

# TRØNDELAG TEATER - REVOLVING STAGE

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## TECHNICAL TENDER SPECIFICATIONS

Date: 14.09.2026

FullScale GmbH

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## Technical Tender Specifications

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### P1 Project Description

#### The Building

Trøndelag Teater is a large theatre with a long-standing tradition which opened in 1816. Between 1994 and 1997, the old theatre was integrated into a new building and expanded to include additional performance venues. Today, the complex houses the following stages:

- Main Stage (Hovedscenen)
- Studio Stage (Studioscenen)
- Old Stage (Gamle Scene) – Original theatre
- Basement Stage (Teaterkjelleren)

The project described in these Technical Tender Specifications will be carried out on the Main Stage (Hovedscenen).

This Main Stage theatre features a modern layout. The stage and auditorium are not separated by a proscenium and thus form a single unit. The side stage areas are also not structurally separated from the main stage.

The stage features a fly tower and an understage.

The stage area currently consists of a grid of panels that can be removed individually. The frames of these panels rest on columns. The stage is 16 m wide and 16 m deep.

The auditorium features a tiered seating structure assembled from an aluminium profile system. Beneath parts of the auditorium lies a type of under-stage area used primarily for storage.

The auditorium and the stage share the same floor level; in other words, there is no raised stage.

An orchestra pit is located between the auditorium and the stage. Six orchestra pit lifts, arranged in two rows, are installed within this pit. These lifts can move vertically between the lower level of the pit and the floor level of the stage and auditorium.

Seating is also installed on these orchestra pit lifts, though it can be removed if necessary.

The audience enters the auditorium through entrances on both sides of the seating.

The auditorium currently has up to 524 seats, arranged in 18 rows and on two side balconies. This includes the rows of seats on the orchestra pit lifts.

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### The Project

Extensive restructuring measures for the stage and auditorium are planned for 2027.

This tender includes a Revolving Stage and a Revolving Ring for the main stage of the Trøndelag Teater.

These are not a replacement for existing systems and are therefore being integrated into the building entirely from scratch.

The Revolving Stage is planned as a double-deck Revolving Stage. Three Stage Lifts will be integrated into the Revolving Stage.

A Revolving Ring is planned around the entire Revolving Stage.

The entire stage area has an understage, which is located at a level approximately 4 meters below the stage level. A pit for the new Revolving Stage was already excavated in this area in the summer of 2026. The Revolving Stage must be integrated into this pit.

The entire system will be integrated into and controlled by the existing stage machinery control system. This control system, which currently operates the overhead machinery and orchestra lifts, is supplied by UNICAN GmbH. UNICAN will also be responsible for controlling the future stage machinery systems specified in this tender. The relevant interfaces are described later in these Technical Tender Specifications.

The modular tiered seating in the auditorium will be removed, and the seating area will undergo a fundamental redesign. The new tiered seating will be constructed partly as a fixed structure and partly using sections with mobile seating units. Mobile seating units are also planned for the orchestra pit platforms and a rehearsal position. There will be also a new transport lift to move the seating wagons between the area beneath the auditorium and the auditorium level. These seating wagons and the transport lift are not part of this tender. The transport lift will be a stand-alone system without integration into the stage machinery control system.

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### Project Members

The parties listed below are the key participants in this project. Naturally, other planners, consultants, and contractors will also be involved:

#### Project Management

- Client: Trøndelag Teater (TT)
- User: Trøndelag Teater (TT)
- Supervising Project Management: Avenu (AV) - managing the project including coordinating and supervising all designers and contractors

#### Design Team

- Theatre Consultant: FullScale (FS) - commissioned with the planning of the stage machinery systems and responsible for the Technical Tender Specifications
- Construction Designer: Multiconsult (MC) – commissioned with the design of the construction works
- Structural Engineer: Multiconsult (MC) - commissioned with the structural analysis of all construction measures
- Electrical Designer: Multiconsult (MC) - commissioned with integrating the new systems into the building-wide electrical infrastructure
- AV/Lighting Designer: Avenu (AV) - commissioned to design the audio, video, and show lighting systems
- HVAC Designer: Multiconsult (MC) - commissioned to plan all HVAC systems
- Designer of Fire Suppression Systems: Multiconsult (MC) - commissioned to design fire suppression systems

#### Contractors

- Stage Machinery Contractor (SMC): Company awarded the contract for the stage machinery on the basis of this tender
- Construction Contractor: Company contracted with structural construction work (steel/concrete)
- Electrician: Company contracted to carry out electrical work
- AV/Lighting Installer: Company contracted for audio, video, and show lighting installations
- Carpenter: Company contracted to install the wooden floors
- HVAC Installer: Company contracted to install HVAC systems
- Fire Suppression Installer: Company contracted to install fire suppression systems

#### Construction Site:

- Site Supervisor: Not yet assigned - person or company responsible for the overall supervision of all construction works
- Construction Supervisor: FullScale (FS) - person or company responsible for supervising of the contractor's work
- (Contractor's) Project Manager: Person responsible for handling the project on behalf of the Contractor
- (Contractor's) Construction Manager: Person responsible for the coordination and execution of the contractor's work

#### Tender:

- Tender Coordinator: Avenu (AV) - Company commissioned to coordinate and handle the tendering process
- Bidder: Company submitting a bid for this tender

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### Interfaces with other project participants

The systems described in these Technical Tender Specifications involve several interfaces with other trades, as outlined below. These trades will carry out their work concurrently with, and dependent upon, the installation of the systems described here.

This necessitates thorough coordination between the services described here and the work performed by other parties. As the stage machinery systems described here are a central component of the overall project, coordination must take place not only during installation but—crucially—during the construction planning phase as well.

### **Scope of work of project participants relevant for this contract**

#### Scope of the Stage Machinery Contractor's own work:

The scope of work is described in greater detail in the respective item specifications; however, the following list provides an initial overview. The scope of this contract includes the following elements:

- The complete structure of the Revolving Stage, including support rollers, the slewing bearing, and all necessary guides; locking positions and substructures for lifting mechanisms; railings and access doors; frames and edge angles for the wooden stage flooring, including trapdoors and floor hatches; as well as mounts for flexible cable feeds, connection boxes, and control cabinets. Provision must be made for the installation space required for control cabinets belonging to other trades.
- The complete structure of the Stage Lifts, including guides; frames and edge angles for the wooden stage flooring, including trapdoors and floor hatches; as well as mounts for flexible cable feeds and connection boxes.
- The complete structure of the Compensating Lifts.
- The complete structure of the Revolving Ring (excluding support columns – see below), including support rollers and necessary guides; edge angles for the wooden stage flooring.
- The complete structure of the Stage Lifts, including guides; frames and edge angles for the wooden stage flooring.
- The complete drive trains for:
  - Revolving Stage
  - Stage Lifts
  - Compensating Lifts
  - Revolving Ring
- The following components must be supplied and installed for all these systems:
  - Electric motor drives, including necessary gearboxes, drive shafts, and other drive components specific to the chosen drive system (e.g., cable drums and cables, push chains, etc.)
  - Brakes, including brake gap monitoring
  - Electromechanical locking devices
  - All components installed outside the control cabinets for safe operation, such as:
    - Encoders
    - Load sensors
    - Limit switches
    - Slack wire detection
    - Cross-groove detection
    - Safety edges
    - Door interlocks

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|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     | <ul style="list-style-type: none"><li>○ Contact switches</li><li>– To integrate the control and monitoring of all these components and to provide power, connecting cables must be routed from all these components to the UNICAN control cabinets.</li><li>– Delivery and installation of the slip ring and terminal boxes</li><li>– Flexible cable feed between revolve and Stage Lift decks, as well as between the revolve and Compensating Lifts</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|     | <p>Commissioning, testing, and acceptance inspections are carried out jointly with the company UNICAN.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|     | <p>The stage machinery contractor is not required to carry out any dismantling work.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|     | <p><u>Scope of UNICAN for the Stage Machinery Control System:</u></p> <p>The overhead stage machinery systems are operated via a control system from UNICAN. UNICAN is an industry-renowned specialist in stage machinery control systems. Since replacing this fully functional control system is neither practical nor desired by the client, the new Revolving Stage, the Revolving Ring, the Stage Lifts, and the Compensating Lifts must be integrated into and operated by this existing system.</p> <p>UNICAN will deliver and install the control cabinets for the drives of these systems - including the axis controllers and frequency converters, and all internal wiring and electrical components.</p> <p>In addition, UNICAN will supply and install a local power distribution unit and a network cabinet on the Revolving Stage.</p> <p>UNICAN will also supply the main control cabinet and the main power distribution unit located upstream of the slip ring.</p> <p>UNICAN is responsible for connecting all cables originating from the components of the Revolving Stage, the Revolving Ring, the Stage Lifts, and the Compensating Lifts to the components within the control cabinets.</p> <p>In addition to the encoders on the drives, the positioning system for the Revolving Stage is supplemented by a dedicated UNICAN system consisting of RFID transmitters and receivers. This system is supplied and installed entirely by UNICAN.</p> <p>UNICAN will submit the documentation for the expansion of the control system and all new components, including updated certificates for SIL-3 certification.</p> <p>UNICAN will lead the commissioning process in collaboration with the stage machinery contractor.</p> |
|     | <p><u>Scope of the Electrician:</u></p> <p>The supply lines to the slip ring will be installed by an external electrician. This company will also route the cables between the slip ring and the UNICAN control cabinets.</p> <p>Furthermore, the power distributions and all power for the AV and show lighting system will be installed by the electrical contractor.</p> <p>Connecting these cables to the slip ring is the responsibility of the electrician.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

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### Scope of the AV/Lighting Installer:

Network racks and network cables for the AV and show lighting system will be installed on the Revolving Stage. These will feed outlet boxes that will be installed below floor hatches on the upper deck of the Revolving Stage, as well as below floor hatches below the deck of the Stage Lifts. Signal converters will also be installed on the Stage Lifts.

The cable connections from the rack and the power distribution to the Stage Lift decks are routed via cable reels, which are part of this tender.

### Scope of the Construction Contractor:

The steel stage structure is being executed by a construction contractor. The stage's steel structure extends up to the Revolving Ring and fully encloses it.

The same applies to the floor structure within the Revolving Stage pit. The open area surrounding the lower level of the Revolving Stage—at the level of the understage—is being developed into a walkable surface. To this end, a steel substructure extends up to the Revolving Stage and fully encloses it.

Since the support structures for the Revolving Ring and the surrounding stage are to be combined in order to minimize the number of steel columns, the construction contractor will install the support columns for the Revolving Ring.

### Scope of the Carpenter:

The wooden flooring on the fixed stage, the understage area, the Revolving Ring, all levels of the Revolving Stage—including Stage Lifts and Compensating Lifts—as well as all trapdoors and floor hatches, will be installed by a carpenter.

The carpentry work for the stage flooring is therefore not part of this tender.

### Scope of the HVAC Installer:

HVAC systems will be installed outside the Revolving Stage. The stage machinery contractor will not be directly involved in the work of this trade.

### Scope of the Fire Suppression Installer:

The fire suppression system including necessary piping will need to be installed along the floor below the Revolving Stage.

### **Interfaces with other trades during the planning phase:**

To ensure that the work of all these trades is aligned, close coordination must take place—immediately after the contract is awarded and during the design planning phase for the stage machinery—with the designers of the other trades and the supervising project management team responsible for scheduling.

### Interfaces with the Supervising Project Management:

- A detailed schedule for the stage machinery systems must be developed in collaboration with the supervising project management team. This process requires taking into account the work of all trades and outlining the interdependencies.

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|     | <p><u>Interfaces with UNICAN</u></p> <ul style="list-style-type: none"><li>– The control of all components and systems must be coordinated with UNICAN.</li><li>– All calculations regarding drive sizing must be submitted to UNICAN during the planning phase so that UNICAN can plan the dimensioning and configuration of the control components.</li><li>– All component data sheets and technical information must be submitted to UNICAN during the planning phase so that UNICAN can plan the control and integration of the components.</li><li>– UNICAN's requirements for specific components must be observed.</li><li>– Space requirements and mounting provisions for the secure installation of control, power, and network cabinets must be taken into account during the detailed design of the Revolving Ring and Revolving Stage structure.</li><li>– Installation space required for RFID-based positioning must be provided.</li></ul> <p><u>Interfaces with the Electrical Designer</u></p> <ul style="list-style-type: none"><li>– Cable routing and the installation of cable support systems on the Revolving Stage's steel structure must be coordinated with the electrical planner during the design phase; sufficient installation space must be ensured.</li><li>– The positioning of work lights, blue lights, and emergency lights must be coordinated, and appropriate installation space must be provided during the detailed design of all system components.</li></ul> <p><u>Interfaces with the AV/Lighting Designer</u></p> <ul style="list-style-type: none"><li>– Space requirements and mounting provisions for the secure installation of power and network cabinets, as well as the outlet boxes must be taken into account during the detailed design of the Revolving Stage structure.</li></ul> <p><u>Interfaces with the Construction Designer</u></p> <ul style="list-style-type: none"><li>– The design engineer has provisionally determined the positions of the support columns for the turntable. The final determination of the positions will take place at a later date. The Revolving Ring must be planned accordingly.</li><li>– The clearances and edge details between the movable stage sections and the fixed stage must be coordinated.</li><li>– The design of the timber flooring on the Revolving Ring, both levels of the Revolving Stage, the Stage Lifts and Compensating Lifts, as well as the trapdoors and floor hatches, must be coordinated.</li></ul> <p><u>Interfaces with the Structural Engineer</u></p> <ul style="list-style-type: none"><li>– Load diagrams with details of the magnitude and direction of all loads introduced into the building must be provided to the structural engineer at an early stage.</li><li>– Specifications regarding approved fastening methods for all structures on the concrete floor or on the building's own steel structure must be observed. All fastening points must be coordinated with and approved by the structural engineer.</li></ul> |

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### Interfaces with the HVAC Designer:

- Thermal loads must be communicated to the HVAC designer at an early stage so that they can proceed with the design of the ventilation system.

### Interfaces with the Designer of Fire Suppression Systems

- The space required for installing the sprinkler heads and the supply lines between the roller assemblies of the Revolving Stage must be coordinated with the designer of the fire suppression systems.

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### P2 Preliminary Remarks

#### Scope of this Technical Tender Specification

According to this Technical Tender Specification, the contractor's scope of work for the stage machinery facilities includes – unless otherwise agreed - the construction design, manufacturing, delivery, assembly, and installation of all components, construction parts, devices, small parts and fastening materials, including all components and system parts, that have not been explicitly specified and that are essential for a proper and complete installation and function of all systems. All work must be carried out in accordance with all relevant standards and regulations. The bid price stated by the bidder applies to fully functional systems and completed facilities including all required components, even if these are not fully listed in this Technical Tender Specification.

The item prices must include all costs incurred in fulfilling the contract. Unless otherwise agreed, the prices must include, but are not limited to, costs for packaging, shipping and delivery, import duties, storage, disposal, environmental charges, tools, technical aids, transport and assembly equipment, travel costs to and from the assembly site, accommodation, meals, wages for employees and freelancers, social security contributions, administration, insurance fees, taxes, risk reserves, deposit fees, reserves for warranty services, etc.

#### General Tender Specification

The completed bid must be submitted in accordance with the specifications provided by the contracting authority.

The price sheet issued with this Technical Tender Specification must be submitted in the .xlsx file format.

Deletions and changes to the text or to the specifications provided in the text are not permitted. All specifications provided in this Technical Tender Specification are binding.

The bidder is obliged to enter prices for all items listed in this Technical Tender Specification, and upon request, product specifications (e.g. brand, type, and technical data).

All item prices and specifications provided by the bidder are binding and form part of the contract.

The bidder is obliged to submit all certificates that are listed in this Technical Tender Specification together with the bid. Certificates cannot be submitted later.

This Technical Tender Specification may list several options for selected items. Prices must be entered for the items and the options. The client will decide if any option will be ordered after the award of contract. The bidder is not entitled to choose the item to be delivered.

The bidder must inform the client of any ambiguities or errors in the tender documents before submitting the bid.

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If the bidder is of the opinion that additional services or facilities are required in addition to those listed in this Technical Tender Specification, explicit mention of this is to be made in the bid.

By submitting the tender, the bidder acknowledges that the information contained in this Tender specification and the associated documents and drawings is sufficient to fulfil all of the services specified in the tender documentation.

### Appendices

These Technical Tender Specifications are supplemented by appendices. These appendices are an integral part of the tender.

A large part of these appendices is intended

- to provide bidders with a better understanding of the spatial and operational characteristics of the theatre
- to show the layout and positioning of the new stage machinery equipment
- to provide information about the interfaces

The depth and extent to which the bidder utilises this information is at his discretion. However, the content of these appendices is assumed to be known when the bid is submitted.

If the bidder has any questions about the content, he must raise them in a timely manner as part of the enquiry management during the tender phase.

The appendices are structured into the following categories:

### Offer prices

This document only contains the technical specifications for the stage machinery equipment included in the scope of this tender. Prices must be given in the Price List, which has been submitted as a separate document together with this Tender.

If the total price of an item differs from the item's individual price, the item's individual price prevails.

All prices must be quoted in Euros. Item prices must be listed exclusive VAT. VAT is only added to the total amount of the bid.

Specifications for the components offered must also be entered in this document.

### Drawings

CAD drawings are issued with this tender in PDF format.

The dimensions indicated in the drawings issued with the tender documents are non-binding. No warranty is expressed for the accuracy of elements shown in these drawings. Exact details may not be shown. All dimensions (lengths, heights, areas, weights, quantities, etc.) must be approved independently by the Contractor during construction design. Expenses for checking given dimensions and for taking necessary measurements must be included in the item price.

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Where the tender drawings are contradicting the text of this tender specification, the text is the governing authority.

### UNICAN documents

Documents of the RFID system that will be used by UNICAN to position the Revolving Stage and Revolving Ring are issued with this tender.

If the bidder requires additional documentation to prepare the offer, he must request this in a timely manner as part of the enquiry management during the tender phase. Please note that obtaining and sending the documents may take several days.

### Photos

Photos of the venue are published with this tender.

The copyright for all photos in this document is held by FullScale GmbH and Trøndelag Teater. None of these photos may be duplicated or reproduced, edited or modified, republished or passed on to third parties in whole or in part without the prior written consent of FullScale GmbH or Trøndelag Teater.

## **Execution times and schedule**

The execution time is according to the project schedule published with the tender documents.

The contractor is obliged to create a detailed schedule based on the published construction schedule and send it to the client no later than 8 weeks after the order is placed. This schedule must be approved by the client.

The published construction schedule only specifies the overarching milestones. The level of detail of the contractor's schedule must be much higher and show the sequence of the individual work steps over the entire duration of the project. Complex processes in particular must be scheduled with great care and presented in greater detail.

The schedule must contain at least the following information:

### Construction Design

The respective planning period must be specified individually for each system and facility (e.g. construction Revolving Ring, Revolving Stage, Stage lifts etc.). These dates must also be detailed in more detail (e.g. drive system Compensating Lift, etc.). Any dependencies between the completion of individual planning work and the start of other planning work must be shown in the schedule. The duration of the inspection and approval by the client specified herein must be taken into account and shown in the schedule.

### Ordering and pre-manufacturing

The respective period for ordering and pre-manufacturing must be specified individually for each system and facility.

