

## **Replacement of the gantry crane and a trash-rack cleaning machine at the Zlatoličje HPP**

**(New gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN)  
Zlatoličje HPP)**

# **Technical specifications**

**December 2023**

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# **1 PRESENTATION OF THE EXISTING GANTRY CRANE WITH A TRASH-RACK CLEANING MACHINE, WITH A CAPACITY OF 2X100 kN, AT THE ZLATOLIČJE HPP**

## **1.1 Introduction**

The Zlatoličje Hydro Power Plant is the first channel-type power plant on the Drava River, built in 1969. This run-of-river power plant features a column-type design, housing two Kaplan turbines. The power plant's net capacity is approx. 160 MW achieved at a flow rate of 550 m<sup>3</sup>/s and a head of 30 m.

A gantry crane with a lifting capacity of 2x100 kN, featuring an integrated trash-rack cleaning machine, is installed on the power plant for the purpose of operating the turbine water intakes by opening and closing them with auxiliary closing boards. Additionally, it serves the dual function of cleaning debris from the trash racks situated at the turbine water intakes.

The current crane with a trash-rack cleaning machine, with a capacity of 2x100 kN, was constructed at the Metalna Maribor factory in 1967 during the construction of the power plant.

The crane, equipped with a trash-rack cleaning machine, is used for lifting the auxiliary closing boards during the closure of the turbine water intakes. Simultaneously, the trash-rack cleaning machine serves to clear debris from the turbine water intakes.

The necessity for a higher lifting capacity arose due to the challenge of retrieving the auxiliary closing boards of the turbine water intakes following the completion of an overhaul or revision.

Due to challenges encountered in cleaning the water intake trash racks under full flow and when the turbine is operating at full power, the replacement of the trash-rack cleaning machine built-into the gantry crane structure became necessary.

Considering the issues outlined above, a preliminary design was drafted in 2021. From this design, a solution was chosen, envisioning the construction of a new crane equipped with a trash-rack cleaning machine. This new system aims to satisfy the updated demands for heightened load capacity, along with modified parameters for the trash-rack cleaning machine.

With the heightened load capacity of both the gantry crane and the trash-rack cleaning machine, there is a necessity for new lifting tongs to manipulate the auxiliary closing boards for closing the turbine water intakes.

During the replacement of the gantry crane with a trash-rack cleaning machine, it is imperative to design and install new protective fencing across both turbine water intakes. The existing fencing will be dismantled, and new fencing will be constructed as an extension of the existing steel part of the ramp, reaching a final height of 1000 mm (with an extension of approx. 500 mm).

## **1.2 Time schedule for the performance of works**

The Invitation to Tender includes an indicative time schedule for the manufacturing and delivery of a new gantry crane with a trash-rack cleaning machine for the Zlatoličje HPP. The schedule outlines deadlines set by the Client for these processes.

## **1.3 Scope of works for the manufacture, supply and installation of a gantry crane with a trash-rack cleaning machine, lifting tongs and the elevation of the ramp**

The scope of the tendered work includes:

- Preparation of design and technical documents.
- Dismantling of the existing gantry crane with a trash-rack cleaning machine, with a capacity of 2x100 kN.
- Manufacturing and supply of a new gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN.
- Manufacturing and supply of new lifting tongs.
- Manufacturing and supply of a ramp elevation, also functioning as a safety fence.
- Execution of civil works.
- Unforeseen works.

The new gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN, must maintain identical port dimensions as the existing crane with a trash-rack cleaning machine, with a capacity of 2x100 kN, currently installed above the turbine water intakes of the power plant.

No modifications or works are planned for the crane runway; it will remain in its current state.

The newly designed and constructed lifting tongs of the auxiliary closing boards must be identical in all connecting dimensions, function and form to the existing ones. The structure must be able to carry a load of 300 kN (existing 200 kN).

A new extension for the existing ramp must be fabricated and installed. This extension will double as a protective fence at the water intakes. It will facilitate the travel of the grab rake up to a final height of 1000 mm along the entire length of the power plant water intake. The specified material for this extension is CrNi.

## 2 DESCRIPTION OF EXISTING GANTRY CRANE WITH A TRASH-RACK CLEANING MACHINE

In light of the outdated nature of the current trash-rack cleaning machine installed on the 2x100 kN gantry crane structure and the necessity to effectively clean turbine water intake trash-racks even under full power conditions, thereby managing the substantial influx of debris (such as leaves, grass, tree trunks, twigs, and other refuse) onto the water intake trash-racks, the Client is looking to replace the existing machine with a new trash-rack cleaning machine, complete with all necessary associated equipment.

The current setup at Zlatoličje HPP includes a gantry crane equipped with a trash-rack cleaning machine, with a capacity of 2x100 kN, comprising a gantry structure, a trolley housing both a lifting mechanism and the trash-rack cleaning machine. Power is transmitted from the gearbox to the running wheel of the two drive trolleys via open gear transmissions.

The trolley with a lifting mechanism is mounted on two rails attached to the gantry beam.

A roof is installed over each lifting trolley, as well as the grab rake drive.

Key specifications of the current gantry crane, equipped with a trash-rack cleaning machine, with a capacity of 2x100 kN, are as follows:

• Type:	Gantry crane - specialized model
• Year of manufacture:	1967 (assembly completed in 1968)
• Operational classification:	Class 1 acc. to JUS M.D1.090
• Max. weight of the locking element (Element No.1):	14040 kg
• Lifting capacity of lifting trolley:	2x100 kN
• Lifting height:	19.50 m
• Lifting speed:	2.5 m/min

- Travel speed of crane: 12.5 m/min
- Travel speed of trolley: 10 m/min
- Length of crane runway: approx. 54 m
- Span between the feet: 5000 mm
- Width of rail: 60 mm
- Weights of main crane components: Trolley with mechanism 7653 kg,  
Gantry 18967 kg,  
Lifting tongs 2600 kg,  
Grab rake 1600 kg
- Total weight of crane with trash-rack cleaning machine: 30820 kg
- Crane wheel pressure on track (and wheel): Gantry bridge 21500 kg  
Trolley 900 kg
- Permissible wheel pressure: 180 kN
- Grab rake volume: 0,35 m<sup>3</sup>
- Drives: Three-phase AC; 380/220V; 50Hz; 44,50 kW (total power of electric motors)
- Stability quotient - with load and additional loads 3.8
- Intrinsic stability 8, at rest, in wind 3.2

### 3 SCOPE OF WORK FOR DESIGNING, SUPPLYING AND INSTALLATION OF A NEW GANTRY CRANE WITH A TRASH-RACK CLEANING MACHINE

#### 3.1 Introductory note

This chapter outlines the fundamental list of supplies and services that the Contractor must incorporate into the scope of manufacturing and delivering the new gantry crane. The list of supplies and services, along with other stipulations outlined in this specification, cannot be regarded as an exhaustive specification of all details.

The Contractor is responsible for aligning the scope of supply with the installation concept. This entails furnishing the entire gantry crane equipment, including the trash-rack cleaning machine, in a manner that ensures functionality, safety, reliability, and adherence to relevant regulations.

Specifications and requirements outlined in the tender documents should not be viewed as restrictive. Furthermore, the equipment supplier is obliged to include, within the contract price, any additional equipment parts or services necessary for the continuous, reliable, and safe operation of the equipment, even if not explicitly specified in the tender documents.

***Prior to submitting a tender, the Tenderer has the option to conduct an inspection of the current condition at the Zlatoličje HPP.***

#### 3.2 The scope of supply for a new gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN

The scope of the works tendered for the construction of a new gantry crane with a trash-rack cleaning machine includes:

- Preparation of technical documents of the new gantry crane with a trash-rack cleaning machine.

- Dismantling of the existing gantry crane with a trash-rack cleaning machine, with a capacity of 2x100 kN.
- Designing, supplying and installing the new gantry crane with a trash-rack cleaning machine.
- Manufacturing of new lifting tongs.
- Construction of a ramp elevation across both unit water intakes (mechanical and civil works).
- Quality control, taking-over, testing.
- Training of the Client's personnel.
- Transport of the equipment.

### **3.2.1 The composition of a gantry crane**

The contractual scope encompasses providing one gantry crane equipped with a trash-rack cleaning machine, inclusive of all necessary power and lifting components. This includes a complete crane gantry with drive trolleys, a lifting trolley capable of handling loads up to 2x150 kN, and the associated driving gear.

At a minimum, the following equipment must be provided as part of the scope of supply for the crane with a trash-rack cleaning machine:

- A gantry crane featuring an open structure constructed with H and I profiles and reinforcements, along with a roof covering the entire gantry area, including the machine room over the lifting trolley and grab rake drive. This should also include drive trolleys and driving gear.
- A trolley equipped with lifting mechanisms and all necessary equipment for driving and lifting loads, such as motors, gearboxes, brakes, wire ropes, and pulleys.
- One set of ancillary crane equipment, including signboards, access ladders with back guards, platforms, grab handles, bumpers, and similar components.
- One set of equipment for ensuring the safety of crane operation, including overload protection for all lifting operations, limit switches, mechanical restraints for gantry, trolley, and lifting mechanisms, as well as mechanisms for protection against overturning and derailment of the crane, thermal protection for electric motors, and emergency stop buttons.
- One set of crane electrical equipment
  - A cabin with swivel seats and control console for crane and trash-rack cleaning machine drives.
  - External LED spotlights (minimum 6 pieces) for workplace lighting and cabin illumination.
  - A horn for warning sounds.
  - Cabling and wiring.
  - A winding drum with power cable.
  - Controller and frequency converter software.
- One set of lubricants and hydraulic fluids for the first filling of bearings and the gearbox.

