



ArcelorMittal

APPENDIX NO. 5

TO THE REQUEST FOR QUOTATION NO 02/0211/2021 Z DNIA 15.11.2021

TECHNICAL SPECIFICATION

For the supply (in accordance with DDP), unloading, erection and commissioning of a new overhead travelling (OHT) crane #1025 of lifting capacity $Q=40t$, consistent with the requirements of AMP for an automatic crane drive control system - Automatic Crane Engine (ACE), 2 sets of electrically driven tongs (ACE) for horizontal transport of hot sheet coils of weight $Q=35t$ and retrofitting of the existing OHT crane #1020 / $Q40t$ for the needs of ACE in the Cold Rolling Mill in Kraków.

The subject-matter of the contract indicated in these specifications relates to the project entitled “*Development of an optimum logistic model and cooling model for the storage area upstream the pickling line in the Cold Rolling Mill of ArcelorMittal Poland S.A.*” (project no. POIR.01.02.00-00-0211/17-00), co-funded under Measure POIR.01.02.00 “Sectoral R&D programmes” of the Smart Growth Operational Programme 2014 - 2020 co-financed by the European Regional Development Fund.

All purchases, services and supplies under DDP INCOTERMS 2010 that are subject to this bid must be included and cooperate with the existing infrastructure and equipment in the Company and must meet the same technological standards. Therefore, the need to preserve the same technological conditions and to maintain unification of devices resulting from the extension of the existing infrastructure determined the records in this specification. The applied records shall be justified by the need to ensure efficient project completion. The above-mentioned regulations shall not require the Bidders to apply the indicated solutions, but only inform them about minimum parameters and standards. Application of some types of solutions shall not be obligatory, but exemplary only. The indications regarding expected technical parameters as well as the indications regarding specified types and manufacturers' names shall be general and refer solely to exemplary designations of equivalent products and shall not be the only acceptable solution. On this basis the Buyer permits equivalent solutions.

The bid must be complete in all respects and must contain all components / equipment required for correct construction, operation and maintenance. The Bidder undertakes to familiarise itself with this specification and make sure that the devices are technically feasible, and to accept full responsibility for the guaranteed operation of devices to be delivered in terms of their capabilities, parameters as well as smooth and reliable functioning.



ArcelorMittal Poland S.A. KRAKÓW

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CHAPTER I

1. FOREWORD

1.1. INTRODUCTION

"ArcelorMittal Poland" S.A. (hereinafter referred to as **the Owner**) implements a full steel making cycle, starting from raw material facilities (coke plant, BF, BOF Plant) to production of finished rolled products.

The **Owner** is interested in the increase in production of Cold Rolling Mill, therefore it is required to increase storage capacity for coils upstream the pickling line and ensure required flow capacity.

1.2. PURPOSE OF THE PROJECT

The purpose of the project is a purchase, installation and commissioning of:

- new OHT crane #1025 of lifting capacity $Q=40.0t$ for transport of hot-rolled sheet coils, consistent with the requirements of AMP for the automatic crane drive control system (ACE). The OHT crane should be controlled by radio system from the "0" level. The OHT crane shall operate in the Cold Rolling Mill bay in aisle Z Y - Pickling Station.
- 2 sets of electrically driven tongs for horizontal transport of sheet coils, consistent with the requirements of AMP for the automatic transport of hot-rolled sheet coils (ACE).
- modernisation of the existing OHT crane #1020 /Q40t for the needs of ACE system.
- carrying out risk analysis, making arrangements with UDT and performing acceptance of the entire ACE system by UDT, i.e. overhead travelling cranes operating in automatic mode and safety zones in the bay (**ATTENTION! Preparation of safety zones is not part of this tender and shall be completed under another project by the Contractor selected to prepare the zones**).

AMP requirements for the automatic crane drive control system (ACE) and ACE tongs are described in CHAPTER III of this specification.

1.3. TARGET

Hot-rolled sheet coils - being processed by the Pickling Plant - shall be supplied by railway transportation directly from the Hot Rolling Mill or from intermediate storage yards. Unloading and delivery of the coils at the production line entrance shall be performed with the use of two Q40t cranes. All transport operations shall be ultimately carried out in automatic mode with the possibility of manual control from the cabin or radio terminal.

To this end, the cranes and tongs shall be equipped with devices and sensors which enable automatic control of movement of cranes and tongs and which are required by the safety system for automatic transport in the bay.

Basic data of transported coils:

- Coil diameter
 - Min.: 1000 (610 - rejects) mm
 - Max.: 2300 mm
- Coil width
 - Min.: 680 mm
 - Max.: 2100 mm
- Coil max. weight: 35.0 t
- Temperature of transported coil: max. 600°C

1.4. CONTENTS OF THE SPECIFICATION

This Specification contains environmental data of the Owner's location in Krakow, required technical standards, necessary technical data, the Bidder's scope of works, the Buyer's/Owner's rights, requirements for technical capabilities of the Bidder, required availability, interchangeability, quality and safety, and other information, which are required for the Technical Bid (e.g. performance guarantee).

1.5. GENERAL REQUIREMENTS

- The Bid submitted by the Bidder shall comply with the requirements of this Specification and price quoted in a separate, sealed envelop addressed as indicated in the Request for Quotation.
- The Bid shall be complete, and all activities and equipment required for proper Project execution shall be specified by the Bidder in its Bid.
- The Bidder shall familiarise itself with this Specification and attached documents and, upon making sure that delivery, erection and commissioning of the crane is feasible for it, it shall assume full responsibility for guaranteed level of functionality of the crane with respect to productivity, performances, parameters, availability and undisturbed operation of process facilities of Cold Rolling Mill in AMP in Kraków.
- The Bidder shall submit the bid in accordance with the tender documentation. **The Bidder should also foresee all additional works not particularly listed in this Specification.**

1.6. ABBREVIATIONS USED IN THE SPECIFICATION

- ACE - Automatic Crane Engine, an abbreviation used to describe the components designed to operate an automatic crane,

- UDT - Office of Technical Inspection,
- PL - Performance Level - safety level, element of risk assessment according to PN-EN ISO 13849-1,
- PLC - programmable logic controller, programmable controller used in industrial automation.
- Safety zones - barriers, gates and related safety features designed to restrict access to specific parts of the bay where overhead cranes operate in automatic mode.

2. ENVIRONMENTAL DATA

Local environmental data for the design purposes are provided in CHAPTER II ITEM 1 of this specification.

3. MEASUREMENT UNITS, STANDARDS, NORMS AND REGULATIONS

The Bidder shall observe standards, regulations and other provisions of the law, referred to in this Specification with respect to completion of delivery and services in accordance with quality assurance rules and meeting delivery and performance deadlines. All other technical requirements shall comply with standards of environment pollution control. List of applicable measurement units, norms, standards and regulations as well as the rules of their application by the Buyer are given in CHAPTER II ITEM 2 of this specification.

4. TECHNICAL INFORMATION

List of basic documentation is described in CHAPTER II ITEM 3. Detailed technical and technological requirements are described in CHAPTER III of this specification.

5. SCOPE OF THE BIDDER'S WORKS

5.1. SUBJECT-MATTER OF THE PROJECT

The subject-matter of the project is:

- 5.1.1 Supply, erection and commissioning of the new OHT crane #1025 of lifting capacity $Q=40.0t$, consistent with the requirements of AMP for the automatic crane control system - Automatic Crane Engine (ACE).
- 5.1.2 Supply, assembly and commissioning of 2 sets of electrically driven tongs for horizontal transport of sheet coils, consistent with the requirements of AMP for the automatic transport of hot-rolled sheet coils (ACE).

5.1.3 Modernisation of the existing OHT crane #1020 / Q= 40.0t for the needs of ACE.

5.1.4 Carrying out risk analysis, making arrangements with UDT and performing acceptance of the entire ACE system by UDT, i.e. overhead travelling cranes operating in automatic mode and safety zones in the bay.

3 operation modes for cranes #1025 and 1020 are foreseen: manual control from the cabin, radio control with a portable control panel and auto operation.

5.2. GENERAL SCOPE OF THE PROJECT

The investment project has been generally split into four parts:

5.2.1. SUPPLY OF THE NEW ACE CRANE (#1025) and 2 SETS OF ACE TONGS.

It comprises pre-fabrication and supply to the Owner's seat (in Kraków):

- of the ACE crane #1025 of lifting capacity Q=40.0t for horizontal transport of hot-rolled sheet coils in aisle Z-Y in the Bay of the Cold Rolling Mill;
- 2 automatic tongs (ACE) for horizontal transport of hot-rolled sheet coils in aisle Z-Y in the Bay of the Cold Rolling Mill and 2 stands for tongs.

5.2.2. ASSEMBLY OF OHT CRANE (#1025).

It comprises erection of the supplied OHT crane and its equipment:

- the ACE crane of lifting capacity Q=40.0, equipped with the electrically driven automatic tongs (ACE) for horizontal transport of hot-rolled sheet coils in aisle Z-Y in the Bay of the Cold Rolling Mill.

5.2.3. COMMISSIONING OF OHT CRANE (#1025).

It comprises cold and hot commissioning, functionality tests, acceptance by the Office of Technical Inspection (UDT) and approval of the delivered and erected crane and its equipment for use.

5.2.4. RETROFITTING THE EXISTING CRANE (#1020) Q40T FOR THE NEEDS OF ACE

- installation of additional devices necessary for operation of the crane in the automatic mode (ACE) and with the tongs (ACE).
- restart of the crane - it comprises cold and hot commissioning, functionality tests, acceptance by the Office of Technical Inspection (UDT) and approval of the retrofitted crane for use.

5.2.5. CARRYING OUT RISK ANALYSIS FOR THE WHOLE SYSTEM OF AUTOMATIC CRANES, MAKING ARRANGEMENTS WITH UDT AND PERFORMING UDT ACCEPTANCES OF THE WHOLE SYSTEM.

- The whole system, i.e. overhead travelling cranes #1020 and #1025 as well as safety zones in the bay, should be taken into consideration in the risk analysis and arrangements with the Office of Technical Inspection.
- **NOTE! Preparation of safety zones is not part of this tender and shall be completed under another project by the Contractor selected to prepare zones.**

5.3. DETAILED SCOPE OF THE PROJECT

The detailed scope of works and requirements are described in CHAPTER III of this Technical Specification.

6. TECHNICAL CAPABILITIES OF THE BIDDER

- The requirements are specified in item IV.1. of the Request for Quotation.

7. WORKS COMPLETION TIME

7.1. DELIVERY OF THE SCOPE OF WORKS

The full scope of work and delivery of this Technical Specification shall be divided into two stages:

- STAGE I including:
 - preparation of a risk analysis for the entire ACE system
 - items 5.2.1, 5.2.2 and 5.2.3 for crane 1025 Q 40.0t, aisle Z- Y shall be completed within max. **12 months** from the date of signing the contract.
 - Item 5.2.4 - Retrofitting of OHT crane #1020 shall be completed within max. **12 months** from the date of signing the contract.
- STAGE II including:
 - Commissioning of OHT cranes #1020 and #1025 in automatic mode.
 - Making arrangements with UDT and acceptance of the whole system by the Office of Technical Inspection -
 - Stage two must be completed by max. **6 months** from the date of signing Stage I Completion Report.
- The period from the date of signing the Contract until the completion of the entire task is a maximum of **18 months**.
- The period from the completion of the entire task until signing the Final Acceptance Certificate is **30 calendar days**.

7.2. WORK SCHEDULE

5.2.4. PRELIMINARY WORK SCHEDULE

A preliminary work schedule comprising periods of time assumed for the completion of stages of the Project shall be attached to the Bid:

- Submission of the technical documentation of the ACE crane #1025 and ACE tongs to be supplied to the Owner for approval.
- Submission of the technical documentation for the retrofitting of crane #1020 for the needs of ACE to the Owner for its approval.
- Submission of a risk analysis of the entire target system approved by the UDT to the Owner.
- Completion of individual supplies that are of key importance to meet the installation and project completion deadlines.
- Take-over of the work site and start of the installation works.
- Erection of the new ACE crane #1025 with its equipment and retrofitting of the crane #1020 for the needs of ACE.
- Commissioning and UDT acceptance of the supplied crane and retrofitted crane, safety zones in the bay, with the equipment.
- Submission of a complete as-built documentation along with the required operating documentation to the Owner.

Once the subject of supply has been completed, 6-month commissioning of each crane in the automatic mode (ACE) shall be carried out. Then, the Bidder / Contractor shall again submit the cranes to the acceptance by the Office of Technical Inspection (UDT).

This schedule should also include a description (specification) of tasks forming-called critical path of the Project and its milestones. Scheduled deadlines shall be guaranteed by the Bidder/Contractor and shall be subject to commercial terms and conditions set forth in the Commercial Bid.

Due to logistics conditions in the aisle Z-Y, the Owner expects an earlier completion of the project of retrofitting of the existing crane #1020 and supply of the ACE tongs.

Local requirements for erection of the crane in the aisle Z-Y and retrofitting of the crane #1020 and, in particular, production conditions, and health & safety requirements must be taken into account.

5.2.5. DETAILED SCHEDULE

Detailed work schedule shall be submitted to the Owner for approval in the framework of performance of the Bidder's/Contractor's scope of work, with consideration of the stages of erection site organisation and securing, performance of all activities related to admission of the Bidder/Contractor by the Health and Safety services to work at the Owner's site, completion of purchases, prefabrication, dismantling and installation, tests and commissioning, acceptance by UDT (Office of Technical Inspection), hand-over for operation and preparation of as-built documentation. This schedule should also include a description (specification) of tasks forming-called critical path of the Project and its milestones.

7.3. GENERAL REQUIREMENTS

The Bidder/Contractor agrees to create work schedules in compliance with the Owner's requirements and standards (MS Project).

8. AVAILABILITY AND INTERCHANGEABILITY

All working parts shall be able to be prepared for operation, inspection, lubrication and replacement/maintenance during a minimum downtime. All similar parts of the equipment shall be interchangeable.

9. QUALITY, SUPERVISION, TRAININGS, WORKMANSHIP, COMMISSIONING, TESTS AND INSPECTIONS

9.1. QUALITY

- Apart from safety, quality issues will be of the highest priority to the Owner at all stages of Project execution.
- Materials and workmanship shall be of high quality, suitable for the intended purpose of application and compliant with practices and standards set forth in this Specification. All components shall undergo inspection according to Quality Assurance Program, which shall be submitted by the Bidder, unless the Buyer has waived it by submission of a written statement.
- The Bidder/Contractor shall submit to the Owner all required quality certificates (including mandatory quality certificate 3.1 according to PN-EN 10205:2006, or equivalent, for materials used and welding works completed).

9.2. SUPERVISION

The Bidder/Contractor shall appoint a coordinator (Site/Project/Work Manager) responsible for supervision of proper course of works in all its aspects and at all stages of execution (quality, progress, on-time performance, etc.) and for cooperation and contacts with the Owner on an ongoing basis.

9.3. TRAININGS

The Owner expects the Bidders/Potential Contractors to carry out trainings dedicated to the Owner's personnel working for Cold Rolling Mill, Transport and Logistics for Flat Products and Central Maintenance Office (for both operation and maintenance personnel). The Bidder shall submit the scope of trainings, number of employees to participate in trainings, number of vocational training groups, venues, dates and times of trainings. Trainings should be organised taking into account that the work is carried out in a four-shift system and they should take place in the morning and afternoon hours and be addressed to electricians, mechanics and crane operators.

