ISO 4301-1:1994 –Lifting equipment. Classification. Part 1: Generalities;
- aa) SR ISO 4301-5:1994 –Lifting equipment. Classification. Part 5: Overhead and gantry cranes ;
- bb) SR ISO 4310:1996 – Lifting equipment. Rules and test methods;
- cc) SR ISO 7296-1:1994 – Cranes and overhead cranes. Graphic symbols. Part 1: Generalities ;
- dd) SR ISO 7363:1998 – Lifting equipment. Technical characteristics and acceptance documents;
- ee) SR ISO 7752-1:1996 – Lifting equipment. Control devices. Location and characteristics. Part 1 : General principles ;
- ff) SR ISO 7752-5:1996 –Lifting equipment. Control devices. Location and characteristics. Part 5 : Overhead and gantry cranes ;
- hh) SR ISO 8566-1:1996 – Lifting equipment. Cabins. Part 1 : Generalities ;
- ii) SR ISO 8566-5:1996 – Lifting equipment. Cabins. Part 5 : Overhead and gantry cranes ;
- jj) SR ISO 8686-5:2000 – Lifting equipment. Calculation criteria of the loads and of test groups. Part 5 : Overhead and gantry cranes ;
- kk) SR ISO 9373:1997 – Lifting equipment and associated equipment. Precision of measurement of parameters during tests ;
- ll) SR ISO 10245-1:1999 - Lifting equipment. Limit devices and indicators.

### **10.1.8 Specific laws, rules, norms and prescriptions concerning the safety and safety for fire prevention and suppression**

These prescriptions, rules and regulations are non-limiting ones, the beneficiary can take other actions to prevent or remove any event (accident).

- Law 307/2006-fire-fighting;
- Safety and hygiene regulation 9/N/1993;
- GD 355/2007 – monitoring the workers health
- Order 508/933 – MMSS and MSF – Population safety and health;
- P 118-99-fire safety;
- Law 307/2006 – fire-fighting
- Law 319/2006 – H&S Law
- H&S Law no. 319/2006.
- GD 300/2006 – Minimum H&S requirements on temporary or mobile sites
- GD 971/2006 – Minimum H&S requirements at the workplace
- GD 1028/2006 – Minimum H&S requirements for the equipments with screens
- GD 1048/2006 – Minimum H&S requirements for the workers use of the PPE
- GD 1091/2006 – Minimum H&S requirements at the workplace
- GD 1146/2006 – Minimum H&S requirements for the workers use of the working equipments
- Department norms MIM – vol. I and V (not cancelled)

### **10.1.9 Specific rules for civil works**

- Law 10/1995 – building quality, published in the OG MO 12/24.01.1995

## 11. Interfaces with the contracted work

### 11.1 Interfaces

The contracted work of the **PROVIDER** will be executed within the following physical limits:

For Automation:

- Existing field device (terminal connectors).

For mechanical:

### 11.2 Worksite

The **PROVIDER** will comply with IT DP 045 "General rules to be applied by LG and IT DP 044 General safety instructions for External Companies that work on the beneficiary's sites.

## 12. Tests - commissioning – reception

### 12.1 Shop test assembly – technical acceptances, simulations, workshop tests

The **PROVIDER** engages to favour the workshop tests, checks, inspections and technical acceptances per each phase being in charge with energy LOTOTO process during tests.

The **PROVIDER** will provide to the **COMPANY** the proposed location (workshop) for tests, a detailed planning and full documentation (including manufacturing drawings) to allow the **COMPANY** to provide feedbacks and participate at all tests assembly, checks, inspections and technical acceptances.

The proposed location (workshop) for the tests must have the capability to perform all tests and measurements. The **PROVIDER** must be able to prove measurement eligibility by presenting all certifications and measuring methods of the measurement tools needed.

The **PROVIDER** will inform the **COMPANY** with at least two months in advance the details related to the verifications, inspections, tests and their planning, which will be conducted in the workshop or plant

The **COMPANY** reserves the right to make suggestions, comments and review all the basic and detailed design still the **PROVIDER** will remain responsible of the final performances and results. The **PROVIDER** must update the manufacturing documents within 10 working days after any improvements/observations are agreed with the **COMPANY**.