### **3.2.2 Composition of the trash-rack cleaning machine**

- Cleaning with the trash-rack cleaning machine must be feasible during periods of maximum river flow. The flow rate through one power unit is 275 m<sup>3</sup>, with a combined total flow of 550 m<sup>3</sup> when both units are operating at full capacity. The weight of the grab rake should consider the debris entrapped on the trash-rack, which the grab rake needs to navigate while descending.
- The weight of the grab rake should enable it to penetrate the upper layer of sediment effectively.

- The trash-rack cleaning machine should be engineered for outdoor operation above the Drava River. All machinery components and support structures must be designed to withstand heavy-duty operating conditions.
- The equipment for the trash-rack cleaning machine shall comprise all necessary machine components of robust design, along with a supporting steel structure suitable for cleaning water intake trash-racks of the specified width and depth.
- The type of trash-rack cleaning machine is a grab rake with a toothed rake, operated by a three-wire rope mechanism. During downward movement, the grab rake's lid with teeth remains open. Upon reaching the trash-rack threshold, the grab rake closes and proceeds closed to the shaking edge of the bin on the table (platform), where it automatically opens, allowing debris to be shaken into the accompanying tractor trailer (or a standard-sized vehicle such as a lorry trailer, etc.).
- The opening and closing rotation of the toothed grab rake shall be driven by a common drive shaft equipped with an integral differential mechanism. The drive mechanism shall be powered by gears.
- A shaker plate, welded to the table (board) of the trash-rack cleaning machine, facilitates the transfer of debris from the open grab rake into the tractor trailer, which is attached to the tractor operated concurrently with the trash-rack cleaning machine.
- The Contractor is responsible for manufacturing and supplying an electric motor drive for the trash-rack cleaning machine, including an electric motor, electro-hydraulic brake, gearbox, limit switches, and an absolute headroom or distance-travelled meter.
- Additionally, the Contractor will provide the complete electrical equipment necessary for operating the trash-rack cleaning machine.

### 3.2.3 Transport of the equipment.

The scope of supply for the crane with a trash-rack cleaning machine encompasses the transportation of all the equipment specified in this Invitation to Tender to and within the site of the Zlatoličje HPP.

## 3.3 **Preparation of technical documents of the new gantry crane with a trash-rack cleaning machine**

Requirements for drafting technical documents:

All technical documents must comply with TS HSE internal technical standards.

Each document must bear an identification number/tag following the coding standard KKS HSE - TS, and classification agreed upon by the Contractor and the Client.

Upon contract conclusion, the Contractor will receive one copy of the applicable labelling system and detailed usage instructions. All technical drawings must adhere to the size specifications outlined in DIN 476.

The following software is to be used for document preparation:

- Microsoft Excel 10 or later
- Microsoft Word 10 or later
- Microsoft Project 10 or later
- Autodesk Autocad 2010 or later
- WSCAD 5.1, EPLAN P8, CADDY++, or as coordinated with the Client beforehand.



### 3.3.1 Detailed design

The detailed design must encompass, at minimum:

- Strength and stability calculations: The supplier is required to perform calculations for all primary load-bearing components of the crane equipped with a trash-rack cleaning machine. These calculations are intended to establish the main dimensions and specifications of the equipment, demonstrate stresses and deformations across individual cross-sections of the structure, and ascertain wheel pressures in accordance with FEM 1.001 standards.
- Shop drawings, assembly drawings, bills of materials, and specifications, spare parts lists, technical brochures for purchased equipment, electrical diagrams etc.

Within the scope of the detailed design, the Contractor is required to provide the Client with, at least:

#### Drawings, diagrams, and schematics

- Layout drawings
- Dimensional drawings
- Loading drawings
- Assembly drawings of the crane and trash-rack cleaning machine assemblies and lifting tongs
- Workshop drawings of factory-built parts of the crane and trash-rack cleaning machine and the lifting tongs
- Assembly drawings
- Cable routing drawings
- Single-line diagrams
- Circuit diagrams
- Drawings depicting the appearance of electrical cabinets

#### Lists and specifications

- A list of installed materials and equipment with their technical characteristics
- A list of fitted equipment with identification numbers
- A list of nameplates
- A list of power consumers
- A list of spare parts
- A list of cables
- A list of terminal boards

#### **Calculations**

The supplier is required to perform calculations for all primary load-bearing components of the crane equipped with a trash-rack cleaning machine and new lifting tongs. These calculations should either determine the main dimensions and specifications of the equipment or demonstrate stresses and deformations in individual cross-sections of the structure in accordance with EN13001 standards. Particular attention must be paid to calculating the stability of the crane with a trash-rack cleaning machine.

#### **Brochures with technical information**

For equipment intended for installation on the crane with a trash-rack cleaning machine and to be commercially purchased, the selected Contractor must supply the Client with technical data

brochures. These brochures may be provided in either English or German. These brochures should include technical descriptions of the equipment, details on the characteristics and performance of the equipment, installation conditions, and other relevant information. Additionally, they should clearly specify the type and catalogue number of the equipment intended for installation on both the crane and the trash-rack cleaning machine.

The detailed design will be provided by the Contractor to the Client:

- in three written copies, and
- one copy on an electronic medium.

### **3.3.2 As-built documents**

As-built documents depict the final condition of the crane with a trash-rack cleaning machine after the completion of works and trial operation. They closely resemble the detailed design in structure.

The Contractor will furnish the as-built documents to the Client:

- in three written copies, and
- one copy on an electronic medium (in passive and in source form).

The technical documents become the property of the Client, who can use them for conducting maintenance work on the gantry crane with a trash-rack cleaning machine.

### **3.3.3 Additional technical documents**

The additional technical documents shall be provided to the Client in three printed copies, along with one copy each on electronic media.

- List of documents
- Time schedule for manufacturing and assembly
- Instructions for transport and installation of the crane on site
- Quality control plan
- Supporting documents
- Crane operating, management and maintenance instructions as separate documents
- Training programme for the Client's personnel
- Crane inspection and registration book
- Brochures containing technical information
- Other relevant documents

#### **3.3.3.1 List of documents**

The list shall be created as a table in Microsoft Excel. The table shall list all drawings and documents that the supplier plans to provide to the Client for inspection or possession as per the terms outlined in this Invitation to Tender.

#### **3.3.3.2 Time schedule for manufacturing and assembly**

It must be created using Microsoft Project. It should encompass all activities related to the supply and manufacture of the crane, including transport and assembly on site, as well as testing and taking-over of the crane. The supplier must send the time schedule to the Client for review within 15 days of the signature of the contract. This submission should include two written copies and one electronic copy in the original file format.

### 3.3.3.3 Quality control plan (QC)

The Quality control plan (QC) must contain a comprehensive list of all inspection procedures that the Contractor plans to execute. These procedures aim to showcase to the Client the quality of materials incorporated, the manufacturing quality of the crane in the factory, and the quality of assembly and field tests. The QC Plan is to be submitted to the Client for review within 30 days after the signing of the contract.

### 3.3.3.4 Supporting documents

Upon completion of the installation, the Contractor is obligated to provide the Client with all documents verifying the quality of materials installed and services rendered. These documents should be organised within a folder titled "Supporting documents." The folder should include inspection and taking-over reports, test certificates, certificates of materials used, measurement protocols, declarations of conformity, welder's A-test, and other technical documents pertaining to the quality of materials installed and services provided.

To ensure document traceability, the supporting documents must be properly filed. Upon completion of the works, the Contractor must furnish the Client with a written copy of the "Supporting documents."

***Upon completion of the works, the Contractor is required to supply the Client with a written declaration of CE conformity for the gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN, as a whole.***

### 3.3.3.5 Instructions for the operation, management and maintenance of a gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN

Instructions for the operation, management, and maintenance of a gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN, must adhere to Annex I of the Rules on Machinery Safety (Official Gazette of the RS No 25/2006) in Slovene. These instructions should be provided as separate documents.

Additionally, for equipment purchased on the market and installed on the crane, the Contractor must include a brochure with technical data and operating and maintenance instructions from the manufacturer.

Preliminary operation, management, and maintenance instructions shall be provided by the Contractor in a single copy after installation or before functional testing.

Instructions for less critical equipment may be in English or German, while those for major equipment requiring extensive maintenance must be translated into Slovenian.

The final instructions for the operation, management and maintenance of the gantry crane with a trash-rack cleaning machine shall be provided to the Client before the handover of the gantry crane with the trash-rack cleaning machine.