Crane operators must undergo a practical training with an instructor. Every trained employee shall obtain a training certificate (stating the trainee name) specifying the contents, scope and duration of the training of a given employee.

9.4. WORKMANSHIP

- The Contractor shall perform the works in accordance with technical conditions of performance and acceptance of works, effective technical regulations, norms and standards, safety at work and fire prevention regulations and agreed Detailed Work Schedule.
- The Contractor shall perform all works related to preparation of equipment, which is subject to UDT acceptance, to such acceptance (including preparation of application for acceptance).
- The offered materials and workmanship shall be of high quality, suitable for the intended purpose of application and compliant with practices and standards set forth in this Technical Specification and in the Detailed Engineering documentation. All components shall undergo inspection (according to Quality Assurance Program which shall be submitted by the Bidder) unless the Owner has waived it by submission of a written statement.
- The Contractor shall provide all basic and auxiliary materials required to perform the works along with necessary tools and special equipment.
- Upon completion of the works, the Contractor shall submit to the Owner the set of operating and maintenance manuals along with functionality test and measurement reports and complete as-built documentation for installed equipment.

9.5. COMMISSIONING

9.5.1. Cold commissioning

The so called "cold" (partial) commissioning of the equipment shall be carried out upon completion of works at a given part of the project, removal of possible defects and irregularities, performance of additional works (if any), which resulted to be necessary during the execution of project-related works, fulfilment of the Owner's health and safety requirements, notification by the Contractor of the readiness to cold commissioning, and after agreeing the terms and conditions of cold commissioning with the Owner. All functional tests shall be carried out during cold commissioning. Any possible defect or irregularity shall be removed during cold commissioning.

The cold commissioning shall be performed with the use of the Contractor's test software. The software must enable:

- testing input and output signals,
- communication with peripheral devices,
- testing signals/safety equipments.

9.5.2. Hot commissioning

The so-called "hot" commissioning of the equipment shall be carried out upon successful completion of all works, completion of cold (partial) commissioning, removal of possible defects and irregularities, execution of additional works (if applicable), which resulted to be necessary during the execution of project-related works, execution of functional tests, fulfilment of the Owner's health and safety requirements, notification by the Contractor of the readiness to hot commissioning, and after agreeing the terms and conditions of hot commissioning with the Owner.

The hot commissioning in the manual mode shall be performed with the use of AMP software. The software shall be adapted by AMP to the electrical diagram provided by the Contractor. AMP shall reserve the right to use the whole or part of the Contractor's test software for its own software. AMP's software for the manual mode shall be made available to the Contractor, but shall remain the exclusive property of AMP.

9.5.3. Adjustment run of overhead cranes (#1020 and #1025) and availability tests - stage I

- The entire implementation of stage I should be completed within no more than 12 months from the date of signing the agreement for this task.
- Completion of Stage I shall be confirmed by signing Stage I completion report by AMP.
- The crane and equipment shall be adjusted during the cold and hot commissioning.
- The expected duration of the availability tests of the crane and its equipment is 30 days, starting from the date of the Contractor's notification of the equipment readiness for testing (upon successful crane's acceptance by the Office of Technical Inspection). At this stage, the availability test shall not include testing the availability of ACE tongs, manipulators and 2D/3D laser scanners. They shall be subject to 30-day availability test after completion of commissioning according to item 9.5.4. Functional commissioning of the cranes in ACE mode.
The Contractor may report the equipment readiness for testing only upon equipment acceptance by the Office of Technical Inspection (UDT).

9.5.4. Functional commissioning of the cranes in ACE mode - stage II

- The entire implementation of stage II should be completed within no more than 6 months from the date of signing the Stage I Completion Report.
- Completion of Stage II shall be confirmed by signing the 'Final Acceptance Certificate' by AMP.
- Once adjustments and availability tests according to item 9.5.3 have been completed, the crane shall be subject to commissioning for operation in automatic mode (ACE).

- Expected time for start-up of ACE mode for each crane is 6 months starting from the completion of the commissioning and tests according to item 9.5.3.
At this time, functions of the automatic mode (ACE) shall be activated and tested along with ACE tongs, manipulators and 2Dlaser scanners within times and in ways agreed with the Contractor.
- After the functional commissioning of the crane in ACE mode is completed, the Contractor shall assign a reference number of the tested software version and the crane shall be again subject to the acceptance by the Technical Inspection Office (UDT).
- After successful acceptance of the crane by the Office of Technical Inspection, 30-day availability test of the crane and its equipment shall be carried out.

9.5.5. PLC Program Log

The Contractor shall develop PLC Program Log for each crane separately in which, during the commissioning until putting the automatic mode into service, the following data are stored:

- Date,
- Time of commencement of works (optional),
- Time of program copying,
- PLC software version (technological part) with indicating the party that made a change (AMP/the Contractor),
- Safety software version (first group of safety software),
- Was the first group of uploaded safety program previously tested and unchanged since the tests (YES/NO/UNCHANGED),
- Safety software version (second group of safety software),
- Was the second group of safety programs previously tested and unchanged since the tests (YES/NO/UNCHANGED),
- Was the software tested after upload (YES/ONLY CHANGES/NO),
- Spaces for comments/remarks,
- Space for signature of a person uploading program to PLC,
- Space for signature of the Contractor/AMP's representative,
- Space for the third (optional) signature of a supervisor/tester.

Log must be completed each time software is downloaded to PLC. In the course of commissioning and making minor changes in the program, which are tested on an ongoing basis, it is permissible to enter version and make entry in the Log collectively before completing the works and leaving the crane. Collective entries must be made at least every 8 working hours.

In addition, the Log must contain table page where each person filling the log out shall enter their first name and surname, company name, contact number, e-mail and signature. This page should be at the beginning of the log.

Depending on the nature of the changes made in the program and whether it is AMP or the Contractor who is responsible for making them, the other party should have its own representative who participates in uploading the program.

The program which does not require uploading the first or the second group of the safety software shall be defined as a technological part.

9.6. INSPECTIONS

Prior to submission of the equipment to acceptance by the Technical Inspection Office, routine inspections of handling equipment installed under the Project shall be carried out (by the team of specialists of the Bidder/Contractor, the Owner and/or third-party entity) in order to confirm the scope and quality of the Project by the Bidder/Contractor. Positive outcome shall be a prerequisite to submit the equipment for acceptance by the Technical Inspection Office. Negative outcome indicating occurrence of faults committed by the Contractor (except for the faults not attributable to the Contractor) shall automatically initiate procedure of corrective actions by the Bidder/Contractor. Upon removal of possible reason(s) of negative outcome of inspection, the OHT crane and/or its equipment shall undergo repeated inspection.

9.7. HAND-OVER TO OPERATION

- Hand-over to operation shall be performed in two stages:

Stage I - after completion of item 9.5.3. - Adjustments and tests of the crane. Completion of stage I shall initiate guarantee period covering completed at this stage supplies and functionalities which were tested during 30-day availability test of the crane. At this stage, the availability test shall not include testing the availability of the supplied ACE tongs, manipulators and 2D/3D laser scanners. They shall be subject to 30-day availability test after completion of the commissioning according to item 9.5.4. Functional commissioning of the cranes in ACE mode.

Stage II - after completion of item 9.5.4. Functional commissioning of the cranes in ACE mode and after signing Final Acceptance Certificate.

- The Final Acceptance Certificate for the whole Project shall be signed only upon reaching all guaranteed parameters (specified in **CHAPTER III item 5** and in **this technical specification**) by the equipment delivered by the Bidder/Contractor and required parameters in accordance with the measurement procedure of technical and technological operation parameters of OHT cranes and equipment, control systems, reliability of operation of all components delivered under the Project agreed with the Owner and upon completion of 30-day **availability tests**.

The **availability test** shall be measured over 30 days of operational activity, during operation of the crane under industrial conditions. Availability tests are calculated based on the following formula:

The **AVAILABILITY RATE** will be greater than or equal to 99.5%.

$$AR = \frac{(W - (Tp + Tt)) \times 100}{W - Tp} \geq 99,5 \%$$

Where:

W = Total hours of crane operation/month

Tp =Maintenance intervals (scheduled downtimes)

Tt =Blocking failures (permissible downtimes)

$$AR = \frac{(720 - (48 + 3)) \times 100}{W - 48} = 99,55 \%$$

Blocking failure = failure preventing all movements of the crane.

10. PAINTING

- The crane and its additional equipment shall be protected from corrosion and heat (due to high temperature in the crane area). The Bidder/Contractor shall submit a proposal of applying suitable primers and finishing coats for individual devices, depending on the conditions in which the crane and its equipment operate.
- When selecting the finishing of structural elements, it is necessary to consider working environment of cranes within the range of possible HCl acid fumes.
- Finishing coat for crane structure - RAL 1028 colour.
- Finishing coat for moving parts (e.g. road wheels, rope pulleys, rope drums, winch trolley run rails, etc. - **RAL 3020** colour (except when another colour is required by provisions of law, rules of safety at work and Owner's Standards).
- Finishing coat inside the cabin - matt mahogany brown **RAL 8016**
- **Final thickness of protective coatings shall be 180-200 µm.**

11. PRICE

- The Bid price shall not be quoted in the Technical Bid.
- The Bid price shall be quoted by the Bidder/Contractor in the Commercial Bid.
- The Bid price shall cover all services (labour consumption), components (materials and parts), equipment (machines and special tools) and other expenditures (e.g. costs of trainings).
- The Bid price shall comprise costs of adaptation of employees and equipment to comply with OHS standards applicable in AMP.

12. PERFORMANCE GUARANTEE

- The Bidder/Contractor guarantees high quality of workmanship of engineering solutions and of materials selected for engineering solutions and high quality of workmanship of individual parts and combined components of the equipment, which is offered in accordance with the requirements of guaranteed parameters set forth in this Technical Specification.
- Performance guarantee (see below) shall comprise individual components and systems (including electric equipment) with respect to their accuracy, ratings/productivity and integrated operation. Performance guarantee shall also comprise individual electric and safety components and systems with respect to their accuracy, ratings/productivity and integrated operation.
- The Guaranteed parameters are specified in **CHAPTER III item 5**.
- The period of guarantee for the whole Project shall begin at the day signing **Final Acceptance Report**. Minimum period of guarantee for supplies and services expected by the Owner is of 24 months.

13. GUARANTEE OF SUPPLY AND WORKMANSHIP QUALITY

- Delivered solutions shall be free of faults and defects arising from the use of defective materials and/or parts and/or from poor workmanship quality. The Bidder/Contractor shall guarantee that delivery will be performed on time and in a form compliant with the contract awarded.
- The Bidder/Contractor shall guarantee that state-of-the-art technical and engineering solutions will be applied.

14. SAFETY OF PEOPLE, WORKS AND OFFERED SUPPLIES

Safety issues shall be the highest priority for the Owner at all stages of the Project execution.

14.1. PRE-CONDITIONS

- The most important consideration during performance of works within the scope of the Project shall be their compliance with applicable regulations concerning the safety of persons and work. The Bidder/Contractor shall make all personnel participating in the Project execution (including personnel of subcontractors accepted by the Owner) familiar with the documents concerning safety at work on the Owner's premises, submit these employees to initial Occupational Health and Safety trainings conducted by OHS Department of the Owner. Knowledge of AMP OHS requirements shall be verified by OHS examination for the contractors carried out by the Owner. Positive result shall be certified in the Safety Passport. The Contractor shall obtain the Passports entitling trained employees to perform work on the Owner's premises.

- Prior to commencement of the works the representatives of the Contractor shall submit proof of valid medical examinations in the form of appropriate document (certificate confirmed by signature and stamp of physician) and shall be trained in the scope of OHS rules and regulations effective at the Owner's site (including Safety Passports for employees of contractors and subcontractors and familiarity with the contents of the Owner's Health and Safety Agreement and standards).
- The approximate time for employees of a third-party Contractor and subcontractors to obtain Owner's OHS Department approval and be allowed to work at the Owner's site is approximately 10 working days, which shall be taken into account in the cost estimate and work schedule. Procedure of obtaining the foregoing authorisation is described in detail in **Health and Safety Agreement**.

14.2. TERMS AND CONDITIONS OF THE BID

- The solutions offered in the Bid shall have approved safety systems to protect employees from consequences of occurrence of potential hazards and to provide them with safe access to the equipment for maintenance or operation purposes.
- The Bid shall comprise declaration that the delivered and installed equipment will have safety features compliant with the Owner's standards (including **LOCK-OUT/TAG-OUT** system).
- The Bidder shall guarantee that the design and installation of the new OHT crane meet OHS requirements included in the Regulation of the Minister of Economy of 21 October 2008 on essential requirements for machinery.

14.3. TERMS AND CONDITIONS OF PERFORMANCE

- Prior to the commencement of the works, the Contractor shall prepare and sign:
 - Memorandum of Understanding,
 - Occupational Risk Assessment ("HIRA") for works performed during the Project execution,
 - Work Organisation Plan (POR) for individual scopes of works,
 - Safety and Health Protection Plan (BIOZ),
 - High-Risk-Lifting Plan (PPWR) for transport operations classified as high risk lifting operations performed with the use of lifting equipment,

The foregoing documents shall be prepared in accordance with AMP standards and agreed with appointed representatives of Health and Safety, technology and maintenance departments of Cold Rolling Mill and with representatives of the Project Owner.

- The Contractor shall commence works after take-over of the construction site and preparation of the Site Take-over Certificate with participation of the parties involved, including a representative of the Project Owner.
- During the execution of individual stages of manufacturing and delivery to the Owner's site, the Supplier shall meet safety requirements determined by the Polish law and applicable standards of the Owner (which are contained in the **Work Health & Safety Agreement**, and in the Internal Safety Standards and Regulations).
- Signing and accepting (without changes) the **Work Health & Safety Agreement** is a prerequisite for admission to commence works.
- **Continuous/permanent** supervision of the Contractor and/or its subcontractors by a coordinator in charge of occupational health and safety is required within the duration of the Project (during working hours of employees of the Contractor and/or its subcontractors). **The Contractor's OHS Coordinator may not perform other duties at the construction site.**
- The Contractor and its subcontractors shall carry out OHS audits according to the Owner's schedule within the duration of the Project.

15. REQUIREMENTS OF THE OWNER FOR THE BID

15.1. GENERAL REQUIREMENTS

- Technical and Commercial Bid shall be delivered separately, according to the Request for Quotation.