Only after engineering is acknowledged by the **COMPANY**, the **PROVIDER** may start manufacturing (partial engineering acknowledgement is accepted). The **PROVIDER** is not allowed to perform any modification without the written approval of the **COMPANY**.

The **PROVIDER** will specify to the **COMPANY** which are the assemblies or sub-assemblies which can be erected in the workshop as well as which must be erected on site. The **COMPANY** will review this proposal and make observations.

The automation technical acceptance concerns the ensemble of functions, having as objective their validation.

### 12.2 On site tests

The **PROVIDER** prepares the testing procedures for the equipment object of contracted work. He ensures the availability of the organising and participating personnel, in terms of quality, number and necessary time, based on the time schedule defined by the general planning for tests:

- Partial tests
- Assembly tests
- Test of energy LOTO elements
- Cold tests
- Hot tests in the exploitation environment





- Adjustment tests
- 72 h test
- ISCIR legal tests for authorization
- Industrial Commissioning
- Performance tests
- Reliability tests

The **PROVIDER** will follow minimum the template provide by the **COMPANY** - Annex no 31 – Template for pre-commissioning and commissioning

### 12.2.1 Description of automation tests specific to the contracted work

The FAT and SAT test for automation must include the minimum tests of the following (open list):

- visualization, operation and functioning of motors and valves in local mode, manual mode;
- visualization, operation and functioning in automatic mode.
- measurements visualization and operation.
- motors, valves and measurements alarms.
- interlocks.
- sequences and calculations.
- stability of PID controls.
- input parameters.
- access levels.
- Acoustic alarms.
- Energy Lock Out test

Other test:

- Data exchange with and other systems;
- Connection between PLC's on the same level;
- Connection between PLC's and HMI station client/server
- Connection between HMI server and clients
- Connection between new Level 1 and new Level 2

Test protocol of tests will be written by the **PROVIDER** and approved by the **COMPANY** using Annex no 31 – Template for pre-commissioning and commissioning

### 12.3 Conformlty of the equipment, object of contracted work

The **PROVIDER** will comply strictly with IT DP 045 "General rules to be applied by LG **PROVIDERS**".

### 12.4 Pre-Commissioning & commissioning

The **PROVIDER** will comply strictly with IT DP 045 "General rules to be applied by LG **PROVIDERS**".

The **PROVIDER** is requested to use smart acceptance criteria for each pre-commissioning and commission activities as per annex no 31 – Template for pre-commissioning/commissioning

Pre-commissioning minimum activities (open list):

Preparation:

Pre-assembly tests & manufacturing intermediary inspections

Integrated Factory Acceptance Tests (FAT)

End phase acknowledgments



Site Acceptance Tests (SAT)  
Erection checking  
End phases acknowledgments

Commissioning minimum activities (open list):

Cold tests  
Hot tests  
End phases acknowledgments  
Test of energy LOTO elements  
72h test  
ISCIR legal tests for authorization  
Industrial commissioning start  
Ramp up  
End phases acknowledgments (PAC)  
Other performance & reliability tests  
End phases acknowledgments (FAC)

#### 12.4.1 Stand-by & Intervention

The **PROVIDER** will have to ensure full support for pre-commissioning and commissioning activities following form of:

- Permanent presence during all pre-commissioning activities
- Permanent presence on **COMPANY'S** site in terms of 8 working hours per shift, week-end and holidays included, during all commissioning tests
- Permanent phone services for technical support and interventions (arrival on site 2 hours) after IC until PAC

This permanent presence will be maintained until achieving the operation of the installation delivered by the **PROVIDER**, as per the specification.

#### 12.5 Training

The training will be performed with training documents established by the **PROVIDER**, in **Romanian** language.

The **PROVIDER** will submit to **COMPANY** during early engineering phases the full training manual with clear syllabus/curricula (table of contents).