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|     | <p><u>Construction</u></p> <p>The dates for the installation and assembly work must be specified in a very high level of detail. Any dependencies based on the necessary assembly sequences must be shown in the schedule. The dates for the assembly of individual locally related components (e.g. installation of Revolving Ring, installation of control cabinets, installation of cable reels, etc.) and, if necessary, individual components must be listed, including the dependencies.</p>                                                                                           |
|     | <p><u>Commissioning</u></p> <p>The dates for commissioning must be specified separately for each individual system. Any dependencies on the completion of the assembly work on the systems must be shown in the schedule.</p>                                                                                                                                                                                                                                                                                                                                                                |
|     | <p><u>Documentation</u></p> <p>The deadline for submitting the documentation is specified in the invitation to tender.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|     | <p><u>Training of theatre staff</u></p> <p>The training period must be shown in the schedule. Due to the tight time constraints, it may be necessary to conduct the training in several training blocks at different times. These training blocks must be listed individually, stating the basic content, and any dependencies on the completion of commissioning and the availability of documentation must be shown.</p>                                                                                                                                                                   |
|     | <p><u>Inspector's tests</u></p> <p>The inspector appointed by the client will carry out the technical inspection of the systems. The test specified by the inspector for the systems must be taken into account. At least 4 days must be allocated for this inspection in 2027.</p> <p>The inspector's tests can only take place after successful commissioning and handover and inspection of the complete documentation.</p> <p>The installation period ends with the handover to the client. However, it must be continued after the handover in the event of defects being remedied.</p> |
|     | <p><u>Acceptance and handover</u></p> <p>The dates specified in the published construction schedule for the acceptance by the client and handover of the facilities to the client must be adhered to. These must be listed as milestones in the schedule.</p> <p>The critical path must be shown and measures for monitoring the critical path as well as the procedure in the event of deadlines being missed must be submitted with the schedule.</p> <p>The schedule must be submitted digitally in .mpp file format.</p>                                                                 |
|     | <p><b>Project Manager</b></p> <p>The contractor must appoint an experienced and fully authorized project manager who has previously been appointed as project manager for at least 3 projects of comparable size and technical complexity.</p>                                                                                                                                                                                                                                                                                                                                               |

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|     | <p>The identity of the project manager must be communicated to the client immediately after the award of contract.</p> <p>The project manager must be fluent in written and spoken English.</p> <p>The contractor must ensure that the project manager is available without restriction for the provision of the required services during the term of the contract. The project manager may only be replaced during the course of the project for reasons beyond the contractor's control (e.g. illness, resignation) and in consultation with the client.</p> <p>The contractor is obliged to ensure that the project manager is fully committed to the project and that his work is not compromised by work on other projects.</p> <p>The client is entitled to reject the project manager if there are reasonable doubts about the project manager's qualifications. For the same reasons, the approval of a project manager can be revoked at any time during the contract term. In this case, the contractor is obliged to immediately provide a replacement with the required qualifications.</p> <p>The project manager plans and coordinates the construction process and the sequence of the individual work steps in accordance with the tender documents. The assembly process must be coordinated with the client's construction management and all other contractors.</p> <p>The project manager is obliged to inform the client of any significant problems or upcoming problems as well as any necessary changes that may cause additional costs, delays in the construction process, the need for replanning or additional organizational or coordination effort, immediately and before the changes are implemented.</p> <p>The Project Manager must attend all project meetings.</p> <p>The Project Manager must support the Inspector's final test and the Client's acceptance process.</p> |
|     | <p><b>Construction Manager</b></p> <p>To supervise the work, the contractor must appoint an experienced and fully authorised site manager who has already been employed as a site manager on projects of comparable size and technical complexity.</p> <p>The identity of the construction manager must be communicated to the client before construction begins.</p> <p>The project manager and the construction manager must not be the same person.</p> <p>The construction manager must be fluent in written and spoken English.</p> <p>The contractor is obliged to ensure that the construction manager is fully committed to the project and that his work is not compromised by work on other projects.</p> <p>The client is entitled to reject the construction manager if there are reasonable doubts about the construction manager's qualifications. For the same reasons, the approval of a construction manager can be revoked at any time during the contract term. In this case, the contractor is obliged to immediately provide a replacement with the required qualifications.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## Technical Tender Specifications

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|     | <p>The construction manager must manage the construction site in compliance with technical standards and relevant safety regulations and in accordance with the instructions of the client's construction supervisor. He is responsible for the safe and proper execution of all assembly work.</p> <p>The construction manager must be responsible for construction means, methods, techniques, sequences or procedures, and for safety precautions and programs in connection with the work of the Contractor.</p> <p>It is the responsibility of the construction manager to coordinate the contractor's work with other contractors working on the project at the same time.</p> <p>The construction manager must coordinate the delivery and storage of materials, parts and equipment with the client's construction supervisor.</p> <p>The construction manager must document the progress of the project and submit daily written reports in English to the client's construction supervisor.</p> <p>The construction manager must attend all construction meetings.</p> <p>The Construction Manager must support the Inspector's final test and the Client's acceptance process.</p> |

### Project meetings

Regular project meetings will be held throughout the project and will be scheduled based on the project status and progress. If necessary, this can also take place once a week. In addition to these regular project meetings, additional meetings may be required to ensure the smooth progress of the project.

If the project manager is unable to attend a meeting for any reason, the contractor is obliged to send a representative to the meeting who has the necessary qualifications, is familiar with the construction progress and has decision-making authority with regard to all construction measures.

### Construction meetings

Regular construction meetings will be held throughout the project and will be scheduled based on project status and progress. These may be held up to once a day if necessary. In addition to these regular construction meetings, additional meetings may be required to ensure the smooth progress of the project.

If the project manager is unable to attend a meeting for any reason, the contractor is obliged to send a representative to the meeting who has the necessary qualifications, is familiar with the construction progress and has decision-making authority with regard to all construction measures.

### Safety on site

All installation work must take into account relevant national and international safety regulations and technical standards, accepted installation methods and common sense.

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|     | <p>The contractor is responsible for the safety of his personnel on the construction site. The contractor is also responsible for taking all necessary measures to exclude any potential dangers for other persons present on the construction site.</p> <p>Dangerous work that requires special precautions such as closing off areas must be coordinated with the site supervisor.</p> <p>The client is entitled to issue guidelines and orders for safety on the construction site that go beyond the legal requirements if they believe this is important for safety on the construction site. The contractor must comply with these guidelines and orders. Extraordinary safety measures that demonstrably cause significant additional costs will be reimbursed to the contractor. The contractor must provide evidence of the additional costs. However, this does not apply to safety measures that are necessary to comply with standards and regulations or that are generally necessary for the contractor's specific work and can therefore be foreseen by the contractor.</p> <p>The contractor's site manager is obliged to give safety instructions to all of the contractor's employees.</p> <p>All safety measures must be agreed with the health and safety officer.</p> <p><b>Installation work</b></p> <p>Construction work must be carried out in accordance with the applicable regulations and standards as well as generally established rules and procedures. Insofar as regulations and standards are applicable, the regulations and standards valid at the time of the construction period.</p> <p>All installation work must be carried out with care for the building and its infrastructure.</p> <p>All material (e.g. steel, cables) and components (e.g. electrical cabinets, machinery parts) dismantled by the contractor as part of his contract must become the property of the contractor, unless otherwise specified in the tender text.</p> <p>Waste must be removed from the construction site within 7 days after dismantling.</p> <p>All areas where installation and assembly work takes place must be cleaned at least daily before leaving the site. Areas where other contractors are also working may need to be cleaned more frequently. The frequency and measures of cleaning may be determined by the site supervisor. The contractor must follow these instructions.</p> <p>Welding and cutting work on existing steel structures as well as drilling and chiselling work on walls and ceilings must be approved by the structural engineer.</p> <p>Hot work that generates flames, heat or sparks, such as welding, flame cutting, grinding, etc., must be reported to the site supervisor in advance. The legal regulations and the site supervisor's instructions must be observed when carrying out the work.</p> <p>Preliminary work carried out by other contractors must be checked on site by the contractor. If agreed preliminaries have not been carried out or the preliminaries have not been implemented as agreed, the site supervisor must be informed immediately.</p> |

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### Drill holes

All openings, drill holes and penetrations in walls and ceilings that are required for the installation of the stage machinery systems and the laying cables and wires are within the contractor's scope of work.

The exact dimensions and the location of all openings, drill holes and penetrations in walls and ceilings must be approved by the structural engineer and the client.

All slots, openings, drill holes and penetrations in walls and ceilings made by the contractor must be closed by the contractor prior to acceptance. The costs for creating slots, openings, drillings and penetrations in walls and ceilings as well as their closure must be included in the unit prices.

All necessary cable penetrations through firewalls must be sealed with approved and certified firestops. The contractor is responsible for ensuring that the work is carried out in accordance with relevant European and national regulations. The contractor must submit all documents and certificates required for acceptance in accordance with these regulations. All associated costs must be included in the individual item prices.

### Quantity take-off

The Contractor must provide evidence of the quantities of all installed items for which he has offered a price per unit (piece, kilogram, metre, etc) in his bid.

This rule also applies for cables and cable support systems unless they are included in the system prices.

Quantity calculations must be submitted together with the partial invoices.

The measurements must relate to the item numbers of this Technical Tender Specification. The measurements must be accompanied by drawing details or sketches that clearly show the location of the systems and equipment listed in the measurements. If the measurements cannot be clearly assigned to installed systems and facilities, a contractor employee must point out the systems and facilities to the client's construction supervisor on site.

All construction works that can no longer be checked by the constructions supervisor after the installation is completed must be photographed by the Contractor. These photos must be submitted together with the quantity calculations.

The quantity take-off is prerequisite for reimbursement. The quantities will be checked by the construction supervisor before invoices are checked and approved. Quantities that are not verified by the construction supervisor will not be reimbursed.

### Commissioning

The contractor must commission all systems in collaboration with UNICAN. Both parties must ensure that all systems are functioning correctly before acceptance by the client. Since UNICAN installs the control system, they are primarily responsible for commissioning. Nevertheless, the stage machinery contractor is obliged to provide constructive and proactive support for the commissioning process and to bring about successful commissioning and acceptance.

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| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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|     | <p>The successful commissioning of all systems is a prerequisite for the acceptance by the client.</p> <p>The commissioning procedures must be developed in collaboration with client.</p> <p>The contractor is obliged to thoroughly check all systems before acceptance and to eliminate any errors, damage and unauthorized deviations from the specifications of this tender in advance. Commissioning must include both mechanical and electrical tests.</p> <p>Tests according to DIN EN 17206 must be carried out individually for each system.</p> <p>In particular, but not exclusively, the following functional tests must be carried out and documented:</p> <ul style="list-style-type: none"><li>– Full functionality of all system components</li><li>– Full range of functions of the control panel and operating panels</li><li>– Test of all plug-in points</li><li>– Test of all emergency stop buttons</li><li>– Test of all safety devices</li><li>– Each brake must be tested individually (function and brake gap monitoring)</li><li>– Each limit switch must be tested individually (emergency and operating limit switches)</li><li>– Slack rope detection</li><li>– The emergency stop must be tested for all directions of movement</li><li>– The maximum speed must be tested</li><li>– The maximum travel distance must be checked</li><li>– Acceleration and braking ramps must be measured</li><li>– All cable and line connections must be checked and the values recorded</li><li>– The load cells must be calibrated, and the overload shutdown must be tested</li><li>– Checking the complete labelling of all system components including all cable and line connections</li></ul> <p>In particular, but not exclusively, the following electrical tests and measurements must be carried out and documented:</p> <p>Mains cable:</p> <ul style="list-style-type: none"><li>– Earth conductor continuity test</li><li>– Measurement of insulation resistance</li><li>– Measurement of loop impedance</li><li>– Measurement of tripping time of residual current device (RCD)</li><li>– Measurement of tripping current of residual current device (RCD)</li><li>– Measurement of phase sequence on all 3-phase connections</li><li>– Measurement of voltage drop at all connections</li></ul> <p>CAT cable:</p> <ul style="list-style-type: none"><li>– Measurement cable length</li><li>– Measurement of wiring (wire map)</li><li>– Measurement of near-end crosstalk (NEXT)</li><li>– Measurement of near-end crosstalk power sum (PSNEXT)</li><li>– Measurement of return loss</li><li>– Measurement of DC loop resistance</li><li>– Measurement of cable attenuation</li></ul> |

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|     | <p>Corresponding measurements must be carried out for all cables.</p> <p>The results of all tests must be documented in a test report. The test report must be signed by the contractor and filed in the documentation. The contractor is responsible for the accuracy of this test report.</p> <p><b>Final tests and inspections</b></p> <p>After commissioning and the handover of the documentation, the client and the theatre consultant will carry out final tests and inspections on all stage machinery systems over a period of several days.</p> <p>The installation quality, integration into the building and operational functionality are checked as part of the final tests and inspections.</p> <p>All systems will be checked thoroughly with regards to their requested functionality and specifications, as well as their compliance with national and international standards and regulations. All machinery parts and electrical facilities will be checked with regards to safety (e.g. fastening methods or protection against electric shock). All safety related systems will be tested, and emergency operation will be simulated (e.g. emergency lowering of lifting devices or emergency stops).</p> <p><b>Inspection tests</b></p> <p>The client will commission an authorized expert to carry out the acceptance tests in accordance with DGUV regulations 17 and 18 (formerly BGV C1) and EN 17206.</p> <p>The expert will have the AB1 and AB2 authorization scope according to DGUV principle 315-390 "Testing of mechanical work equipment for event technology". The expert will carry out preliminary, construction and acceptance tests as specified in this document.</p> <p>The test will be carried out in accordance with DGUV principle 315-390 "Testing of mechanical work equipment for event technology". The manufacturer's test instructions and test criteria, current standards, codes and regulations as well as established technical rules will be used as the basis for the test.</p> <p>All documents required for the preliminary test must be agreed by the contractor with the authorized expert as part of the construction design and submitted to him for testing.</p> <p>Technical personnel, the necessary test weights and other technical aids required for testing the systems must be provided by the contractor and included in the offer price.</p> <p>All systems will be carefully tested for their required functionality (e.g. synchronized group movements under full load) and specifications (e.g. maximum acceleration or noise emission) as well as for their compliance with national and international standards and regulations. All machine parts and electrical equipment will be tested for safety (e.g. fastening methods or protection against electric shock). All safety-relevant systems will be tested, and emergency operations will be simulated (e.g. emergency lowering of lifting devices or emergency stop).</p> <p>Test documents will be prepared for all mechanical equipment, electrical and control systems, and associated structural equipment (e.g. access walkways) and handed over to the client as part of the documentation. In addition to the approval, the test</p> |

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documents will contain a precise description of the defects identified, an assessment of these defects in relation to safety risks, and, if necessary, specifications for remedying the defects.

All test results will be documented by the expert with the prescribed test certificates.

The contractor must organize and schedule the preliminary, construction and acceptance tests together with the expert. The scheduling must be done in such a way that the date for acceptance by the client specified in the project schedule can be met. When scheduling, the construction activities of the other trades must also be taken into account.

Successful expert inspection is a prerequisite for acceptance by the client. A successful expert inspection is established when the contractor's installed systems are released for use without restrictions and any remaining defects are classified by the expert as only minor and do not restrict the safe use of the systems.

This also includes any necessary multiple inspections in the event of delayed completion of individual system components and the associated partial acceptances if the contractor is responsible for these. Furthermore, this also includes follow-up inspections if these are necessary due to defects in the execution.

### Acceptance by the Client:

The construction work must be accepted by the client. Acceptance must take place on the date specified in the schedule.

The prerequisites for acceptance by the client are:

- All systems installed by the contractor are fully functional and ready for operation
- Commissioning tests have been successfully carried out by the Contractor and test protocols are filed in the documentation
- Contractor has handed over the complete technical documentation according to these Technical Tender Specifications
- The inspection test in accordance with DGUV regulations 17 and 18 (formerly BGV C1) and EN 17206 by the authorized expert has been successfully completed and a final test report from the expert is available, which certifies the full operational safety of the systems

If the above requirements are not met, acceptance cannot take place.

If significant defects are discovered during the final tests and inspections or the inspection test by the authorized expert, the client is entitled to refuse acceptance. All costs incurred for further acceptance dates must be borne by the contractor.

### Support after project completion

Due to the integral role of the stage machinery for the theatre, the support and availability of the contractor's technical support even after the project has been completed is of utmost importance to the client.

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Availability of technical support during the warranty period must be as follows:

- Telephone hotline must be available on from Monday to Friday from 08:00 to 23:00; on Saturdays from 09:00 to 21:00; the telephone hotline needs to be answered by a technically skilled person who is familiar with the control system and stage machinery systems of the theatre. Contact must be established within a timeframe of maximum 10 minutes.
- In the event of a technical fault, the contractor must ensure that the fault diagnosis is carried out as soon as possible, within a maximum of 10 minutes via online access to the system within the support times specified above
- If the failure cannot be corrected by the technical staff of the theatre; a qualified technician of the contractor must arrive on site maximum 24 h after the initial phone call

Online/telephone and on-site support may only be outsourced to third parties with the client's consent.

The above requirements apply to online/telephone support provided by a subcontractor.

Subcontractors providing on-site support must be trained in repairing the installed systems and have the necessary spare parts available. Proof of the subcontractor's expertise in carrying out the required repair work must be presented to the client.

Liability and responsibility for contract fulfilment remains with the contractor and cannot be shifted to a subcontractor. The client is entitled to refuse the appointment of a subcontractor if there are reasonable doubts about the subcontractor's qualifications. Furthermore, the approval of a subcontractor can be revoked at any time for the same reasons within the warranty period. In this case, the contractor must provide a replacement immediately.

By signing the contract, the contractor agrees to these conditions.

### Environmental Requirements

The contractor shall plan this stage machinery project in such a way that environmental impacts are reduced—both during manufacture, delivery, and installation and throughout the entire expected service life of the systems.

The following environmental requirements apply:

#### Environmental Compatibility of Materials Used

The selection of materials must be based on ecological criteria and the principles of the circular economy.

- **Substance Restrictions and Compliance:** All installed components (especially control systems, sensor technology, and cabling) must demonstrably comply with the RoHS Directive (2011/65/EU). Plastics, lubricants, and seals must not contain any Substances of Very High Concern (SVHC) exceeding the permissible threshold values specified in the REACH Regulation.
- **Recyclability:** The construction must be designed in such a way that materials can be separated by type and recycled at the end of their service life.

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- **Lubricants:** Rapidly biodegradable lubricants (e.g., complying with the EU Ecolabel) must be preferred for gears, guides, and ropes to minimize environmental impact during maintenance or in the event of leakages.

### Service Life of Components

A long operational lifespan is the most effective lever for resource efficiency. The stage machinery must be designed for durability and longevity.

- **Design and Calculation:** The bidder must prove the mechanical service life of the main components (winches, gearboxes, rope drums, bearings). Load-bearing equipment and drives must be dimensioned for a high number of load cycles.
- **Wear Minimization:** Mechanical wear must be kept to a structural minimum through intelligent engineering (e.g., optimized rope reeving to prevent fleet angles, material-friendly geometries of the guide systems) and the selection of components.
- **Obsolescence Protection:** The bidder must demonstrate how electronic components and control systems are protected against premature functional obsolescence (e.g., through modular software updates and standardized interfaces).

### Energy Efficiency (via Design and Components)

The stage machinery systems must exhibit minimal energy consumption values during both operation and standby modes.

- **High-Efficiency Drives:** Electric motors shall be selected with due consideration to energy efficiency, provided that this is compatible with the technical, operational, safety and control requirements of the system. The assessment must take into account the entire drive system, including axis controllers, frequency converters, the motor, the brake, and the gearbox, where applicable under the EU Ecodesign regulations for the respective power classes. Upon request, the contractor is required to demonstrate that this requirement has been implemented.
- **Standby Management:** Components included within the Contractor's scope of work shall be configured and selected with due consideration to energy consumption during standby and non-operational periods, provided that this is compatible with the technical, operational and safety requirements of the systems

### Maintenance and Spare Parts

The system must be designed for ease of maintenance to conserve resources during the operational phase.

- **Availability of parts (Right to Repair):** Wherever possible, the bidder should use standard industrial components with a high probability of long-term availability and compatibility with successor products. No components or parts should be used for which the manufacturer has already announced an "end-of-life" status, or for which imminent discontinuation is foreseeable due to technical advancements.
- **Repairability over Replacement:** The design must be modular so that defective individual components (e.g., individual contactors, relays, or bearings) can be replaced using standard tools, preventing the need to scrap entire large assemblies.
- **Maintenance Intervals and Sensors:** By utilizing low-maintenance components or predictive maintenance approaches (Condition Monitoring), unnecessary preventive material replacements must be avoided.

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### Packaging and Shipping/Transport

Transport to the venue/tender site must be ecologically optimized.

- **PPWR Compliance:** All packaging must comply with the European Packaging and Packaging Waste Regulation (PPWR). Single-use plastic packaging must be reduced to an absolute minimum.
- **Reusable Transport Systems:** Reusable transport racks, heavy-duty returnable pallets, or recyclable wooden crates must be used to transport heavy components (winches, control cabinets, platform elements).
- **Logistics Optimization:** The bidder must demonstrate that the transport volume has been optimized through smart disassembly/pre-assembly at the factory to minimize the total number of truck deliveries to the construction site.
- **Means of Transport:** For the transport of goods, the most environmentally friendly means of transport that can be implemented within the timeframe are to be used.

### Waste Management on the Construction Site

Installation and commissioning on-site must not cause unnecessary environmental impact.

- **Waste Separation and Disposal Plan:** The contractor must submit a site-specific waste disposal plan for the installation phase. Packaging materials, metal scrap, cable remnants, and hazardous waste (e.g., empty lubricant containers, cleaning rags) must be collected separately and sent to certified recycling streams.
- **Avoidance of Hazardous Waste:** Cleaning agents and auxiliary substances used during on-site installation and adjustment must be solvent-free and hazard-label-free (or at least readily biodegradable).
- **Take-Back Obligation:** All packaging and transport aids resulting from the installation must be taken back entirely by the contractor free of charge and professionally repurposed or recycled.

Upon request, the contractor is required to demonstrate that all these requirements have been implemented.

The Bidder must submit, together with the tender, a description of his approach to reducing the overall environmental impact of the delivery and his strategy for complying with the Environmental Requirements set out above.

The description shall not exceed two (2) A4 pages.

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### P3 Preliminary Technical Remarks

#### General Technical Notes and Requirements

All EN and ISO standards, national technical standards and regulations, state building regulations, official ordinances and laws, established rules and work processes and official safety guidelines apply in the version valid at the time of execution.