15.2. REQUIREMENTS FOR TECHNICAL BID

Technical Bid for completion of the scope of the works described in this Specification shall comprise the following sections:

- I. **Name and registered office of the Bidder.**
- II. **General description and information of offered supplies and services.**
- III. **Scope of works comprised in the Bid.**
- IV. **Data sheet - bid drawing, i.e. Performance data, parameters, unit pressures on the crane runway, general dimensions in accordance with the Technical Specification.**
- V. **Single line diagram of power systems with indication of proposed power of individual drives.**
- VI. **Single line diagram of automation equipment system (ACE) and network.**
- VII. **Bill of materials and works with indication of quantities.**
- VIII. **List of suppliers and potential sub-suppliers.**

- IX. Exclusions from the Bid (supplies and services to be provided by the Buyer/Owner).
- X. Acceptance of the Owner's Responsibility Matrix or the Bidder's proposal for a Responsibility Matrix, i.e. division of responsibilities/works clearly defining the scope of the Supplier and the Buyer/Owner.
- XI. Schedule showing milestones of supplies of components, installation, test runs, handover for operation, etc.).
- XII. Guaranteed performances (as per Technical Specification).
- XIII. Guarantees.
- XIV. Safety at work guarantees according to effective provisions of Polish law and the Owner's standards (including organisation chart and rules of performance of safety at work supervision during execution of the whole Project).
- XV. Declaration that the expertise and experience held and site visit are sufficient to complete the entire task.
- XVI. Declaration that the scope of supplies and services will be completed in accordance with good engineering practice and in compliance with the provisions of the law
- XVII. Declaration that the scope of the works will be completed in accordance with Technical Documentation prepared on the basis of Tender Documentation listed in Technical Specification.
- XVIII. Statement of confidentiality confirming that the Bidder/Contractor will protect confidential information of the Owner and will not make available technical, technological or any other information it has received in course of this request for bid to any third party.
- XIX. The Bid validity.
- XX. Statement and/or references (taking into account the records related to statements and/or references described in item 6 of this Specification and in the Request for Quotation).
- XXI. Other information provided by the Bidder/Contractor, which do not bear any cost-related data but may affect the quality of the Technical Bid.

16. LANGUAGE OF THE CONTRACT

Mandatory language of the Contract (the bid, technical documentation, operating and maintenance manuals, masks of devices, diagrams, user manuals, the Contractor's supervision, contacts and agreements with the Owner's personnel and with government bodies, etc.) **shall be Polish**. All costs of translation and interpretation services during the period of Project execution shall be borne by the Bidder/Contractor.

17. INFORMATION, EXPLANATIONS AND AGREEMENTS

17.1. PERSONNEL OF THE BIDDER/CONTRACTOR

The Bidder/Contractor shall specify in the Bid the names and functions (scopes of responsibilities) of its employees (along with contact information) appointed and authorised to be in touch with the Owner at the stage of Bid Submission, Evaluation and Negotiation.

17.2. PERSONNEL OF THE OWNER

- Jacek Buzdygan (Project Manager) - AMP Engineering
(e-mail: jacek.buzdygan@arcelormittal.com ; phone no.: +48 668 634 934);
- Zbigniew Marzec (Electrical Specialist) - AMP Central Maintenance - Kraków
(e-mail: zbigniew.marzec2@arcelormittal.com; phone no.:+48 12 290 60 01,
phone no.: +48 608 518 203)
Jacek Cieślak (Mechanical Specialist) - AMP Central Maintenance - Kraków
(e-mail: jacek.cieslak@arcelormittal.com; phone no. +48 795 414 944)
- Grzegorz Łojek (Automation Specialist) - AIM (ACE)
(e-mail: grzegorz.lojek@arcelormittal.com ; phone no.: +48 882 115 043)
- Dariusz Kowalski (Automation Specialist) - AIM (ACE)
(e-mail: Dariusz.kowalski@arcelormittal.com ; phone no.: +48 662 214 808)
- Krzysztof Krupa (User Leader) - Cold Rolling Mill in Kraków
(e-mail: krzysztof.krupa@arcelormittal.com ; phone no.: +48 662 214 675)
- Grzegorz Peciak (Health and Safety Specialist) - Kraków Hot Rolling Mill
(e-mail: grzegorz.peciak@arcelormittal.com ; phone no.: +48 668 110 634)

17.3. INFORMATION, CORRESPONDENCE, EXPLANATIONS AND AGREEMENTS

All information regarding the Technical Bid coming from the Bidder/Contractor and directed to the Owner (including correspondence, explanations and agreements) shall be delivered only and exclusively through the persons referred to in the Request for Quotation, item VII 9.

18. OTHER

18.1. WASTE PRODUCTION AND RECYCLING

Production, segregation, transport, collection, storage and recycling of wastes produced during the implementation of the Project is the Bidder's/Contractor's responsibility. Wastes produced during performance of the works shall be disposed of at the disposal yard. **The Contractor shall hold appropriate licence required by the law to perform the foregoing activities, or, in contrary case, it shall hire licensed company(-ies) to complete these works.**

The only exception is scrap of non-ferrous metals and of iron alloys, which shall be processed to charge scrap (according to **Chapter III item 6**) and handed over to the Owner.

Costs of scrap processing to charge material shall be wholly borne by the Bidder/Contractor.

A list of codes of wastes (according to the Polish law) which will be most commonly in use under this Project is as follows:

- Scrap of ferrous metals waste code: 160117, 170405, 191001.
- Scrap of non-ferrous metals waste code: 160118, 170401, 170402.
- Mixed metal scrap waste code: 170407.
- Ceramic waste waste code: 161103, 161104.
- Concrete and debris waste waste code: 170101.
- Electric cables waste code: 170411, 170604.
- Oils, greases waste code: 130110, 130208.
- Electric motor scrap waste code: 160216.
- Other waste codes to be selected on case-by-case basis.

18.2. MEASUREMENTS

The measurements specified below shall be made at the Bidder's/Contractor's costs in the scope of the Project execution:

- Inventory surveying.
- Working geodetic measurements.
- As-built surveying (survey reports).
- Power measurements (effectiveness of electric shock protection, cable insulation resistance).
- Measurements of guaranteed performances.

18.3. PROTECTION OF CONTRACTOR'S PROPERTY

The Contractor shall be responsible for protection of its own property and the property of its sub-contractors, including parts, components and complete equipment stored at the Owner's site and intended to be used under this Project over the duration of the Project until commissioning and handing over to the Owner for operation.

18.4. ENTRY/EXIT OF THE BIDDER'S/CONTRACTOR'S PERSONNEL AND MATERIALS TO/FROM THE ERECTION SITE

- The Contractor shall strictly adhere to the regulations on movement of persons and materials at the Owner's site in AMP Kraków.
- Handling of project-related supplies (i.e. their loading and unloading, storage and transport between different operations) is within the Contractor's scope of responsibility.

The Owner may make available the areas which may be used to store supplies to and at the cost of the Contractor.

18.5. ADDITIONAL CONDITIONS OF PROJECT EXECUTION

Additional requirements/expectations of AMP to be fulfilled by the Bidder/Contractor during execution of the Project, which may considerably affect calculation of the task value are as follows:

- The Bidder/Contractor shall agree to participate in coordination meetings at dates to be determined by the Owner.
- The Bidder/Contractor shall agree to prepare notes, reports and schedules in accordance with the requirements of the Owner.
- The Bidder/Contractor shall be solely and entirely responsible for correctness of information, parameters and dimensions quoted in the documentation and shall be held liable for any damage arising from provision of incorrect information.
- Acceptance of technical documentation by ArcelorMittal Poland S.A. shall not assume mitigation or lifting of the Contractor's liability for the equipment.
- The Bidder/Contractor shall nominate the **Site Manager** with appropriate/required approvals for the whole period of construction/project execution until its completion.
- The Bidder/Contractor shall provide geodetic services for construction/project being executed.
- The Bidder/Contractor shall provide back-up copies of control software for frequency converters, PLC controllers and HMI panels.

CHAPTER II

1. ENVIRONMENTAL DATA

Local environmental data for the location of ArcelorMittal Poland S.A. Cold Rolling Mill in Kraków.

1.1. LOCATION

Altitude above sea level	219 m asl
Longitude	50° 05'16.6"N
Latitude	20° 05'30.6"E
The nearest urban agglomeration	Kraków
The nearest airport	Balice - Kraków

1.2. ENVIRONMENTAL DATA

Data	Value, measurement unit
Maximum temperature	+37.4 °C (historical value)
Minimum temperature	-32.7 °C (historical value)
Average annual temperature	+8.7 °C
Average annual relative humidity	77 %
Maximum monthly precipitations	313 mm
Maximum momentary wind velocity	3.5 m/s
Seismic zone	no



Fig. Location of the new crane for the pickling line.

2. STANDARDS, NORMS AND REGULATIONS

GENERAL COMMENTS

Equipment, services and technologies offered by the Bidder/Contractor shall comply with its best technical and technological expertise and norms and standards specified below.

Equipment, materials and parts used to implement the Project shall meet all technical, environmental protection and safety standards required by the provisions of Polish law.

Appendix no. 1 - Legal instruments

Appendix no. 2 - Location and environmental data

Appendix no. 3 - LOTO

Appendix no. 4 - Visual management

Appendix no. 5 - Automation standard (AIM Addendum to tender - automation system requirements PL V16)

2.1. Formats of documentation files - standards applicable in ArcelorMittal Poland S.A.

Documents: *.*.doc, *.*.pdf, *.*.xls (Microsoft Word 2010, Microsoft Excel 2010, Adobe Reader)

Schedules: *.*.mpp (Microsoft Project 2010)

Mechanical documentation: *.*.dwg, *.*.dwt (AutoCAD ver. 13 or higher, Autodesk Design Review)

Electrical documentation: *.*.zw1 (PDF, EPlan ver.5.5/P8)

Photos, images: *.*.jpg

3. BASIC DOCUMENTATION

List of basic documentation

Item	No. of design/drawing	Title
1	Suwnice B1.pdf	Diagram of BWZ next to the Pickling Plant - assumed place of the OHT crane erection
2	118801	Exemplary installation of the OHT cranes, aisle Z-Y
3	Sketch	Assembly of wheels
4	E3-102728	Schematic diagram of Heppenstall tongs power supply
5	Plan stref bezpieczeństwa.xlsx (safety zone plan)	Conceptual and illustrative drawings of safety zones

CHAPTER III - SCOPE OF THE BIDDER/CONTRACTOR'S WORKS

1. SUPPLY OF NEW ACE CRANE #1025, ACE TONGS, COMPONENTS OF RETROFITTING EQUIPMENT FOR THE CRANE #1020 FOR THE NEEDS OF ACE

1.1 The following works shall be performed under the crane supply:

- Preparing and agreeing with AMP on the Technical Documentation (workshop drawings) for manufacture and prefabrication of all components of the crane (optionally, purchase of complete solutions if the Bidder/Contractor does not manufacture this type of equipment).
- Supply of prefabricated units of the crane to the Owner (location - ArcelorMittal Poland S.A. - Cold Rolling Mill in Krakow) and storage of the components in a designated storage place.

1.2 The following works shall be performed under the tongs supply:

- Preparing and agreeing with AMP on Technical Documentation (workshop drawings) for the electrically driven tongs (ACE) for horizontal transport of hot sheet coils of a maximum weight $Q=35t$.
- Manufacture of 2 sets of electrically driven tongs (ACE) for horizontal transport of hot sheet coils of a maximum weight $Q=35t$ (optionally, purchase of complete solutions if the Bidder/Contractor does not manufacture this type of equipment).
- Supply of 2 sets of electrically driven tongs (ACE) for horizontal transport of hot sheet coils of a maximum weight $Q=35t$ to the Owner (location - ArcelorMittal Poland S.A. - Cold Rolling Mill in Krakow) and storage in a designated storage place.

1.3 The following works shall be performed under the supply of retrofitting equipment for the crane #1020 for the needs of ACE:

- Preparing and agreeing with AMP and the Office of Technical Inspection on Technical Documentation (workshop drawings) of retrofitting equipment for the crane #1020 for the needs of ACE.
- Prefabrication of components of the retrofitting equipment for the crane #1020 for the needs of ACE (optionally, purchase of complete solutions if the Bidder/Contractor does not produce this type of equipment).
- Supply of the components of the retrofitting equipment for the crane #1020 for the needs of ACE to the Owner (location - ArcelorMittal Poland S.A. - Cold Rolling Mill in Krakow) and storage of the components in a designated storage place.

Detailed technical and technological data of the cranes and tongs are given in the table below.

Devices/software which are currently installed on the crane #1020 and other systems in AMP are indicated in the table by grey background and square brackets []. Considering the optimisation of spare parts inventory, grouping own staff of specialists and owned tools for programming these devices, the Owner is interested in maintaining the standardisation of technical solutions. However, it shall not limit the Contractor in offering new models of devices which are of equivalent technical level or functionality.

Item	Technical and technological information	Description
1	TYPE OF THE CRANE	Overhead travelling crane, supported, adapted to operate with two types of electrically driven tongs for horizontal transport of hot sheet coils: - Heppenstall tongs currently installed on the crane #1020 and - new ACE tongs.
2	NUMBER OF OHT CRANES AND TONGS COVERED BY THE PROJECT	
2.1	New crane #1025	Q= 40.0 t
2.2	Tongs	2 sets of tongs consistent with the requirements of ArcelorMittal for automation of hot sheet coils transport (ACE).
2.3	Retrofitting for the needs of ACE	OHT crane #1020
3	LIFTING CAPACITY	
	OHT crane (aisle Z-Y)	Q 40.0 t
4	SPAN OF TRAVEL RAILS	
	Aisle Z- Y (OHT crane Q=40.0 t)	27.8 m
5	LENGTH OF OHT CRANE TRACK	
	Aisle Z-Y (OHT crane Q=40.0t)	540 m
6	LEVEL in aisle Z- Y (measured from "0" level)	
6.1	Rail head level (OHT crane Q=40 t)	+12 m
6.2	Ceiling level - please consider possible deformations of the ceiling	+15.4 m (possible deformations up to 150 mm)
7	BRIDGE RAILS (type of rail)	
	Aisle Z-Y (OHT crane Q=40 t)	SP 100 (KP 100)
8	SPEED OF TRAVELLING EQUIPMENT	
8.1	Travel speed of OHT crane	125 m/min.
8.2	Travel speed of bridge trolley	45 m/min.
8.3	Lifting equipment Q 40t	2 - 22 m/min. (fully load)
8.4	Lifting equipment Q 40t	up to 36 m/min. for ¼ Q
9	HOOK WORKING ANGLE	
9.1	Q 40 t hook working angle	16.0 m
9.2	Lifting height of Q 40 t hook	+ 12.5 m

9.3	Q 40 t hook distance in extreme position	Position 1 - 1800 mm (on the power supply side - Y axis) Position 2 - 2150 mm (Z axis)
10	TONGS ROTATION RANGE	Required minimum rotation angle: 340°.
CONTROL OF THE OHT CRANE		
11	Aisle Z-Y (OHT crane Q=40.0t)	From the operator's cabin / radio control / ACE mode
12 OPERATOR'S CABIN		
12.1	Air-conditioned cabin	<p>Air-conditioning system must ensure temperature of +20°C (±2°C) to be maintained inside the cabin. The cabin is equipped with an industrial air conditioning unit with an evaporator and heating system adapted to the working environment in accordance with Chapter II item 1 and temperature in the crane area of +60°C. All works related to equipment must be performed in accordance with the Act of 15 May 2015 (<i>Journal of Laws of 2015, item 881</i>) by authorised personnel and company as well as recorded in required documentation.</p> <p>Brand, model and type of air conditioning units must be submitted to the AMP GU-42 for acceptance. Method of condensate disposal must be submitted to AMP for acceptance.</p> <p>Access to the air conditioner for maintenance purposes must be ensured. During the guarantee period inspections specified by the Manufacturer must be carried out by an authorised service team.</p> <p>Rectangular pre-insulated ducts and fittings with sheet shell must be applied.</p>
12.2	Cabin equipment	<ul style="list-style-type: none"> - lighting system with adjustable light intensity, - HMI panel installation [TP 1200] with position adjustment function. - 15" ACE touch panel installation with position adjustment function. The panel shall be supplied by AMP. - 24" monitoring touch panel with position adjustment function. The panel shall be supplied by AMP. - U=230V power supply system with plug-in socket, - electric heater (independent from air conditioning) - 2 kg powder extinguisher holder (extinguisher is a part of the supply), - tilt windows with the possibility to be cleaned inside, - documentation pocket