The training sessions will be organized at the **COMPANY** location thus to comply with the proper development of different phases of the project per each speciality, by ensuring the necessary know-how to different intervention parties, at the adequate moment.

The prerequisites for each speciality are necessary to be defined and addressed before each training.

The **PROVIDER** will provide for this training the necessary personnel having a perfect and very accurate knowledge and experience about the equipment.

##### 12.5.1.1 Training topics & proposed personnel to be trained by the **PROVIDER**

Main subject of training	No of people
Automation L0	2
Automation L1	2
Automation L2&IT	2
Mechanical , hydraulic and HTV	20
Electric	12
Process	10



### 12.5.2 Location for the training

- On-site, in the plant of the **COMPANY**
- On the installation erected in the plant, on the site of the **COMPANY**

### 12.5.3 Time schedule of the training

The ensemble of this training will be organized thus to comply with the proper development of different phases of the project, by providing the necessary know-how to different intervention parties at the adequate moment.

The training scheduling will take into account that the availability of **COMPANY's** personnel is limited due to production priorities and working shifts, the **PROVIDER** will make sure of this situation and arrange the full availability of his own training personnel.

The **PROVIDER** will specify in his offer the time schedule for the training period.

The **PROVIDER** will finalize the time schedule for the training period after performing the functional analysis.

### 12.6 Reception

The **PROVIDER** will comply strictly with IT DP 045 "General rules to be applied by LG **PROVIDERS**".

The Reception will take place 3 months after the Industrial Commissioning start-up, under the reservations that:

- The work executed by the **PROVIDER**, as well as the Equipment object of contracted work, achieve the results and performances defined in article " Results and Performances to be achieved and measurement»
- The **PROVIDER** has complied with all his contractual obligations.

## 13. Documents to be supplied

All the documents to be supplied from the **PROVIDER** will be in Romanian and English language.

The documents issued in a foreign language must be supplied in the "original language" version and the translation in Romanian language.

The final versions of all documents, updated and accurate, will be submitted to the **COMPANY** prior to the Industrial Commissioning or as per agreed planning.

### 13.1 List of documents to be supplied (non-exhaustive list)

Appropriate test certificates, material certificates, welding related quality documents and machined parts quality & test documents must be provided by **PROVIDER** in the corresponding phase of purchase & manufacture.

- Quality plan of the project as per ISO 9001 / 9002 / 14001
- BE and DE with indication of all static and dynamic loads (preliminary in the offer the **PROVIDER** will present an the loads discharged on the metallic structure of the bay)
- Drawings and documentations for mechanical and civil works:
  - Drawings for assemblies, sub-assemblies, details with the detailed list of drawings
  - Assembly layouts showing the cinematic diagram of the equipments and the possible interferences between moving sub-assemblies
  - The reactions on wheels ( trolley & crane ), the wheel load diagram, vertical and horizontal loads / wheel & wheel assembly, driving & idle wheels
  - General layouts for implementation
  - Assembly layouts for civil works and reduction of loads