The left/right directions are defined with a viewing direction from the auditorium towards the stage tower and is used for the auditorium and the stage tower

The term 'upstage' is used for the back of the stage while the term 'downstage' is used for the front of the stage.

The reference point for all height information in this tender document and the associated plans is the stage level, which is specified as 0.00 m and thus deviates from the architectural height information.

The stage and auditorium centreline must be measured by the contractor and must form the basis for the entire construction design and subsequent construction work.

Necessary machinery, equipment, tools and auxiliary materials, unless specified separately, as well as storage costs, personnel costs and all other costs incurred by the contractor when carrying out the order must be included in the respective item prices.

All rooms must be returned to their original condition after completion of the work, i.e. all barriers, covers, temporary supports, fastening materials and dirt must be removed.

Only building materials and components that have valid certification in accordance with national regulations may be used.

Only brand new materials, components and systems may be installed. This also applies to steel profiles and cables. Used materials, components and systems will not be accepted under any circumstances, even if they show no signs of use. The contractor is obliged to prove, using order documents, that the materials, components and systems used are brand new if the client requests this due to justified doubts.

If components with the same function are used in different parts of the system, they must be identical in order to facilitate the supply of spare parts and maintenance. This applies in particular to electrical components such as circuit breakers or incremental encoders. The mixed use of components with the same function from different manufacturers is not accepted. Mixed components must be replaced with components of the same brand and type at the contractor's expense.

If individual components are purchased or services are outsourced to subcontractors, it must be ensured that the supplier/subcontractor is also aware of the requirements of these Technical Preliminary Remarks.

#### Steel Structures

Only new steel products may be used.

The standards EN 1090-1 and -2 form the basis for all welded structures. All welded structures must be manufactured by a company certified to Execution Class 3 in accordance with EN 1090-1. This certificate, as well as the welding certificate

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|     | <p>pursuant to EN 1090-2, must be presented upon request. Subcontractors commissioned to perform welding work must also be certified.</p> <p>Welders must be certified according to EN 287-1. This certificate must be presented upon request.</p> <p>For all steel structures, a maximum deflection of <math>l/750</math> up to a maximum of 10 mm must be taken into account.</p> <p>Measures for decoupling structure-borne sound must be taken for all moving systems.</p> <p>Flame cuts and cut surfaces must be cleaned and deburred and/or grinded.</p> <p>All steel structures must be designed to be torsionally rigid and have low vibration characteristics.</p> <p>All steel structures must be finished in RAL 9005 mat black unless otherwise stated in the item description.</p> <p>All steel parts must be protected against corrosion in the factory by means of coatings consisting of rust protection, primer and top coat. The steel parts must be derusted, degreased and coated. The surface treatment must not take place on the construction site. Only imperfections may be treated on the construction site.</p> <p>Before acceptance, all defects must be repaired with primer and top coat in accordance with the original coating. The damage-free condition must be maintained until acceptance by the client.</p> <p>Hollow profiles must be sealed with end caps.</p>                                                                                     |
|     | <p><b>Electrical Facilities and Control System</b></p> <p>All required cabling for the contractor's systems, including power cables, network cables and flexible cable feeds, must be installed by the contractor. The item descriptions specify which parts must be supplied and installed by the stage machinery contractor and which by others.</p> <p>The cost of cabling must be included in the item prices. In addition, connecting all cables to the systems specified in this Technical Tender Specification are within the contractor's scope of work, and the cost must be included in the item prices.</p> <p>The control cabinets, server cabinets, connection boxes and other required distribution boxes will be delivered by others</p> <p>All conductive components must be included in the potential equalization system.</p> <p>Incorrect operation of the control desks must not lead to electrical or mechanical damage to the systems.</p> <p>In order to avoid interference in the media technology and building technology systems, the systems must have high-quality NF filtering in accordance with EMC Directive 89/336/EEC and must not cause interference in other systems. The systems must be protected against electromagnetic interference. The systems must not exceed the specified limits for emitted interference in accordance with EN 61000-6-4 and must not fall below the limits for interference immunity in accordance with EN 61000-6-2.</p> |

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Among others, the following standards and regulations must also be taken into account for the electrical installation:

- FEL
- NEK 400:2026
- NEK EN 60204-1

The contractor is responsible for the unrestricted functioning of all electrical systems of the stage machinery.

### Electrical Cabinets

All electrical cabinets and racks for the stage machinery will be delivered and installed by UNICAN.

All electrical cabinets and racks for white/blue/emergency lights will be delivered and installed by the electrician.

All electrical cabinets and racks for the AV and stage lighting systems will be delivered and installed by the AV contractor.

### Connection boxes/local control panels

The following section should be considered as general guidelines. Since a large part of the electrical infrastructure in this project is being installed by UNICAN or the electrician, many of the points listed below do not apply.

The following specifications are applicable to all connection boxes, terminal boxes and local control panels. Henceforth only the term connection box will be used for all of these different types of boxes.

All connection boxes must be of the same type and brand. Connection boxes of different type or brand may only be used upon approval by the client.

Connection boxes will be mounted to brick walls, concrete walls, steel structures or wood panels. Mounting material must be included into the item price.

The enclosure of connection boxes must be made of sheet steel with a minimum panel thickness of 1.25 mm. Connection Boxes must comply with protection rating IP 44 or better according to EN 60529 (this class must be achieved with all connectors, cable fittings, etc. installed) .

All control elements, sockets and indicators except the cable glands must be mounted to the front side of the enclosure. All control elements, sockets and indicators must be mounted horizontally in equal distance to each other and at equal height.

The front side must be a lid. Only the lid of the connection boxes must have hinges. Lids must have a key lock. The key must be identical to the keys of the electrical distribution boards and other electrical cabinets.

The enclosure must be at least primed on the inside and powder-coated outside. All connection boxes must be finished in RAL colours. All connection boxes positioned in the fly tower must be finished in RAL 9005 black. Other obligatory colours may be given to the contractor during construction design. All colours must be approved by

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| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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|     | <p>the client. Finishing the connection boxes in RAL colours must be included in the item price of the connection boxes.</p> <p>Connection boxes need to be corrosion-resistant and have high notched impact resistance.</p> <p>The labelling of the connection boxes must be carried out in accordance with the respective item texts of these Technical Tender Specifications. The contractor needs to get approval for labels that are not specified in these Technical Tender Specifications. Connection boxes must be labelled with white lettering engraved on a black Resopal® or aluminium plates fixed to the front side of each connection box with rivets.</p> <p>Top-hat rails made of minimum 1.5 mm thick galvanized steel must be mounted to the rear panel of the connection boxes. Terminal strips for all power lines must be installed on the top-hat rails. Terminals with green/yellow insulation body must be used for grounding.</p> <p>Connections between connectors and terminal strips must be made with single conductors with dedicated colour assignment.</p> <p>Cable glands must be used for cable entries in all connection boxes. The diameter of cable glands must match the cable diameter and provide dust proof sealing and strain relief. Cable glands must not limit the IP rating of the connection boxes.</p> <p>All cables and wires must be permanently marked at their beginning and end with a number or code on printed plates. All numbers/codes must correspond to the labelling in the wiring diagrams.</p> <p>The style of labelling (e.g. font type, font size, font colour, type of label etc.) must be consistent in all connection boxes.</p> <p>For mounting the fixtures screws with a blunt ends must be used.</p> <p>Connection boxes must be connected to the potential equalization system.</p> <p>Lids of connection boxes must be connected with the enclosure by a flexible potential conductor 1 x 4 mm<sup>2</sup>.</p> <p>The connection boxes must be fully pre-assembled at the contractor's workshop.</p> <p>The connection boxes must be delivered on site including small parts and fastening material; installed; cables must be fed into the connection boxes and must be connected; the connection boxes must be labelled, commissioned, and tested.</p> |
|     | <h3>Cable Support Systems</h3> <p>Cabling must be done in compliance with national regulations and standards.</p> <p>The following requirements must be followed for cable support systems:</p> <p>All cable support systems must comply with EN 61537 and must be of the same brand and type. Cable support systems of different type or brand may only be used upon approval by the client.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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|     | <p>Only steel cable trays, steel cable ladders, steel cable ducts, pipes or C-rails with steel clips, and steel pipes must be used as cable support systems for cabling. Cable support systems have to be made of steel. Cable support systems made of plastic are not accepted.</p> <p>Cable support systems must be installed with the corresponding moulded parts for intersections, branches, curves as well as transitions to cable support systems of the same type but different dimensions.</p> <p>Interrupting cable support systems without the use of moulded parts is not permitted.</p> <p>All the cables must be mechanically fastened at least every 60 cm. Steel clips suitable for the diameter of the chosen cables must be used for the fastening. Cable ties and tape are not accepted for fastening cables to the cable support systems.</p> <p>All cable trays must be labelled 'Stage Machinery' at least every 4 metres.</p> <p>All cable support systems in the stage tower above stage level must be finished in RAL 9005 black. Cable support systems in public areas must be finished in a RAL colour to be coordinated with the architects. This includes all visible parts of the cable support systems. Finishing cable support systems in RAL colours must be included in the item price of the cable support systems.</p> <p>All cable trays must be designed with a separating strip made of steel for different voltage potentials.</p> <p>All support systems within the fly tower or public areas must be closed with a lid. The lids need to be finished in the same RAL colour as the rest of the cable support systems. The lid must be connected to the cable tray with a potential equalisation conductor (green/yellow) of at least 4 mm<sup>2</sup> cross-section.</p> <p>All the parts of the cable support systems must be connected with a conductor (green/yellow) of at least 4 mm<sup>2</sup> cross-section to the building's potential equalisation system. The joints of the cable support systems must be connected with electrically conducting material.</p> <p>All raw edges of cable trays must be equipped with edge protection.</p> <p>End caps or edge protectors in the same colour as the cable support system must be used at the end of the cable support systems. For steel-armoured round conduits, end caps must be installed before cabling and may not be added later by cutting them open.</p> <p>All cable support systems must be laid horizontally or vertically in a straight line on walls or below ceilings.</p> <p>Cable support systems must be cleaned before cabling. Waste and construction dust must be removed.</p> <p>All accessories (system-dependent small parts or accessories like bracket clamps, base plates, straight connectors, angle connectors, corner connectors, end terminations, joint strips, cable protection rings, edge protection tape, grounding screws etc.) that are required for setting up the cable support systems, as well as auxiliary material for the assembly must be included in the item prices for each system part of the stage machinery system.</p> |

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| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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|     | <p><b>Cables</b></p> <p>All new cables need to be made of halogen-free material.</p> <p>The required types and quantities of cables and network lines for the stage machinery are manufacturer-specific. For this reason, and in order not to restrict competition, no information on this is included in this technical specification.</p> <p>All cables have to be laid on cable support systems. Cables that are not laid on cable support systems are not accepted.</p> <p>Cables must be laid neatly next to each other on the cable support systems. Disorganized cable routing is not acceptable. Adequate heat dissipation must be ensured for high-current cables. Cables must be laid at the spacing specified by the manufacturer.</p> <p>All cables must be laid uncut from start to end. Extending cables is not accepted.</p> <p>All cables need to have a black jacket and must not be painted. In case specific cables are not available in black, installation has to be done in a way so that coloured cables are not visible anywhere from the audience (e.g. use lids on cable support systems).</p> <p>When laying cables, attention must be paid to the maximum permissible tensile stress and the minimum permissible bending radii. This applies especially to data lines.</p> <p>All cables and wires must be permanently marked at the beginning and end with a number or code on printed plates. All numbers/codes must correspond to the labelling in the cable lists.</p> <p>Cables carrying high voltage and low voltage must be laid separated. Cable trays might be equipped with a separating strip for different voltage potentials.</p> <p>All steel structures must be fitted with individual potential equalisation conductors and connected to the main potential equalisation system.</p> <p><b>Labels/Signs/Tags</b></p> <p>The Contractor is obliged to carry out labelling of all of the supplied systems, system parts, electrical components, cables, etc. All mandatory labels according to standards and regulations as well as necessary warning and information signs are also within the scope of work.</p> <p>As part of the construction design, a labelling system must be agreed with the client. This includes colours and font styles. The existing labelling system in the building/facility must be taken into account and, where applicable, continued for all newly supplied systems and components.</p> <p>All labels, signs and tags are to be presented to the client for approval.</p> <p>Labelling must be permanent. Labels, signs and tags must be non-fading. Labels must be designed in such a way that they cannot be damaged or fall off either during normal use or during maintenance and servicing.</p> <p>Engraved or embossed Resopal® or aluminium signs are to be used for all labels and signs if possible. For tags, e.g. on cables, industrial tag systems must be used that are designed for the intended purpose. Handwritten labels and signs, as well as homemade and hand-written tags are not accepted.</p> |

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Everything has to be labelled in an easily-legible. The style of labelling (e.g. font type, font size, font colour, type of label etc.) must be consistent. Labelling must correspond to the contractor's planning and documentation documents.

Load signs must be installed at least at the following area that show the ELL for the Revolving Ring and the Revolving Stage including the Stage Lifts and Compensating Lifts:

- 1 pc Stage
- 1pc Understage

These signs must be mounted in easily visible positions.

All signs with load capacities as well as warning and information signs have to be in local language and English, and a font size of at least 14 points must be used.

The cost of all labels, signs and tags must be included in the item prices.

### **Stage Machinery:**

All systems must comply with the requirements of DIN EN 17206, DGUV 17/18 (formerly: BGV C1) and Directive 2006/42/EC, as well as all relevant standards that are either referred to in these standards or that must be applied due to the components or systems used.

All control-relevant components must have SIL 3 approval according to EN 61508. To submit a quote, a test certificate from a recognized testing institute must be submitted, which confirms SIL 3 approval according to EN 61508 for the control system.

For all stage machinery systems, an inspection book in accordance with DGUV 17/18 must be supplied and, after acceptance by the inspector, the original must be filled out and handed over to the client.

All conductive structural parts must be connected to a common equipotential bonding system and incorporated into the protective measures.

The complete drive trains and all control-related components must be designed to at least IP 54 protection class.

The following points must generally be taken into account when selecting components, dimensioning and designing the stage machinery:

### Risk Assessment:

The contractor must conduct risk assessment according to EN 17206 and DIRECTIVE 2006/42/EC for all systems. The Risk assessment must be part of the documentation.

### Maintenance:

Maintenance and repair work must be able to be carried out economically and safely.

The contractor must provide design solutions that are optimized for keeping time and effort for repair and maintenance to a minimum. This means that all system components must be readily accessible, and the need for disassembly to reach

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specific parts must be kept to the absolute minimum. For components subject to high wear, the design must allow for replacement with minimal expenditure of time and manpower. The contractor is responsible for drawing the client's attention to system components that can only be installed in such a way that access for maintenance work is restricted, or whose replacement requires special measures.

### Fastening methods:

All structural elements must be secured against unintentional loosening.

All bolted connections that do not need to be opened during operation must be secured.

All attachments to walls, floors, ceilings, or other building structures must be coordinated with and approved by the structural engineer in advance.

### Machine frames:

All drives must be mounted on machine frames with structure-borne sound insulation. This must prevent the transmission of structure-borne sound to the building.

Fastening screws must not impair the sound decoupling.

The machine frames must not be placed on grating panels, but must transfer the loads to support beams or girders of the building's supporting structure.

### Motors:

Motors must be appropriately sized to meet the requirements and suitable for the intended application.

Motors must have at least protection class IP 54 in accordance with EN 60529.

All motors must be equipped with temperature monitoring and automatic shutdown in the event of overheating.

Electric motors must always be designed without external ventilation.

All operating and maintenance elements must be clearly visible and easily accessible.

### Gearboxes:

All gearboxes must be designed for twice the nominal load in motion for at least 400 operating hours.

Gearboxes must have at least protection class IP 54 according to EN 60529.

### Oil collection containers:

Oil collection containers for leaking gear oil or other lubricating oils from the drive unit must be integrated into the machine frame below each drive unit. The oil pans must be designed to at least accommodate the maximum possible leakage quantity.

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|     | <p><u>Lubrication:</u></p> <p>Linear plain bearing systems must be provided with grease nipples or sufficiently dimensioned grease chambers for suitable permanent lubrication.</p> <p><u>Brakes:</u></p> <p>All drives for vertical movements must be equipped with two independently acting, low-noise theatre brakes with air gap monitoring.</p> <p>The brakes must be designed in accordance with the required payloads (ELL) in accordance with the specifications of DIN EN 17206 for the static holding of loads and for braking the loads at full travel speed.</p> <p>Brakes must be designed as safety brakes that are permanently closed and are only released when moving. In the event of a power failure, the brakes must close automatically.</p> <p>In order to reduce the load on the structures, the brakes must be activated one after the other during an emergency braking.</p> <p>Brakes must be easily accessible and must be able to be checked individually. In an emergency, both brakes must be able to be released manually at the same time.</p> <p>Brakes must have brake monitoring.</p> <p><u>Operational and overtravel limit switches:</u></p> <p>All motorized systems for lifting persons, as well as for lifting and suspending loads above persons—such as fly bars and stage lifts—must be equipped with a redundant, safety-related limit switch configuration suitable for implementation within a SIL 3 (Safety Integrity Level 3) safety function. This also applies to systems that pose a risk to the health of persons due to movement during operation.</p> <p>All systems used for lifting people like stage lifts shall be equipped with a redundant, safety-rated limit switch configuration suitable for implementation in a SIL3 (Safety Integrity Level 3) safety function.</p> <p>Each end position (operational upper/lower limits as well as emergency over-travel limits) shall be monitored by separate, high-precision mechanical position switches.</p> <ul style="list-style-type: none"><li>– Operational Limit Switches:<br/>Independent operational limit switches must be provided at the highest and lowest legal travel points (top and bottom landing levels). When triggered, these switches must safely decelerate and stop the drive via the control system or frequency inverter. Regular operational stops must not cause undue stress on the braking system.</li><li>– Emergency Limit Switches<br/>Safety-rated emergency limit switches must be installed beyond the operational limits (overtravel zone). These switches must act as a hard cut-off. In the event of an overtravel, they must directly disrupt the safety circuit (safety chain), instantly dropping the main power contactors and engaging the mechanical safety brakes</li></ul> <p>All safety-relevant limit switches shall feature positive opening contacts according to</p> |

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|     | <p>All safety-relevant limit switches shall feature positive opening contacts according to EN 60947-5-1 to ensure reliable disconnection even in the event of contact welding.</p> <p>The switches shall be wired dual-channel to the safety PLC to meet the diagnostic coverage requirements necessary for a SIL3 architecture.</p> <p>The switch assembly must feature a central adjustment mechanism that allows for the simultaneous, synchronous shifting of all cam profiles and switching levels (block adjustment) to facilitate efficient zero-point calibration.</p> <p>All mechanical locking mechanisms (e.g. platform locks) shall be actively monitored by safety interlock switches.</p> <p>The interlocking switches shall be suitable for use in SIL3 / PL e safety systems.</p> <p>Depending on the hazard analysis, the switches shall utilize electro-mechanical safety switches with guard locking.</p> <p>The system must independently monitor both the "locked" mechanical state and the "unlocked" state, feeding both signals back into the safety control system.</p> <p>Resetting the system after a severe emergency limit switch violation must only be possible via a secure manual override function restricted to authorized service personnel.</p> <p>The limit switches must be installed in such a way that they are easily accessible for adjustment.</p> <p><u>Encoders:</u></p> <p>All encoder systems and their evaluation paths must be suitable to achieve Safety Integrity Level 3 (SIL3) in accordance with IEC 61508 / IEC 62061 within the respective safety functions.</p> <p>Encoders must provide real-time feedback for exact positioning, speed synchronization between multiple units, and slippage detection.</p> <p>The encoders must be adapted to the intended application and the specific type of drive.</p> <p>Encoders must be installed to perform the following core functions:</p> <ul style="list-style-type: none"><li>– Close the control loop between the motor and the drive system</li><li>– Provide redundant positioning signals for software limit switches and travel synchronization between multiple axes.</li></ul> <p>The data from the respective encoders (e.g., motor shaft and drum/output shaft) must be constantly monitored and cross-checked by the safety system. In the event of any impermissible deviations or slippage, the drive/winch must be stopped immediately in a controlled, safe manner.</p> <p>To ensure maintenance-free operation, the absolute position of the drives must be retained mechanically; encoders utilizing a battery backup for position retention are strictly prohibited. After any interruption of the power feed, the absolute position of the drives must be immediately and reliably available without requiring a homing run.</p> |