12.3	Fixed cabin	Fixed cabin - assembly Z axis - easy access to the cabin - two independent access routes (please consider emergency evacuation route)
12.4	Q 40 t crane cabin	Cabin entrance at + 9.47 m level /Z axis/ Distance of cabin platform from rail axis - 1080 mm
12.5	Cabin dimensions	- height - 2120 mm - width - 1700 mm - length with the platform - 2700 mm
12.6	Q 40 t crane cabin platform	- barrier around the platform up to the height of 2100 mm - access gate equipped with a safety switch - access ladder from the platform level leading to girder platform (barrier around the platform must be used as the ladder)
12.7	OHT crane operator control panel	Control of all possible movements including opening (opening/closing) of the tongs by the operator. Reset of safety system and debugging control system via control switch (outside HMI). Change of control mode between cabin/radio/ACE modes made in the operator's cabin. Integrated rotary station.
13	DRIVES	Asynchronous squirrel-cage motors equipped with external source cooling and winding temperature sensors KTY, supplied with power from frequency converters. Regenerative rectifier [SINAMICS S120] or equivalent is to be used allowing for return of the power excess to network. After the rectifier, a switch disconnecter with position control, controlled by the PLC, is to be used. Drive control units [CU-320] are to be installed near the PLC controller. Power units connected to the control unit via the network [DRIVE CLiQ]. Panel [AOP30] for advanced diagnostics of drives is to be installed near the control unit. Brake contactors are to be controlled by drive system. License for firmware cards used in the drives must be handed over to AMP. 24 DC drive supply by contactors controlled from the PLC.
14	DRIVE CONFIGURATION	
14.1	Bridge	Four drive motors with incremental encoders supplied with power by four frequency converters. Motors must be selected so as to enable the OHT crane operation with the use of two engines in the event of failure of one driving unit. A selector switch for switching the operating mode of the groups (1-1 + 2-

		<p>2) located in the container. Each of the motors must be equipped with an external cooling system, KTY temperature sensor and incremental encoder. It is also required to ensure temperature sensors installed on gear units of the bridge travel mechanism. Brakes must be equipped with brake release sensors.</p>
14.2	WINCH TROLLEY	<p>Two drive motors supplied with power via one frequency converter. After the frequency converter, motor switches for current protection of each motor are to be used. Each of the motors must be equipped with an external cooling system, KTY temperature sensors and incremental encoder. It is also required to ensure temperature sensors installed on gear units of the trolley travel mechanism. Brakes must be equipped with brake release sensors.</p> <p>The trolley should be provided with a possibility to install a junction box for power cables and a control box with secure access for operators. 40% of free space should be provided inside the control box. On the winch trolley two emergency stops must be provided on both sides of the cable drum.</p> <p>It is also required to ensure a cable reel to supply the tongs as well as a reel for supply and Profibus communication of PLC controller of the automatic tongs. The cable routes on the winch made of steel pipes. Cables routed on the winch must be protected against possible damage along their entire length.</p> <p>IP65 cabinet 600x600x300 with protected power supply UPS 230V AC true on-line and 24 V DC is to be assembled.</p>
14.3	Winch (Q=40t)	<p>One drive motor supplied with power by one frequency converter.</p> <p>Reducer of lifting capacity equipped with a spindle limit switch used for: release and switch off downwards, release, switch off, and emergency switch off upwards. Lifting mechanism to be equipped with an absolute encoder and safety linear-absolute encoder installed on the reducer.</p> <p>The winch drum must be equipped with sensors detecting double winding of cable (if detected, further lifting is not permitted).</p> <p>Two disc brakes are to be assembled.</p> <p>Brakes must be equipped with brake release sensors and lining wear sensors.</p> <p>Reducer to be equipped with temperature and oil level sensor.</p>

15	ENCODERS	<p>The following encoders are to be installed:</p> <p>trolley travel - an incremental encoder on the motors: 2 pcs, and an incremental encoder on a loose wheel: 1 pc</p> <p>bridge travel - an incremental encoder on the motors: 4 pcs and an incremental encoder on a loose wheel: 1 pc</p> <p>load capacity Q 40 t - an incremental encoder on the motor: 1 pc, an absolute safety encoder on the lifting capacity reducer: 1 pc and a safety absolute-linear encoder: 1 pc</p> <p>All encoders installed on the motors must be connected to the encoder modules [SMC30], while the other to PLC.</p>
16 ADDITIONAL EQUIPMENT		
16.1	Tongs for horizontal transport of hot coils	<ul style="list-style-type: none"> - within the scope of supply - 2 sets of ACE tongs for horizontal transport of hot sheet coils Q=35 t adapted to operate with ACE crane. - control of motors for closing (opening) and tongs rotation must be performed with the use of frequency converters. The converters should be installed in a control box on the tongs. - tongs, together with ACE devices and light signalling of tong operation installed, must be resistant to shocks and temperature occurring during the transport of hot sheet coils.
16.2	Technical data of the tongs:	<ul style="list-style-type: none"> - European class 6 (FEM A7 M7) - lifting capacity 35 t - co-operating hook no. 63 - maximum coil temperature 600°C - minimum opening range 500 mm - maximum opening range 2360 mm - width of tongs foot including arm ≤ 330 mm - closing speed 3.5 - 4.0 m/min - rotational speed 2 - 2.5 rpm - tongs rotation angle 340 ° - supply voltage 3 x 400 V - control voltage 110 (V) AC - drive of tong closing and rotating mechanism - gear, 3-phase motors adapted for operation with frequency converter, - light signalling 2 sets installed in two structure planes of the visible tongs from "0" level and crane cabin
16.3	Equipment for tongs required for ACE	<ul style="list-style-type: none"> a/ inclinometer b/ measurement of tongs opening (encoder) c/ limit switches for min. and max. tongs opening (action confirmed by light signalling installed on

		<p>the structure of the tongs)</p> <p>d/ pyrometric temperature measurement of a coil handled in the tongs</p> <p>e/ measurement of tongs rotation angle - encoder on the motor</p> <p>f/ rotation limit switches</p> <p>g/ sensors detecting load on the tongs feet (action confirmed by light signalling installed on the structure of the tongs)</p> <p>h/ lateral limit switches preventing crushing and damage to a coil (action confirmed by light signalling installed on the structure of the tongs)</p> <p>i/ optical sensor for clearance control</p> <p>j/ IP65 electric box with tongs controller - PLC S7-300 CPU315-2DP (6ES7315-2AH14-0AB0) with necessary I/O modules and CAN 300 PRO communication module. PLC controller, I/O modules and CAN 300 communication module shall be delivered by AMP.</p> <p>k/ connection of the tongs automation system with the crane trolley automation system (UPS 230 VAC power supply, profibus)</p> <p>l/ light signalling</p> <p>m/ protective plates mounted inside the arms protecting edges of the coils against damage</p> <p>n/ inclinometer, encoders, sensors, switches connected to PLC controller of the tongs.</p>
16.4	Stand	Stand for Q 35t tongs within the scope of delivery - 2 sets enabling assembly, inspection and repair of tongs
17	WHEEL SETS FOR BRIDGE TRAVEL	
17.1	Bridge travel mechanism	<p>Forged wheels - 8 sets of wheels without flanges, thrust rollers</p> <p>Forged wheels material: 1055, raceway thickness: 58 - 62 HRC</p> <p>Assembly of wheels including locks.</p>
17.2	Maximum bridge travel wheels load	315 kN
17.3	Trolley travel mechanism	<p>Forged wheels - 4 sets.</p> <p>Forged wheels material: 1055, raceway thickness: 58 -62 HRC.</p> <p>Assembly of wheels including locks.</p>

18	TRANSPORT CONDITIONS	The gripping tongs adapted for horizontal transport of hot sheet coils Internal diameter of a coil min. 508 mm max. 610 mm Coil external diameter min. 1000 mm max. 2300 mm Coil width min. 700 mm max. 2100 mm
19	LIGHTING OF THE CRANE WORKING AREA	To assure safe operation of the OHT crane, it shall be equipped with lamps suspended under the platforms - 7 pcs (5 pcs on the girders and 2 pcs on the trolley). Access to these lamps for maintenance purposes shall be provided. Lighting is to be controlled from the radio transmitter.
20	SIGNALISATION OF CRANE OPERATION	
20.1	Sound signals	Acoustic signal of OHT crane operation (horn or bell of sound intensity higher than the background in which it works).
20.2	Signalisation of crane operation	Light signalling of crane operation (minimum 1 flashing lamp arranged on crane structure in a place well visible from "0" level; colour: blue). Requirement of AMP ST 007 standard
20.3	Failure indication - converters not ready.	Lack of readiness: converters failure (red control in the cabin and red lamp outside the crane),
20.4	Signalling activation of lifting capacity reducer	Traffic signals - orange lamp
20.5	Radio control signalling	Light signalling - green lamp
20.6	Signalling of automatic operation	Light signalling - a lamp, colour: white
20.7	Hook working area	The OHT crane to be equipped with blue warning projectors (LED) to signal danger zone in the hook's working area.
21	AMBIENT TEMPERATURE	
	Aisle Z-Y	Maximum +60°C for the OHT crane
22	POWER SUPPLY TO THE CRANE	
22.1	Voltage	3 x 400V
22.2	OHT crane trolleys - aisle Z-Y	Open, steel trolleys - steel profiles, 3 guides. Current collector - as per basic documentation attached to Technical Specification. Two collectors per each current circuit are to be used. Two additional "PE" collectors installed on the buffer

		beam of the OHT crane are to be used in order to ground the crane through a travel rail.
22.3	Main switch of the crane	The main switch and the auxiliary power switch with a visible gap in between and a possibility of mechanical locking in switched-off position, to be installed in the cabinet outside the container.
22.4	Control voltage	230 (V) AC 24 (V) DC
23	POWER SUPPLY TO WINCH TROLLEY	<p>Cable carrier for power supply and control cables. When selecting the carrier ensure 20% reserve. Cables dedicated to cable carriers should be foreseen for the power supply. 2x Profibus cable, 6x Ethernet cable (for network with additional functionality) and a 6-core fibre optic cable should be routed in the cable carrier.</p> <p><u>Technical requirements for the cable carrier:</u></p> <ul style="list-style-type: none"> - cable carrier designed for supplying power should be equipped with pass-through chutes made of galvanised steel along the entire travel length, - system with rollers to reduce friction during travel - system with a floating arm to compensate for non-linearities in the travel path - the design of cables should include strain relieving centre element to ensure adequate durability of cables in the carrier, - cables mounted on the ends of the carrier by means of special mounting clamps, - it should be possible to open the system on both sides of the carrier to ensure easy installation and removal of cables.
24	ELECTRICAL EQUIPMENT, ELECTRIC CONTAINER	
24.1	Q 40 t crane (aisle Z-Y)	<p>Electric equipment shall be installed in an air conditioned container and in a cabin and if necessary, outside the container/cabin on the crane structure. In the latter case, electric equipment should be selected to suit operation at max. ambient temperature of +60°C.</p> <p>All control and pass-through cabinets installed on the crane outside the container must have swing door with universal key locks. Protection rating IP65</p>
24.2	Container air conditioning unit	An industrial air conditioning unit - ensuring temperature of +20°C (±2°C) inside the container - with an evaporator and heating system adapted to the working environment in accordance with Chapter

		<p>Item 1 and temperature in the crane area of +60°C. All works related to equipment shall be performed in accordance with the Act of 15 May 2015 (<i>Journal of Laws of 2015, item 881</i>) by authorised personnel and company as well as recorded in required documentation.</p> <p>Brand, model and type of air conditioning units must be submitted to the AMP GU-42 for acceptance. Method of condensate disposal shall be submitted for acceptance.</p> <p>Access to the air conditioner for maintenance purposes must be ensured. During the guarantee period inspections specified by the Manufacturer must be carried out by an authorised service team. Rectangular pre-insulated ducts and fittings with sheet shell must be applied. Main duct installed on the container plus at least three vertical distribution ducts.</p>
24.3	Control container	<p>The container must be equipped with:</p> <ul style="list-style-type: none"> - suitable air conditioning system - fire-fighting system with activation signalling in the cabin, on the crane bridge (optical and acoustic) and transmitting alarms to the crane PLC controller, - tilting table for service laptop (near PLC) - space for technical documentation of the crane, - inner lighting of the container to be switched on both sides (four lamps with emergency modules) - 230V service socket, - escape door with opening control, door unlocking switch located inside the container, - control and power equipment to be installed on open areas with moving parts covered - areas of various mechanisms to be marked, - electronic protection with the possibility to set current values shall be used in 24VDC control circuits; the status of the protection must be monitored by PLC. <p>About 30% of reserve space should be left on each area.</p> <p>Cables should be arranged in the lower part of the container along control room fields.</p> <p>Communication cables, e.g. Ethernet / Profibus must be separated from power cables to avoid interferences.</p> <p>Terminal blocks of cables are to be placed in the bottom part of control areas.</p> <ul style="list-style-type: none"> - inlet and outlet cable glands are to be installed in the bottom part of the drive areas. <p>Rectifiers, inverters to be mounted on withdrawable trolleys - allowing for easy replacement.</p>

25	ANTI-COLLISION SYSTEM	
25.1	For Q 40 t crane Winch travel	A two-stage system of limit switches is required (deceleration, stopping). SICK DL50 laser sensors for the winch trolley. (2 sets) Delivery of DL50 sensors shall be within the AMP's scope of responsibility.
25.2	For Q 40 t crane Bridge travel mechanism in the direction of the crane #1020	Application of two-stage anti-collision system (SICK DL50 laser sensors - 2 pcs). DL50 sensors shall be delivered by AMP.
25.3	For Q 40 crane Bridge travel mechanism in the direction of the overhaul area	Application of two-stage anti-collision system (SICK DL50 laser sensors - 2 pcs). DL50 sensors shall be delivered by AMP.
26	SYSTEM OF MANUAL RELEASE OF TRAVEL MOTOR BRAKES	Use self-braking motors equipped with a lever for manual release of brake of the bridge and trolley drive mechanisms.
27	BRIDGE TRAVEL DRIVE	System to be used: motor, clutch, transmission, compensation shaft, running wheel.
28	OHT CRANE SAFETY SYSTEM	<p>The OHT crane must be designed in accordance with PN-EN 61508 and PN-EN ISO 13849 standards. The Contractor shall perform a risk analysis for the entire system, taking into account the fact that the cranes will be operated in automatic mode (ACE) in the safety zones of the bay (barriers, gates and related safety elements).</p> <p>AMP shall provide the Contractor with a Safety Zone Plan including pre-designated safety zones and individual elements of safety systems. AMP shall specify the minimum PL (Performance Level) requirements that must be met for each element of the safety zone system. If, during the analysis, the Contractor considers that a higher Performance Level is required than that indicated in the minimum requirements, this change shall be agreed with the safety zone contractor.</p> <p>The risk analysis and safety concept must be agreed with the Office of Technical Inspection. The complete analysis should be submitted to AMP. If there is a direct reference in the specification to the Performance Level when describing components, a component of equal or higher PL should be used.</p> <p>The Contractor is obliged to cooperate with the entity which prepares safety zones in the bay. In particular, this applies to making arrangements</p>