### 3.3.3.6 Program for training the Client in the operation of a gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN

The program for training the Client should be based on the instructions for the operation, management, and maintenance of the gantry crane with a trash-rack cleaning machine. It should include practical demonstrations of the crane's operation and maintenance procedures.

Typically, the training process will occur in the field after the completion of crane assembly. However, it may begin as early as the equipment manufacturing phase if the Contractor deems it necessary for demonstrating specific procedures adequately.

The program shall be accompanied by appropriate technical documents containing descriptions and instructions to facilitate the Client's personnel in becoming familiar with the procedures for operating, managing, and maintaining the crane as comprehensively as possible.

#### 3.3.3.7 Inspection and registration book for a gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN

The crane inspection and registration book must be provided to the Client prior to inspection by an authorised institution. It must be meticulously completed in compliance with the prescribed legislation.

#### 3.3.3.8 Controller and frequency converter software

The electronic medium should include the software for the frequency converters, comprising all parameters for each frequency converter individually, as well as the software for the controller, if applicable.

#### 3.3.3.9 Brochures containing technical information

For equipment designated for installation on the gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN, and to be procured commercially, the chosen Contractor is obligated to furnish the Client with technical data brochures in Slovene.

These brochures are expected to encompass technical descriptions of the equipment, its characteristics, performance, and installation conditions.

Additionally, the brochures must specify the type and catalogue number of the equipment intended for installation on the gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN.

### 3.3.4 Review of the technical documents

The selected Contractor is required to submit the technical documents to the Client for review. However, the review process by the Client does not absolve the document producer of their responsibility as the designer or manufacturer of the gantry crane with a trash-rack cleaning machine. During the document review process, the Client will assess whether the Contractor has adhered to the requirements outlined in the tender documents and other contract provisions regarding the design, construction, and procurement of materials for the new crane with a trash-rack cleaning machine and the new lifting tongs. The Client may also suggest modifications to the manufacturer based on their experience with operating and maintaining existing cranes and trash-rack cleaning machines, with the aim of enhancing the overall project suitability and efficiency.

#### 3.3.4.1 Procedure for reviewing documents

The Contractor shall send two copies of the documents to the Client for review. Following review, one copy of the documents will be returned to the Contractor, clearly labelled as "APPROVED," "APPROVED WITH MARKED CORRECTIONS," or "UNAPPROVED - RETURNED FOR CORRECTIONS."

Documents marked as "Approved" have been thoroughly examined and meet the requirements outlined in the tender documents and other contractual provisions without objections.

Documents labelled as "Approved with marked corrections" have been reviewed, with minor deviations or suggested changes identified.

For documents labelled as "Approved" or "Approved with marked corrections," the Contractor is permitted to proceed with further design or manufacture. However, any identified corrections or comments must be promptly addressed by the Contractor.

However, documents marked "Approved with marked corrections" must be corrected by the Contractor without delay and resubmitted in duplicate to the Client for review.

When documents are labelled as "Unapproved - returned for corrections," it signifies that major discrepancies or irregularities have been identified during the review process. Consequently, the Contractor is unable to proceed with designing or manufacturing the equipment based on these documents.

In such cases, the Contractor must promptly correct the documents and submit them in duplicate to the Client for re-evaluation.

Additionally, for documents labelled as "Approved" and stamped "For execution," the Contractor must immediately provide the Client with three copies.

Each revision should be clearly identified in the document header with the amendment or correction number, date, and content. Moreover, corrections must be distinctly highlighted within the document.

#### 3.3.4.2 Deadlines for the submission of technical documents

The Contractor is obligated to provide the following documents to the Client for review and coordination by the specified time-frame:

Within fifteen (15) days following the contract's signature:

- List of documents
- Time schedule for manufacturing and assembly
- Preliminary quality control plan
- Preliminary dimensional drawings of the crane and main components
- Preliminary list of electrical consumers and motors

Before commencing factory production of the equipment or placing orders for purchased equipment:

- Final quality control plan
- Workshop drawings of equipment
- Assembly drawings of the crane and assemblies
- Brochures containing technical data for the purchased equipment
- List of installed equipment
- Technological lubrication schemes
- Circuit diagrams, single-line diagrams etc.
- Lists of power and signalling cables
- Programme for training the Client's personnel

Thirty (30) days before the commencement of installation in the field:

- Instructions for the transport and installation of the gantry crane with the trash-rack cleaning machine on site
- Programme for testing the gantry crane with a trash-rack cleaning machine

Until the installation is complete or the equipment is tested:

- Preliminary management and maintenance instructions
- Preliminary quality assurance book
- Preliminary "As-built" documents
- Crane inspection and registration book

Before the crane with a trash-rack cleaning machine is handed over:

- Final management and maintenance instructions

- Final "As-built" documents
- Final quality assurance book

### 3.3.5 Design and design criteria

#### 3.3.5.1 Loads and port dimensions of a gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN

The total loads of the gantry crane on the crane runway must not exceed the calculated maximum permissible wheel pressure of 180 kN. The layout and the appropriate number of running wheels of the gantry crane will be determined by the design.

Furthermore, it is imperative that the port dimensions of the crane remain unchanged. Any potential increase in the crane's reach can only be implemented with the explicit agreement of the Client.

#### 3.3.5.2 Environmental exposure of the gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN

The gantry crane, with a capacity of 2x150 kN, is situated at the turbine water intake of the Zlatoličje power plant, subject to all external weather conditions typical for the region. Operation of the crane with the trash-rack cleaning machine is expected within the temperature range of -20 to +45 °C.

For corrosion protection, exposure C5 VH in accordance with SIST EN ISO 12944-2:2018 must be considered. Additionally, parts immersed in water, such as the grab rake and lifting tongs, should adhere to exposure Im1.

#### 3.3.5.3 Noise and vibration

##### Noise

The air pressure, measured in accordance with ISO 3746, during the operation of the crane with the trash-rack cleaning machine, must not exceed 85 dB when measured at a distance of 1 m from the source of the noise.

##### Vibrations

During all operational scenarios, the vibration level of the rotating parts must not surpass the maximum permissible values for zone A, as defined by ISO 10816-1 class IV.

Additionally, the minimum natural frequency of the crane structure with a trash-rack cleaning machine should exceed 0.7 Hz.

#### 3.3.5.4 Classification of equipment

The design of both the mechanical and electrical equipment of the gantry crane with a trash-rack cleaning machine must primarily adhere to the regulations outlined in SIST EN 13001.

Steel structure  $\geq$  HC2,S4 (EN 13001)

Main lifting mechanism  $\geq$  M6 (FEM)

Mechanisms for longitudinal and lateral movements  $\geq$  M6 (FEM)

#### 3.3.5.5 Regulations and standards

It is mandatory that the design, manufacturing, and installation of the gantry crane with a trash-rack cleaning machine comply with various regulations and standards in force in the Republic of Slovenia. These include:

- Rules on Machinery Safety (OG RS No. 25/2006)
- Compliance with SIST EN 1090 for the construction of the complete gantry crane with a trash-rack cleaning machine.
- Rules on General Measures and Norms for Safety at Work with Elevators (OG SFRY, No. 30/69)
- Health and Safety at Work Act (OG RS, No. 56/99)
- Rules on Machinery Safety (OG RS No. 25/2006)
- Rules on Health and Safety Requirements for the Use of Work Equipment (OG RS, No. 101/2004)
- Rules on Personal Protective Equipment Used by Workers at Work, OG RS, No. 89/99)
- Regulation on Personal Protective Equipment (OG RS, No. 97/2000)
- Rules on Safety Signs at Work (OG RS No. 89/99)
- Decree on Safety and Health Protection at Work at Temporary and Mobile Construction Sites (OG RS, No. 83/2005)
- Decree on Management of Waste (OG RS, No. 34/2008)
- Compliance with Electrical Directives (89/392/EEC, 73/23/EEC, 89/336/EEC)
- Rules on Lightning Protection System of Buildings (OG RS, No. 28/2009).

In addition to the rules, regulations, and laws mentioned above, compliance with other applicable standards for the equipment in question is mandatory, as specified in this Invitation to Tender or as proposed by the Tenderer in its tender submission.

In cases where no standard or rules are available for the equipment, it must be designed, manufactured, and installed following generally applicable technical practices.

#### 3.3.5.6 Reliability and safety

Ensuring the safety and reliability of the crane with the trash-rack cleaning machine is the responsibility of the Contractor.

All travel and lifting mechanisms must be fitted with electrically controlled brakes, ensuring that any loss of voltage to the electric motors triggers an immediate brake application.

Particular attention should be given to the crane's stability, preferably ensured through design features or mechanical restraints.

At a minimum, the crane should incorporate the following safety devices:

- Limit switches for all shifts
- Overload switches for all lifts
- Thermal protection for all electric motors
- Emergency stop button
- Brakes for all drives
- Manual anchor clamps for crane anchoring
- Protection against crane overturning

### 3.4 Dismantling of the existing gantry crane with a trash-rack cleaning machine, with a capacity of 2x100 kN

As part of the construction of the new gantry crane with a trash-rack cleaning machine, the Contractor will be responsible for dismantling and removing the existing gantry crane with a trash-rack cleaning

machine, which has a capacity of 2x100 kN. The existing gantry crane is situated above the turbine water intakes at the Zlatoličje power plant.