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|     | <p>After the power feed to the drives has been interrupted, the absolute position of the drives must still be available.</p> <p><u>Load Measurement and Monitoring:</u></p> <p>All drives of the upper and lower machinery must be equipped with a direct load measuring device that is continuously active, including when the machine is at a standstill. Estimating or measuring the load indirectly via the motor current of the frequency converter is strictly prohibited.</p> <p>The measurement accuracy must be within +/- 5% of the Entertainment Load Limit (ELL).</p> <p>The safety-related control system must utilize this direct load measurement to reliably trigger both an overload shutdown and an underload detection (underload shutdown) in accordance with EN 17206.</p> <p>The load monitoring must bring the drive to a standstill in case of an overload or underload fault. It must be possible to bridge these safety functions on the drives for testing purposes. This must be done strictly via the control software subject to appropriate user access rights.</p> <p>Slack-rope detection for the winches of the upper machinery shall be achieved via a separate, dedicated system independent of this load measurement setup.</p> <p><u>Slack-rope detection:</u></p> <p>All winches and hoisting drives of the upper machinery shall be equipped with a separate, dedicated, and hardware-based slack rope detection system. This system must operate completely independently of the electronic load measuring device (ELL monitoring).</p> <p>The system must reliably detect any loss of rope tension (e.g., if the load or bar encounters an obstacle during downward travel) and instantly trigger a safe, controlled stop of the drive to prevent accidental load drops or uncontrolled unspooling.</p> <p>The slack rope detection must function effectively across the entire travel range, including during acceleration, deceleration, and at the final limit positions.</p> <p>The friction within the entire wire rope path of the detection mechanism must be kept to an absolute minimum to prevent false triggering or delayed system responses.</p> <p>The detection device must be infinitely adjustable and feature a fine-adjustment mechanism. This adjustment must allow the activation threshold for the slack rope detection to be set individually and precisely for each individual supporting wire rope.</p> <p>The output of the slack rope detection system must be hardwired or safely communicated into the safety-related control architecture to execute a safety-directed shutdown according to the risk assessment derived from EN 17206.</p> <p><u>Cross-groove detection:</u></p> <p>All winches and hoisting drives of the upper and lower machinery utilizing grooved drums shall be equipped with a separate, dedicated, and hardware-based cross-groove / cross-winding detection system. This system must operate completely independently of any software-based position or load monitoring calculations.</p> |

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|     | <p>The system must reliably and instantaneously detect if a wire rope leaves its designated drum groove, jumps a groove, or begins to cross-wind (wrap over itself) during operation.</p> <p>Upon detection of a cross-groove or cross-winding fault, the system must instantly trigger a safe, immediate, and controlled emergency stop of the drive to prevent rope deformation, structural overloading, or unpredictable load displacement.</p> <p>The detection mechanism must function flawlessly across the entire travel range and under all operational speed profiles (including rapid acceleration and deceleration) as well as under varying load conditions.</p> <p>The detection system must feature a fine-adjustment mechanism to calibrate the sensor sensitivity precisely to the diameter and geometry of the specific wire ropes used. The mechanical tolerances of the detection device must prevent false triggering caused by normal, operational rope vibrations or slight dynamic oscillations.</p> <p>The output of the cross-groove detection system must be hardwired into the safety-related control architecture (Safety PLC) to ensure a safety-directed shutdown adhering to the risk assessment requirements of EN 17206.</p> <p><u>Wire ropes:</u></p> <p>Only standardized steel wire ropes in strict accordance with EN 12385-1, EN 12385-2, EN 12385-4, and EN 12385-5 may be used.</p> <p>The wire ropes and their specific terminations must fully comply with the safety specifications of EN 17206. All wire ropes must be dimensioned according to the Entertainment Load Limit (ELL) and the required specific safety factors.</p> <p>A Type 2.2 factory certificate according to EN 10204 must be presented for all wire ropes.</p> <p>To ensure stable lifting operations and uniform spooling, all wire ropes must be rotation-resistant (in accordance with EN 12385) and mechanically pre-stretched.</p> <p>For the wire rope terminations, the specifications of EN 17206 and EN 13411 must be strictly observed. Where wedge sockets or equivalent systems are utilized, the dead end of the rope must be secured with a proper rope clamp. The remaining loose wire rope tail behind the clamp must be completely enclosed and fixed to the live rope using a heavy-duty heat-shrink tube to ensure no open strands or sharp wires protrude from the connection.</p> <p>High-strength shackles (or approved theatre-grade quick-connectors) with safety pins must be provided to connect the rope termination to a turnbuckle used for rope length compensation. Turnbuckles must be explicitly designed for lifting applications, featuring lock nuts and positive anti-twisting devices (such as split pins or tension sleeves). The turnbuckles shall be securely attached to the system using safety-rated shackles.</p> <p>A detailed structural calculation must be submitted by the contractor to verify the necessary minimum breaking force (MBL) of each wire rope type and to prove adequate dimensioning for the respective application.</p> |

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|     | <p><u>Wire rope drums:</u></p> <p>The design and manufacturing of the wire rope drums must fully comply with the safety specifications of EN 17206. The drum groove profiles must be precisely machined in accordance with DIN 15061-2.</p> <p>The wire ropes must be wound strictly in a single layer only. To prevent the rope from jumping off the drum, the drum end flanges must project radially beyond the fully wound rope layer by at least 1.5 times the nominal rope diameter.</p> <p>Each wire rope must be securely attached to the drum using at least 3 independent rope clamps and must retain a minimum of 3 full safety windings on the drum when the load-bearing equipment is at its lowest operational position.</p> <p>All wire rope drums must be equipped with a continuous, spring-loaded rope pressure bar mechanism to actively prevent cross-groove winding or overlapping, ensuring the ropes remain securely seated within their designated groove profiles. The correct winding process on the drum must be continuously monitored via the automated control system.</p> <p>To minimize shaft deflection and guarantee structural rigidity under dynamic loads, all wire rope drums must be rigidly supported by bearings on both sides (no cantilevered drum mountings allowed).</p> <p><u>Wire rope pulleys:</u></p> <p>The design and manufacturing of all wire rope pulleys – including head pulleys, diverter pulleys, and drop pulleys – must fully comply with the safety specifications of EN 17206. The groove profiles of the pulleys must be precisely machined in accordance with EN 17206 and DIN 15061-1.</p> <p>To minimize operational noise during scenic movements, all pulley frames must be structurally decoupled from the building or steel framework to prevent the transmission of structure-borne noise. Where multiple pulleys are mounted on a single common shaft, suitable measures (such as low-friction thrust washers or axial spacers) must be implemented to eliminate mutual vibrations and friction between adjacent pulleys.</p> <p>To reduce rope wear and operational noise, all pulleys must be manufactured from high-grade, abrasion-resistant cast polyamide (PA 6G) or an approved equivalent material.</p> <p>All pulleys must be completely maintenance-free, permanently lubricated, and sealed dust-tight (IP-rated sealing). They must be rigidly supported on both sides using high-quality roller bearings or ball bearings to minimize deflection under load; the use of plain/sleeve bearings is strictly prohibited.</p> <p>All pulleys must be fitted with robust wire rope retainers (rope guards) at the entry and exit points. These protection devices must remain fully effective during underload or severe slack rope conditions, ensuring the rope cannot dislodge from the pulley groove.</p> <p><u>Safety Edges/Bumpers:</u></p> <p>Shearing and crushing points must be avoided by primary structural design. Where this is not feasible, suitable pressure-sensitive safety edges must be installed.</p> |

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|     | <p>The entire safety edge system (including the profile, transmission, and evaluation unit) must be safety-rated and suitable for applications up to Performance Level d (PL d), Category 3 in accordance with ISO 13849-1 (or SIL 2 according to IEC 62061).</p> <p>The safety edges must be dimensioned such that the available mechanical deformation travel (cushioning zone) of the rubber profile safely exceeds the maximum calculated braking and over-travel distance of the machinery. This calculation must account for the system operating at maximum speed with maximum payload, as well as the worst-case relative speed of any adjacent system traveling in the opposite direction. The profile type and height must be selected individually to suit the specific installation position and operational hazards.</p> <p>Upon activation of a safety edge, a safety-directed stop procedure (Stop Category 1 according to EN 60204-1) must be initiated immediately. If the hazard zone is formed by two moving systems, the control architecture must ensure that both the system with the activated edge and the adjacent moving system are brought to an immediate standstill.</p> <p>Following a safety edge shutdown, the control system must permit a restricted bypass command allowing operators to drive the causing system strictly in the opposite direction of its initial movement to safely release trapped persons or materials.</p> <p>The safety edges must operate on the closed-circuit principle to guarantee that any cable break, short circuit, or mechanical damage to the profile is immediately detected as a fault and prevents operation.</p> <p>All necessary substructures, mounting profiles, and routing channels for the safety edges must be fully included within the item unit prices of the respective systems.</p> <p><u>Control Electronics:</u></p> <p>The drive control electronics, including all axis controllers and frequency inverters, shall be installed either within centralized electrical enclosures located in dedicated electrical rooms or in localized control cabinets situated adjacent to the respective drive systems. The specific installation topology depends on the structural and system requirements and is defined within the individual item descriptions.</p> <p>All localized control cabinets installed outside of dedicated, clean electrical rooms (e.g., within the under-stage or over-stage machinery areas) must feature a minimum protection rating of IP54 to guarantee reliable protection against dust ingress and splashing water.</p> <p>All enclosures housing inverters or heat-generating electronic components must be equipped with an active, automatically regulated climate control system (such as filter fans or active cooling units). This system must be dimensioned to safely dissipate thermal loads and prevent overheating or condensation under all operational conditions.</p> <p>The entire installation must strictly adhere to EMC guidelines in accordance with EN 61800-3. This requires the mandatory use of continuous, high-attenuation shielded motor cables, proper large-surface EMC shielding clamps at all entry points, and appropriate line reactors or EMC filters to reliably suppress electromagnetic interference and protect adjacent safety systems.</p> |

## Technical Tender Specifications

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### 1. Technical Systems

The following stage machinery systems are the subject of this tender and must be supplied and installed:

- Revolving Stage, double  
Integrated into the Revolving Stage:
  - 3x Stage Lifts
  - 3x Compensating Lifts
- Revolving Ring

None of these stage machinery systems replace existing installations; rather, they are being installed for the first time. Therefore, existing infrastructure cannot be utilized. All substructures and mountings must be newly constructed.

The Revolving Stage - including the Stage Lifts - and the Revolving Ring are used for scenic purposes. This means that these systems are operated during performances, even in quiet moments, and people are moved while they are in motion.

This establishes strict requirements regarding operating noise and the design of the systems—with respect to both operation and the necessary safety equipment.

The Compensating Lifts are not used for scenic purposes or to transport people. Although they are sometimes moved during performances, they can be operated very slowly or at appropriate moments to minimize operating noise. Nevertheless, all design should prioritize low noise generation.

All these systems are controlled via the UNCIAN control system.

The wooden flooring for all levels of the stage machinery systems described here will be installed by another company.

## Technical Tender Specifications

| No.           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| <b>1.1.</b>   | <b>Stage Machinery</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>1.1.1.</b> | <b>Revolving Stage</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|               | <b>1. <u>General Description:</u></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|               | <p>This item comprises the Revolving Stage.</p> <p>The Revolving Stage must be designed as drum revolve with a cylindrical shape.</p> <p>The Revolving Stage has three sections, designated as follows:</p> <ul style="list-style-type: none"><li>– Upper deck or upper level – Upper platform at the same floor level as the stage floor.</li><li>– Lower deck or lower level – Lower platform at the same level as the understage.</li><li>– Technical level – Area within the pit and beneath the lower deck.</li></ul> <p>The upper and lower levels must be fully accessible from all sides.</p> <p>Three single-deck lifts must be integrated into the Revolving Stage. The three Stage Lifts are identical in design. Each features a platform and must be capable of traveling between the lower and upper levels of the Revolving Stage.</p> <p>Three Compensating Lifts must be integrated into the Revolving Stage. The Compensating Lifts are provided to close the opening for the Stage Lifts on the lower level of the Revolving Stage—thereby creating a continuous surface—as soon as the Stage Lifts move out of their lower position.</p> <p>To transmit power, signal, and network cables to the Revolving Stage, a slip ring must be provided at the stage's pivot point, within the slewing ring.</p> <p>Flexible cable supply systems must be provided to supply technical infrastructure to the movable Stage Lift decks for stage machinery (locking mechanisms, etc.) or media outlets (AV, stage lighting).</p> <p>Trapdoors and floor hatches for AV/lighting outlets are to be integrated into the upper deck of the Revolving Stage and the Stage Lifts.</p> <p>The entire Revolving Stage is to be constructed as a steel structure.</p> <p>Particular attention must be paid to installing the drive units in such a way that noise and vibrations are dampened.</p> <p>The pivot point of the Revolving Stage must be measured precisely before installation begins.</p> <p>This system is controlled entirely via the UNICAN control system. The interfaces for power management, control, and signal connections must be coordinated with UNICAN as part of the contractor design.</p> |

## Technical Tender Specifications

| No. | Description |
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### 2. Technical Specifications:

#### Performance parameters:

The Revolving Stage must have the following specifications:

- Dimensions:
  - Diameter upper deck: 9.5 m
  - Diameter lower deck: 9.5 m
  - Floor area upper deck: 70.9 m<sup>2</sup>
  - Floor area lower deck: 70.9 m<sup>2</sup>
  - Total height: 5.85 m
- Levels:
  - Floor level upper deck: 0 m
  - Floor level lower deck: - 4.05 m
  - Floor level pit: - 5.85 m
- Performance parameters:
  - Rotation speed, variable: 0,0033 m/s - 1.0 m/s  
(measured at the outer edge / 9 m diameter)
  - Control ratio: 1:300
  - Max. acceleration: 0.3 m/s<sup>2</sup>
  - Positioning accuracy: ± 3 mm
  - Duty cycle: continuous duty S1
- Load specifications upper deck:
  - Payload, static: 6 kN/m<sup>2</sup>
  - Total payload, static: limited to 120 kN
  - Point load, static: 9 kN  
based on an area of 200 x 200 mm
  - Payload, dynamic: 2.5 kN/m<sup>2</sup>
  - Total payload, dynamic: limited to 120 kN
- Load specifications lower deck:
  - Payload, static: 5 kN/m<sup>2</sup>
  - Total payload, static: limited to 120 kN
  - Point load, static: 5 kN  
based on an area of 200 x 200 mm
  - Payload, dynamic, lower deck: 2.5 kN/m<sup>2</sup>
  - Total payload, dynamic, lower deck: limited to 120 kN
- Noise emissions (measured in the first row of seats on the orchestra pit lifts):
  - S System active but in standby mode: 30 dB
  - Rotation at maximum speed/full load: 35 dB
  - Acceleration at 0,2 m/s<sup>2</sup>: 35 dB
  - Max. acceleration: 40 dB

#### Layout:

The Revolving Stage is to be installed in a pit specifically excavated for this purpose, which will have been constructed in advance during the summer of 2026. The depth of the pit, measured from the under-stage floor level, is 1.8 m. The pit has a rectangular

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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|     | <p>footprint measuring 10.5 m by 12 m. It is positioned to provide a clearance of 0.5 m between the Revolving Stage and the pit walls on the sides and rear, and a clearance of 2.5 m at the front.</p> <p>The under-stage floor level is approximately 4.05 m below the stage level.</p> <p>The total height of the Revolving Stage structure, from the pit floor to the top edge of the stage deck, is approximately 5,850 mm.</p> <p>The stage deck, which rests on steel supports, will be dismantled in the installation area prior to the installation of the Revolving Stage. Following the mechanical installation of the Revolving Stage, the deck will be fitted to interface with the Revolving Stage. The construction of the stage deck and its substructure will be carried out by other companies and is not part of this tender.</p> <p>The under-stage area encompasses the entire stage footprint, excluding the side stages. There is no floor covering on the concrete slab in the under-stage area. In the pit area, a raised floor—consisting of a timber deck on a steel substructure—will be installed at the under-stage floor level. Following the mechanical installation of the Revolving Stage, this floor will be fitted to interface with the Revolving Stage. The construction of the timber floor and its substructure will be carried out by other companies and is not part of this tender.</p> <p>A wooden floor is being installed by another contractor on both accessible levels of the Revolving Stage, including all Stage Lifts and Compensating Lifts. The wooden flooring assembly consists of the wooden floor panels, sleepers, shims, and impact sound insulation placed between the wood flooring and the steel structure of the Revolving Stage. Based on current planning, the total height of the wooden floor assembly is set at 145 mm. This build-up height must be taken into account during the planning of the Revolving Stage.</p> <p>Necessary maintenance access points in the wooden flooring must be coordinated with the construction designer at an early stage.</p> <p><u>Steel structures</u></p> <p>The structure of the Revolving Stage must be made of steel. The dimensions, profile types, and arrangement of the steel structures must be specified by the contractor as part of their planning. However, the following requirements must be considered.</p> <p>The design must adhere to the concept outlined in the tender drawings.</p> <p>The upper and lower levels of the Revolving Stage must be connected to one another by columns. The columns transfer the loads to the steel beams of the machine level in the pit, and on to the supports of the Revolving Stage. The columns transfer the loads from the upper and lower levels to the horizontal steel beams of the machine level in the pit, and on to the supports of the Revolving Stage.</p> <p>The exact arrangement of the columns depends on the overall structural design. However, the columns must maintain a minimum distance of 500 mm from the outer edge of the Revolving Stage to avoid the risk of crushing between these columns and the support columns of the Revolving Ring, which also maintain a minimum distance of 500 mm from the outer edge of the Revolving Stage.</p> <p>Furthermore, the columns must not be installed in the area of the access openings on the short sides of the Stage Lifts. The columns must not restrict the maximum possible</p> |

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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|     | <p>clear width of these access points; a clear access width of at least 1.0 m must be maintained here.</p> <p>Similarly, no columns may be installed in the area of the access openings on the long sides of the two outer Stage Lifts. A clear access width of at least 4.3 m must be maintained here. To handle the forces resulting from the wide span above these openings, a truss must be installed along the edge of each opening on both sides, supported by columns positioned to the left and right of the openings. The height of the truss must be selected to ensure a clear height of 3 m beneath it, measured from the floor level of the lower tier to the underside of the truss.</p> <p>The structural design of the upper deck must be as compact as possible to ensure maximum headroom between the lower deck and the steel structure of the upper deck. However, horizontal steel beams for the wooden flooring sleepers must be installed across the entire area of the upper and lower decks—with the exception of the openings for Stage Lifts, trapdoors, and floor hatches—at a maximum spacing of 600 mm.</p> <p>For the installation of the Stage Lifts and the Compensating Lifts, an opening measuring 5.4 x 5.4 m must be provided in the centre of the Revolving Stage. All necessary installation spaces for the integration of the Stage Lifts and Compensating Lifts must be provided. It is important to note that the drive units, consisting of motors, gearboxes, and drive shafts, must be installed in the lower part of the Revolving Stage below the lower deck; no drive components, except for the vertical support cables of the Stage Lifts, may be installed above the lower deck.</p> <p>Necessary supports for the drive components, including pulleys, must be provided.</p> <p>To horizontally stabilize the vertical movement, the Stage Lifts must be guided along their entire travel path. The guide rails are to be mounted on vertical steel beams between the lower and upper levels of the Revolving Stage, outside the operating range of the Stage Lifts. The guide rails must be precisely aligned to ensure accurate guidance. They must be constructed to allow for smooth, quiet movement, free from jerking or rattling. Any joints along the guide rails must be continuously welded and ground flush across the entire surface.</p> <p>To prevent the Stage Lifts from sinking under heavy loads due to wire rope stretching while stationary, a locking mechanism must be provided at each corner of the platforms. This mechanism consists of locking bolts mounted on the platforms that can move linearly.</p> <p>Locking rails featuring a row of locking holes must be installed as mating components along the entire travel range of the Stage Lifts. These locking rails must be mounted on vertical steel beams located between the lower and upper levels, outside the operating path of the Stage Lifts. Upon reaching the parking positions, the locking bolts are engaged and driven horizontally into the holes in the locking rails.</p> <p>The hole spacing must allow for locking at 200 mm intervals. The geometry of the locking bolts and the holes in the locking rails must be precisely matched and designed to withstand the static payload of the Stage Lifts. To avoid structural stress caused by misalignment of the locking holes, the locking rails must be manufactured and installed with high precision.</p> |