		<p>with the Office of Technical Inspection and submitting all documents from this Office or inquires of the safety zone contractor to this Office in an immediate manner. The Contractor shall provide the safety zone contractor with a risk analysis in the scope pertaining to safety zones or to the overall project.</p> <p>The communication between the safety zone controller and the crane controller shall be handled by AMP automation specialists together with the Contractors of cranes and zones.</p> <p>Safety switches are to be located:</p> <ul style="list-style-type: none">- at entry gates: 4 pcs- in the cabin: 1 pc- in the container at the door: 2 pcs- on the crane trolley: 2 pcs <p>Resetting crane safety systems: When the power supply to the crane is switched off, the safety system must be reset via a button located in the operator's cabin, ACE system supervision room (in the bay), radio transmitter or in the cassettes at the exit gates from the crane.</p> <p>At the entry gates to the crane a cassette is to be installed with:</p> <ul style="list-style-type: none">- a push-button to request entry that activates signalling of requested entry on the crane in the cabin- a lamp signalling permission to enter- reset push-button- crane readiness lamp for automatic operation <p>The lamp signalling permission to enter lights up when the operator on the operator's panel turns a switch that locks the crane movement.</p> <p>State of all components of the safety circuit must be monitored by PLC controller and be checkable by HMI panel. The entire logic of the safety system must be programmed in the PLC.</p> <p>Application of independent safety relays shall not be allowed.</p> <p>Safety functions of the inverters should be used. The entire safety system must be included in one F- Runtime group.</p> <p>The OHT crane safety system shall cooperate with safety system of zones in the bay. The bay shall be divided into zones which may be available or prohibited for the crane operation.</p>
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28.1	ZONE SENSORS - BRIDGE TRAVEL	Safety sensors controlling the movement of the crane between the zones in the bay shall be installed on the crane and in the bay. In case of power supply failure and power supply return, the crane must recognise the zone in which it is located. There shall be 7 control points. Exact location of the zones shall be agreed with AMP. The safety zone plan contains an illustrative concept of zones. Manner of the assembly of sensors in the bay should enable further relocation of boundaries of zones. Common activating units for both cranes should be provided.
28.2	ZONE SENSORS - TROLLEY TRAVEL	Safety sensors controlling the movement of the crane between the zones in the bay shall be installed on the crane winch and on the bridge. In case of power supply failure and power supply return, the crane must recognise the zone in which it is located. There shall be maximum 5 control points. Exact location of the zones shall be agreed with AMP. The safety zone plan contains an illustrative concept of zones. Manner of the assembly of the sensors on the bridge should enable further relocation of boundaries of zones.
28.3	SAFE MEASUREMENT PL E - BRIDGE TRAVEL	The Contractor shall purchase and install an absolute measuring system based on a camera and 2D code tags. The measuring system must comply with PL E safety standards and must communicate with the controller using the Profisafe protocol. Required measuring range from the beginning of the bay (service area / column 118) to the decoiler / column 95. Required accuracy: 20 cm. Minimum speed of movement for measurement: 4m/s Camera/sensor should be thermally protected. 2D codes should be available for cleaning and located on the Z-axis crane girder (cannot be located at the trolleys) - their location must be agreed with AMP. The system should signal when the codes are dirty. The system must work correctly even if two consecutive codes are unreadable.
28.4	SAFE MEASUREMENT PL E - TROLLEY TRAVEL	The Contractor shall purchase and install an absolute measuring system based on a camera and 2D code tags. The measuring system must comply with PL E safety standards and must communicate with the controller using the Profisafe protocol. The required measuring range over the entire travel range of the trolley. Required accuracy: 20 cm. Minimum speed of movement for measurement: 4m/s Camera/sensor should be thermally protected. 2D codes should be available for cleaning and their location must be agreed with AMP. The system should signal when the

		codes are dirty. The system must work correctly even if two consecutive codes are unreadable.
28.5	SAFETY SWITCH FOR MEASURING SYSTEMS	The Contractor shall purchase and install a two-position switch to change the method of zone inspection (safety sensors / safety measurement as described in items 28.1, 28.2, 28.3, 28.4) with a coded key meeting PL E requirement and connected to the safety controller.
29	CRANE CONTROL SYSTEM	<p>Entire logic of OHT crane operation shall be implemented in PLC program.</p> <p>The crane shall be controlled in three modes: from operator cabin, by radio or automatically.</p> <p>Operation mode switch between cabin/radio/radio+ACE mode shall be handled in the operator's cabin. Operation mode switch must be plugged into safety inputs of the crane PLC. The operating mode switch shall comply with PL e cat. 4.</p> <p>Crane control system must be adapted to two types of tongs. The control system shall be based on a Programmable Logic Controller - PLC Siemens CPU 6ES7416-2FP07-0AB0 or equivalent. The PLC shall be provided by the Owner (AMP).</p> <p>Control system of the PLC, measuring equipment of ACE system and terminals in the cabin shall be powered via UPS online.</p> <p>The current status of safety and control devices, temperature in the container and air conditioner operation must be controlled by the controller inputs. 20% spare I/O capacity shall be maintained in the controller.</p> <p>It is required to install, in the feeder, a network analyser with programmable recording of voltage and current anomalies, with programmable alarms sent to the controller. The analyser must be connected to the Ethernet of the crane.</p> <p>HMI panels [Siemens TP1200] for fault diagnostics and visualisation of the condition of individual drives shall be installed in the operator's cabin and container.</p> <p>Radio controller should allow for performance of all functions available from the operator's cabin, such as:</p> <ul style="list-style-type: none"> - control of bridge and crane travel by means of a X-Y joystick, - lifting control by a linear joystick, - tongs mechanism control (rotation, opening/closing), - switching on the lightning under the crane, - acoustic signalling (bell),

		<ul style="list-style-type: none"> - start button, - emergency STOP lockable button, - acknowledging faults, resetting safety system, - key switch of radio control. - it is required to ensure two reserve buttons in the transmitter and two output relays in the receiver. <p>Through HMI panels the following functionalities are provided for:</p> <ul style="list-style-type: none"> - displaying the equipment work parameters, - crane errors monitoring, - checking the status of PLC I/O, - monitoring the status of Profibus, Ethernet networks, - checking the status of various mechanisms (motor temperatures, current, speed, current alarms), - power system supervision, - checking power and control circuits protection, - safety system supervision, - possibility to copy alarm history by USB output in the HMI panel, - possibility to change the allowable lifting capacity for testing during acceptances by the Office of Technical Inspection (UDT) by authorised persons, <p>After completion of commissioning, copies of PLC and HMI control programs, description of PLC control algorithm [CU320], list of parameter settings of rectifiers and inverters and access source codes shall be transferred.</p> <p>A description of PLC functional control together with a description of applied solutions and calculations on PL and SIL control safety level shall be delivered to the UDT and AMP.</p> <p>The OHT crane control system should allow the operator to select manner of control - with an enabled or disabled anti-sway system.</p> <p>The Contractor shall provide all software licenses to AMP.</p>
30	OVERLOAD PROTECTION SYSTEM	<p>A system protecting from overload of lifting equipment with function of measurement and visualisation (display) of weight being lifted shall be provided. The limiter must be adjustable. Scales used shall not have to be officially verified. Scales measurement must be connected to the PLC. Provide for displays of values of lifted weight to be installed in the cabin and outside the cabin.</p>

31	ANTI SWAY SYSTEM	The system is activated by crane operator with the use of a switch available on the panel. Switching on and operation shall be indicated by a control lamp on the crane control panel.
32	Bridge travel control system	Sensors controlling deformation of the crane bridge shall be installed at the side of the thrust rollers.
33	OHT CRANE END STOPS	
	Aisle Z-Y	1300 mm
34	OHT CRANE WIDTH	
	OHT crane Q40	In connection with the necessity to limit the blind spot of the crane, distance between the hook and the crane end stop must be up to 5200 mm (total crane width - 10400 mm)
35	OHT CRANE BRIDGE- PLATFORMS	
35.1	Platform	Continuous platforms on the drive side and non-drive side of the girders. The platform should be equipped with two 6 kg powder extinguisher holders (the extinguishers are part of the Contractor's supply)
35.2	Barriers	Barriers around the platform up to the height of min. 1650 mm (tube Ø 40mm)
35.3	Ladders	Ladders for access to platforms of the winch trolley in extreme positions
35.4	Platform for operating collectors	Platform for operating collectors 2200 x 1200 - barrier around the platform up to the height of 2100 mm - cover for exposed moving parts
36	ANCHORING POINTS	- on the crane trolley: 5 points of class A - along the girders: anchor points of class C - fixed rope system - along buffer beams: anchor points of class C - fixed anchoring system The anchoring points must comply with the AMP ST 003 standard - Working at height.
37	CLASS OF MECHANICAL LOAD ACCORDING TO FEM	
37.1	Work intensity group	A7
37.2	Lifting system (Q=40 t)	M8

37.3	Trolley (Q=40 t)	M7
37.4	Bridge (Q=40t)	M7
37.5	Girders	Positive deflection of the girders from 0 to L/750
38	ACE SYSTEM	
38.1	Electric container	<p>a/ protection of area for assembly of control equipment 600 x 1200</p> <p>b/ assembly of power supply 230V AC, 1300 VA</p> <p>c/ assembly of Ethernet cable of category 6 ACE area - cabin</p> <p>d/ assembly and connection of WiFi radio modem (to be supplied by AMP) on the bridge at the place agreed with AMP</p> <p>e/ assembly of 19" PC terminal with WinCC Client 19" PC terminal and licence shall be delivered by AMP</p> <p>f/ assembly of holder for 15" ACE terminal intended for operating scanners and manipulators. 15" ACE terminal shall be delivered by AMP.</p> <p>g/ S7 416 F controller shall be installed as the PLC of the crane. S7 416 F controller shall be delivered by AMP.</p> <p>Possible 'islands' (remote I/O) shall be also manufactured by [SIEMENS]. The installed software shall be completely open and prepared for future installation of additional software blocks by AMP specialists.</p>
38.2	Cabin	<p>a/ assembly of a box 500 x 600 x 300 (width x height x depth)</p> <p>b/ assembly of box power supply 230 V AC, 1000 VA</p> <p>c/ assembly of holder for 15" ACE terminal. The panel shall be supplied by AMP.</p> <p>d/ assembly of power and signal cable - box-terminal</p>
38.3	OHT crane girders	<p>a/ assembly and commissioning of a radar receiver for the measurement of crane bridge position (crane travel) - X axis; SYMEO radar distance meter, model LPR-1D24. The radar shall be supplied by AMP.</p> <p>b/ assembly and commissioning of a radar receiver for the measurement of winch trolley position - Y axis, and connecting it with ACE PLC in the container (power supply, Ethernet); SYMEO radar distance meter, model LPR-1DHP. The radar shall be supplied by AMP.</p> <p>c/ assembly of incremental encoders for drive of crane travelling mechanism - X axis</p> <p>d/ assembly of SICK laser sensors for the calibration of crane position (2 sets) - X axis. The sensors shall</p>

		be supplied by AMP.
38.4	Winch trolley, tongs	<p>a/ assembly of load weight control system (sheet coils); a measurement error may not exceed +/- 2% of the actual weight within the whole measurement range. The system shall be connected with the PLC. Net/gross values shall be read-out and basic functions, such as: tare, weight determination, zeroing, tare cancelling, fault acknowledgement shall be programmed.</p> <p>b/ assembly of a system for measurement of tongs position (lifting mechanism) - Z axis, transmission of signal/information to the PLC (lifting mechanism - absolute linear encoder).</p> <p>c/ assembly and commissioning of radar transmitter for measurement of winch trolley position - Y axis, SYMEO radar distance meter, model LPR-1DHP. The radar shall be supplied by AMP.</p> <p>d/ assembly of incremental encoders for a drive of winch trolley travelling mechanism - Y axis</p> <p>e/ assembly of SICK laser sensors for the calibration of winch trolley position (2 sets), Y-axis. The sensors shall be supplied by AMP.</p>
38.5 A	2D scanners and manipulators - OPTION A	<p>a/ the Contractor shall prepare assembly spots and construction, install 3 sets of a manipulator of two degrees of freedom (two-axis) and 2D scanner mounted on the manipulator:</p> <p>a1/ manipulator: the first degree of freedom is +/- 180 degrees rotation, second one - +45/-90 degrees tilt. Design according to the figure included in Chapter IV, Description of manipulator and scanner.</p> <p>a2/ 2D LiDAR scanner, type: [LMS511-20100 PRO] - scanners to be supplied by AMP.</p> <p>b/ two sets shall be assembled under the crane trolley, on the opposite sides (exact position to be agreed with AMP). The third set shall be assembled on one of four additional assembly spots described below:</p> <p>b1/ the Contractor shall prepare assembly spots, construction and cabling for four additional sets - manipulator and 2D scanner: two under the crane trolley, one under the cabin, one under a bucket next to the trolleys (exact position to be agreed with AMP). It should be possible to adjust the position of the manipulator to a small extent on all assembly spots (4 assembly positions in a square)</p> <p>b2/ power and communication cables must be protected and fixed to the structure in such a way</p>

		<p>that sockets are not subject to stress during movement</p> <p>c/ scanner and manipulator must be secured against falling and vibration</p> <p>d/ scanner and manipulator must be secured against high temperature (screens, flange)</p> <p>e/ scanning field of the scanner should be 190 degrees with a range up to 80 metres, minimum 26 metres for objects of low remission</p> <p>f/ the Contractor shall provide for maintenance access to all sets of manipulators and additional assembly spots</p> <p>g/ manipulator control system and scanner reading must be connected to the terminal in the container</p> <p>h/ the Contractor shall deliver manufacturer's drivers for scanner and manipulator</p> <p>i/ details on manipulators are included in Chapter IV, Description of manipulator and scanner.</p>
38.6	Monitoring system	<p>a/ assembly and commissioning of seven CCTV IP full HD cameras - two on the trolley, two on the crane bridge, one next to the cabin and two IP cameras in the container. Exact location and camera model to be determined with AMP. The cameras shall monitor tongs operation and load transportation. The camera model must be approved by AMP (and must be supported by IT system).</p>
38.7	Thermal protection	<p>a/ electronic equipment (sensors, network devices) exposed to infrared radiation emitted by hot steel coils in the bay shall be protected by thermal shields.</p>
38.8	Aisle Z-Y	<p>a/ assembly and commissioning of a radar transmitter for the measurement of crane bridge position - X axis, SYMEO radar distance meter, model LPR-1D24. The radar shall be supplied by AMP. Assembly of cables and 230V AC power supply to the radar transmitter cabinet shall be performed under the scope of supply.</p>
38.9	Software	<p>a/ the Contractor shall install, configure and connect ACE measurement equipment with the crane PLC and read out data and save them in DB block. It shall make these data available for the needs of ACE.</p> <p>b/ programming environment of the crane PLC [STEP 7 v5.6]. If the program uses any additional extensions/modules/licences/libraries, the Contractor shall prepare an exact list of the</p>