The old gantry crane will need to be disassembled into manageable assemblies (with transport dimensions) by the Contractor and transported to a designated landfill. The Client will determine the disposal location for the disassembled parts of the gantry crane. The loading and transportation of the individual components of the old gantry crane to the landfill will be carried out by the Contractor. The landfill is situated within the Zlatoličje HPP.

Certain components will be retained by the Client and transported by the Contractor to a location to be specified by the Client.

## 4 TECHNICAL DATA, DESCRIPTION AND REQUIREMENTS FOR MANUFACTURING A NEW CRANE WITH A TRASH-RACK CLEANING MACHINE, WITH A CAPACITY OF 2X150 kN

### 4.1 Technical data of the gantry crane, 2x150 kN

• Type	Gantry crane, 2x150 kN
• Gantry design	Gantry with integrated trash-rack cleaning machine
• Steel structure	≥ HC2,S4 (EN 13001)
• Lifting, travelling mechanism	≥ M6 (FEM)
• Lifting capacity	2x150 kN
• Permissible wheel pressure:	180 kN
• Lifting height	19.50 m
• Lifting speed	0 to 3 m/min
• Crane travel speed	0–20 m/min
• Lifting trolley travel speed	0–10 m/min
• Distance between rails	5000 mm
• Length of crane runway	54 m
• Crane mass	to be determined by the designer
• Crane gantry drive	frequency-controlled electric motor
• Lifting trolley drive	frequency-controlled electric motor
• Crane and trash-rack cleaning machine control	shared cabin with separate consoles

#### 4.1.1 Description and general requirements

The gantry crane, equipped with a trash-rack cleaning machine, will serve the purpose of lifting and transporting the closing boards during the closure of the turbine water intake. Concurrently, the trash-rack cleaning machine will be utilised to clear debris from the turbine water intakes.

The crane operates intermittently, experiencing extended periods of non-operation, whereas the trash-rack cleaning machine is utilised regularly, often several times a week.



All electric motor drives responsible for travel and lifting operations on the crane are outfitted with frequency converters for speed control, **except for the drive utilised for lifting the grab rake of the cleaning machine.**

#### Joint lifting

During the closure of the turbine water intakes, the closing boards need to be transferred from the storage area to the water intake niche.

To lift the closing boards, which can weigh up to 14.5 tons each, a specialised suspension device is employed - lifting tongs affixed to the wire rope pulleys.

It's crucial that the lifting mechanism maintains uniform lifting speed across both wire rope pulleys, or alternatively, ensures the horizontal alignment of the lifting tongs to prevent the closing boards from becoming jammed due to uneven lifting (oblique lifting).

To enhance the crane's lifting capacity, **new 30-ton lifting tongs** will need to be designed and manufactured.

#### The gantry of the crane

The gantry's two main beams are supported transversely by four feet. These feet are linked by a front beam equipped with running wheels and a frequency-controlled electric motor drive.

The entire gantry structure, including all beams, must be open and constructed using H and I profiles with reinforcements.

The gantry's drive mechanism should be without open gear transmission, utilising a gearbox with an attached electric magnetic brake and a frequency-controlled motor.

The drive is performed on 50% of the running wheels of the gantry by monitoring the number of revolutions of the running wheels on both sides of the gantry.

Braking is performed by a frequency converter, with additional safety braking provided by a brake integrated into the drive electric motor.

A protective roof is installed on the upper side of the gantry to shield the lifting trolley and trash-rack cleaning machine drives from weather elements.

Lifting trolley rails are affixed to the gantry beams at the specified length. Dampers are installed at the two furthest positions on the gantry for added stability.

The crane is furnished with a platform and safety fence to facilitate access to the lifting trolley, the drives of the trash-rack cleaning machine, gantry supports, and any other equipment necessitating maintenance.

Access to the crane's gantry can be achieved via the crane leg with stairs. If space constraints prohibit this approach, access may be provided by a ladder with a back guard.

#### Lifting trolley

The position of the lifting trolley is safeguarded by limit switches. Drive for the lifting trolley is facilitated by a frequency-controlled electric motor through a closed gearbox directly mounted on the trolley's drive running wheel.

The electric motor driving the trolley is equipped with an integrated electric brake. The supporting structure of the lifting trolley is welded.

For the lifting mechanism of the 2x150 kN gantry crane, two interconnected wire rope drums are employed, driven by a gearbox, an electro-hydraulic brake, an elastic clutch, and a frequency-controlled electric motor. The housing of the gearbox must be a closed welded design with replaceable bearings.

Load measuring sensors are integrated into the lifting mechanism, and signals routed to the PLC for crane control. Clamps are installed on the trolley for added safety. Lubrication of all bearings on both trolleys, including the lifting mechanisms, is performed manually using grease nipples.

#### Control and power supply for the gantry crane with a trash-rack cleaning machine

To supply power to the crane and the trash-rack cleaning machine, a winding drum with a power cable is affixed to the upstream side of the gantry.

The positioning of the winding drum ensures that the power cable is deposited in the same location as on the previous crane with the trash-rack cleaning machine. Similarly, the power cable connector is situated in the same position.

Crane operations are initiated through commands issued from the cabin. Electric motors, controlled by frequency converters, power the lifting mechanisms of both the crane and the trash-rack cleaning machine, as well as driving the trolley and the gantry. A PLC controller, responsible for control and protection functions, ensures coordinated operation of all drives.

Furthermore, all lifting mechanisms should be equipped with overload protectors, designed to deactivate the actuator when a 10% overload is detected. Crane overturning protection is also mandated at each lifting point for added safety.

#### Crane accessories

To enhance the crane's lifting capacity, it will be essential to design and fabricate new lifting tongs capable of lifting 30 tons. These tongs must have the same dimensions of the existing ones, including the position of the hooks for securing the load, attachment points on the wire rope pulley, dimensions (length and width), and must be of a suitable size to fit in the storage area. The mechanism for opening and closing the hooks for securing the load should be reliable, simple, and have the same functionality as the existing mechanism used for manipulating the lowering and lifting of closing boards from the turbine water intake niche and storage areas. Furthermore, the new lifting tongs must enable the safe lowering of a diver into the closing board niche. Additionally, they should feature a detachable safety platform that can be affixed to the tongs structure if necessary.

In addition to the above, the crane, along with the trash-rack cleaning machine, should be outfitted with a minimum of six LED floodlights strategically positioned to illuminate the entire area beneath the crane, including the vicinity of the trash-rack cleaning machine. Other necessary additions include a horn, warning signs, signage, and two video cameras.

Moreover, the crane must be equipped with anchor clamps to facilitate parking when not in use.

## **4.2 Technical data and operational requirements for the new trash-rack cleaning machine**

### **4.2.1 Description**

In light of the outdated nature of the current trash-rack cleaning machine installed on the 2x100 kN gantry crane structure and the necessity to effectively clean turbine water intake trash-racks even under full power conditions, thereby managing the substantial influx of debris (such as leaves, grass, tree trunks, twigs, and other refuse) onto the water intake trash-racks, the Client is looking to replace the existing machine with a new trash-rack cleaning machine, complete with all necessary associated equipment.

### **4.2.2 Technical data**

The trash-rack cleaning machine's structure is integrated with that of a 2x150 kN gantry crane. The machine room will be designed to enclose both the drive structure of the trash-rack cleaning machine

and the lifting trolley of the gantry crane entirely with sheet metal. A shared machine room cabin will provide protection for all associated lifting and drive equipment installed on both the gantry crane and the trash-rack cleaning machine against external elements.

The platform supporting the grab rake is designed robustly and includes additional guides to aid in dislodging debris into the existing tractor trailer. The space between the platform and the edge of the water intake ramp should be minimised.

A lifting wire rope mechanism is utilised for the movement of the grab rake, with lifting and lowering operations conducted by a winch located within the machine room of the crane gantry. The grab rake should be constructed with a sturdy design.

#### **Technical data:**

Trash-rack cleaning machine type	grab rake, operated by a three-wire rope mechanism
Winch type	three-drum winch
Load capacity	to be determined by the designer ( <i>expected min. 6000 kg</i> )
Grab rake load capacity	to be determined by the designer ( <i>expected min. 3000 kg</i> )
Grab rake weight	<b>The correct weight shall be calculated and determined by the designer</b>
Mechanism group	≥M7
Max. flow for one unit	275 m <sup>3</sup>
Max. flow for both units	550 m <sup>3</sup>
Suspension	2 lifting wire ropes, 1 closing wire rope
Drum speed	0-30 m/min
Length of wire rope	to be determined by the designer
Lifting height	approx. 19 m
Wire rope diameter	to be determined by the designer
Installed capacity	to be determined by the designer
Volume	min. 1 m <sup>3</sup>
Mechanical protection	IP55
Corrosion protection	C5 and Im1 (high, durability more than 25 years)

**Grab rake opening and closing system** - The grab rake should be driven by a common shaft alongside a differential mechanism for opening and closing (similar design to the existing trash-rack cleaning machine, with the chain drive replaced by a gear drive).