## Technical Tender Specifications

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|     | <p>All necessary installation spaces for the integration of electrical cabinets must be provided. In total, space must be provided for 6 electrical cabinets for the Stage Lifts, 3 electrical cabinets for the Compensating Lifts, 1 cabinet for AV power, 1 cabinet for work and blue lights, and a 19" rack for AV network and signal distribution. Each electrical cabinet has a maximum footprint of 1000 x 600 x 400 mm (H x W x D). The rack has a maximum footprint of 1000 x 600 x 500 mm (H x W x D). If the design limits the available height, this must be coordinated with the other designers as part of the contractor's design process.</p> <p>A total of 4 openings for trapdoors and 8 openings for floor hatches must be integrated in the upper deck of the Revolving Stage.</p> <p>The use of personal lifts is planned for these trapdoors in the future. Each trapdoor opening must be designed to accommodate a trapdoor panel measuring 1.1 x 1.1 m, which, when removed, leaves a free area of 1 x 1 m.</p> <p>Connection boxes with AV and stage lighting outlets will be mounted beneath the openings for the floor hatches. Based on current planning, the connection boxes measure 300 x 450 x 175 mm (W x L x D). Mounting brackets must be provided for these connection boxes. Provision must be made for the necessary opening - including the edge profiles - and the integration must be coordinated with the AV designer.</p> <p>The trapdoors and floor hatches themselves are not part of this tender and will be supplied by a different contractor. However, the size and design of the trapdoor/floor flap supports must be coordinated with the construction designer.</p> <p>The outer edges of both levels of the Revolving Stage, as well as all edges bordering the central openings for the Stage Lifts, trapdoors, and floor hatches, must be constructed using L-shaped angle profiles aligned precisely with the floor level of the surrounding areas. A structural floor assembly thickness of 145 mm must be taken into account for this purpose; the exact height is yet to be determined by the respective specialist planners.</p> <p>Deflection of the overall structure under full load must not result in jerky movements of the Revolving Stage or Stage Lifts, increased noise emissions, erroneous position measurements, functional impairments, misalignment with surrounding floor surfaces, or permanent deformation of components.</p> <p>The design must be torsionally rigid to withstand the forces resulting from dead weight and maximum payload during maximum acceleration and braking. In addition to the structural analysis of the entire assembly, torsional rigidity must be verified for both Category 1 and Category 0 stops.</p> <p>The entire structure of the Revolving Stage must be aligned with such precision that, regardless of the Revolving Stage's parked position, the maximum vertical offset of the upper and lower level are relative to a defined reference elevation does not exceed <math>\pm 2</math> mm.</p> <p><u>Support for the Revolving Stage</u></p> <p>The Revolving Stage is supported at its pivot point by a central bearing—designed as a ball-bearing slewing ring—and by track rollers along the outer circumference. The</p> |

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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|     | <p>entire steel structure of the Revolving Stage must be designed to distribute the load between the bearing and the track rollers at the outer edge.</p> <p>The central bearing and the track rollers must be installed on the concrete floor slab of the pit. Measures for noise decoupling between the Revolving Stage structure and the concrete floor must be taken.</p> <p>The central bearing and the track rollers must be designed with the lowest possible overall height to allow maximum installation space for the drive units and electrical cabinets.</p> <ul style="list-style-type: none"><li>– Track rollers:<br/>The track rollers must be arranged in pairs and mounted on plinths on the concrete floor. It must be possible to route cable trays between the plinths. Track rollers must be adjustable in height to compensate for tolerances in the revolve structure. They must be mounted exactly tangentially to the centre of the Revolving Stage to minimize frictional forces, and installed at precisely the same height to ensure continuous full-surface contact between the rollers and the track.<br/><br/>Track rollers must have cast steel cores with ball bearings and flat profile rubber wheels made of Vulkollan® as tread which must be oil and grease-resistant.<br/><br/>The running track for the track rollers is running above the track rollers. The running track must be made of thick sheet steel. The running track must be installed to allow for smooth, quiet movement, free from jerking or rattling. Any joints along the running track must be continuously welded and ground flush across the entire surface</li><li>– Central bearing:<br/>The central bearing must be a high-precision, heavy-duty central slewing ring bearing to serve as the main centre pivot.<br/><br/>The bearing must be dimensioned to withstand all static, dynamic, and asymmetric loads occurring during stage operations, including:<ul style="list-style-type: none"><li>• Maximum axial loads (dead weight of the Revolving Stage structure plus full live load / scenic elements)</li><li>• Tilting moments resulting from eccentric load distribution on the Revolving Stage</li><li>• Horizontal loads occurring during operation, e.g., from forklifts</li></ul><br/>The bearing must be an ungeared type.<br/><br/>The diameter of the central slewing bearing must be large enough to allow the slip ring units to be installed within the bearing. However, for reasons of load distribution, the diameter should not be less than 1.5 m.<br/><br/>The bearing must be rated for continuous duty (S1 operation), capable of continuous rotation for up to 60 minutes under full operational load without excessive heat generation or degradation.</li></ul> |

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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|     | <p>The slewing ring must be specially optimized for silent operation suitable for theatrical environments.</p> <p>The bearing must exhibit low and consistent rotational resistance (running torque) across all speed ranges to ensure smooth, judder-free motion starting from a standstill.</p> <p>The bearing must feature minimal backlash (reduced clearance / preloaded) to prevent any noticeable tilting, wobbling, or shifting of the Revolving Stage during movement or when heavy scenic loads cross the gap to the fixed stage floor.</p> <p>The bearing must be equipped with high-efficiency, durable lip seals (integral seals) on both sides to prevent dust, stage debris, and scenic fluids from entering the raceways, and to retain lubrication.</p> <p>Re-lubrication ports (grease nipples) must be easily accessible.</p> <p>Deliverables must include complete technical documentation, structural calculations, load charts, installation instructions, a lubrication schedule, and a factory test certificate according to EN 10204 - 3.1.</p> <p><u>Drive train:</u></p> <p>The Revolving Stage must be moved by independent friction drive units acting directly upon a dedicated drive ring (friction rim) mounted underneath the stage platform. The number of drive units may be determined by the contractor, but no fewer than two and no more than six drive units should be provided.</p> <p>The frequency-controlled electric motor drive and the gearbox must be designed in accordance with the requirements listed here.</p> <p>The complete drive train must be rated for continuous duty (S1 / 100% duty cycle) according to EN 60034-1.</p> <p>The drives must provide smooth, variable speed control from an ultra-low crawl speed up to maximum operational speed. Acceleration and deceleration ramps must be fully adjustable via the control system to ensure judder-free starts and stops.</p> <p>The motors must be mounted on machine frames. The machine frames must be anchored to the concrete floor. The individual drives must be fitted with easily removable wire mesh guards with a mesh size of less than 25 mm. The entire drive unit (including motors and gearboxes) must be mounted with structure-borne noise isolation to ensure quiet operation.</p> <p>Two friction wheels must be installed for each drive for a better transmission of the driving forces. Both friction wheels must link mechanically. Each drive unit must feature an adjustable, spring-loaded or pneumatic contact pressure mechanism to maintain constant and optimal traction against the drive ring, effectively preventing wheel slippage under all dynamic load conditions.</p> <p>The friction wheels must be equipped with specialized, heavy-duty coatings optimized for high traction, minimal wear, and silent running. The material must not develop "flat spots" during prolonged standstill periods under load.</p> <p>The friction wheel drive unit must be pressed against the Revolving Stage structure by spring-loaded tensioning screws. Contact pressure must be adjusted by these</p> |

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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|     | <p>tensioning screws. The tensioning mechanism must be mounted to brackets that must be fixed either to the concrete floor of the pit. The springs must compensate for minor inaccuracies of the structures. Measures for noise decoupling between the steel mounting structure of the friction wheel drive unit and the concrete floor must be taken. A sound absorbing enclosure might be installed around the entire friction wheel drive unit to reach the required noise levels.</p> <p>Deliverables must include complete electrical schematics, torque and traction calculations, motor data sheets, and maintenance manuals.</p> <p><u>Temperature monitoring:</u></p> <p>Every motor must be equipped with a temperature monitoring system. The temperature monitoring system must utilize a bimetallic switch in a normally closed configuration.</p> <p>Benchmark product: <i>Klixon</i> or equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.</p> <p><u>Brakes:</u></p> <p>Each drive unit must be equipped with an electromagnetic brake. Each brake must be capable of safely stopping and holding the fully loaded Revolving Stage from maximum speed in the event of an emergency stop or power failure.</p> <p>"The brake gap monitoring system for all brakes shall utilize contactless inductive proximity switches to reliably detect the release and wear status; the use of standard mechanical microswitches is strictly prohibited.</p> <p><u>Encoders:</u></p> <p>Encoders must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p>Encoders must provide real-time feedback for exact positioning, speed synchronization between multiple units, and slippage detection.</p> <p>The Revolving Stage must be equipped with one high-resolution rotary absolute encoder with a separate wheel and CANopen communication interface (compliant with CiA 406).</p> <p>Additionally, all motor shafts must be provided with incremental encoders utilizing an RS422 interface (24V), featuring two tracks shifted by 90 degrees for precise direction and speed detection.</p> <p>In addition, UNICAN will install a proprietary path-measurement system based on RFID technology. The RFID antennas will be mounted on the Revolving Stage along the outer edge at the level of the technical deck within the pit, while the receiver units will be installed in the pit itself. Documentation regarding the RFID components is provided in the appendix to this tender. The exact number of RFID antennas required has not yet been determined; however, installation space must be provided for a large number of these antennas above the profiles for the drive pressure rollers and</p> |

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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|     | <p>beneath the access doors for the electrical cabinets. UNICAN will be responsible for installing all components of the RFID system.</p> <p><u>Safety bumpers:</u></p> <p>Safety bumpers must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p>Safety bumper executed as a foam-molded part, utilizing a dual-channel monitored safety interface compliant with PL d / Category 3 requirements. Direct wiring to the failsafe inputs of the safety PLC is permitted, provided that continuous cross-fault and wire-break monitoring is ensured</p> <p>To provide flawless protection against shearing and crushing hazards, tactile safety bumpers must be installed on all four sides along the edges of the openings for the Stage Lifts and beneath the upper deck structure of the Revolving Stage to provide protection against shearing and crushing.</p> <p>The following total lengths are required:</p> <ul style="list-style-type: none"><li>– 2 x 5.4 m (along the edges at the sides of Stage Lifts 1 and 3)</li><li>– 6 x 1.8 m (along the ends of the Stage Lifts)</li></ul> <p>Benchmark product: <i>Haake</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.</p> <p><u>Axis controller:</u></p> <p>The axis controllers are supplied and installed by UNICAN.</p> <p>Even if the positioning accuracy is achieved via the control system, neither the mechanical design nor the selection of drive components must compromise the target positioning accuracy of +/- 3 mm. This also applies to repetitive movements.</p> <p><u>Frequency inverters:</u></p> <p>The Frequency inverters are supplied and installed by UNICAN.</p> <p><u>Control cabinets:</u></p> <p>All control cabinets and electrical cabinets for the stage machinery are supplied and installed by UNICAN.</p> <p><u>Cabling:</u></p> <p>Cabling must comply with the specifications in the Technical Preliminary Remarks.</p> <p>All necessary cable connections between the electrical/electromechanical system components and the UNICAN control cabinets must be established and accounted for. The cables must be connected at the component end. UNICAN will handle the connection of the cables to the control cabinets. The supply and installation of the cables and cable support systems must be fully included in the unit price for the Revolving Stage.</p> |

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For the cost calculation, an average cable length of 12 m is to be assumed for these cables.

### Cable trays for other cables:

Cable trays must be supplied and installed for the cabling of other trades. The following cable routes must be established:

- from the slip ring assembly terminal boxes to the UNICAN control cabinets
- from the slip ring assembly terminal boxes to the AV and show lighting system electrical cabinets/racks
- from the AV and show lighting system electrical cabinets/racks to the outlet boxes on the Revolving Stage
- from the AV and show lighting system electrical cabinets/racks to the terminal boxes of the Stage Lift dynamic cable carriers
- from the dynamic cable carriers to the AV and show lighting outlet boxes

Sizes, quantities, and routing paths are currently still being finalized.

The following quantities should be included for cost estimation purposes:

- 25 m cable tray 200/60 mm
- 40 m cable tray 100/60 mm
- 20 m rigid steel conduit DN32
- 40 m rigid steel conduit DN20

### Access doors:

To secure access to Stage Lifts 1 through 3, self-closing, switch-monitored doors must be installed at the ends of the Stage Lifts, between the enclosures of the steel columns. The doors must have a minimum height of 2.2 m and feature wire mesh with a mesh size of less than 20 mm.

The doors must be installed at a distance of at least 100 mm from the shear edge.

The door locking mechanism shall be executed as a heavy-duty safety switch featuring a separate actuator bar and a 24V DC power supply for integrated guard locking monitoring.

Benchmark product: *Schmersal AZM 161* or approved equivalent  
Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.

### Plug-in railings:

Plug-in railings must be provided to secure the access points along the long sides of Stage Lifts 1 and 3. These railings must be 1,100 mm high and feature both a handrail and a knee rail. A profile at the base must prevent a person's foot from passing underneath the railing.

Floor sockets must be provided for the plug-in railings; these sockets must be equipped with a switching contact that signals the presence of the inserted railing to the control system, thereby enabling movement commands for the Stage Lifts.

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|     | <p>Plugs must be supplied to seal the socket openings when the railings are not in place.</p> <p>The plug-in railings must be installed at a minimum distance of 150 mm from the shear edge.</p> <p>The plug-in railing monitoring system shall utilize high-durability mechanical position switches equipped with a standard roller lever to reliably detect the insertion status (inserted/removed) within the floor sockets.</p> <p>Benchmark product: <i>Schmersal 236</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.</p> <p><u>Enclosures and covers:</u></p> <p>The supports located between the lower and upper levels—including the pulleys, locking rails, guide rails, and the associated cable and wire rope routing—must be fully enclosed around their entire circumference to the greatest extent possible. Vertical slots must be provided in the cladding to accommodate the movement of the platforms, the locking mechanism, and the wire rope feeds; these slots must be fitted with brush strips to prevent the ingress of small objects.</p> <p>Furthermore, full-surface cladding must be installed along the outer edge of the Revolving Stage to enclose the technical level located in the pit beneath the lower level. Removable access panels for the control cabinets must be integrated into this cladding. In addition, a removable access panel must be provided to allow access to the technical level for maintenance work on the drive systems for the Stage Lifts, the Compensating Lifts, and the slip ring. If not all components can be reached from a single access point, multiple access points must be provided accordingly.</p> <p>The removal and installation of the access panels must be possible without tools. Additionally, an access door must be incorporated to provide maintenance access to the technical level, which houses the Stage Lift and Compensating Lift drives as well as the slip ring assembly.</p> <p>Openings must be provided for the RFID antennas of the UNICAN positioning system. The details of this arrangement must be coordinated with UNICAN as part of the Contractor's design.</p> <p>The lift shaft for the Compensating Lifts must also be fully clad.</p> <p>The enclosures and covers must be constructed from birch plywood with the following properties:</p> <ul style="list-style-type: none"><li>– Beech plywood in accordance with EN 13986 and EN 636-2 S</li><li>– face grades B/BB as per EN 635-2</li><li>– formaldehyde release class E1</li><li>– flame-retardant Euroclass B-s1, d0 according to EN 13501-1</li><li>– sanded both sides</li><li>– Minimum thickness 10 mm</li></ul> <p>Material thickness is to be selected based on the substructure requirements, ensuring adequate protection against impact during normal operation and maintaining the dimensional stability of the enclosures and covers.</p> |

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Edges must be protected with metal edge guards.

The cladding around the technical level within the pit can optionally be executed using wire mesh, in compliance with the requirements of EN 294.

The necessary substructures and mounting brackets for the cladding and covers must be provided.

### Warning Signs:

Four backlit signs with two-line text must be installed in the Understage area around the Revolving Stage as warning signs when the movement is activated. The text is to be agreed on. The cost of these signs must be included in the item price.

### **3. Scope of work:**

The following list provides an overview of the services to be performed by the contractor. However, these tasks provide only an overview and are not limited to the items listed:

- Contractor's design for the systems described herein with the specified properties and taking into account the given assembly conditions -> the construction design must comply with the requirements of the Preliminary Technical Remarks
- Submission of the contractor's design for approval to the client
- Prefabrication and configuration of all components
- Delivery of all components to the construction site
- Provision of all components required for in-house transport from delivery to the assembly position
- Installation of the necessary substructures, mounting fixtures and fixing points
- Installation of the Revolving Stage structure
- Installation of the drive units
- Installation of the electrical infrastructure
- Installation of all necessary cables
- Assisting the commissioning of the systems (testing system parameters, brakes, safety functions) by UNICAN
- Submission of the technical documentation for approval to the client -> the documentation must comply with the requirements of the Preliminary Technical Remarks
- Participation in and support of the inspection tests as specified in the Preliminary Technical Remarks
- Participation in and support of the acceptance tests with the client as specified in the Preliminary Technical Remarks

### **4. Components to be delivered and installed:**

All components necessary for a functioning system must be supplied, even if they are not explicitly listed. The scope of the components to be supplied also depends on the manufacturer-specific system configuration. However, the system essentially consists of but is not limited to the following components:

- Revolving Stage structure
- Central bearing

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|     | <ul style="list-style-type: none"><li>– Track rollers including running track</li><li>– Steel frames for the trapdoors</li><li>– Access doors and guardrails</li><li>– Mounting structure for the slip ring</li><li>– Mounting structure for the dynamic cable carriers</li><li>– Friction drive units / gearbox / brakes</li><li>– Encoders</li><li>– Safety Bumpers</li><li>– Cables and cable support systems</li><li>– All necessary small and fastening parts</li><li>– Enclosures and covers</li><li>– Backlit warning signs</li></ul> |

### 1.1.2. Stage Lifts

#### 1. General Description:

This item covers the Stage Lifts on the Revolving Stage. The Stage Lifts must be installed in the Revolving Stage - within the previously described open area at the centre of the stage - as shown in the drawings.

The drive trains must be located beneath the Compensating Lifts provided under the Stage Lifts.

All three Stage Lifts are identical and must be designed for transporting persons during rehearsals and performances. This results in stringent requirements regarding operating noise and safety devices.

Trapdoors and floor hatches for AV/lighting outlets are to be integrated into the platforms of the Stage Lifts.

The entire Stage Lifts are to be constructed as a steel structure.

Particular attention must be paid to installing the drive units in such a way that noise and vibrations are dampened.

These systems are controlled entirely via the UNICAN control system. The interfaces for power management, control, and signal connections must be coordinated with UNICAN as part of the contractor design.

#### 2. Technical Specifications:

##### Performance parameters:

The Stage Lifts must have the following specifications:

- Dimensions:
  - Platform length: 5.4 m
  - Platform width: 1.8 m
  - Platform area: 9.72 m<sup>2</sup>
- Performance parameters
  - Travel speed, variable: 0,001 m/s – 0,3 m/s

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|     | <ul style="list-style-type: none"> <li>Control ratio: 1:300</li> <li>Max. acceleration: 1.0 m/s<sup>2</sup></li> <li>Positioning accuracy: ± 1.0 mm</li> <li>Travel: 4.05 m</li> <li>Duty cycle: S3/40%</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|     | <ul style="list-style-type: none"> <li>Load specifications upper deck: <ul style="list-style-type: none"> <li>Payload, static: 6 kN/m<sup>2</sup></li> <li>Total payload, static: 58.32 kN</li> <li>Point load, static: 9 kN<br/>based on an area of 200 x 200 mm</li> <li>Payload, dynamic: 2.5 kN/m<sup>2</sup></li> <li>Total payload, dynamic: 24.3 kN</li> </ul> </li> <li>Noise emissions (measured in the first row of seats on the orchestra pit lifts): <ul style="list-style-type: none"> <li>System active but in standby mode: 30 dB</li> <li>Movement at maximum speed/full load: 35 dB</li> <li>Acceleration at 0.5 m/s<sup>2</sup>: 35 dB</li> <li>Max. acceleration: 40 dB</li> </ul> </li> </ul> |

### Layout:

The Stage Lifts must travel between the under-stage area at -4.05 m and the stage level; to achieve this, the platforms must be guided along the entire travel path. The guide rails required for this purpose are already described in the section on the Revolving Stage and must be priced there as well. Guide shoes compatible with these guide rails must be mounted at all four corners of the Stage Lifts.

The Stage Lifts must be driven by a wire rope winch drive with four support cables each.

Attachment points for the winch drive wire ropes must also be provided at all four corners. From there, the wire ropes are routed via pulleys to the drive units. This requires one pulley per wire rope at the upper deflection point, located directly beneath the deck of the Revolving Stage. Depending on the positioning and design of the drive unit, multiple pulleys may also be required.

To prevent the Stage Lifts from lowering while at rest due to rope elongation under heavy loads, a locking mechanism must be provided to secure them in the stationary position.

The locking rails required for this purpose are already described in the section on the Revolving Stage and must be priced there as well.

In addition to the components already described, locking bolts compatible with the locking rails must be provided at all four corners of the Stage Lifts.

A wooden floor is being installed by another contractor on the Stage Lifts. The wooden flooring assembly consists of the wooden floor panels, sleepers, shims, and impact sound insulation placed between the wood flooring and the steel structure of the Revolving Stage. Based on current planning, the total height of the wooden floor assembly is set at 145 mm. This build-up height must be taken into account during the planning of the Revolving Stage.