- Dimensioning layout for civil works
- PID : Pipe Instrumentation Design Diagrams
- Piping isometric drawings
- Sub-contracting of his scope of supply
- Particular technical specifications
- Calculation notes.
- Electrical and automation layouts and drawings
  - Developed diagrams: electrical circuit diagram, electrical cabinet bill list, electrical cabinet layout, layout of equipment installation and cable route, wiring diagrams, cable list, etc
  - Network diagram, signal list, hardware configuration,
  - PID diagram with electrical tag
  - Description of software application for PLC, HMI, Level 2 software, database architecture, tables and fields
  - General and detailed functional analysis
  - General and detailed organic analysis
  - The list of tasks for acceptance and tests
  - The commented listings
  - The source code for all software and all necessary tools to develop application, programs (L1 and L2),
- Reliability study
- Governance model
- FMEA analysis
- Technical description during erection phases for all performed operations (daily)
- Complex lifting plans
- Instructions for energy Lock Out / Tag Out/ Try Out.
- Study for safety during conception including HIRA
- Detailed equipment and component list
- Detailed handling procedure
- All standards used and catalogs
- Detailed sequence equipment and components mounting for warehousing and transport optimisation
- Table of "usual" lifetime for the critical equipment's
- All the execution details needed for the manufacturing of the crane,
- 3D simulations (with animations and interferences pointed)
- Procedure for control and calibration of weighting system
- List of TPM/CM measures and actions for all project phases
- Detailed planning for design phase (MS Project 2007)
- Detailed planning for manufacturing with clear milestones for the pre-inspections and final inspections (MS Project 2007)
- Detailed planning for erection phase (MS Project 2007)
- Detailed planning for commissioning phase (MS Project 2007)
- Detailed list of operations for erection/mounting and list of verification/checking's
- Description of operational modes for erection, mounting, site assembly and tests (technological file)
- Technical control file and protocol description for all tests as per **COMPANY'S** template
- Listing and adjustment sheets
- Instructions for operation, exploitation and maintenance including Lockout/tag out process
- Preventive maintenance plan
- Complete constructor file
- Risk assessment for all phases
- The documentation listed during the submission of the incorporation certificate (or the conformity certificate, in case of an order for turn-key work) or of the CE certificate



Specific documentation – non exhaustive list

### 13.2 Diffusion methods of drawings/documents

The **PROVIDER** will comply strictly with IT DP 045 "General rules to be applied by LG **PROVIDERS**".

The **PROVIDER** is requested to propose to **COMPANY** the easy of structuring the documentation before starting any process. The final documentation structure as well as the naming of each file must be agreed by the **COMPANY**.

All drawings will be submitted in \*.dwg format as well as \*.pdf format.

All the drawings and documentation to be received will be defined into an excel list (centralizer of all documents/drawings) as per annexed model file. This list will act as a monitoring file (live document) for all send, updated review documents and drawings.

Any document or drawing is sent with the updated excel list (summary of all documents/drawings).

The **COMPANY** does not accept partial transmittals or any other type of list fragmented list.

After submitting the drawings/documentation (as per each milestone agreed) the **PROVIDER** must be available to explain and receive the final feedback for all the design submitted during a working meeting at **COMPANY'S** premises.

The documentation, included As Build will be provide on paper (4 files) and CD (3 pcs)

Prior to as build documentation the **PROVIDER** will submit the draft of modifications to **COMPANY** for review (modifications in red colour)

As Built documentation will contain also the drawings and documentation unchanged (as original)

The CD will contain the files in editable form (doc, xls, CAD, Eplan)  
and pdf / tif

#### Planning

The key estimated dates for the development of the project are:

1	<b>New crane of 275 tf</b>		<b>45 days</b>	<b>Day 0</b>	<b>Day 45</b>
2	<b>Technical part</b>		<b>25 days</b>	<b>Day 0</b>	<b>Day 25</b>
3	Send RFQ	C	3 days	Day 0	Day 3
4	Make site survey	P	10 days	Day 3	Day 13
5	Send technical offer	P	7 days	Day 3	Day 10
6	Analyze technical offers and send feedback	C	10 days	Day 10	Day 20
7	Update technical offers as per feedback	P	3 days	Day 17	Day 20
8	Technical agreement	C&P	5 days	Day 20	Day 25
9	<b>Commercial part</b>		<b>20 days</b>	<b>Day 25</b>	<b>Day 45</b>
10	Send commercial offer	P	5 days	Day 25	Day 30
11	Negotiate contract	C&P	15 days	Day 30	Day 45

C= Company

P = PROVIDER

The **PROVIDER** defined and deliver his planning by specifying the all the phases, including the preparation studies and works.

The planning document will be defined in Microsoft project 2007 and will be submitted in the original format that is the \*.mpp extension.



The planning will be made respecting the succession of the tasks rather the task type (electric, mechanical, etc..).

The **PROVIDER** will avoid using the tasks constrains (i.e. must start on, must finish on, etc) and will use links for all tasks.