		<p>software required for programming and editing of this program.</p> <p>The software shall be fully explicit, clear and reasonably described by notes. The software shall be tested by the Contractor before start-up.</p> <p>The Contractor shall enter program source codes upon completed start-up.</p> <p>c/ entire logic of the OHT crane operation shall be comprised in the PLC.</p> <p>d/ software installed in the crane PLC written by the Contractor shall be the property of AMP. The Contractor shall ensure proper functioning of the crane and equipment in accordance with the contract.</p> <p>e/ the supplier shall provide all data and instructions necessary for proper setup and communication of peripherals with the PLC.</p>
38.10	ACE Software	<p>After hot commissioning of the OHT crane carried out by the Contractor, the commissioning of ACE mode shall be carried out. The Contractor shall provide support of an automation engineer who will participate in the start-up of the program created by AMP. Specific tasks of the Contractor's automation engineer shall include supervising Safety program to maintain certification and guarantee required safety as well as confirming that modifications made will not affect guarantee terms and conditions. The Contractor's representative shall participate in testing of ACE system. Expected time for the commissioning of ACE shall be 6 months. ACE software shall cooperate with the safety controller in the bay which manages and controls access to the zones in the bay. The Contractor of zones shall be responsible for validation of the controller and safety program.</p>
38.11	ACE Software - Acceptance by the Office of Technical Inspection (UDT)	<p>Upon completion of ACE commissioning, the Contractor of cranes shall again subject the entire system (cranes and safety zones) to the acceptance by the Office of Technical Inspection.</p>
38.12	Network	<p>The Contractor shall assemble and connect enabled network equipment delivered by AMP according to the concept described in Chapter IV "Final configuration of the network on the OHT crane". Equipment delivered by AMP shall comply with Appendix AIM Addendum to tender- automation system requirements V16.</p>
39	RETROFITTING OF OHT CRANE #1020 FOR THE NEEDS OF ACE	

39.1	Documentation	Preparation of technical documentation and agreeing it with AMP and UDT. The Contractor shall be responsible for all necessary certifications and documents. The risk analysis for #1020 crane should be included in the risk analysis for the new crane due to the same functionality and shared safety zones.
39.2	Retrofitting	Performance of works related to retrofitting of OHT crane #1020 in accordance with the documentation.
39.3	Signalling of automatic operation	ACE mode light signalling - a lamp, colour: white
39.4	Crane control system	Operation mode switch between cabin/radio/radio+ACE mode shall be handled in the operator's cabin. Operation mode switch must be plugged into safety inputs of the crane PLC. The operating mode switch shall comply with PL e cat. 4. The Contractor shall purchase PLC modules necessary for the operation of retrofitting equipment. The safety system (safety sensors) must meet Performance Level e.
39.5	Electric container	a/ assembly of 19" PC terminal with WinCC Client The terminal together with the license shall be delivered by AMP. b/ assembly of holder for 15" ACE terminal intended for the operation of scanners and manipulators. 15" terminal shall be delivered by AMP.
39.6	ZONE SENSORS - BRIDGE TRAVEL	Safety sensors controlling the movement of the crane between the zones in the bay shall be installed on the crane and in the bay. In case of power supply failure and power supply return, the crane must recognise the zone in which it is located. There shall be 7 control points. Exact location of the zones shall be agreed with AMP. The safety zone plan contains an illustrative concept of zones. Manner of the assembly of sensors in the bay should enable further relocation of boundaries of zones. Common activating units for both cranes should be provided.
39.7	ZONE SENSORS - TROLLEY TRAVEL	Safety sensors controlling the movement of the crane between the zones in the bay shall be installed on the crane winch and on the bridge. In case of power supply failure and power supply return, the crane must recognise the zone in which it is located. There shall be maximum 5 control points. Exact location of the zones shall be agreed with AMP. The safety zone plan contains an illustrative concept of zones. Manner of the assembly of the sensors on the bridge should enable further relocation of boundaries of zones.

	SAFE MEASUREMENT PL E - BRIDGE TRAVEL	The Contractor shall purchase and install an absolute measuring system based on a camera and 2D code tags. The measuring system must comply with PL E safety standards and must communicate with the controller using the Profisafe protocol. Required measuring range from the beginning of the bay (service area / column 118) to the decoiler / column 95. Required accuracy: 20 cm. Minimum speed of movement for measurement: 4m/s Camera/sensor should be thermally protected. 2D codes should be available for cleaning and located on the Z-axis crane girder (cannot be located at the trolleys) - their location must be agreed with AMP. The system should signal when the codes are dirty. The system must work correctly even if two consecutive codes are unreadable.
	SAFE MEASUREMENT PL E - TROLLEY TRAVEL	The Contractor shall purchase and install an absolute measuring system based on a camera and 2D code tags. The measuring system must comply with PL E safety standards and must communicate with the controller using the Profisafe protocol. The required measuring range over the entire travel range of the trolley. Required accuracy: 20 cm. Minimum speed of movement for measurement: 4m/s Camera/sensor should be thermally protected. 2D codes should be available for cleaning and their location must be agreed with AMP. The system should signal when the codes are dirty. The system must work correctly even if two consecutive codes are unreadable.
	SAFETY SWITCH FOR MEASURING SYSTEMS	The Contractor shall purchase and install a two-position switch to change the method of zone inspection (safety sensors / safety measurement as described in items 28.1, 28.2, 28.3, 28.4) with a coded key meeting PL E requirement and connected to the safety controller.
39.8 A	2D scanners and manipulators - OPTION A	<p>a/ the Contractor shall prepare assembly spots and construction, install 3 sets of a manipulator of two degrees of freedom (two-axis) and 2D scanner mounted on the manipulator:</p> <p>a1/ manipulator: the first degree of freedom is +/- 180 degrees rotation, second one - +45/-90 degrees tilt. Design according to the figure included in Chapter IV, Appendix 2 "Manipulator and scanner V03"</p> <p>a2/ 2D LiDAR scanner, type: [LMS511-20100 PRO] - scanners to be supplied by AMP.</p>

		<p>b/ two sets shall be assembled under the crane trolley, on the opposite sides (exact position to be agreed with AMP). The third set shall be assembled on one of four additional assembly spots described below:</p> <p>b1/ the Contractor shall prepare assembly spots, construction and cabling for four additional sets - manipulator and 2D scanner: two under the crane trolley, one under the cabin, one under a bucket next to the trolleys (exact position to be agreed with AMP). It should be possible to adjust the position of the manipulator to a small extent on all assembly spots (4 assembly positions in a square)</p> <p>b2/ power and communication cables must be protected and fixed to the structure in such a way that sockets are not subject to stress during movement</p> <p>c/ scanner and manipulator must be secured against falling and vibration</p> <p>d/ scanner and manipulator must be secured against high temperature (screens, flange)</p> <p>e/ scanning field of the scanner should be 190 degrees with a range up to 80 metres, minimum 26 metres for objects of low remission</p> <p>f/ the Contractor shall provide for maintenance access to all sets of manipulators and additional assembly spots</p> <p>g/ manipulator control system and scanner reading must be connected to the terminal in the container</p> <p>h/ the Contractor shall deliver manufacturer's drivers for scanner and manipulator</p> <p>i/ details on manipulators are included in Chapter IV, "Description of manipulator and scanner".</p>
39.9	Monitoring system	<p>a/ assembly and commissioning of three CCTV IP full HD cameras, two on the crane bridge and one next to the cabin, exact location and camera model to be agreed with AMP. The cameras shall monitor tongs operation and load transportation. The camera model must be approved by AMP (and must be supported by IT system).</p>
39.10	Thermal protection	<p>a/ electronic equipment (sensors, network devices) exposed to infrared radiation emitted by hot steel coils in the bay shall be protected by thermal shields.</p>
39.11	ACE Software	<p>After retrofitting of OHT crane #1020 and acceptance by UDT, the start-up of ACE software shall be carried out. The Contractor shall provide support of an</p>

		<p>automation engineer who will participate in the start-up of the program created by AMP. The Contractor's representative shall participate in testing of ACE software. Expected time for ACE start-up shall be 6 months from the completion of retrofitting of the OHT crane #1020.</p> <p>ACE software shall cooperate with the safety controller in the bay which manages and controls access to the zones in the bay. The Contractor of zones shall be responsible for validation of the controller and safety program.</p>
39.12	ACE Software - Acceptance by the Office of Technical Inspection (UDT)	<p>Upon completion of ACE commissioning, the Contractor shall again subject the entire system (cranes and safety zones) to the acceptance by the Office of Technical Inspection. The Contractor shall ensure that all necessary documents related to works on the #1020 overhead travelling crane are issued, taking into account the requirements specified in the Regulation of the Minister of Economy of 21 October 2008 on essential requirements for machinery.</p>
39.13	Tongs for horizontal transport of coils	<p>Adaptation of the OHT crane to operate with ACE tongs, with the possibility to operate with existing tongs, shall be carried out as in the case of newly designed crane. Electrical diagram of the existing tongs is presented in the basic documentation.</p> <p>Assembly of a cable reel for supply of ACE tongs and Profibus communication.</p>
39.14	Anti-collision system	<p>Application of an anti-collision system - [SICK laser sensors - a two-stage system for the new crane Q 40t in operation (1 set) for the bridge travel mechanism.</p>
39.15	Bridge travel control system	<p>Sensors controlling deformation of the crane bridge shall be installed at the side of the thrust rollers.</p>
39.16	WINCH TROLLEY	<p>Assembly of an absolute linear safety encoder. The encoder shall be connected to the PLC.</p>
39.17	Network	<p>The Contractor shall assemble and connect enabled network equipment delivered by AMP according to the concept described in Chapter IV "Final configuration of the network on the OHT crane". Equipment delivered by AMP shall comply with Appendix "AIM Addendum to tender- automation system requirements V16".</p>
39.18	Existing measurement systems	<p>If necessary, the Contractor shall change the position of SYMEO radars to ensure stable measurement. (The change may be necessary upon the supply of the new OHT crane, currently the measurement works</p>

		properly).
40	TECHNICAL DOCUMENTATION	
40.1	Content of the Documentation	Full technical documentation must be submitted in four paper copies and in soft electronic editable copy on an attached CD.
40.2	Delivering documentation	The as-built documentation concerning the crane shall be prepared in accordance with the Polish law and AMP standards. It shall be delivered to the Owner's seat prior to submission of the OHT crane to acceptance by UDT. A copy of the recently installed (newest) version of control software must be also delivered (drives, PLC, HMI).
41	DOCUMENTATION FOR ACCEPTANCE OF OVERHEAD CRANES	Documentation for acceptance of OHT cranes shall be prepared in accordance with Polish law and UDT instructions. Complete documentation shall be approved by UDT.
42	MARKING AND IDENTIFICATION OF OVERHEAD CRANES	Prior to submission of OHT cranes to acceptance the Contractor shall provide all plates, inscriptions and symbols (including safety and warning symbols) to identify the cranes in accordance with Polish law, UDT instructions and AMP standards.
43	ACCEPTANCE OF OVERHEAD CRANES	
43.1	Acceptance by the Owner	Availability tests of the manual mode (stage I) and availability tests of automatic mode (stage II) shall be made as part of acceptances to be performed by the Owner. The CONTRACTOR shall inform the Owner about its readiness to carry out tests for Stages I and II. Tests shall take place at the time agreed upon by the parties in the presence of authorised representatives of the Contractor, AMP project supervision and the User. The condition for project acceptance is confirmation of all guaranteed parameters and successful completion of tests for both Stages. Details can be found in Chapter I, item 9.7.
43.2	Acceptance by the Technical Inspection Office (UDT)	As far as acceptances of cranes by the UDT are concerned, the CONTRACTOR shall arrange all works, documents, notifications, fees etc.
44	AVAILABILITY OF OVERHEAD CRANE AND ACE EQUIPMENT	The required availability of crane and ACE is minimum 99.5% measured during operating hours within 30 subsequent days (720 h) , less scheduled downtimes (inspections and maintenance) and idle time of OHT crane (no manning).

45	SPARE PARTS	
45.1	For the time of commissioning	The Bidder shall provide spare parts and components necessary (indispensable) for correct execution of tests, commissioning, functionality tests and acceptance of OHT cranes.
45.2	Reference spare parts	The Bidder shall submit a list of reference spare parts and components necessary (indispensable) to keep continuity of overhead crane operation within the whole guarantee period (the list shall include quantities and prices of individual items).
46	GUARANTEE SERVICE	
46.1	Diagnostics	Remote diagnostics of the overhead crane through the WiFi network.
46.2	Response time of supplier's service	Up to 24 h starting from the confirmed notification.
45.3	Time to start on-site intervention	Up to 72 h from the confirmed notification
46.4	Maintenance service of AMP S.A.	Acceptance of operation of maintenance services of AMP S.A. in the scope of crane inspections required by the law and AMP standards and in the scope of crane repairs (by authorised employees of the Owner) with the use of reference spare parts.
47	POST-GUARANTEE SERVICE (OPTION)	The Owner expects proposal of post-guarantee service (time of service team response and of fault removal, repair costs, etc.).

- Inscriptions on control panels and screens, operating manual and working instructions shall be made in Polish.
- OHT crane shall have assigned and indicated anchoring points according to applicable regulations.
- New OHT crane with its equipment and modifications to the existing crane #1020 must meet the requirements of the EU Directive 2006/42/EC on machinery, new essential requirements (including issuing of EC Declaration of Conformity and CE certificate).

2. ERECTION OF THE NEW ACE CRANE #1025 AND RETROFITTING OF THE CRANE #1020

The following works shall be performed within the scope of OHT crane erection:

- Performance of safety audits at the erection site (in the place of crane erection) and in erection site facilities over the whole period of the erection according to the schedule,
- Performance of continuous/permanent safety supervision of works executed by the Contractor and/or its Sub-contractors by safety at work coordinator (OHS Inspector) over the whole period of the erection,
- Supply of crane prefabricates to the erection site i.e. to the aisle Z-Y,
- Supply of gripping tongs to the erection site (in the place of crane erection) i.e. to the aisle Z-Y,
- Erection of the crane prefabricates on crane runways in the aisle Z-Y,
- Erection of crane equipment,
- Preparation of electric systems for the OHT crane in accordance with the documentation,
- Completion of OHT crane rigging,
- Assembly of gripping tongs to sheave blocks,
- Assembly of other crane elements not mentioned above (in accordance with technical documentation),
- Marking of OHT cranes and tongs,
- Execution of working land surveys and measurements required by law (as-built survey reports),
- Erection of the crane prefabricates and retrofitting equipment on the crane #1020.