Power and signal supply for the locking units and limit switches is provided via flexible cable supply systems, which are described as a separate item. Provision must be

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|     | <p>made for the necessary installation space, mounting points, and cable strain relief mechanisms on the Stage Lift platforms.</p> <p>In addition, connection boxes with outlets for AV and stage lighting systems, as well as fixtures for work lights and blue lights, are to be installed beneath every two floor hatches per platform. These are supplied via flexible cable supply systems that are separate from the power lines serving the stage machinery. Provision must be made for the necessary installation space, mounting points, and cable strain relief mechanisms on the Stage Lift platforms.</p> <p><u>Steel structures</u></p> <p>The structure of the Stage Lifts must be made of steel. The dimensions, profile types, and arrangement of the steel structures must be specified by the contractor as part of their planning. However, the following requirements must be considered.</p> <p>The design must adhere to the concept outlined in the tender drawings.</p> <p>The platforms must be constructed as dimensionally stable, torsion-resistant frames.</p> <p>The Stage Lift platforms must be designed to be as compact as possible to minimize the overall structural height, as Compensating Lifts must be installed beneath the Stage Lifts at the lower level, and the available installation space in this area is limited.</p> <p>Horizontal steel beams serving as the substructure for the wooden flooring must be installed across the entire surface area of the platforms—with the exception of openings for trapdoors and floor hatches—at a maximum spacing of 600 mm.</p> <p>A total of 4 openings for trapdoors and 2 openings for floor hatches must be integrated in the upper deck of the Revolving Stage as shown in the tender drawings.</p> <p>The use of personal lifts is planned for these trapdoors in the future. Each trapdoor opening must be designed to accommodate a trapdoor panel measuring 1.1 x 1.1 m, which, when removed, leaves a free area of 1 x 1 m.</p> <p>Removable beams must be installed between the trapdoors to support the trapdoors. These supports are to be fastened to the steel structure of the Stage Lifts using either detachable bolted connections or suitable pin connections. It must be possible to open the entire connected area of the individual trapdoors by dismantling these beams. The areas for the trapdoors must therefore be kept free of any structures to ensure full access. This must allow for the creation of an opening measuring up to 4.3 x 1 m.</p> <p>Connection boxes with AV and stage lighting outlets will be mounted beneath the openings for the floor hatches. Based on current planning, the connection boxes measure 140 x 300 x 175 mm (W x L x D). Mounting brackets must be provided for these connection boxes. Provision must be made for the necessary opening - including the edge profiles - and the integration must be coordinated with the AV designer.</p> <p>The trapdoors themselves are not part of this tender and will be supplied by a different contractor. However, the size and design of the trapdoor supports must be coordinated with the construction designer.</p> <p>The side surfaces between the corner profiles of the stage floor and the safety edges must be smooth and fully enclosed.</p> |

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|     | <p><u>Guide carriages</u></p> <p>Four guide carriages compatible with the Revolving Stage's guide rails must be mounted at the four corners of the lifting platform. Together with the guide rails, they must form a rigid, heavy-duty linear guidance system to ensure precise vertical movement of the Stage Lifts without tilting, twisting, or jamming. The guide carriages must feature a low-backlash design to minimize lateral play and eliminate horizontal swaying during movement. The entire guiding system must be engineered for ultra-low noise and vibration-free running.</p> <p>The guide systems must be aligned with extreme accuracy. For this purpose, the guide carriages must have sufficient capability for precise adjustment and alignment.</p> <p>The material used for the contact surfaces must ensure low starting and running resistance as well as minimal noise generation and a long service life. A metal-on-metal guide arrangement is not acceptable.</p> <p><u>Locking system:</u></p> <p>A heavy-duty, automated static locking system must be installed to mechanically secure the Stage Lifts in their designated rest or performance positions. For this, locking bolts must be installed at each corner of the lifting platforms. These can be extended into locking rails at each corner of the Stage Lift below the platform to lock the Stage Lifts in place when parking.</p> <p>The system must utilize electromechanically actuated locking bolts that engage automatically once the Stage Lift reaches its target position. To achieve this, the locking bolts must be guided in horizontal sliding guides and equipped with electric linear actuators and limit switches.</p> <p>The geometry of the locking bolts must be tapered pins that match the conical sockets in the locking rails. The locking mechanism must provide a completely backlash-free (zero-play) connection between the Stage Lift platform and the Revolving Stage substructure to eliminate any vertical or horizontal movement, wobbling, or vibrations when the lift is static.</p> <p>The sliding guides must have sufficient capability for precise adjustment and alignment.</p> <p>The mechanism must be robust enough to withstand the operational forces, including asymmetrical live loads, impact loads from scenic elements, and theatrical performances.</p> <p>The locking mechanism must remain securely engaged in the event of a power failure or loss of control signal (mechanical self-locking or spring-applied holding).</p> <p>Each individual locking unit must be equipped with limit switches or proximity sensors to continuously monitor the exact status: "Fully Locked" and "Fully Retracted".</p> <p>The locking and unlocking process must be fast, smooth, and optimized for silent operation suitable during live performances.</p> <p><u>Drive train:</u></p> <p>Each Stage Lifts must be moved by a motorized winch drive system. The electric motor drive and the gearbox must be designed in accordance with the requirements</p> |

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|     | <p>listed here. It is up to the contractor to decide whether to use one or two motors. If two motors are used, they must be mechanically synchronized via drive shafts.</p> <p>When arranging the drive components for the central Compensating Lift, the dimensions of the Revolving Stage's slip ring must be taken into account.</p> <p>The complete drive train must be rated for Intermittent periodic duty with a cyclic duration factor of 40% (S3 / 40%) according to EN 60034-1.</p> <p>The drives must provide smooth, variable speed control from an ultra-low crawl speed up to maximum operational speed. Acceleration and deceleration ramps must be fully adjustable via the control system to ensure judder-free starts and stops.</p> <p>The entire drive unit (including motors and gearboxes) must be mounted with structure-borne noise isolation to ensure quiet operation. The entire drive assembly (including motors and gearboxes) must be engineered for silent operation. The drive unit must be installed with vibration isolation.</p> <p>The Stage Lifts are each suspended from four wire ropes and moved by means of them. For this purpose, a wire rope is attached to each corner of the lifting platform and routed via upper and lower pulleys to the corresponding wire rope drum. The wire ropes must be monitored for slack. The drums must also be equipped with a cross-groove detection system.</p> <p>The contractor is free to use a reeved cable arrangement or counterweights to reduce the lifting load. However, the use of counterweights must not restrict access widths to the Stage Lifts.</p> <p>The cable systems must feature a length compensation mechanism to account for cable elongation.</p> <p>Certified cable end terminations and tensioning devices must be used.</p> <p>Drive speeds must be continuously adjustable and independent of the load, within the specified minimum and maximum values.</p> <p>A lockable maintenance switch must be provided for each drive train. Each maintenance switch must simultaneously disable all individual drives within a drive train.</p> <p><u>Temperature monitoring:</u></p> <p>Every motor must be equipped with a temperature monitoring system. The temperature monitoring system must utilize a bimetallic switch in a normally closed configuration.</p> <p>Benchmark product: <i>Klixon</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.</p> <p><u>Brakes:</u></p> <p>Each drive unit must be equipped with two independent electromagnetic brakes. Each brake must be capable of safely stopping and holding the fully loaded Stage Lift from maximum speed in the event of an emergency stop or power failure. The brakes must be equipped with brake gap monitoring.</p> |

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|     | <p>The brake gap monitoring system for all brakes shall utilize contactless inductive proximity switches to reliably detect the release and wear status; the use of standard mechanical microswitches is strictly prohibited.</p> <p><u>Encoders:</u></p> <p>Encoders must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p><i>Motor Shaft Encoder Units:</i></p> <p>All motor shafts shall be equipped with a combination absolute and incremental encoder unit operating at 24V.</p> <p>The incremental component shall utilize an RS422 interface featuring two tracks shifted by 90 degrees for precise direction and speed detection.</p> <p>The absolute component shall feature a Synchronous Serial Interface (SSI) via RS422, providing a minimum resolution of 8,192 steps per turn (13-bit single-turn) and a measuring range of at least 4,096 turns (12-bit multi-turn).</p> <p>To ensure high operational reliability and zero-maintenance operation, the absolute encoder must not utilize a battery backup system for position retention.</p> <p>Benchmark product: <i>TR Electronic CE58</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product, and must be programmable via an RS232 interface or an approved equivalent configuration tool.</p> <p>Alternative Configuration: As a fully permissible alternative to the primary motor shaft configuration, the contractor may offer a Safety Integrity Level 3 (SIL3) certified encoder solution mounted on the motor shaft. This alternative unit shall feature a redundant electrical interface consisting of two separate SSI channels (2x SSI) combined with one incremental output channel (1x incremental), while strictly adhering to all other voltage, resolution, battery-free, and physical specification requirements detailed in the primary baseline profile.</p> <p><i>Drum Shaft Encoder Units:</i></p> <p>A secondary encoder system shall be supplied and installed on the drum shaft. The technical characteristics, electrical interfaces, signal configurations, resolution, programming capabilities, and battery-free multi-turn design of this secondary unit shall strictly match the identical specifications defined for the primary motor shaft encoders above.</p> <p><u>Limit switches:</u></p> <p>Limit switches must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p>All systems used for lifting people like stage lifts shall be equipped with a redundant, safety-rated limit switch configuration suitable for implementation in a SIL3 (Safety Integrity Level 3) safety function.</p> <p>Benchmark product: <i>Stromag 51 series</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.</p> |

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|     | <p><u>Load measurement:</u></p> <p>Load measurement must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p>The direct load monitoring system shall utilize high-precision load sensors featuring dynamic reserve capabilities and a 4...20 mA analogue output, including an integrated +4 mA test option that allows for safe functional verification without affecting active control signals or process operations."</p> <p>The integrated load sensing system must guarantee a measurement accuracy of at least <math>\pm 5\%</math> relative to the maximum permissible payload of the Stage Lift. This accuracy must be maintained across the entire specified vertical travel path.</p> <p>The load sensors and their mounting assemblies must be structurally and electronically rated to withstand all maximum dynamic loads, peak forces, and shock loads. This specifically includes the transient dynamic forces occurring during sudden acceleration, deceleration, and emergency braking sequences, precisely under Category 1 (controlled stop) and Category 0 (uncontrolled stop) braking events. The sensors must deliver reliable, drift-free measurements immediately after such events without requiring recalibration.</p> <p>Benchmark product: <i>Primosensor MA-***kN-T101</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.</p> <p><u>Slack-rope detection:</u></p> <p>Slack-rope detection must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p>The slack wire detection system at the drum shall be executed utilizing an insulated copper busbar assembly to reliably monitor rope tension and detect any slack conditions across the entire wrapping area.</p> <p><u>Cross-groove detection:</u></p> <p>Cross-groove detection must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p>The cross-groove and cross-winding detection system at the drum shall be executed utilizing an insulated copper busbar assembly or a spring-loaded roller bar equipped with two switches configured as both normally closed (N.C.) and normally open (N.O.), to reliably detect any improper rope tracking or groove-jumping across the entire wrapping area.</p> <p><u>Safety bumpers:</u></p> <p>Safety bumpers must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p>Safety bumpers executed as a foam-molded part, utilizing a dual-channel monitored safety interface compliant with PL d / Category 3 requirements. Direct wiring to the failsafe inputs of the safety PLC is permitted, provided that continuous cross-fault and wire-break monitoring is ensured.</p> |

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| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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|     | <p>To provide flawless protection against shearing and crushing hazards, tactile safety bumpers must be installed on all four sides along the outer perimeter of the Stage Lifts, as well as beneath the upper deck structure where hazardous gaps or trapping points may occur during vertical movement.</p> <p>To provide flawless protection against shearing and crushing hazards, tactile safety edges must be installed on all four sides along the outer perimeter of the Stage Lifts, as well as beneath the upper deck structure where hazardous gaps or trapping points may occur during vertical movement.</p> <p>The system must cover the following total lengths per Stage Lift:</p> <ul style="list-style-type: none"><li>– 2 x 5.4 m (installed along the long sides of the Stage Lifts)</li><li>– 2 x 1.8 m (installed along the short sides of the Stage Lifts)</li></ul> <p><u>Axis controller:</u></p> <p>The axis controllers are supplied and installed by UNICAN.</p> <p>Even if the positioning accuracy is achieved via the control system, neither the mechanical design nor the selection of drive components must compromise the target positioning accuracy of +/- 1 mm. This also applies to repetitive movements.</p> <p><u>Frequency inverters:</u></p> <p>The Frequency inverters are supplied and installed by UNICAN.</p> <p><u>Control cabinets:</u></p> <p>All control cabinets and electrical cabinets for the stage machinery are supplied and installed by UNICAN.</p> <p><u>Cabling:</u></p> <p>Cabling must comply with the specifications in the Technical Preliminary Remarks.</p> <p>All necessary cable connections between the electrical/electromechanical system components and the UNICAN control cabinets must be established and accounted for. The cables must be connected at the component end. UNICAN will handle the connection of the cables to the control cabinets. The supply and installation of the cables and cable support systems must be fully included in the unit price for the Revolving Stage.</p> <p>For the cost calculation, an average cable length of 12 m is to be assumed for these cables.</p> <p><u>Cable trays for other cables:</u></p> <p>Cable trays must be supplied and installed for the cabling of other trades.</p> <p>The following quantities should be included for cost estimation purposes:</p> <ul style="list-style-type: none"><li>– 5 m rigid steel conduit DN32</li><li>– 5 m rigid steel conduit DN20</li></ul> |

## Technical Tender Specifications

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### 3. Scope of work:

The following list provides an overview of the services to be performed by the contractor. However, these tasks provide only an overview and are not limited to the items listed:

- Contractor's design for the systems described herein with the specified properties and taking into account the given assembly conditions -> the construction design must comply with the requirements of the Preliminary Technical Remarks
- Submission of the contractor's design for approval to the client
- Prefabrication and configuration of all components
- Delivery of all components to the construction site
- Provision of all components required for in-house transport from delivery to the assembly position
- Installation of the necessary substructures, mounting fixtures and fixing points
- Installation of the Stage Lift structure
- Installation of the winch drive units and installation
- Installation of the electrical infrastructure
- Installation of all necessary cables
- Assisting the commissioning of the systems (testing system parameters, brakes, safety functions) by UNICAN
- Submission of the technical documentation for approval to the client -> the documentation must comply with the requirements of the Preliminary Technical Remarks
- Participation in and support of the inspection tests as specified in the Preliminary Technical Remarks
- Participation in and support of the acceptance tests with the client as specified in the Preliminary Technical Remarks

### 4. Components to be delivered and installed:

All components necessary for a functioning system must be supplied, even if they are not explicitly listed. The scope of the components to be supplied also depends on the manufacturer-specific system configuration. However, the system essentially consists of but is not limited to the following components:

- Stage Lift structure
- Guide trolleys
- Locking bolts
- Drive train including motor, gearbox, drive shafts (for more than one drive), brakes, wire ropes and deflection pulleys
- Limit switches
- Encoders
- Load sensors
- Safety Edges
- Cables and cable support systems
- All necessary small and fastening parts

## Technical Tender Specifications

| No. | Description |
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### 1.1.3. Compensating Lifts

#### 1. General Description:

This item covers the Compensating Lifts on the Revolving Stage. The Compensating Lifts must be installed in the Revolving Stage - within the previously described open area at the centre of the stage at the lower level of the Revolving Stage - as shown in the drawings.

The Compensating Lifts must fill the opening in the floor of the lower level of the Revolving Stage, which is created when the Stage Lifts described above leave their lower position and move upwards. The Compensating Lifts therefore have the same platform dimensions as the Stage Lifts and are located directly beneath them. There is one Compensating Lift for each of the three Stage Lifts.

The travel distance of the Compensating Lifts is very short, as they move only slightly more than the structural height of the Stage Lifts. They are used solely to level the floor surface once the Stage Lifts move from their lower position.

The drive trains must be located directly below the platform of the Compensating Lifts.

All three Compensating Lifts are identical and must not be designed for transporting persons, neither for set-up nor during performances. This results in less stringent requirements regarding operating noise and safety devices.

The entire Compensating Lifts are to be constructed as a steel structure.

These systems are controlled entirely via the UNICAN control system. The interfaces for power management, control, and signal connections must be coordinated with UNICAN as part of the contractor design.

#### 2. Technical Specifications:

##### Performance parameters:

The Compensating Lifts must have the following specifications:

- Dimensions:
    - Platform length: 5.4 m
    - Platform width: 1.8 m
    - Platform area: 9.72 m<sup>2</sup>
  - Performance parameters
    - Travel speed: 0.01 - 0,1 m/s
    - Control ratio: 1:10
    - Max. acceleration: 0.2 m/s<sup>2</sup>
    - Positioning accuracy in the upper position: ± 1.0 mm
    - Travel, depends on the design: estimated approx. 0.55 m
    - Duty cycle: S2/10min
  - Load specifications:
    - Payload, static: 5 kN/m<sup>2</sup>
    - Total payload, static: 48.6 kN
    - Point load, static: 7.5 kN
- based on an area of 200 x 200 mm

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                             |
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|     | <ul style="list-style-type: none"><li>• Payload, dynamic: n/a</li><li>• Total payload, dynamic: n/a</li></ul>                                                                                                                                                           |
|     | <ul style="list-style-type: none"><li>– Noise emissions (measured in the first row of seats on the orchestra pit lifts):<ul style="list-style-type: none"><li>• System active but in standby mode: 30 dB</li><li>• Movement at maximum speed: 45 dB</li></ul></li></ul> |

### Layout:

The Compensating Lifts must travel between their lower parking position below the lower position of the Stage Lifts and the lower level of the Revolving Stage. The platforms must be guided along the entire travel path. The guide rails of the Stage Lifts can be used for this. Guide shoes compatible with these guide rails must be mounted at all four corners of the Stage Lifts.

A wooden floor is being installed by another contractor on the Stage Lifts. The wooden flooring assembly consists of wooden floor panels, sleepers, shims, and impact sound insulation placed between the wood flooring and the steel structure of the Revolving Stage. Based on current planning, the total height of the wooden floor assembly is set at 145 mm. This build-up height must be taken into account during the planning of the Revolving Stage.

Power and signal supply for limit switches – and the load cells in case Linklifts are used (see below) – must be provided via flexible cable supply systems. Due to the short travel path energy chains may be used.

Maintenance access panels must be provided in the platform decks above drive components, including transfer gearboxes. These can be designed as removable insert panels and do not require hinges.

### Steel structures

The structure of the Compensating Lifts must be made of steel. The dimensions, profile types, and arrangement of the steel structures must be specified by the contractor as part of their planning. However, the following requirements must be considered.

The design must adhere to the concept outlined in the tender drawings.

The platforms must be constructed as dimensionally stable, torsion-resistant frames.

The Compensating Lift platforms must be designed to be as compact as possible to minimize the overall structural height, as Compensating Lifts and Stage Lifts must be stacked on top of each other below the lower level of the Revolving Stage, and the available installation space in this area is limited.

Horizontal steel beams serving as the substructure for the wooden flooring must be installed across the entire surface area of the platforms—with the exception of openings for trapdoors and floor hatches—at a maximum spacing of 600 mm.