#### **4.2.3 Operational requirements**

The trash-rack cleaning machine must be capable of cleaning the water intake trash-racks under full flow through the power unit. The grab rake must have the ability to clean the entire length of the water intake trash-rack segment in a single working cycle.

Operational requirements:

Single water intake width:	9500 mm
Max. flow - one unit operating	275 m <sup>3</sup>
Max. flow - both units operating	550 m <sup>3</sup>
Grab rake lifting height:	approx. 19 m
Grab rake lifting speed	0-20 m/min
Grab rake lowering speed	0-30 m/min
Trash-rack grille spacing	100 mm
Tilt of the trash-rack	15°
Electrical voltage	to be determined by the designer

Operating temperature range	-15 °C to +45 °C
Wind speed	18,9 m/s
Hurricane wind speed	40 m/s
Design acceleration	0.2 g

The trash-rack cleaning machine must be operated manually from its control console located in the shared crane control cabin. Visibility from the cabin to both the trash-rack cleaning machine operating area and the load lifting area must be ensured, achieved through a glass floor and a camera with a screen.

The trash-rack cleaning machine is affixed to a 2x150 kN gantry crane structure. It is equipped with a machine room, closing board, grab rake, three-drum winch, electrical equipment for operation, a fence, and an access ladder with lifting and lowering operations conducted by a winch located within the machine room of the crane gantry. During downward movement, the grab rake's lid with teeth remains open. Upon reaching the trash-rack threshold, the grab rake closes and proceeds closed to the shaking edge of the bin on the table (board), where it automatically opens to allow debris to be shaken into the accompanying tractor trailer. A shaker plate is welded to the table (board) of the trash-rack cleaning machine to facilitate the removal of rubbish from the open grab rake.

#### 4.2.4 Equipment, materials and services to be provided by the supplier

The comprehensive scope of supply for the trash-rack cleaning machine includes:

- a) Design and fabrication of a trash-rack cleaning machine tailored for water intake cleaning, encompassing all necessary components for standard operation.
- b) Preparation of detailed design and submission for approval.
- c) Provision of all essential specialised tools for installation.
- d) Supply of spare parts, oils, and lubricants.
- e) Compilation of a list of electric motors.
- f) Provision of diagrams for electrical equipment.
- g) Procurement of required equipment and materials, including input controls.
- h) Manufacturer's testing and quality controls.
- i) Transport of equipment to the Zlatoličje HPP.
- j) Assembly services.
- k) Testing and controls at the Zlatoličje HPP.
- l) Preparation of handover documentation.
- m) Training sessions for the Client's personnel.

During operational testing of the trash-rack cleaning machine, a diver must be present to inspect the condition of the trash-racks and verify the grab rake's extreme position at the trash-rack threshold.

## 5 CRANE ACCESSORIES

### 5.1 Lifting tongs

To improve the crane's lifting capacity, it's crucial to develop and manufacture new lifting tongs capable of lifting 30 tons. These tongs must precisely match the dimensions of the existing ones, including the positioning of load securing hooks, attachment points on the wire rope pulley, tong length, and must be of a suitable size to fit in the storage area, among other factors. The mechanism for opening and closing the hooks securing the load should replicate the reliability, simplicity, and functionality of the existing mechanism used for handling the lowering and lifting of closing boards from the turbine water intake niche and storage areas.

## 5.2 Safety fence

The existing safety fence is to be removed. A new safety fence, 1000 mm in height, is to be installed. In order to achieve this, the Tenderer is responsible for raising the existing ramp to a final height of 1000 mm, an increase of approximately 500 mm, along the entire length of both turbine water intakes. The stainless material utilised should match the thickness of the existing extension. The entire length of the elevated ramp must be adequately reinforced with ribs securely anchored in the concrete above the turbine water intakes. The calculation and dimensioning of the ramp extension and reinforcing ribs must account for the new weight of the grab rake and the debris it will handle.

Construction works for the concrete wall or ramp extension on the existing trash-rack cleaning machine ramp shall be carried out to meet the specified requirements:

- Drill holes with a diameter of  $\phi$  2.5/25 cm into the existing concrete for vertical concrete reinforcement. Affix steel reinforcing iron rods, each 700 mm long, using high load anchor glue-Sika AnchorFix N.
- Install formwork and complete internal reinforcement. Pre-weld the appropriate number of Nelson anchors to the existing steel wall.
- Pour concrete using C25/30 grade concrete. If necessary, carry out grouting of cavities between the concrete and the steel lining after concreting.
- After dismantling the formwork, level the concrete wall with Sika MonoTop-620 for the final coat. Apply 2 coats of SikaSikagard-63 N in RAL 7032 over the final coat.

It is essential for the construction Contractor to coordinate the execution of the works with the installer of the trash-rack cleaning machine. Concreting of the works will be conducted in at least two parts, depending on the installation of the new trash-rack cleaning machine and the operation of the existing one.

## 6 SPECIAL TECHNICAL REQUIREMENTS

### 6.1 Mechanical equipment

#### 6.1.1 Supporting steel structure for gantry, crane lifting trolley and trash-rack cleaning machine

The supporting components of the gantry, lifting trolley, and trash-rack cleaning machine must be constructed through welded assemblies, utilising S355J2+N or equivalent steel.

The construction of the gantry, lifting trolley, and trash-rack cleaning machine should be robust and engineered to withstand maximum loads. They should feature an open design, utilizing H and I profiles along with reinforcements.

The gantry of the crane, along with the lifting trolley and trash-rack cleaning machine, must be assembled in a manner where individual supporting elements are bolted together on-site. Welding of the primary steel structure on the ground is prohibited.

Corrosion protection for all crane structure components must be applied up to the final coatings at the manufacturer's facility. Only repairs to structural damage are permissible; no alterations to the original design are allowed.

The outline of the gantry, including its base, should closely resemble that of the existing crane.

#### 6.1.2 Crane roof

A roof shall be installed over the entire area above the gantry to shield the crane lifting trolley equipment and the trash-rack cleaning machine drive from external weather conditions.

The roof covering and side protection shall consist of painted steel sheets (RAL 9006) with a minimum thickness of 0.8 mm, securely fastened to the supporting steel structure of the roof using stainless steel screws.

The side guards of the crane roof should also be outfitted with appropriate translucent panels. Additionally, the roof should be equipped with rainwater traps and drains, directing water to the level of the gantry running wheels.

#### 6.1.3 Wire ropes

Wire ropes must conform to the standards outlined in DIN 3064-2. For all lifting operations, galvanised wire ropes from reputable manufacturers such as Pfeifer, Teufelberger, or CasarVrvi must be provided, ensuring they are of adequate length. It is imperative to consider that a minimum of three wraps remain on the drum at maximum hook release.

#### 6.1.4 Gearboxes

All gearboxes must be of the sealed type, featuring welded housing and lubricated with an oil bath. The use of worm gearboxes and external open gear drives is prohibited. Roller bearings should be used for shaft mounting. Additionally, all lifting gearboxes should be equipped with visual oil indicators.

#### 6.1.5 Wire rope drum

Wire rope drums must be welded. Wire rope can only be wound onto the drum in a single plane. The width of the drum should allow for a minimum of three wraps of wire rope to remain after reaching the required lifting point. Wire rope drums must be done using double-row drum roller bearings.

#### 6.1.6 Brakes

All brakes must be electrically controlled and provide mechanical braking in case of power loss. Driving brakes may be directly mounted on the electric motors and must be capable of handling 150% of the torque of the associated motor or halt crane or lifting trolley movement with the load. Holding brakes for lifting mechanisms must be rated for 200% of the torque of the load they support and must be mounted on the gearbox side.

### 6.2 **Lifting tongs**

The new 30-ton capacity lifting tongs must match the dimensions and functions of the existing tongs, including the positioning of hooks for securing closing boards, attachment points on the wire rope pulley, and overall length. The mechanism for opening and closing the hooks for securing the load should be reliable and simple to facilitate the manipulation of lifting closing boards from the turbine water intake niche and storage areas.

Corrosion protection for the lifting tongs must adhere to the specifications outlined for environmental exposure Im1, which includes epoxy zinc primer, epoxy mastic glass flake intermediate, and polyurethane finish.

### 6.3 **Corrosion protection**

The crane's corrosion protection encompasses the procurement of coating materials from an approved, reputable manufacturer by the Client. It also includes surface preparation and the execution

of coating. All equipment must undergo corrosion protection at the Contractor's factory. The only anticipated repairs on the crane involve addressing damages incurred during transportation and installation, along with applying a final decorative coating if deemed necessary.

For corrosion protection of both the crane and the trash-rack cleaning machine, a protection system rated for exposure C5 VH in DSF min. 320 µm and a minimum lifespan of 25 years is specified.