3. COMMISSIONING OF DELIVERED OHT CRANE #1025 WITH ITS EQUIPMENT AND COMMISSIONING OF RETROFITTED CRANE #1020

The following works shall be performed within the scope of OHT crane commissioning:

- Performance of safety audits at the erection site (in the place of crane erection) and in erection site facilities (over the whole period of the commissioning according to the schedule),
- Performance of continuous/permanent safety supervision of works executed by the Contractor and/ or its Sub-contractors by safety at work coordinator (OHS Inspector) over the whole period of the commissioning,
- Connection of power supply to the crane,
- Execution of measurements of cable insulation conditions, efficiency of electric shock protection and lighting intensity,
- Completion of cold commissioning,
- Completion of functionality tests of all crane components and mechanisms,
- Completion of hot commissioning,
- Measurements of OHT cranes geometry,
- Performance of necessary adjustments and removal of all defects and faults,
- Preparation of as-built documentation (including operating instructions, operating and maintenance manuals and Occupational Risk Assessment (HIRA) for operation, maintenance and repair and conduct in case of occurrence of emergency conditions and need of evacuation),
- Providing training for the Owner's employees (to be concluded with issue of certificates stating names of the trainees for individual employee groups),
- Preparation of OHT cranes for acceptance by UDT (including preparation of acceptance documentation),
- Submission of OHT crane to acceptance by UDT (registration of the cranes at UDT) on behalf of the Owner,
- Completion of OHT crane acceptance by UDT (to be concluded with issue of Certificate of unconditional crane acceptance and approval for use),
- Completion of availability tests of the crane and its equipment (to be carried out by Cold Rolling Mill and supervised by the Contractor) within 30 days from unconditional acceptance of the crane by UDT. During the availability tests all guaranteed parameters must be tested,
- Crane acceptance by Working Team composed of the Owner's, User's and Contractor's employees,
- Signing the Final Acceptance Certificate and handing over the OHT crane for operation in the Cold Rolling Mill.

4. DOCUMENTATION REQUIRED DURING PROJECT EXECUTION

- Verified/up-dated Work Schedule,
- Memorandum of Understanding,
- Occupational Risk Assessment ("HIRA") for works performed,
- BIOZ (Health and Safety Plan),
- Work Organisation Plan prepared on the basis of the Schedule attached in appendix to this Technical Specification,
- Preparation and submission of weekly work progress reports expressed in percentage, according to the Buyer's/Owner's instructions,
- Preparation of Reports of safety at work audits.

5. GUARANTEED PARAMETERS

List of guaranteed parameters, which shall be verified during acceptance performed by the Buyer:

- 5.1 Meeting the operational requirements of the crane** (examining whether the crane can handle the following with the tongs:
- a. 1 hot coil of steel sheet with a maximum weight of 35 t,
 - b. 1 hot coil of steel sheet with maximum dimensions given in the Chapter I in item 1.3 herein;
- 5.2 Speed of OHT crane mechanisms - bridge and trolley travel, lifting capacity, tongs** (three control measurements of speed of the specified mechanisms to verify compliance with technical and operating parameters of OHT cranes).
- 5.3 Lifting height of OHT cranes** (three control measurements of the lifting height of the OHT cranes to verify compliance with the technical and operating parameters of the crane).
- 5.4 Temperature inside operator's cabin during crane operation** (measurement shall be made inside the cabin every 30 minutes within 4 hours of the crane operation - result to be compared with guaranteed parameter: arithmetic mean value of measurement results; guaranteed value: $+20^{\circ}\text{C} \pm 2^{\circ}\text{C}$).
- 5.5 Availability of OHT crane and its equipment is 99.5%** (measured during operating hours within the period of availability test i.e. 30 days of operation - 720 h less scheduled downtimes for revisions and maintenance and idle time of OHT crane (no manning)).
- 5.6 Efficiency and operation of overloading protection system** (checking operation of the crane overloading protection system to verify compliance with technical and operating parameters of OHT cranes - guaranteed parameter: three successful checks of system operation).
- 5.7 Efficiency and operation of anti-collision system** (checking operation of crane anti-collision system to verify compliance with technical and operating parameters of OHT cranes - guaranteed parameter: three successful checks of system operation).

- 5.8 Anchoring points - minimum 5 points on the trolley of the crane, C class anchoring points along the girders and buffer beams - fixed rope system (guaranteed parameter: compliance of anchoring points with operating and maintenance manuals of the crane and with AMP ST 003 standard).
- 5.9 Deflection of OHT crane (three control measurements of the crane deflection to verify compliance with valid UDT requirements).
- 5.10 Efficiency and operation of safety system equipment - three tests of the behaviour of entire system for independent actuation of each safety circuit, in accordance with the safety requirements.

6. SCRAP CHARGE PARAMETERS

6.1 Overall dimensions of a single scrap piece

- maximum length: 1500 mm
- maximum width: 500 mm
- maximum thickness 500 mm

6.2. Maximum weight of a single scrap piece

- maximum weight of a single scrap piece: 1500 kg

6.3 Prerequisite

Prerequisite for the single scrap piece is to meet requirements specified in 6.1 and 6.2 of this Chapter at the same time.

7. DIVIDING THE SCOPE BY STAGES

7.1. The scope of Stage I includes:

- Supply of new ACE crane #1025, 2 x ACE tongs, components of retrofitting equipment for the crane #1020 for the needs of ACE.
- Assembly of new ACE crane #1025, ACE 2 x tongs, components of retrofitting equipment for the crane #1020 for the needs of ACE.
- Presentation of documents necessary for the completion of deliveries, assembly, commissioning and acceptance by the Office of Technical Inspection mentioned above.
- Painting.
- Carrying out standard check-ups.
- Performing cold and hot commissioning of crane #1025 and crane #1020 in manual mode.
- Adjustment run of cranes #1025 and #1020 in manual mode.
- Availability tests of cranes and equipment in manual mode.
- Establishing and keeping PLC Software Logs.
- Making arrangements and acceptance of the entire system (cranes and safety zones) by the Office of Technical Inspection.

7.2. The scope of Stage II includes:

- Performing start-ups of equipment not involved in manual operation, in particular devices: scanners, manipulators and ACE tongs in automatic mode.

- Keeping the PLC Software Log.
- Providing support for ACE software start-up (start-up of automatic mode).
- Carrying out standard check-ups.
- Providing safety documents / certificates for the automatic mode.
- Presenting other documents included in the project scope.
- Participating in ACE software tests (automatic mode).
- Availability test of cranes and equipment in automatic mode (ACE), acceptance test of guaranteed parameters.
- Repeated acceptance of the entire system in the yard (cranes and safety zones) by the Office of Technical Inspection.

7.3. Comments on dividing the scope by stages.

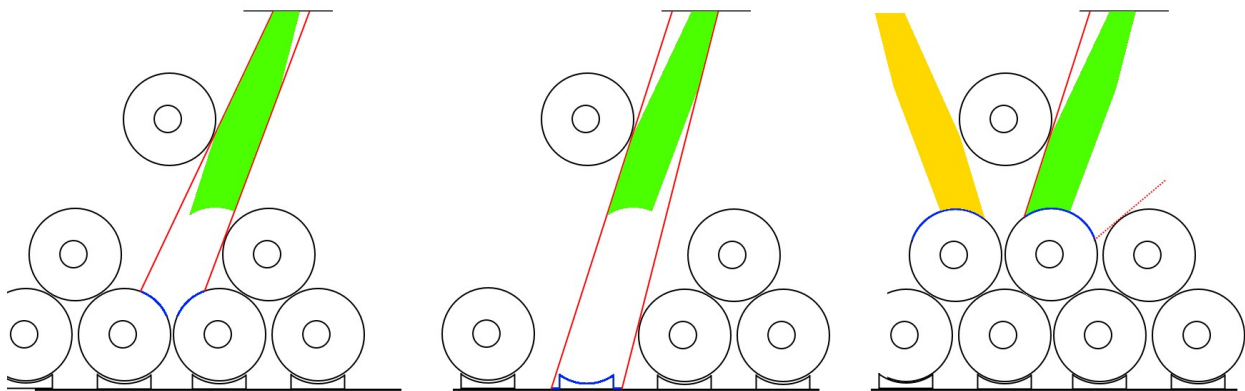
- The scope of the project not included in sections 7.1 and 7.2 should be treated as belonging to Stage I.
- Any changes in the division of the scope into Stage I and Stage II require written consent of the Owner and must be justified and presented in the bid.

CHAPTER IV: DESCRIPTION OF MANIPULATOR AND SCANNER

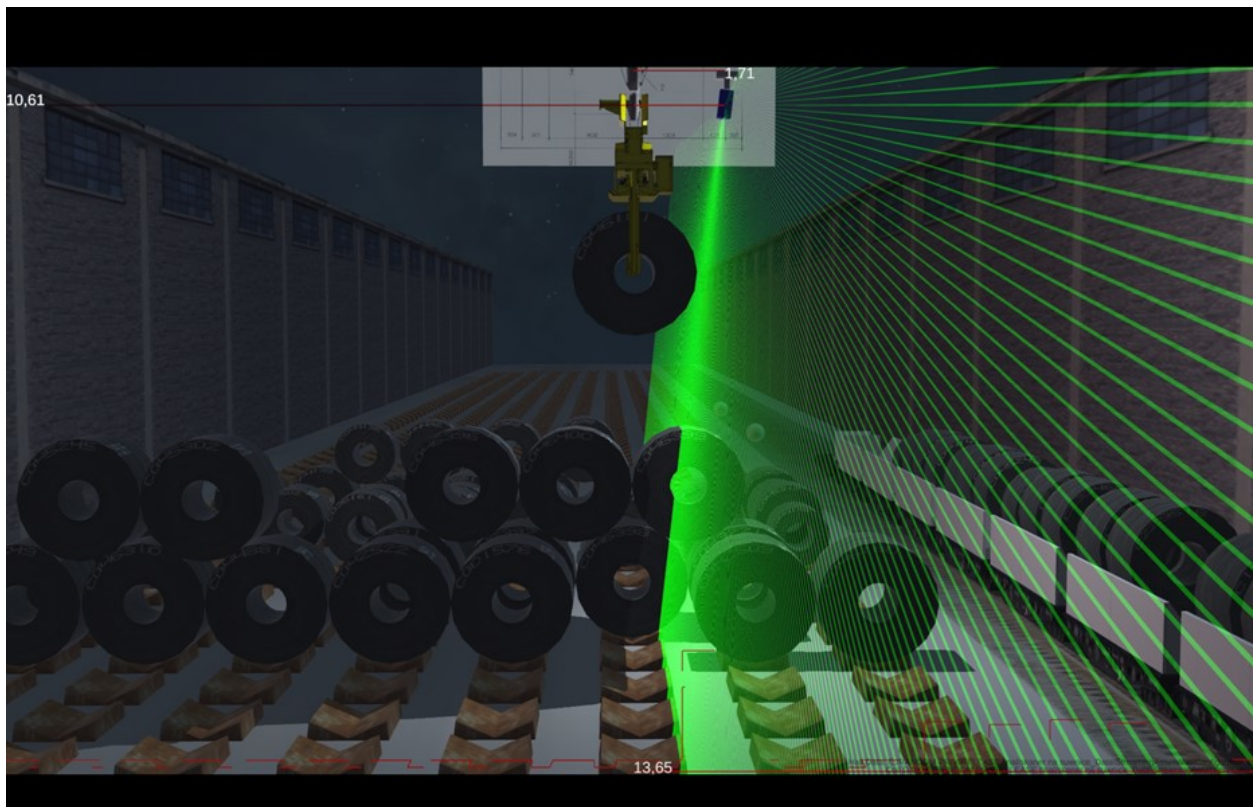
1. Scanner function.

Scanners will have two basic functions: scanning the place where a coil is to be placed and control scanning during driving. When it comes to the location of scanners, the first function narrows assembly possibilities much more.

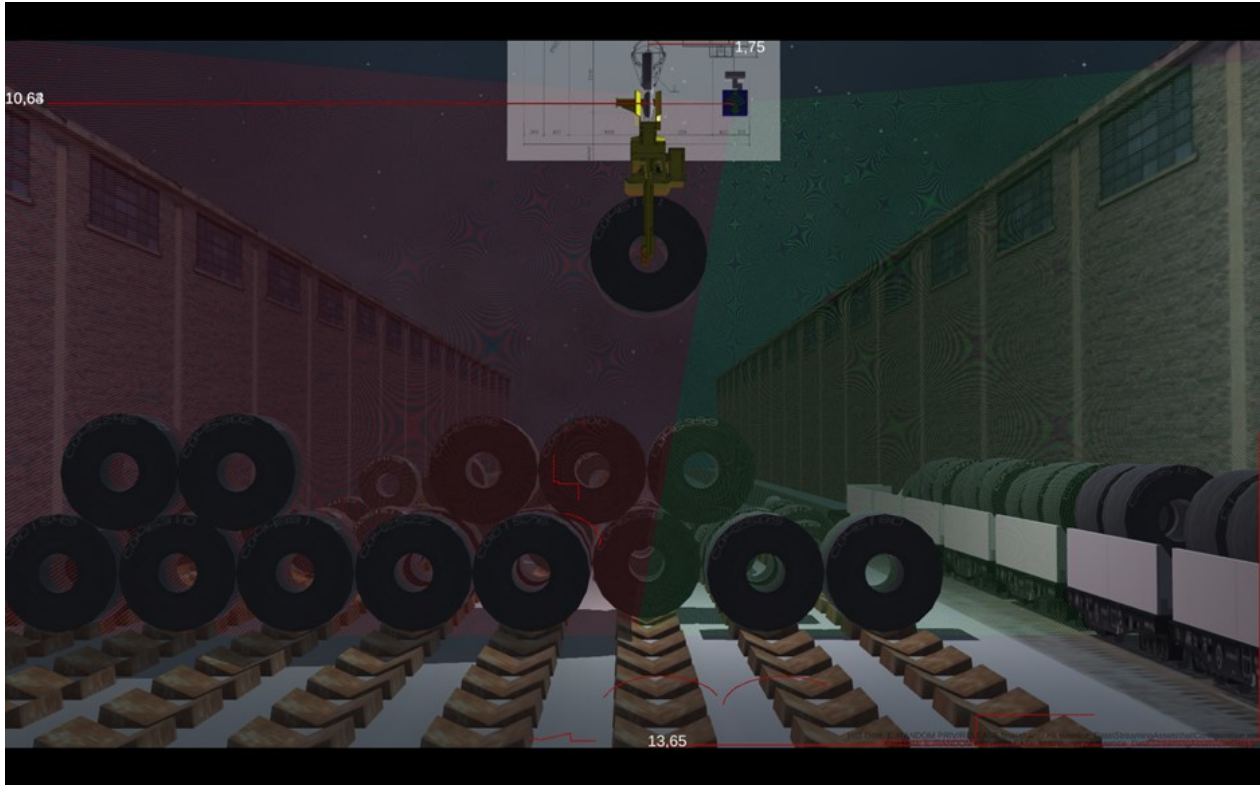
The position of the scanner must enable it to scan a coil stand and coils on which another coil is to be placed in the second/third layer in two planes.



Simulation of the range and resolution of one of the scanners for the preferred configuration is visualised below. We require at least the same range and resolution as for the preferred configuration.