### Guide carriages

In case the guide rails of the Stage Lifts are used to guide the Compensating Lifts, four guide carriages compatible with the guide rails must be mounted at the four corners of the lifting platform. Together with the guide rails, they must form a rigid,

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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|     | <p>heavy-duty linear guidance system to ensure precise vertical movement of the Stage Lifts without tilting, twisting, or jamming. The guide carriages must feature a low-backlash design to minimize lateral play and eliminate horizontal swaying during movement. The entire guiding system must be engineered for ultra-low noise and vibration-free running.</p> <p>The guide systems must be aligned with extreme accuracy. For this purpose, the guide carriages must have sufficient capability for precise adjustment and alignment.</p> <p>The material used for the contact surfaces must ensure low starting and running resistance as well as minimal noise generation and a long service life. A metal-on-metal guide arrangement is not acceptable.</p> <p><u>Drive train:</u></p> <p>Each Compensating Lifts must be moved by a motorized drive system.</p> <p>Consequently, there are no special safety requirements. Travel speed is also of minor importance due to the short travel distance. Finally, operating noise is not as significant a factor as it is for the Stage Lifts. However, minimizing the overall construction height is of great importance due to the arrangement beneath the Stage Lifts and the limited space available below the lower level of the Revolving Stage.</p> <p>The design is based on the Serapid Linklift® LL50 drives, featuring a motor unit with distribution gearboxes and connecting shafts.</p> <p>When arranging the drive components for the central Compensating Lift, the dimensions of the Revolving Stage's slip ring must be taken into account.</p> <p>The complete drive train must be rated for short-time duty S2 / 10 min according to EN 60034-1.</p> <p>The drives must provide smooth, variable speed control from a low crawl speed up to maximum operational speed. Acceleration and deceleration ramps must be fully adjustable via the control system to ensure judder-free starts and stops.</p> <p>The entire drive unit (including motors and gearboxes) must be mounted with structure-borne noise isolation to ensure quiet operation. The entire drive assembly (including motors and gearboxes) must be engineered for silent operation. The drive unit must be installed with vibration isolation.</p> <p>A lockable maintenance switch must be provided for each drive train. Each maintenance switch must simultaneously disable all individual drives within a drive train.</p> <p><u>Temperature monitoring:</u></p> <p>Every motor must be equipped with a temperature monitoring system. The temperature monitoring system must utilize a bimetallic switch in a normally closed configuration.</p> <p>Benchmark product: <i>Klixon</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.</p> |

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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|     | <p><u>Brakes:</u></p> <p>Each drive unit must be equipped with two independent electromagnetic brakes. Each brake must be capable of safely stopping and holding the fully loaded Stage Lift from maximum speed in the event of an emergency stop or power failure. The brakes must be equipped with brake gap monitoring.</p> <p>The brake gap monitoring system for all brakes shall utilize contactless inductive proximity switches to reliably detect the release and wear status; the use of standard mechanical microswitches is strictly prohibited.</p> <p><u>Encoders:</u></p> <p>Encoders must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p><i>Motor Shaft Encoder Units:</i></p> <p>All motor shafts shall be equipped with a combination absolute and incremental encoder unit operating at 24V.</p> <p>The incremental component shall utilize an RS422 interface featuring two tracks shifted by 90 degrees for precise direction and speed detection.</p> <p>The absolute component shall feature a Synchronous Serial Interface (SSI) via RS422, providing a minimum resolution of 8,192 steps per turn (13-bit single-turn) and a measuring range of at least 4,096 turns (12-bit multi-turn).</p> <p>To ensure high operational reliability and zero-maintenance operation, the absolute encoder must not utilize a battery backup system for position retention.</p> <p>Benchmark product: <i>TR Electronic CE58</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product, and must be programmable via an RS232 interface or an approved equivalent configuration tool.</p> <p>Alternative Configuration: As a fully permissible alternative to the primary motor shaft configuration, the contractor may offer a Safety Integrity Level 3 (SIL3) certified encoder solution mounted on the motor shaft. This alternative unit shall feature a redundant electrical interface consisting of two separate SSI channels (2x SSI) combined with one incremental output channel (1x incremental), while strictly adhering to all other voltage, resolution, battery-free, and physical specification requirements detailed in the primary baseline profile.</p> <p><u>Limit switches:</u></p> <p>Limit switches must meet the requirements set out in the "Preliminary Technical Limit switches must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p>All systems used for lifting people like stage lifts shall be equipped with a redundant, safety-rated limit switch configuration suitable for implementation in a SIL3 (Safety Integrity Level 3) safety function.</p> |

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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|     | <p>Benchmark product: <i>Stromag 51 series</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.</p> <p><u>Load measurement:</u></p> <p>Load measurement must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p>The direct load monitoring system shall utilize high-precision load sensors featuring dynamic reserve capabilities and a 4...20 mA analogue output, including an integrated +4 mA test option that allows for safe functional verification without affecting active control signals or process operations.</p> <p>Benchmark product: <i>Primosensor MA-***kN-T101</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.</p> <p><u>Axis controller:</u></p> <p>The axis controllers are supplied and installed by UNICAN.</p> <p>Even if the positioning accuracy is achieved via the control system, neither the mechanical design nor the selection of drive components must compromise the target positioning accuracy of +/- 1 mm. This also applies to repetitive movements.</p> <p><u>Frequency inverters:</u></p> <p>The Frequency inverters are supplied and installed by UNICAN.</p> <p><u>Control cabinets:</u></p> <p>All control cabinets and electrical cabinets for the stage machinery are supplied and installed by UNICAN.</p> <p><u>Cabling:</u></p> <p>Cabling must comply with the specifications in the Technical Preliminary Remarks.</p> <p>All necessary cable connections between the electrical/electromechanical system components and the UNICAN control cabinets must be established and accounted for. The cables must be connected at the component end. UNICAN will handle the connection of the cables to the control cabinets. The supply and installation of the cables and cable support systems must be fully included in the unit price for the Revolving Stage.</p> <p>For the cost calculation, an average cable length of 12 m is to be assumed for these cables.</p> |

## Technical Tender Specifications

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### 3. Scope of work:

The following list provides an overview of the services to be performed by the contractor. However, these tasks provide only an overview and are not limited to the items listed:

- Contractor's design for the systems described herein with the specified properties and taking into account the given assembly conditions -> the construction design must comply with the requirements of the Preliminary Technical Remarks
- Submission of the contractor's design for approval to the client
- Prefabrication and configuration of all components
- Delivery of all components to the construction site
- Provision of all components required for in-house transport from delivery to the assembly position
- Installation of the necessary substructures, mounting fixtures and fixing points
- Installation of the Compensating Lift structure
- Installation of the drive units and installation
- Installation of the electrical infrastructure
- Installation of all necessary cables
- Assisting the commissioning of the systems (testing system parameters, brakes, safety functions) by UNICAN
- Submission of the technical documentation for approval to the client -> the documentation must comply with the requirements of the Preliminary Technical Remarks
- Participation in and support of the inspection tests as specified in the Preliminary Technical Remarks
- Participation in and support of the acceptance tests with the client as specified in the Preliminary Technical Remarks

### 4. Components to be delivered and installed:

All components necessary for a functioning system must be supplied, even if they are not explicitly listed. The scope of the components to be supplied also depends on the manufacturer-specific system configuration. However, the system essentially consists of but is not limited to the following components:

- Compensating Lift structure
- Guide trolleys (system-dependent)
- Drive train including motor, gearbox, drive shafts (for more than one drive), brakes
- Limit switches
- Encoders
- Load sensors
- Cables and cable support systems
- All necessary small and fastening parts

## Technical Tender Specifications

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### 1.1.4. Slip Ring

#### 1. General Description:

This item comprises the slip ring for the Revolving Stage. The slip ring must provide continuous, unrestricted electrical and optical transmission between the stationary theatre infrastructure and the Revolving Stage structure.

The slip ring assembly is installed at the pivot point of the Revolving Stage, within the slewing bearing. It must be secured to the concrete floor and the steel structure of the Revolving Stage.

#### 2. Technical Specifications:

The slip ring assembly must be a hybrid three-part slip ring assembly that features a two-part concentric design to strictly separate critical optical data transmission from standard power, network and control signals. Two optical rotary joints – one for optical multimode, one for optical singlemode will form the inner inner concentric section, while the electrical slip ring will form the outer concentric section.

The slip ring assembly must be engineered for continuous rotation (S1 duty cycle capability).

The slip ring assembly must operate low-noise.

The entire slip ring assembly must be housed in a robust, dust-proof enclosure with a protection rating of at least IP65 to protect the sensitive optical and electrical components from dust, theatre smoke fluid residues, and debris.

The housing must be equipped with an anti-rotation arm (torque arm) to absorb dynamic rotational forces during stage movement without stressing the connected fibre optic or copper cables.

#### Inner Core – Multimode (Optical Rotary Joint):

- All critical AV and show data will be transferred via the optical multimode
- It must transmit lightwave guide signals without interruption.
- The optical core must exhibit extremely low insertion loss and high return loss to guarantee error-free, real-time transmission of safety protocols, network signals, and digital audio/video streams.
- The optical core must be easily accessible for professional cleaning and inspection via a dedicated service hatch or removable cap without requiring the complete disassembly of the electrical outer ring section.

#### Inner Core – Singlemode (Optical Rotary Joint):

- Network data of the stage machinery control system by UNICAN will be transferred via optical singlemode
- It must transmit lightwave guide signals without interruption.
- The optical core must exhibit extremely low insertion loss and high return loss to guarantee error-free, real-time transmission of safety protocols, network signals, and digital audio/video streams.
- The optical core must be easily accessible for professional cleaning and inspection via a dedicated service hatch or removable cap without requiring the complete disassembly of the electrical outer ring section.

## Technical Tender Specifications

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### Outer Section (Electrical Slip Ring):

- The outer concentric section must contain classic electrical rings and brushes.
- It shall feature dedicated channels for power (AV and show lights, stage machinery) and separate, control signals, as well as CAN Bus.
- The electrical section must feature gold-on-gold wire brush contacts to ensure consistent, low-resistance connections, low electrical noise, and maintenance-free operation over extended periods.

All power lines, network, signal, and fibre-optic connections that must be routed through the slip ring assembly are listed in the appendix to this tender.

The full set-up of the slip ring is listed in the slip ring configuration in the appendix to this tender.

The enclosure of the slip ring must be finished in mat black.

The slip ring must be designed for the rotation speed of the Revolving Stage.

The slip ring must be able to withstand short circuit ratings supplied by the electrical designer in the design phase for the revolve. Dialogue between stage machine contractor and electrical designer is required.

All rings must be connected to terminals in two terminal boxes, one on the input and output side.

The slip ring should not protrude above the floor level of the lower deck of the Revolving Stage.

### **3. Scope of work:**

The following list provides an overview of the services to be performed by the contractor. However, these tasks provide only an overview and are not limited to the items listed:

- Construction design for the systems described herein with the specified properties, in coordination with the other systems specified in this tender (especially the Stage Machinery control system) and taking into account the given assembly conditions -> the construction design must comply with the requirements of the Preliminary Technical Remarks
- Submission of the construction design for approval to the client
- Prefabrication and configuration of all components
- Delivery of all components to the construction site
- Provision of all components required for in-house transport from delivery to the assembly position
- Installation of the necessary substructures, mounting fixtures and fixing points
- Installation of the necessary electrical infrastructure including the terminal boxes
- Installation of the Slip Ring
- Installation of all necessary cable connections
- Commissioning of the system (testing/measuring cable connections) -> commissioning must comply with the requirements of the Preliminary Technical Remarks

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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|     | <ul style="list-style-type: none"><li>– Submission of the technical documentation for approval to the client -&gt; the documentation must comply with the requirements of the Preliminary Technical Remarks</li><li>– Participation in and support of the inspection tests as specified in the Preliminary Technical Remarks</li><li>– Participation in and support of the acceptance tests with the client as specified in the Preliminary Technical Remarks</li></ul> |

#### **4. Components to be delivered and installed:**

All components necessary for a functioning system must be supplied, even if they are not explicitly listed. The scope of the components to be supplied also depends on the manufacturer-specific system configuration. However, the system essentially consists of but is not limited to the following components:

- Slip Ring
- Terminal boxes
- Cables and cable support systems
- All necessary small and fastening parts

### **1.1.5. Cable Reels for the AV and Show Lighting Systems**

#### **1. General Description:**

This item comprises the Spring-loaded Cable Reel to feed power and fibre to the AV and Show lighting outlets on the stage lifts.

#### **2. Technical Specifications:**

High-durability, automatic spring-driven cable reel designed for the simultaneous transmission of low-voltage power and high-speed fibre optic data via a single specialized hybrid reeling cable.

The assembly must feature a modular slip ring body for electrical power alongside a non-contacting or ultra-low attenuation rotary joint for fibre optics.

The tender drawings show a design in which the cable unwinds horizontally from the drum and is redirected upwards towards the stage lift via a deflection pulley. The cable drum is positioned below the level of the lower turntable deck, adjacent to the drive units for the compensating lifts and stage lifts. The vertical section of the cable must run beneath the compensating lift, while the horizontal section must pass through the compensating lift platform. The cable must be routed as close as possible to the outer edge of the compensating lift. The contractor is free to choose the side for this installation.

Metal sleeves at least 7 cm high must be installed on the compensating lifts around the openings for the cable feed-throughs to protect the cables.

The Spring-loaded Cable Reel must be designed for a travel of 4.05 m.

## Technical Tender Specifications

| No. | Description |
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The Spring-loaded Cable Reel must have the following configuration:

- Travel path: 4.05 m
- Travel speed: 0,3 m/s<sup>2</sup>
- Cable configuration:
  - 1x Power: 5x 4 mm<sup>2</sup> -> 5G4
  - 2x Fibre: Multimode 50/125 10G OM3 (12 pairs)
- IP rating: IP65

### Electrical Slip Ring Unit:

The cable reel must have a heavy-duty slip ring system sized for 4 mm<sup>2</sup> conductors with a continuous current load rating corresponding to the maximum capacity of 5G4 cables.

### Fibre Optic Rotary Joint: I

There must be an integrated, high-precision fibre optic rotary joint supporting 24 channels (12 pairs) Multimode OM3.

The system shall be immune to electromagnetic interference from the adjacent power cores.

The cables shall be a halogen-free hybrid cable engineered specifically for continuous reeling and deflection applications, featuring high tensile strength and a tight bending radius.

All cables of the slip ring unit must be connected to terminals in two terminal boxes, one on the input and one on the output side. The terminal box must be installed in close proximity to the spring-loaded cable reel.

The cable reel shall have a heavy-duty cable mesh grip for proper strain relief at the anchoring point on the stage lift.

The drum must remain under constant tension to follow the lift movement automatically.

All necessary mounting brackets and hardware for under-stage steel structure fixation must be provided.

### **3. Scope of work:**

The following list provides an overview of the services to be performed by the contractor. However, these tasks provide only an overview and are not limited to the items listed:

- Construction design for the systems described herein with the specified properties, in coordination with the other systems specified in this tender (especially the Stage Machinery control system) and taking into account the given assembly conditions -> the construction design must comply with the requirements of the Preliminary Technical Remarks
- Submission of the construction design for approval to the client
- Delivery of all components to the construction site
- Provision of all components required for in-house transport from delivery to the assembly position
- Provision of all tools required for the installation
- Provision of the necessary mechanical and electrical components

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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|     | <ul style="list-style-type: none"><li>– Installation of the Spring-loaded Cable Reel including cabling</li><li>– Commissioning of the systems after installation (testing with connected control desks) -&gt; commissioning must comply with the requirements of the Preliminary Technical Remarks</li><li>– Submission of the technical documentation for approval to the client -&gt; the documentation must comply with the requirements of the Preliminary Technical Remarks</li><li>– Participation in and support of the inspection tests with the authorized inspector -&gt; inspection tests must comply with the requirements of the Preliminary Technical Remarks</li><li>– Participation in and support of the acceptance tests with the client -&gt; acceptance tests must comply with the requirements of the Preliminary Technical Remarks</li></ul> |

#### **4. Components to be delivered and installed:**

All components necessary for a functioning system must be supplied, even if they are not explicitly listed. The scope of the components to be supplied also depends on the manufacturer-specific system configuration. However, the system essentially consists of the following components:

- Spring-loaded Cable Reel including cable
- Deflection pulley
- Mounting brackets
- Terminal box
- Necessary installation material
- Cables and cable support systems

### **1.1.6. Cable reels for Stage Lift Infrastructure**

#### **1. General Description:**

This item comprises the Spring-loaded Cable Reel to feed power and fibre to the Stage Lifts.

#### **2. Technical Specifications:**

The configuration of this cable reel depends on the contractor's system setup. It is primarily used to transmit the power supply and signals for the locking devices. The exact configuration must be determined by the bidder. All other specifications must comply with those of the cable reels described above.

#### **3. Scope of work:**

The following list provides an overview of the services to be performed by the contractor. However, these tasks provide only an overview and are not limited to the items listed:

- Construction design for the systems described herein with the specified properties, in coordination with the other systems specified in this tender (especially the Stage Machinery control system) and taking into account the given assembly conditions -> the construction design must comply with the requirements of the Preliminary Technical Remarks
- Submission of the construction design for approval to the client

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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|     | <ul style="list-style-type: none"><li>– Delivery of all components to the construction site</li><li>– Provision of all components required for in-house transport from delivery to the assembly position</li><li>– Provision of all tools required for the installation</li><li>– Provision of the necessary mechanical and electrical components</li><li>– Installation of the Spring-loaded Cable Reel including cabling</li><li>– Commissioning of the systems after installation (testing with connected control desks) -&gt; commissioning must comply with the requirements of the Preliminary Technical Remarks</li><li>– Submission of the technical documentation for approval to the client -&gt; the documentation must comply with the requirements of the Preliminary Technical Remarks</li><li>– Participation in and support of the inspection tests with the authorized inspector -&gt; inspection tests must comply with the requirements of the Preliminary Technical Remarks</li><li>– Participation in and support of the acceptance tests with the client -&gt; acceptance tests must comply with the requirements of the Preliminary Technical Remarks</li></ul> |

#### **4. Components to be delivered and installed:**

All components necessary for a functioning system must be supplied, even if they are not explicitly listed. The scope of the components to be supplied also depends on the manufacturer-specific system configuration. However, the system essentially consists of the following components:

- Spring-loaded Cable Reel including cable
- Deflection pulley
- Mounting brackets
- Terminal box
- Necessary installation material
- Cables and cable support systems

### **1.1.7. Revolving Ring**

#### **1. General Description:**

This item comprises the Revolving Ring.

The Revolving Ring must be designed as a single-level structure that encloses the Revolving Stage at stage level.

The entire Revolving Ring is to be constructed as a steel structure. It is supported by steel columns designed by the structural designer and constructed by the building contractor. Due to these interfaces, intensive coordination regarding both loads and the installation sequence is required as part of the contractor's design.

Particular attention must be paid to installing the drive units in such a way that noise and vibrations are dampened.

The pivot point of the Revolving Ring must be measured precisely before installation begins.

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This system is controlled entirely via the UNICAN control system. The interfaces for power management, control, and signal connections must be coordinated with UNICAN as part of the contractor design.

### 2. Technical Specifications:

#### Performance parameters:

The Revolving Stage must have the following specifications:

- Dimensions:
  - Outer diameter: 12 m
  - Inner diameter: 9.5 m
  - Floor area: 42.2 m<sup>2</sup>
- Levels:
  - Floor level: 0 m
- Performance parameters:
  - Rotation speed, variable: 0,0033 m/s - 1.0 m/s  
(measured at the inner edge / 9 m diameter)
  - Control ratio: 1:300
  - Max. acceleration: 0.3 m/s<sup>2</sup>
  - Positioning accuracy: ± 3 mm
  - Duty cycle: continuous duty S1
- Load specifications:
  - Payload, static: 6 kN/m<sup>2</sup>
  - Total payload, static: limited to 120 kN
  - Point load, static: 9 kN  
based on an area of 200 x 200 mm
  - Payload, dynamic: 2.5 kN/m<sup>2</sup>
  - Total payload, dynamic: limited to 120 kN
- Noise emissions (measured in the first row of seats on the orchestra pit lifts):
  - System active but in standby mode: 30 dB
  - Rotation at maximum speed/full load: 35 dB
  - Acceleration at 0,2 m/s<sup>2</sup>: 35 dB
  - Max. acceleration: 40 dB

#### Layout:

The Revolving Ring is to be mounted to the steel columns installed by the building contractor.

The stage deck, which rests on steel supports, will be dismantled by the building contractor in the installation area prior to the installation of the Revolving Ring. Following the mechanical installation of the Revolving Ring, the deck will be fitted to interface with the Revolving Stage. The construction of the stage deck and its substructure will be carried out by other companies and is not part of this tender.