All steel structures and equipment must receive comprehensive protection within the workshop. Any damage to the coating system post-installation shall be repaired promptly at the affected location.

**“The Client retains the authority to demand an extra 100% decorative coating, inclusive of all preparatory procedures essential for achieving the desired final quality, should the damage extent to any individual finished surface exceed 5%, at the Contractor's cost.”**

When designing the structure of the crane with a trash-rack cleaning machine and the new lifting tongs, as well as during the execution of corrosion protection for both the crane and the lifting tongs, the following regulations and standards must be adhered to:

- Rules on the Mechanical Resistance and Stability of Construction works (OG of RS, No. 101/2005)
- SIST EN 1993-1-1 Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings
- SIST EN ISO 8501-1 Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness - Part 1 Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
- ISO 8503-2 Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel Substrates - Part 2: Method for the grading of surface profile of abrasive blast cleaned steel - Comparator procedure
- ISO 14713 Protection against corrosion of iron and steel in structures - Zinc and aluminium coatings - Guidelines
- ISO 2063 Thermal spraying -- Metallic and other inorganic coatings - Zinc, aluminium and their alloys
- SIST EN ISO 12944, Parts 1-8 Paints and varnishes - Corrosion protection of steel structures by protective paint systems
- ASTM D3359-97 Standard Test Methods for Measuring Adhesion by Tape Test
- SIST EN ISO 2808:1999 - Paints and varnishes - Determination of film thickness (ISO 2808:1997)
- SIST EN ISO 2178:1999 - Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method (ISO 2178:1982)

Workshop application:

- Surface blasting up to Sa 2<sup>1/2</sup> according to ISO 8501-1
- Cleaning and dusting
- Application of one coat of zinc-rich epoxy primer, with a minimum dry film thickness of 60 µm
- Application of one intermediate epoxy coating, with a minimum dry film thickness of 180 µm
- Application of one final polyurethane topcoat, with a minimum dry film thickness of 80 µm

Ensuring a total minimum dry film thickness of 320 µm.

Repairs after installation:

- Protection and degreasing of sensitive equipment as required.
- Local blasting cleaning of damages up to Sa level 2<sup>1/2</sup>

- Cleaning, dusting, and degreasing.
- Application of two coats of epoxy coating locally, with a total minimum dry film thickness of 120 µm
- Application of one coat of polyurethane topcoat locally, with a minimum dry film thickness of 80 µm

Ensuring a total minimum dry film thickness of 320 µm.

When specifying the protective technology for equipment, the Contractor must consider environmental exposure of C5 VH and a life expectancy of more than 25 years as per SIST EN ISO 12944-5 and 6 standards.

The finishing shade should be **RAL 9006**.

The corrosion protection of the grab rake, lifting tongs, and the trash-rack cleaning machine ramp shall adhere to the requirements of the Im1 environmental exposure, following the specified recommendations:

Workshop implementation:

- Surface blasting up to Sa 2<sup>1/2</sup> according to ISO 8501-1
- Cleaning and dusting
- Application of one coat of zinc-rich epoxy primer, with a minimum dry film thickness of 60 µm
- Application of one intermediate epoxy mastic glass flake coating, with a minimum dry film thickness of 3 x 150 µm
- Application of one final polyurethane topcoat, with a minimum dry film thickness of 80 µm

Ensuring a total minimum dry film thickness of 590 µm.

The finishing shade should be **RAL 9005**.

#### Restrictions and quality requirements

The Contractor is obligated to conduct the works in compliance with relevant regulations, industry best practices, and the recommendations outlined in SIST EN ISO 12944-7.

Upon completion of the works, the Contractor must furnish a "Declaration of Quality" confirming adherence to the provided specifications, along with any applicable warranty declarations and batch attestations (quality certificates) for the installed coating materials/paints.

The Client retains the right to conduct observations and/or quality control at all stages of surface protection, both in the workshop and post-installation.

To ensure proper compatibility among coating materials/paints, it is advised to utilise materials solely from a single manufacturer/supplier for implementing the corrosion protection system.

Following the recommendations of SIST EN ISO 12944-7, strict adherence to the manufacturer/supplier's instructions provided in the technical documentation of the materials is paramount. This includes adherence to mixing ratios of coating components, the durability of the component mix ("pot-life"), qualities of thinners and cleaners, including permissible dilution ranges (maximum 5%), and inter-coat intervals (drying times between each coat of paint contingent upon climatic conditions during application).

The Contractor may only execute corrosion protection of equipment under suitable climatic conditions, which include:

- The metal substrate temperature must be at least 3°C higher than the dew point temperature.



- The substrate intended for painting must be thoroughly dry.
- The temperature of both the substrate and material during painting must not fall below 10°C.
- The temperature of both the substrate and material must not exceed 30°C.

The adequacy of corrosion protection under suitable climatic conditions and the utilisation of appropriate materials must be documented through daily entries in the corrosion protection log, which should include details such as substrate temperature, air temperature, relative humidity, and the commercial grades of materials employed (including material name and batch number).

#### **6.4 Fences and platforms**

Railings, platforms, gratings, platforms, ladders, and handholds, along with their respective fixing materials, must be constructed using structural steel. These elements are screwed on to the base structure of the crane or secured using different detachable ties.

Fences, platforms and walkways should be strategically positioned to ensure access to all crane components, including the trash-rack cleaning machine, for periodic maintenance. A ladder equipped with a back guard along the crane leg must be provided for accessing the crane with a trash-rack cleaning machine.

Galvanised grating is recommended primarily for covering landings, stairs, and other platforms. Railings, landings, gratings, platforms, ladders, and handholds must undergo hot-dip galvanisation. All metal components must be galvanically connected to ensure equalised electrical potential, utilising suitable conductors as per TSG-N-003.

#### **6.5 Running wheels**

The running wheels must be forged using 42CrMo4 or a similar steel for the guide rim, followed by heat treatment, honing, and flame hardening.

Dimensioning of the running wheels for the gantry crane and trash-rack cleaning machine must consider the existing crane track's shape and dimensions, ensuring it does not exceed the calculated maximum wheel pressure.

Open gearbox drive of running wheels is strictly prohibited.

#### **6.6 Bearings**

Only high-quality roller bearings, lubricated with either oil bath or grease, are permitted. Preference should be given to double-row drum roller bearings.

#### **6.7 Crane lubrication system**

The system must allow for manual lubrication, with grease nipples provided for the bearings of the gantry crane travel drive, lifting trolley travel drives, and lifting mechanisms. Inaccessible lubrication points must be reachable through the shortest possible hose to an accessible point for visual inspection.

#### **6.8 Bolting material**

All bolting connections must use metric bolting material conforming to DIN standards, with a minimum quality of 8.8 steel and corrosion protection (galvanised, hot-dip galvanised, etc.). Stainless steel bolts are mandatory for all connections smaller than M16.

## 6.9 Bumpers

To prevent the gantry crane, along with the trash-rack cleaning machine and the 2 x 150 kN lifting trolley, from derailing, bumpers must be installed at the extreme positions of the crane and lifting trolley rails.

Special emphasis should be placed on the bumpers for the gantry, ensuring they align with the existing stoppers of the crane track.

## 6.10 Anchor clamps

Anchor clamps must be embedded on the gantry crane with the trash-rack cleaning machine to facilitate parking of the crane.

## 6.11 Electrical equipment

### 6.11.1 Power supply

The power supply to the gantry crane with the trash-rack cleaning machine originates from a socket located on the cable winding drum. From there, it connects to an electrical cabinet situated at the base of the crane, housing the main switch for powering the actuators.

The winding drum should be designed to be powered by an electric motor.

The power cable wound onto the drum should form a single spiral. A new electrical cable, tailored to the total power requirements of the crane's consumers, must be wound onto the winding drum, with dimensions determined by the crane manufacturer. The cable should withstand various external climatic conditions and mechanical stresses. It is recommended to use a Panzerflex cable from Palazzo or an equivalent.

The attachment position of the drum to the crane's gantry should ensure that the electric cable unwinds in the same position as the cable of the existing crane.

The power cable connecting point is centrally located on the deck between the two power units.

Separate power supplies should be designated for the lighting and other crane assemblies.

Supplying a power cabinet with an integrated circuit breaker is also included in the scope of supply. This cabinet must be mounted on the building's wall adjacent to the crane to replace the existing cabinet. The power supply cable between the cabinet and the power plant's distributor remains unchanged.

### 6.11.2 Cabin with control consoles

The crane with a trash-rack cleaning machine should feature a cabin strategically positioned for optimal visibility. The cabin must feature glazed sides and a bottom, providing a panoramic view of the entire working area, including both the crane and the trash-rack cleaning machine. The front glass of the cabin must have the capability to open at least two windows from within the cabin - one positioned in front of the lifting tong console and another in front of the trash-rack cleaning machine operating console.

Glazing material chosen must prioritise safety, ensuring personnel safety in the event of breakage. Equipped with essential amenities, the cabin should include an anti-dewlap device, heating system, and air conditioning for operator comfort.