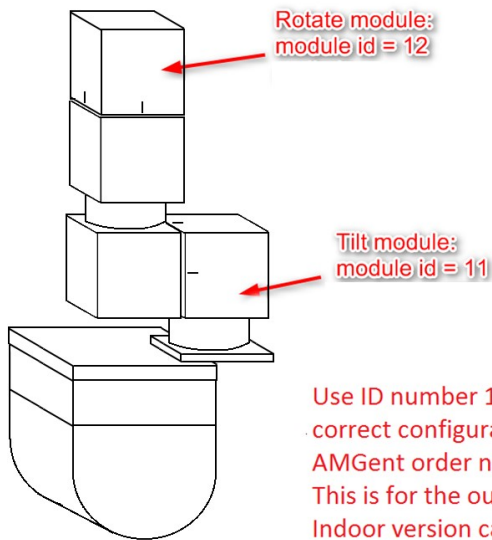
Light green lines show the scanner field of view unobstructed by the coil handled in tongs or by the tongs themselves. Light red lines show the scanner field of view obstructed by the coil handled in the tongs or by the tongs themselves. Light red lines (locally discontinuous) at the bottom of the drawings show points seen by the scanner in the coordinate system of the bay. The stands and coils will be scanned in two planes.





2. Manipulator configuration.

Manipulator model preferred by AMP is [Shunk powercube] or equivalent, with basic IP, as shown in the figure below.



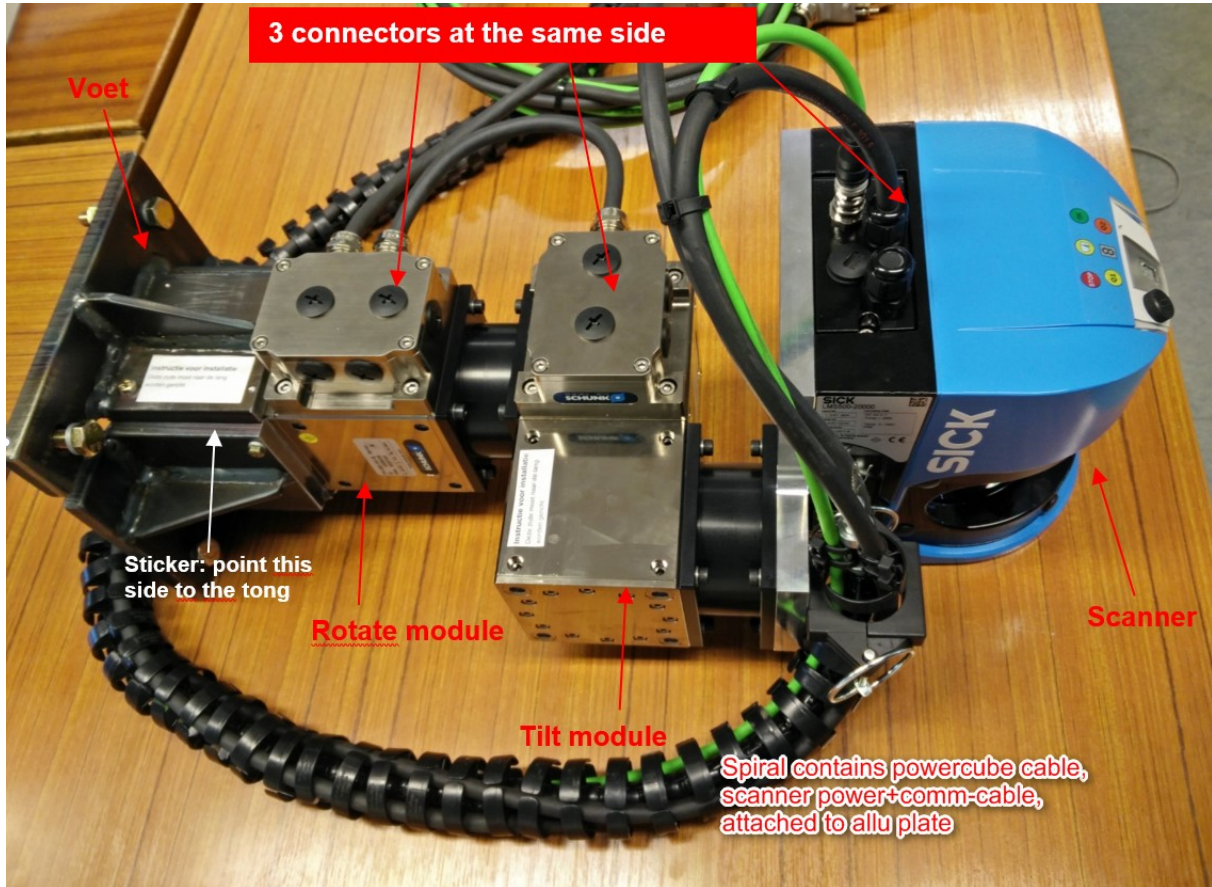
1320240	2-DOF ROBOT STRUCTURE WITH PR090,V5,SMP,5M	bestehend aus: - 2 Stk. Schwenkmodul PR090-161-B-IP65 (without curled cable)	Sonderparameter für die Montage: - Reference: USE Index = YES - Reference: Max. Distance Switch = 1000 - Rotationsmodul ID 12 (no limits) - Schwenkmodul ID 11 (+45°/-90°)
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3. Scanner model.

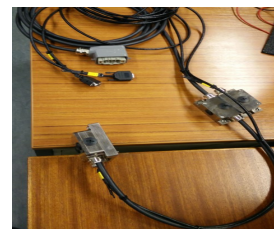
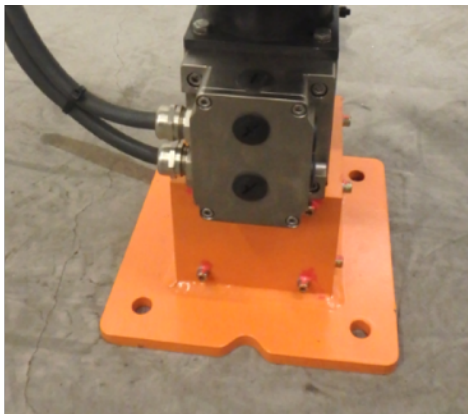
[SICK 2D LiDAR scanner, type: LMS511-20100 PRO] or equivalent.

4. Remarks regarding manipulator fixing and cabling.

Cables and connectors should be secured against stresses and damage. To this end, we recommend to use protective spiral and attach cables to the aluminium plate, as shown in the figure below.



Factory fixing of the manipulator is too poor for extreme operating conditions. We require application of a solid fixing element and protection against falling. We require application of vibration-damping elements.



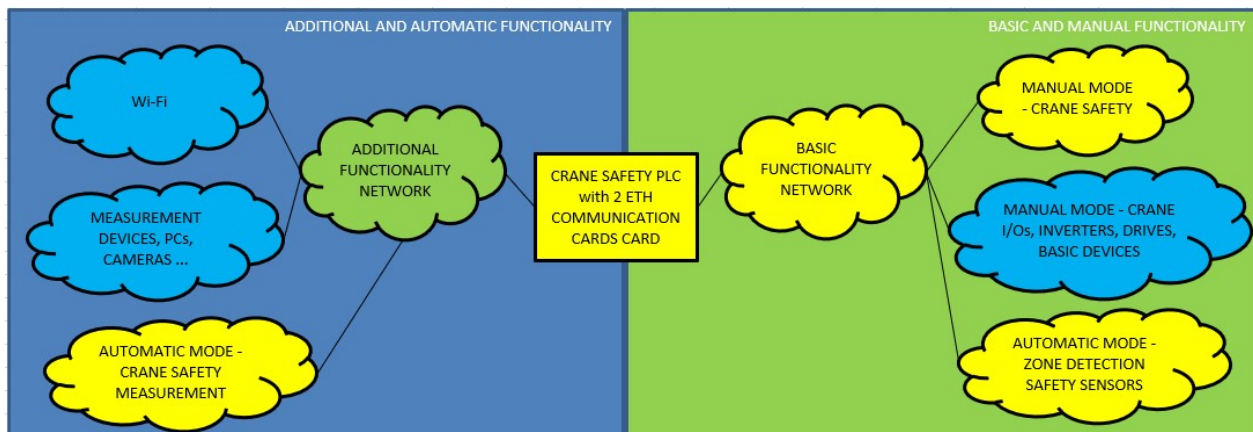
We require assembly of service cables to the manipulators.

Final configuration of the network on the OHT crane - architecture:

The target network architecture for the new crane #1025 and modernised crane #1020 assumes division into two industrial networks:

- Network with basic functionality of cranes - configured by the Contractor according to its best practice - approval by AMP is required. The network with basic functionality is to be used mainly for operating the crane travel devices and safety elements for operating the crane in basic - manual mode. This section is highlighted in green on the conceptual drawing below.
- The network with additional crane functionality shall be used mainly for: remote access to cranes, remote operation and configuration of additional devices, cameras, measuring systems and additional devices required for ACE mode operation (PC, scanners, manipulators). Network devices in this group shall be configured by AMP.

The crane safety PLC equipped with two Ethernet cards shall be the central point of the entire architecture. The primary network shall be connected to the first Ethernet card. The secondary network shall be connected to the second Ethernet card. In this way, network separation can be achieved.



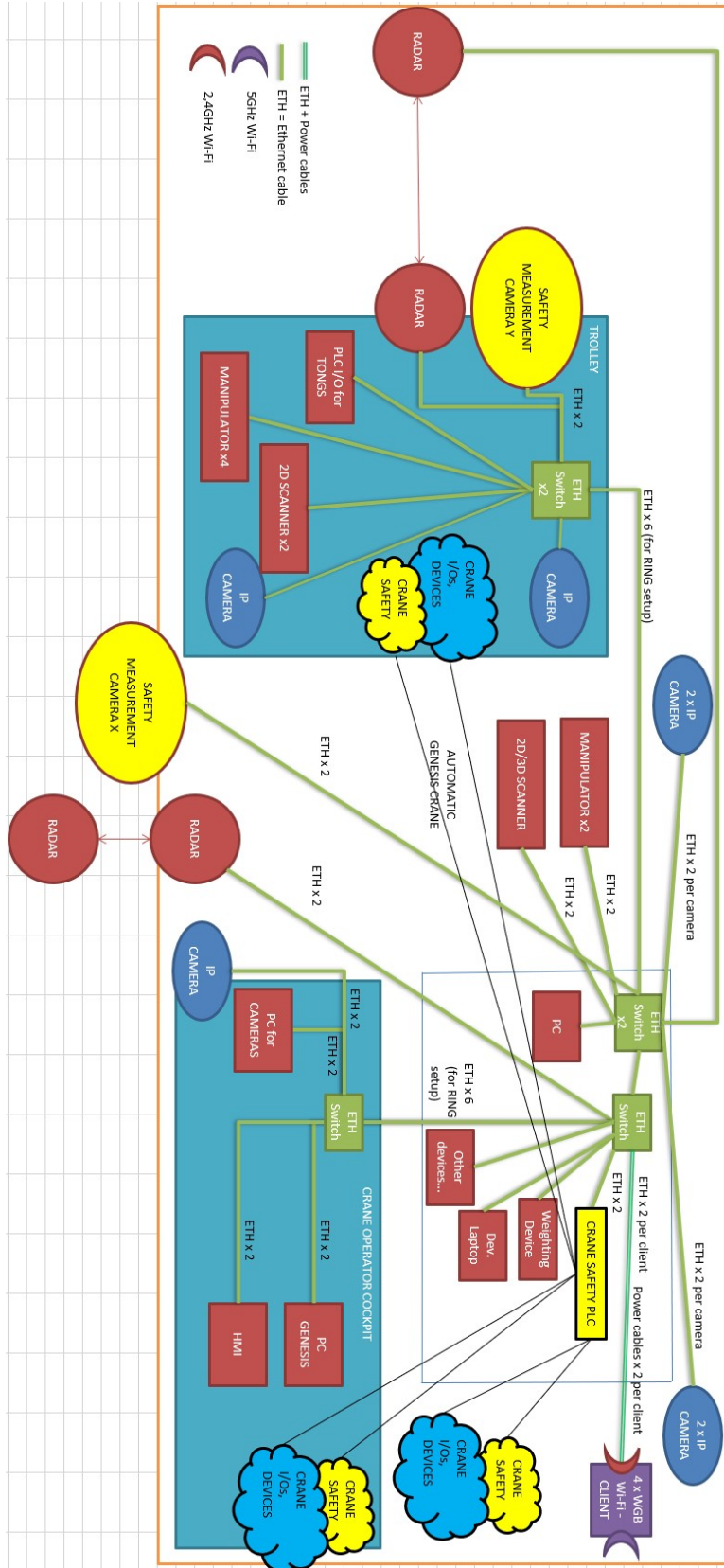
The network for crane #1020 should be extended to the extent shown in the diagram

Target network configuration for the crane - network with basic functionality - requirements:

- The Contractor shall secure and route the Ethernet cables to any other devices with Ethernet port from the nearby network points. All network connections to terminal equipment must have at least one backup Ethernet cable.
- Cables must be secured against damage. Cables must be shielded. All cables must be ended with high-quality industrial RJ45 plugs. All 8 wires shall be used in each cable.
- All Ethernet cables must be laid in the manner preventing the occurrence of interferences from power lines and other electric equipment. Metal cable routes should be prepared in order to protect cables against mechanical damage.
- All Ethernet cables shall be shielded and be of min. cat. 5e. Cable ends (RJ-45) shall have shield connectors and also be of min. cat. 5e.
- Type of cabling and network components shall be accepted by AMP.
- The architecture of the basic part must be agreed with AMP.

Target network configuration for the crane - network with additional functionality - conceptual diagram and requirements:

- The Contractor shall run Ethernet cabling according to the conceptual diagram. Description of diagram:
- The Contractor shall lay 6 Ethernet cables between the area where network devices will be installed in the container and a network rack on the crane trolley. Two of them shall be connected to the enabled device delivered by AMP and the other four shall be reserve cables. In addition, the Contractor shall lay and form a six-core fibre optic cable between the container and a network rack on the crane trolley. The Contractor shall select cables designed for movable and flexible connections.
- Ultimately, 4 WBG – Client Wi-Fi devices shall be mounted on the crane. The Contractor shall lay 2 Ethernet cables between the area where network devices will be installed in the container and the place where each of four Wi-Fi Clients on the crane will be mounted (one cable in each pair shall be a reserve cable). In addition, the Contractor shall lay 2 power cables to supply all these devices (one of them shall be a reserve cable). The Contractor shall install Wi-Fi devices provided by AMP.
- The Contractor shall lay 6 Ethernet cables between the area where network devices will be installed in the container and a network rack in the crane cabin. In addition, the Contractor shall lay 8 Ethernet cables from the rack in the cabin to terminal equipment: two of them shall be connected to the Genesis PC, two of them shall be connected to the PC for cameras, two shall be connected to a camera, and the remaining cables shall be reserve or shall be connected to HMI panel.
- The Contractor shall secure and route the Ethernet cables to any other devices with Ethernet port from the nearby network points. All network connections to terminal equipment must have at least one backup Ethernet cable.
- Cables must be secured against damage. Cables must be shielded. All cables must be ended with high-quality industrial RJ45 plugs. All 8 wires shall be used in each cable.
- All Ethernet cables must be laid in the manner preventing the occurrence of interferences from power lines and other electric equipment. Metal cable routes should be prepared in order to protect cables against mechanical damage.
- All Ethernet cables shall be shielded and be of min. cat. 5e. Cable ends (RJ-45) shall have shield connectors and also be of min. cat. 5e.
- Type of cabling and network components shall be accepted by AMP.
- Final version of the architecture of the additional part must be agreed with AMP.



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