**PROVIDER** will make his planning taking into consideration that the defined task duration for a phase must not exceed the phase duration divided by 20. If tasks exceed this duration the **PROVIDER** must split the main task in smaller ones.

The erection and tests phases are done on hourly base planning.

The **PROVIDER** also establishes the following different planning and ensures the compliance with:

- Detailed time schedule of the project, allowing to monitor the details of:
  - ▶ Studies and design
  - ▶ The dates for the submission of documents
  - ▶ The reviews of conception and design
  - ▶ The procurement and manufacturing
  - ▶ The workshop tests, pre-inspections, final inspection before delivery, FAT
  - ▶ The civil works
  - ▶ The transportation
  - ▶ The training periods
  - ▶ The on-site erection.
  - ▶ Shop test assembly
  - ▶ The tests and commissioning.

The **PROVIDER** will send a weekly update of the planning in Microsoft project 2007 (\*.mpp format) for all the above phases except for the erection, shop test assembly, tests and commissioning.

## 14. Project management

The **PROVIDER** must comply and respect with the governance model of the **COMPANY** and assure full availability and collaboration on the following:

1. Kick off meeting
2. Project monitoring meetings (during erection daily)
3. Safety meetings
4. Presence in safety and quality audits
5. Special safety trainings
6. On spot analysis (RCA, etc) related to the project
7. Clarifications and technical discussions

Any change considered in the initial organization of the **PROVIDER** must be announced with at least 3 days in advance by submitting a new organization sheet.

All roles and responsibilities inside the **PROVIDER's** organization must be clearly detailed and explained to **COMPANY** representatives.

### 14.1 Procedure for quality control

The **PROVIDER** will comply strictly with IT DP 045 "General rules to be applied by LG **PROVIDERS**"

The **PROVIDER** will transmit to the **COMPANY** with at least two months in advance, his **Quality Insurance Manual** as well as the **Quality Insurance Plan**, specific to the respective contracted work which he will apply during the entire period for studies, manufacturing, and erection ad commissioning of concerned equipment.



## 15. Presentation of the offer

### 15.1 Presentation of the technical offer

In his offer, the **PROVIDER** must strictly comply with the splitting into posts as described in the above chapters.

The **PROVIDER** will define its technical offer considering the instructions provide in the Annex 00 - Instruction for bidders on quotation

The **PROVIDER** will use to clarify its own supply the Annex 11 Scope of works template

### 15.2 . Price breakdown

The **PROVIDER** will use the format of the Annex 11 Scope of works template to detail the price breakdown

## 16. Annexes

- Annex 00 Instruction for bidders
- Annex 01 Technical specification
- Annex 02 04 F.DP.054 Technology of works\_V2\_EN
- Annex 03 F.DP.087 Questionnaire for Contractor H&S V1\_EN
- Annex 04 Cartus dwg-Autocad
- Annex 05 Energy fluids for crane and erection
- Annex 06 Layout and existing bay drawings
- Annex 07 Wheels single
- Annex 08 Hook traverse
- Annex 09 Available space for pre-mounting
- Annex 10 Engineering of the existing crane PR152
- Annex 11 Scope of works template
- Annex 12 GENERAL IT REQUIREMENTS for new Automation Systems DAD 2019 Aug
- Annex 13 Template for pre-commissioning and commissioning
- Annex 14 Preparing data send to PDC system
- Annex 15 LG application for data exchange
- Annex 16 IT DP 044 General safety instructions for External Companies that work on the beneficiary sites\_rev1.DOC
- Annex 17 IT DP 046 WCM Specification for suppliers Rev.0.
- Annex 18 IT DP 045 General rules to be applied by Liberty contractors- engl – rom
- Annex 19 GCIP-00-Liberty
- Annex 20 Additional layout
- Annex 21 Supply details
- Annex 22 General arrangement drawings of hoisting gearboxes
- Annex 23 Camera recommendation
- Annex 24 Electrical Bay SWD and contact line
- Annex 25 Spare parts for 2 years recommendation