Ergonomically designed seats should be placed adjacent to each command console within the cabin - one for crane operations and another for controlling the trash-rack cleaning machine. Alternatively, a single ergonomically designed seat can facilitate the operation of both the trash-rack cleaning machine and the crane.

Controls within the cabin should facilitate the lifting and running of the lifting trolley and gantry, along with separate controls for the grab rake operation.

Indicators within the cabin should display real-time information on the lifting load and stability, ensuring safe operation. Furthermore, the cabin should feature signalling for overload protection and alerts for other crane faults. Floodlights controlled from the cabin should illuminate the entire working area of both the crane and the trash-rack cleaning machine, with positioning optimised to clearly illuminate the closing board and turbine water intake niche guide.

Additionally, the cabin should be outfitted with a screen for displaying images captured by attached video cameras - one for the trash-rack cleaning machine and two for the crane.

#### 6.11.3 Frequency converters

Frequency converters must ensure precise load positioning during both raising and lowering operations. For this purpose, the lifting motor must be equipped with built-in incremental encoders, which are connected to the frequency converter.

Additionally, frequency converters should feature an integral electric motor braking system, complete with braking resistors.

Frequency converters utilised to drive the gantry must also incorporate incremental encoders.

It is recommended that frequency converters, such as those from ABB or similar reputable manufacturers, be accompanied by associated equipment such as input and output filters, encoders, braking interfaces, and braking resistors.

#### 6.11.4 Electric motors

The electric motors utilised must possess suitable characteristics for the designated lift or movement tasks. They should be specifically designed for operation with a frequency converter and sourced from the same manufacturer as the frequency converters. Furthermore, these motors must be equipped with an independently powered fan. IP protection ratings should be selected according to the environmental conditions to which the motors will be exposed.

For lifting mechanisms, the engine power must exceed at least 130% of the power required to lift the rated load.

#### 6.11.5 Control of the gantry crane with a trash-rack cleaning machine, and wiring

The operation of the gantry crane with a trash-rack cleaning machine should be managed by one or more controllers (PLC). These controllers are responsible for overseeing all commands and actuators, including executing overload protection functions.

Each lifting operation must incorporate overload protection to prevent lifting beyond the rated load capacity. Furthermore, lifting mechanisms must feature a pre-stop switch and a limit switch for added safety.

Additionally, the crane must be equipped with a stability indicator to monitor the position of the lifting trolley and the load during lifts. Stability calculations should be continuously performed and displayed in the cabin's control panel, along with the current load of the selected lift.

To enhance safety, measuring probes should be installed in the axles of the two running wheels of the gantry drives to measure wheel pressure on the crane track. Signals from both running wheels, with one integrated into the up-stream trolley and the other into the down-stream trolley, should be transmitted to the PLC to enhance the crane's protection against overturning.

Fault diagnosis capabilities must be integrated into the control system, providing alarms for malfunctions, lift overloads, motor thermal and current overloads, power supply failures, and automation failures. Each alarm must clearly identify the specific element at fault, ensuring efficient

troubleshooting. A dedicated panel on the crane should display potential faults and monitor basic parameters such as motor currents and temperatures.

It is recommended to utilise control equipment from the Siemens SIMATIC S7 series, including the processor part and corresponding input/output units.

Frequency converters should be linked to the controller.

Documentation, including controller software and frequency converter data, must be provided on electronic media upon crane handover.

Limit switches should be installed for signalling the end positions of lifting trolley movement and winding drums. Limit switches must also be installed on winding drums to detect both extreme positions.

Switchgear components such as contactors, motor protection switches, and fuses are recommended from Eaton or similar reputable manufacturers.

Clamps material in cabinets should be sourced from Weidmueller or similar quality providers.

Electrical cabinets and resistors must be shielded from weather elements (rain, snow) with protective sheeting, supplemented by insulating mats in front of the electrical cabinets. Cabinets should be sourced from Rittal or similar trusted suppliers. Adequate protection against external conditions, including appropriate IP protection ratings and cabinet heating or cooling where necessary, must be selected.

Connecting cables must be fine-wire braided and tailored to withstand the conditions experienced on the crane, including resistance to temperature, oil, grease, and repeated bending in moving parts. Lapp cable or similar high-quality alternatives are recommended. Control circuit cables must have at least 75% of wires free within the cable.

In case of an isolated system, protection of control circuits should be ensured through neutralisation, and by earth contact controllers.

The crane with a trash-rack cleaning machine should be equipped with acoustic-optical signal columns for enhanced safety.

Lightning protection measures must be implemented in accordance with the Rules on lightning protection system of buildings (OG of the RS, No. 28/2009).

#### 6.11.6 Specific features of lifting operations

Overload testing:

To facilitate static and dynamic overload testing of the crane with a trash-rack cleaning machine, provisions must be made to enable blocking crane overloads. This blocking mechanism should be activated via the control panel using a password, ensuring that only authorised personnel can activate it.

#### 6.11.7 Electromagnetic compatibility

All electrical equipment must comply with the Slovenian Electromagnetic Compatibility (EMC) Regulations and related legislation. International standards such as EN and IEC 61000, which address electromagnetic compatibility, must also be considered.

Installed devices should not generate excessive electromagnetic interference and should demonstrate resistance to such interference.

### 6.12 Spare Parts

All spare parts specified in this document must be included within the contract scope.

For each type and size of equipment listed below, the following spare parts must be supplied:

- Electric motors: 1 piece for lifting trolley drive, 1 piece for grab rake drive, 1 piece for driving gear.
- Frequency converters: One for each type installed.
- Limit switches.
- Load meter.
- Controller central processing unit (CPU).
- Input/output cards for the controller and frequency converters.
- Operator panel: One set for the crane, and one set for the trash-rack cleaning machine.
- Brake linings: One pair for each type.
- Clutch elastic inserts: One set for each type.
- Electrically controlled brake actuators.
- 4 pcs LED spotlight.
- 2 pieces of grab rakes.
- Contactors, relays, protection switches, etc.

## **7 OTHER SPECIAL REQUIREMENTS FOR MANUFACTURING A NEW GANTRY CRANE WITH A TRASH-RACK CLEANING MACHINE, WITH A CAPACITY OF 2X150 KN**

The Contractor's scope of services shall primarily encompass:

- Planning and organising all activities for the execution of the works.
- Preparation of technological and supporting documents.
- Testing and trialling equipment in the factory.
- Dismantling the existing gantry crane with a trash-rack cleaning machine, with a capacity of 2x100 kN.
- Transporting all equipment listed in this tender to the Zlatoličje HPP.
- Unloading and storing equipment on-site.
- Provision of temporary storage areas and facilities on-site.
- On-site internal transport.
- Installation of equipment.
- Documentation on occupational health and safety, fire safety, and environmental protection for work on the installation.
- Field testing, including inspection by an accredited institution.
- Trial operation period of 3 months.
- Training the Client's staff with the operation of the gantry crane.

The Contractor must adhere to the following guidelines when providing the services:

- Conduct the work in compliance with the technical regulations and standards applicable in the Republic of Slovenia.
- Execute works on-site in accordance with laws, regulations, and orders pertaining to occupational safety and health, fire safety, and environmental protection.
- Ensure the safety of equipment and workers on-site.
- Organise the worksite on the installation as per the decree on work at temporary and mobile construction sites.
- Remove waste from the site promptly.

- Utilise tools and equipment that are well-maintained and inspected within specified deadlines.
- Arrange for necessary installation preparations, platforms, and scaffolding.
- Provide measuring devices and instruments for testing and checking equipment on the installation.
- Supply weights for conducting load tests.
- Ensure that the crane undergoes inspection by an approved crane inspection body and obtain a certificate of inspection and test of the working equipment from that body.
- Carry out the work during the agreed-upon working hours with the Client (weekdays from 7 a.m. to 3 p.m.).

## **8 QUALITY CONTROL, TAKING-OVER, TESTING AND TRAINING**

### **8.1 General**

This section outlines the conditions and requirements for inspecting and verifying materials, equipment, and services throughout the manufacturing, factory assembly, field assembly, testing, and trial operation phases. The goal is to demonstrate equipment conformity to regulations, standards, and tender requirements, ensuring reliable and safe operation.

The Client will appoint one or more quality controllers to oversee equipment quality control procedures conducted by the Contractor and its Subcontractors at all manufacturing stages.

All controls, taking-overs, and tests must be communicated to the Client with at least 5 (five) days' notice.

The Client reserves the right to inspect equipment workmanship at the Contractor's or supplier's premises at reasonable times and without prior notice.

The Contractor or equipment supplier must provide all necessary equipment, devices, standards, and instruments for conducting checks. Measuring equipment must be calibrated and accompanied by valid certificates.

If, upon testing, the Client discovers any defects or non-conformities with technical conditions, standards, or regulations, the Client may reject the equipment or parts thereof. The Client will notify the Contractor in writing within a reasonable time-frame, specifying the reasons for rejection.

### **8.2 Quality control plan (QC plan)**

Regarding quality assurance and quality control (QA/QC), the chosen supplier must submit a comprehensive quality control plan to the Client before commencing equipment manufacturing. This plan should detail procedures for material and equipment manufacturing and testing in the factory, as well as assembly work and on-site testing.

As a minimum, each control procedure outlined in the plan should include:

- Name of the control procedure
- Drawing number referencing the procedure
- Call point (R, W, H)
- Relevant regulation or standard
- Permitted tolerances
- Report number for completed control procedure

The Client will review the plan and specify control procedures requiring the presence of a Client representative or quality controller.

The quality controller will be present for critical checks, including:

- Material collapse testing for heavily loaded crane parts
- Non-destructive testing of significant welds in the steel structure.
- Non-destructive testing of running wheel materials, dimensions, and heat treatments.
- Factory test assemblies and equipment testing
- Verification of main dimensions of the supporting structure
- Inspection of corrosion protection stages for steel structures in both factory and field settings
- On-site installation verification
- Field testing

For more complex inspections, tests, or trials, the Contractor must develop specific programs and submit them to the Client for review well in advance. The Client will identify in the quality control plan the procedures requiring such programs, especially for equipment tests during factory assembly and crane testing after field assembly.

The Contractor's quality assurance plan for materials, equipment, and services must consider the following control procedures:

- Testing mechanical properties of materials (strength, contraction, yield strength, toughness):  
In accordance with EN10204
- Magnetic particle inspection of materials:  
In accordance with EN 1291
- Ultrasonic inspection of materials:  
In accordance with SIST EN 583 or EN 10160
- Ultrasonic examination of flat steel products (reflectance method):  
In accordance with EN 10160
- Liquid penetrant testing:  
In accordance with SIST EN ISO 3452 or EN 1289
- Visual inspection:  
Based on approved drawings, written instructions, and relevant standards or recommendations
- Dimensional control:  
Based on approved drawings, written instructions, and relevant standards or recommendations
- Functionality tests:  
Based on approved drawings, written instructions, and relevant standards or recommendations, and additional Client requirements
- Weld inspection and welder testing:  
In accordance with EN 729 and EN 287  
With acceptance criteria of Class C per SIST EN ISO 5817 or Class 2 per EN 12517
- Inspection of corrosion protection performance:

***As detailed in Item 6.3 of this Invitation to Tender.***

### **8.3 Documenting reports on conducting controls:**

The Contractor is required to prepare a report for each test, measurement, or take-over conducted. Each report must include:

- Subject of the control
- Dimensional drawing, drawing or standard referenced for the check
- Measured value
- Permitted tolerance
- Date of measurement
- Measuring tool used for the measurement
- Climatic conditions during the measurement
- Name and surname of the measurement operator
- Name and surname of the Customer's quality controller

These reports shall be provided to the Client as part of the supporting documentation, typically included in the quality assurance book.

#### **8.4 Materials quality control**

All materials utilised must adhere to applicable standards, undergo testing, and be certified in compliance with EN 10204.

The Client retains the right to request additional testing for verifying material suitability if deemed necessary.

Materials for all load-bearing components of the steel structure and other loaded sections must be approved at minimum in accordance with EN 10204 Type 3.2.B.

Material certifications must outline the chemical composition and mechanical properties, including tensile strength, yield point, and impact toughness at -20°C.

Steel sheets utilised in fabricating loaded structural components must undergo testing for material lamination conformity as per EN 10164.

#### **8.5 Quality control of equipment manufacturing in the factory**

During the manufacturing process of each piece of equipment at the Contractor's factory, the following controls will be conducted:

- Visual checks
- Dimensional control
- Weld inspection
- Test assembly and partial functional check of assemblies

#### **8.6 Quality control of purchased equipment**

The Contractor is accountable for the quality of equipment sourced from their subcontractors and must select suppliers with effective quality assurance systems.

For the bought equipment to be installed on the crane with a trash-rack cleaning machine, the supplier must provide the Client with appropriate technical documentation, including type test reports, installation and assembly instructions, maintenance instructions, spare parts list, etc.

All installed equipment must either bear the CE marking or be accompanied by a declaration of conformity with relevant legislation.



For individual major equipment pieces, the Client will mandate that functional testing is conducted by the manufacturer in compliance with EN 10204 Type 3.2.B.

### **8.7 On-site installation quality control**

During the installation of the crane with a trash-rack cleaning machine at the Zlatoličje HPP, the Client's representative (works supervisor) will oversee the installation works in accordance with the Contractor's approved technical documentation.

Throughout the execution of the works, the supervisor or another Client representative will ensure that the on-site activities comply with regulations governing occupational health and safety on temporary and mobile construction sites, as well as fire protection regulations in the Republic of Slovenia.

During field installation supervision, the Client's representative shall conduct checks including:

- Verification of gantry geometry, gantry and lifting trolley running wheels, grab rake position, lifting tong position, and other equipment.
- Examination of bolted joint tightening torques.
- Visual inspection for corrosion protection damage.
- Inspection of electrical equipment installation.

### **8.8 Functional testing and field adjustments of assembled equipment**

During equipment testing, the Contractor's testers should collaborate closely with representatives of the Client's staff.

The Contractor must provide a detailed test program for the crane with a trash-rack cleaning machine and other technical documentation to the Client for review before testing.

All equipment required for testing, including weights for testing the gantry crane with the loaded trash-rack cleaning machine, will be the responsibility of the Contractor, who will also be responsible for cleaning up and removing the equipment from the site after testing.

Testing of the equipment may begin once the assembly of the gantry crane equipment has been completed and documented.

If, during the tests, the Client's supervisor finds that a specific piece of equipment does not meet the technical specifications and requirements outlined in the Tender documents, they may reject that piece of equipment and notify the Contractor in writing within a reasonable time, stating the reason for refusal.

After completion of the installation, the following checks must be conducted on the gantry crane with a trash-rack cleaning machine, as recorded in the minutes:

- Verification of assembly and installation correctness of electrical hardware
- Confirmation that the equipment is filled with lubricating media
- Visual leak check
- Control of cabling and wiring
- Inspecting the repairs conducted on the corroded corrosion protection

#### **Testing of the gantry crane equipment under no-load conditions:**

- Motion control of all travel and lifting mechanisms
- Operation check of limit switches

- Functionality testing of travel and lifting mechanisms

Testing equipment under rated load conditions:

- Speed control of lifting mechanisms and crane drives
- Measurement of main beam deformation
- Brake performance check
- Load and stability indication assembly control

Overload testing according to SIST ISO 4310/97

*Static test*

The static test involves overloading individual lifting mechanisms by 25% while keeping the gantry crane stationary. This is done to measure the bending of the gantry crane support structure. The test is conducted with the gantry crane in stationary positions corresponding to the maximum loads on its individual parts. During the test, the load is raised by approximately 100 mm and left hanging for at least 10 minutes. The bending of the gantry crane support structure with the trash-rack cleaning machine is measured throughout the test.

*Dynamic test*

The dynamic test involves implementing a 10% overloading of the individual lifting mechanisms while simultaneously lifting loads. During the test, the load is repeatedly lifted, carried, and lowered until all mechanisms, brakes, and safety devices on the crane with a trash-rack cleaning machine have been thoroughly tested.

Upon successful completion of testing the gantry crane with a trash-rack cleaning machine, the Contractor must obtain a certificate of inspection and testing of the working equipment in accordance with Slovenian legislation from an authorised institution in Slovenia. The certificate, along with the report from the accredited institution, must be provided by the Contractor to the Client along with the other required documentation outlined in this Invitation to tender.

## **8.9 Trial operation**

After successful completion of the functional testing of the gantry crane with a trash-rack cleaning machine, a trial operation of the crane is foreseen under the supervision and material responsibility of the Contractor.

During this period, the Contractor shall remedy any defects and damages that may have occurred at his own expense.

The trial period is 3 months (90 calendar days).

Upon completion of the trial operation of the gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN, the crane is handed over to the Client, and a Taking-Over Certificate is issued.

## **8.10 Warranty**

The warranty period for all supplied equipment shall commence on the date of handover of the gantry crane with a trash-rack cleaning machine, with a capacity of 2x150 kN.

The Contractor is obligated to provide the Client with a warranty statement for the gantry crane with a trash-rack cleaning machine and all supplied equipment for a minimum period of 2 years.

Additionally, the Contractor shall furnish the Client with a warranty statement for the corrosion protection. The corrosion protection of the gantry crane with a trash-rack cleaning machine and all supplied equipment must be guaranteed for 10 (ten) years from the date of delivery. During the

warranty period, the volume of defects on 10% of the surfaces of the individual units (systems) shall not exceed Ri 2 according to ISO 4628-3. There shall be no blistering (ISO 4628-2), cracking (ISO 4628-4), and flaking (ISO 4628-5).

### **8.11 Client personnel training**

The Contractor's experienced experts shall conduct the training of the Client's personnel according to a program devised by the Contractor and pre-approved by the Client.

The training will occur after the completion of the installation of the gantry crane with a trash-rack cleaning machine in the field. Part of the training can be arranged during the manufacturing and factory test assembly of the crane equipment, allowing the staff to familiarise themselves with the construction details of the equipment.