A wooden floor is being installed by another contractor on the Revolving Ring. The wooden flooring assembly consists of the wooden floor panels, sleepers, shims, and impact sound insulation placed between the wood flooring and the steel structure of

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|     | <p>the Revolving Stage. Based on current planning, the total height of the wooden floor assembly is set at 145 mm. This build-up height must be taken into account during the planning of the Revolving Stage.</p> <p>The drive system shall be installed below the Revolving Ring. The Revolving Ring must be supported by a dual-track roller layout to ensure optimum load distribution, stability, and tilt resistance.</p> <p><u>Steel structures</u></p> <p>The structure of the Revolving Ring must be made of steel. The dimensions, profile types, and arrangement of the steel structures must be specified by the contractor as part of their planning. However, the following requirements must be considered.</p> <p>The design must adhere to the concept outlined in the tender drawings.</p> <p>Necessary supports for the drive system must be provided.</p> <p>The outer edges of both levels of the Revolving Ring – at the inner and outer diameter - must be constructed using L-shaped angle profiles aligned precisely with the floor level of the surrounding areas. A structural floor assembly thickness of 145 mm must be taken into account for this purpose; the exact height is yet to be determined by the respective specialist planners.</p> <p>Deflection of the overall structure under full load must not result in jerky movements of the Revolving Stage or Stage Lifts, increased noise emissions, erroneous position measurements, functional impairments, misalignment with surrounding floor surfaces, or permanent deformation of components.</p> <p>The design must be torsionally rigid to withstand the forces resulting from dead weight and maximum payload during maximum acceleration and braking. In addition to the structural analysis of the entire assembly, torsional rigidity must be verified for both Category 1 and Category 0 stops.</p> <p>The entire structure of the Revolving Ring must be aligned with such precision that, regardless of the Revolving Ring's parked position, the maximum vertical offset of the floor substructure does not exceed <math>\pm 2</math> mm.</p> <p><u>Support for the Revolving Stage</u></p> <p>The entire Revolving Ring assembly must rest on two concentric lines of rollers (roller tracks), arranged in parallel along the inner and outer diameters of the Revolving Ring structure.</p> <p>The stationary substructure to which the rollers are attached must be mounted on the steel columns installed by the building contractor. The structure must be designed to ensure a largely uniform distribution of the load onto these columns.</p> <p>The height of these columns and the installation sequence must be coordinated with the building designer as soon as possible. The entire steel structure of the Revolving Ring must be designed to distribute the load between the bearing and the rollers at the outer edge.</p> <p>Measures for noise decoupling between the Revolving Ring structure and the columns must be taken.</p> |

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|     | <p>Track rollers must be adjustable in height to compensate for tolerances in the revolve structure. They must be mounted exactly tangentially to the centre of the Revolving Ring to minimize frictional forces, and installed at precisely the same height to ensure continuous full-surface contact between the rollers and the track.</p> <p>The Revolving Ring must be horizontally guided and stabilized by horizontally acting guide rollers to withstand typical horizontal loads (e.g., from forklifts).</p> <p>Track rollers must have cast steel cores with ball bearings and flat profile rubber wheels made of Vulkollan® as tread which must be oil and grease-resistant.</p> <p>The running track for the track rollers is running above the track rollers. The running track must be made of thick sheet steel. The running track must be installed to allow for smooth, quiet movement, free from jerking or rattling. Any joints along the running track must be continuously welded and ground flush across the entire surface</p> <p><u>Drive train:</u></p> <p>The Revolving Ring must be moved by independent friction drive units acting directly upon a dedicated drive ring (friction rim) mounted underneath the Revolving Ring flooring. The number of drive units may be determined by the contractor, but no fewer than two and no more than six drive units should be provided.</p> <p>The frequency-controlled electric motor drive and the gearbox must be designed in accordance with the requirements listed here.</p> <p>The complete drive train must be rated for continuous duty (S1 / 100% duty cycle) according to EN 60034-1.</p> <p>The drives must provide smooth, variable speed control from an ultra-low crawl speed up to maximum operational speed. Acceleration and deceleration ramps must be fully adjustable via the control system to ensure judder-free starts and stops.</p> <p>The motors must be mounted on machine frames. The machine frames must be mounted to the stationary part of the Revolving Ring structure. Measures for noise decoupling between the steel mounting structure of the friction wheel drive unit and the support columns must be taken. A sound absorbing enclosure might be installed around the entire friction wheel drive unit to reach the required noise levels.</p> <p>Two friction wheels must be installed for each drive - drive wheel on the outside and a counter-roller on the inside of the drive ring for a better transmission of the driving forces. Both friction wheels must link mechanically. Each drive unit must feature an adjustable, spring-loaded or pneumatic contact pressure mechanism to maintain constant and optimal traction against the drive ring, effectively preventing wheel slippage under all dynamic load conditions. The springs must compensate for minor inaccuracies of the structures.</p> <p>The friction wheels must be equipped with specialized, heavy-duty coatings optimized for high traction, minimal wear, and silent running. The material must not develop "flat spots" during prolonged standstill periods under load.</p> <p>Deliverables must include complete electrical schematics, torque and traction calculations, motor data sheets, and maintenance manuals.</p> <p><u>Temperature monitoring:</u></p> |

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|     | <p>Every motor must be equipped with a temperature monitoring system. The temperature monitoring system must utilize a bimetallic switch in a normally closed configuration.</p> <p>Benchmark product: <i>Klixon</i> or approved equivalent<br/>Any alternative product offered must meet or exceed the technical and quality standards of the benchmark product.</p> <p><u>Brakes:</u></p> <p>Each drive unit must be equipped with an electromagnetic brake. Each brake must be capable of safely stopping and holding the fully loaded Revolving Stage from maximum speed in the event of an emergency stop or power failure.</p> <p>"The brake gap monitoring system for all brakes shall utilize contactless inductive proximity switches to reliably detect the release and wear status; the use of standard mechanical microswitches is strictly prohibited.</p> <p><u>Encoders:</u></p> <p>Encoders must meet the requirements set out in the "Preliminary Technical Remarks" of this tender.</p> <p>The Revolving Stage must be equipped with one high-resolution rotary absolute encoder with a separate wheel and CANopen communication interface (compliant with CiA 406).</p> <p>Additionally, all motor shafts must be provided with incremental encoders utilizing an RS422 interface (24V), featuring two tracks shifted by 90 degrees for precise direction and speed detection.</p> <p>In addition, UNICAN will install a proprietary path-measurement system based on RFID technology. The RFID antennas will be mounted on the Revolving Stage along the outer edge at the level of the technical deck within the pit, while the receiver units will be installed in the pit itself. Documentation regarding the RFID components is provided in the appendix to this tender. The exact number of RFID antennas required has not yet been determined; however, installation space must be provided for a large number of these antennas above the profiles for the drive pressure rollers and beneath the access doors for the electrical cabinets. UNICAN will be responsible for installing all components of the RFID system.</p> <p><u>Axis controller:</u></p> <p>The axis controllers are supplied and installed by UNICAN.</p> <p>Even if the positioning accuracy is achieved via the control system, neither the mechanical design nor the selection of drive components must compromise the target positioning accuracy of +/- 3 mm. This also applies to repetitive movements.</p> <p><u>Frequency inverters:</u></p> <p>The Frequency inverters are supplied and installed by UNICAN.</p> <p><u>Control cabinets:</u></p> |

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All control cabinets and electrical cabinets for the stage machinery are supplied and installed by UNICAN.

### Cabling:

Cabling must comply with the specifications in the Technical Preliminary Remarks.

All necessary cable connections between the electrical/electromechanical system components and the UNICAN control cabinets must be established and accounted for. The cables must be connected at the component end. UNICAN will handle the connection of the cables to the control cabinets. The supply and installation of the cables and cable support systems must be fully included in the unit price for the Revolving Stage.

For the cost calculation, an average cable length of 15 m is to be assumed for these cables.

### **3. Scope of work:**

The following list provides an overview of the services to be performed by the contractor. However, these tasks provide only an overview and are not limited to the items listed:

- Contractor's design for the systems described herein with the specified properties and taking into account the given assembly conditions -> the construction design must comply with the requirements of the Preliminary Technical Remarks
- Submission of the contractor's design for approval to the client
- Prefabrication and configuration of all components
- Delivery of all components to the construction site
- Provision of all components required for in-house transport from delivery to the assembly position
- Installation of the necessary substructures, mounting fixtures and fixing points
- Installation of the Revolving Ring structure
- Installation of the drive units
- Installation of the electrical infrastructure
- Installation of all necessary cables
- Assisting the commissioning of the systems (testing system parameters, brakes, safety functions) by UNICAN
- Submission of the technical documentation for approval to the client -> the documentation must comply with the requirements of the Preliminary Technical Remarks
- Participation in and support of the inspection tests as specified in the Preliminary Technical Remarks
- Participation in and support of the acceptance tests with the client as specified in the Preliminary Technical Remarks

### **4. Components to be delivered and installed:**

All components necessary for a functioning system must be supplied, even if they are not explicitly listed. The scope of the components to be supplied also depends on the manufacturer-specific system configuration. However, the system essentially consists of but is not limited to the following components:

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- Revolving Ring structure
- Track rollers including running track
- Steel frames for the trapdoors
- Friction drive units / gearbox / brakes
- Encoders
- Cables and cable support systems
- All necessary small and fastening parts

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## 2. Additional Services

### 2.1. Contractor's Design Services & Submissions

#### 2.1.1. Contractor's Design

##### General:

The Contractor must provide a comprehensive and coordinated set of Production and Installation Documentation (Technical Submittals) based on the design intent laid out in this tender.

The submittal package must fully comprise, but is not limited to:

- Shop & Installation Drawings: Detailed assembly drawings, fabrication layouts, interface details, and structural fixing points.
- Engineering & Calculations: Structural calculations (statures), safety verification, thermal and acoustic performance analyses as required by the technical specifications.
- Component Schedules & Lists: Comprehensive bills of materials, equipment lists, and technical data sheets for approval.
- Coordination: Active interface coordination with other site trades to ensure clash-free installation.

All quantities and dimensions specified in the tender documents must be checked on site by the contractor before the construction design is created and delivery services are ordered.

All planning documents must be prepared in accordance with the guidelines listed below. Documents and drawings that deviate from these guidelines will not be accepted.

The planning documents must be submitted in full by the date specified in the schedule so that the Client can carry out a complete review of the submittals. The costs for multiple test runs due to missing, incomplete or significantly incorrect documents will be invoiced to the contractor.

No fabrication or installation must commence prior to the formal "Approved" or "Approved as Noted" status of the respective submittal by the Client's Representative.

After the contract is signed, the contractor will receive DWG files containing floorplans for all floors and sectional drawings of the building.

##### Submission of construction design:

The construction design must be prepared in accordance with the construction schedule and submitted to the client for approval. After approval, the construction design must be submitted in accordance with the following specifications.

##### Form:

The documentation must be submitted digitally.

The documentation in paper must be submitted in file folders. The folder structure will be specified by the client.

In addition to the planning documents, each folder must contain a table of contents.

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|     | <p>The file names must correspond to the titles of the documents. If the titles of the documents cannot be adopted in full due to their length, care must be taken to ensure that the titles are understandable and comprehensible when shortening them.</p> <p>The contractor must use BIM software throughout the entire project. All drawings and documentation must be generated directly from the BIM models. All systems, system parts and components in the project must be fully modelled in BIM.</p> <p>The naming of BIM models, as well as any drawings derived from them, must comply with the naming conventions specified by the client or an alternative agreed upon with the client.</p> <p>Other files must be saved in the following file formats:</p> <ul style="list-style-type: none"><li>– Text documents: .docx and .pdf</li><li>– Lists/tables: .xlsx and .pdf</li><li>– CAD drawings: .dwg, .pdf</li></ul> <p>All files in .pdf format must be saved in colour as the original files. All CAD drawings in .pdf file format must be saved to scale.</p> <p>All documents such as descriptions, lists, tables, etc. must contain at least the following information on the respective cover sheet:</p> <ul style="list-style-type: none"><li>– Name of the project</li><li>– Name and address of the contractor</li><li>– Title of the document (the title must clearly describe the content of the document)</li><li>– Date of creation of the document</li></ul> <p>All drawings must have a drawing header in the bottom right-hand corner. The drawing header must contain at least the following information:</p> <ul style="list-style-type: none"><li>– Name of the project</li><li>– Name and address of the contractor</li><li>– Name of the client</li><li>– Text: 'Stage Machinery Systems'</li><li>– Drawing title (the title must clearly describe the contents of the drawing)</li><li>– Drawing number (drawing numbers may not be used more than once; different versions/revisions must be clearly marked)</li><li>– Creation date of the drawing</li><li>– Scale</li><li>– Paper size</li><li>– Name of the head designer</li><li>– Name of the CAD designer</li></ul> <p>A document containing a clear explanation of the drawing numbering system used must be submitted.</p> <p>All systems, components and parts shown in the drawings must be marked and, where necessary for understanding, provided with a description. For example, in the case of steel beams, information on type, dimensions and steel grade must be included, or at least a clear reference to a parts list item with the required information must be included.</p> |

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All symbols and pictograms used without labelling must be listed in a key on each drawing. The naming of the symbols and pictograms must be clear and comprehensible. Necessary technical specifications of the components represented by symbols and pictograms that are required for understanding and assessing of these components must be listed in the key.

The construction design must be prepared in English without exception. Third-party documents, e.g. data sheets, may only be submitted in another language after consultation with the client and his approval. Documents in other languages are generally not accepted. The contractor is responsible for the accuracy of the content of independently prepared translations of documents from other manufacturers.

All information in the documentation must be clear and comprehensible. Established and industry-typical terms must be used.

### Technical Submittal Package:

The contractor's submittals must contain at least the following documents:

- 3D model of the Revolving Stage and Revolving Ring;
- Overview plans of all floors as well as all relevant sections on a scale of 1:50, showing all installations, cable support systems, etc. included in the scope of work of the contractor, including all dimensions; these plans must also contain all information that is relevant for the other trades
- Assembly plans of the individual systems on a scale of at least 1:30; with all dimensions, component designations, information on all non-load-bearing components (e.g. steel cables, steel cable end connections, tension bolts, etc.) and references to the construction plans of all structural elements
- Construction plans of all components on a scale of at least 1:10; at least in front and side views and top view; including the representation of all fastening and connecting elements; including all dimensions, profile types, material specifications, etc.
- Layout plans of the electrical cabinets, control panels and connection boxes including all installed components
- Circuit diagrams of all main and sub-distributions
- Layout and descriptions of the user interfaces of control panels
- Control schematic
- Slip ring configuration
- Cable List of all planned cable connections including cable type, start and end point and the associated system
- Calculations for the design of relevant system components such as drives, gearboxes, rope diameters, drum diameters, etc.
- Risk assessment all systems
- Load plans with the magnitude and direction of the loads introduced into the structure as well as strength and stability verifications
- Static analysis for all load-bearing components
- Electrical connection values of the systems
- Thermal loads of the technical systems
- Circuit diagrams
- Terminal diagrams

In addition, data sheets for all purchased parts required for the approval of the construction design (e.g. drives, gearboxes, wire ropes, valves, axis controllers, frequency inverters, encoders, load cells, etc.) must be submitted.

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|     | <p>The following information, drawings and calculations must be submitted to the client of other trades as early as possible as part of the construction design:</p> <p>Submission of planning documents for approval to the structural engineer:</p> <ul style="list-style-type: none"><li>– Load plans with the size and direction of the loads introduced into the building</li><li>– Strength, stability and structural integrity analyses for all load-bearing components</li><li>– Size and location of all required wall and ceiling openings</li></ul> <p>The duration of the review and approval must be agreed with the structural engineer at the beginning of the construction design; the duration of the review and approval must be taken into account when complying with the agreed milestones.</p> <p>The submissions to other project participants as mentioned in the section P1 Interfaces must be completed with successful approval before the construction design is handed over to the client for approval.</p> <p><u>Approval of the construction design:</u></p> <p>The entire construction design, including all documents and drawings specified in this tender and required for execution, must be submitted to the client for review and approval.</p> <p>The client will review all documents for general compliance with the specifications of the tender documents and the relevant standards and regulations. After the check has been completed, the construction design is provided with an inspection note. Documents and drawings that have not been approved must be revised in accordance with the comments of the client and resubmitted for approval.</p> <p>System components without approval may not be delivered to the construction site. Assembly work may only begin after the documents have been approved by the client. Work carried out without approval of the relevant documents may have to be dismantled at the request of the client's construction management. The client is entitled to refuse acceptance and payment for these systems and facilities.</p> <p>The construction design documents can also be submitted in stages for individual systems after consultation with the client. However, these documents will only be checked if they are complete systems.</p> <p>Interfaces to other parts of the system must be fully specified and presented in a coherent and comprehensible manner. If a system cannot be fully tested due to unclear interfaces to other parts of the system, no approval or only limited approval will be granted.</p> <p>If subsequent planning of other systems results in changes to parts of the system that have already been approved, the planning documents for these systems must be resubmitted for approval. Planning that has been changed compared to the approval will not be accepted and may lead to refusal of acceptance.</p> <p>If the construction design is submitted in full for all systems at once, the review and approval period by the client and theatre consultant is 30 working days. If the construction design for individual systems is submitted at different times, appropriate periods for review and approval by the client must be planned and agreed upon with the client, depending on the scope and the availability of the client and theatre</p> |

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consultant. If the approval of individual systems is time-critical and requires rapid review and approval, this must be coordinated with the client in advance.

The contractor is responsible for coordinating the approval of the construction design.

The approval does not release the contractor from his obligation to check his documents for accuracy before assembly begins. The responsibility and liability for the unrestricted functionality and safe operation of all systems, including all components and individual parts, as well as the technical, structural, dimensional and visual accuracy of the work carried out remains with the contractor. The contractor's responsibility and liability is not removed by the approval of the assembly drawings by the client. However, by giving its approval, the client confirms that the systems and facilities as shown in the construction design meet its requirements.

If it becomes necessary during the construction phase to construct a system differently than planned and approved, the relevant planning documents must be submitted to the client for approval before the changes are implemented.

### 2.1.2. Technical Documentation

#### General:

The documentation must meet the requirements of DIN EN 17206, DIN EN 62079 and EN ISO 12100 as well as the European Machinery Directive 2006/42/EC.

The documentation must be created in accordance with the guidelines listed below. Documentation that deviates from these guidelines will not be accepted and will be regarded as non-delivery.

The documentation must be submitted in full by the date specified in the schedule so that the client can carry out a complete review of the documentation. The costs for multiple reviews due to missing, incomplete or significantly incorrect documents will be invoiced to the contractor based on the amount of work involved.

Approval of the documentation by the client is a prerequisite for the inspection tests and acceptance by the client.

#### Submission of documentation:

The documentation must be prepared in accordance with the construction schedule and submitted to the client for approval.

The construction design must be submitted in accordance with the following specifications.

#### Form:

The documentation must be submitted digitally.

The documentation must be submitted in file folders. The folder structure will be specified by the client.

In addition to the documentation documents, each folder must contain a table of contents.

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| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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|     | <p>The file names must correspond to the titles of the documents. If the titles of the documents cannot be adopted in full due to their length, care must be taken to ensure that the titles are understandable and comprehensible when shortening them.</p> <p>The contractor must use BIM software throughout the entire project. All drawings and documentation must be generated directly from the BIM models. All systems, system parts and components in the project must be fully modelled in BIM.</p> <p>Other files must be saved in the following file formats:</p> <ul style="list-style-type: none"><li>– Text documents: .docx and .pdf</li><li>– Lists/tables: .xlsx and .pdf</li><li>– CAD drawings: .dwg, .pdf</li><li>– 3D model: .ifc</li><li>– Electrical diagrams: Eplan and .pdf</li></ul> <p>All files in .pdf format must be saved in colour according to the original files. All CAD drawings in .pdf file format must be saved to scale.</p> <p>All documents such as descriptions, lists, tables, etc. must contain at least the following information on the respective cover sheet:</p> <ul style="list-style-type: none"><li>– Name of the project:</li><li>– Name and address of the contractor</li><li>– Title of the document (the title must clearly describe the content of the document)</li><li>– Date of creation of the document</li></ul> <p>All drawings must have a plan header in the bottom right-hand corner. The plan header must contain at least the following information:</p> <ul style="list-style-type: none"><li>– Name of the project</li><li>– Name and address of the contractor</li><li>– Name of the client</li><li>– Text: 'Stage Machinery Systems'</li><li>– Drawing title (the title must clearly describe the contents of the drawing)</li><li>– Drawing number (drawing numbers may not be used more than once; different versions/revisions must be clearly marked)</li><li>– Creation date of the drawing</li><li>– Scale</li><li>– Paper size</li><li>– Name of the responsible planner</li><li>– Name of the draughtsman</li></ul> <p>A document containing a comprehensible explanation of the drawing numbering system used must be submitted.</p> <p>All systems, components and parts shown in the drawings must be labelled and, if necessary for understanding, provided with a description. For example, steel girders must include information on type, dimensions and steel grade or at least a clear reference to a parts list item with the required information.</p> <p>All symbols and pictograms used without labelling must be listed in a key on each drawing. The naming of the symbols and pictograms must be clear and comprehensible. Necessary technical specifications of the components represented</p> |

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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|     | <p>by symbols and pictograms, which are necessary for the understanding and evaluation of these components, must be listed in the key.</p> <p>The documentation must be prepared in English without exception. All manuals for the control system, control desks and control panels, and other documentation required by operators of the systems must be prepared both in English and in Norwegian. Documents in other languages are generally not accepted. Third-party documents, e.g. data sheets, may only be submitted in another language after consultation with the client and his approval. The contractor is responsible for the accuracy of the content of independently prepared translations of documents from other manufacturers.</p> <p>All information in the documentation must be clear and comprehensible. Established and industry-typical terms must be used.</p> <p><u>Documentation documents:</u></p> <p>The documentation must contain at least the following documents:</p> <ul style="list-style-type: none"><li>– Protocols, certificates and attestations:<ul style="list-style-type: none"><li>• Protocol of the acceptance test of all systems by the manufacturer or an expert</li><li>• Record of all tests and inspections carried out for commissioning</li><li>• Proof of electrical testing in accordance with EN 60204</li><li>• Declaration of conformity for all systems</li><li>• SIL 3 certificate</li><li>• Declaration of conformity that the system has been designed in accordance with the SIL 3 certificate</li><li>• Certificate in accordance with DIN EN 1090-1</li><li>• Copies of the factory certificates for the entire system</li><li>• Protocol of the user training</li><li>• Certificates for steel cables, steel quality etc.</li><li>• All necessary test certificates for products and parts that require approval by a recognized authority</li><li>• Risk assessment</li></ul></li><li>– Fully revised planning documents:<ul style="list-style-type: none"><li>• 3D model of the Revolving Stage and Revolving Ring</li><li>• Overview plans of all storeys as well as all relevant sections at a scale of 1:50 with the positions of all installations, pipe routes etc. that are within the contractor's scope of services, including all dimensions</li><li>• Assembly plans of individual systems at a scale of at least 1:30; including all dimensions, component designations, specifications of all non-structural components (e.g. steel cables, steel cable end connections, clamping bolts, etc.) and references to the construction plans of all structural elements</li><li>• Construction plans of all structural elements at a scale of at least 1:10; at least in front and side view as well as top view; representation of all fastening and connecting elements; including all dimensions, profile types, material specifications, etc.</li><li>• Layout plans of the electrical cabinets, control panels and connection boxes including all fixtures</li><li>• Layout and circuit diagrams for all main, sub and mains distribution boards</li><li>• Layouts and descriptions of the user interfaces of control panels</li><li>• Control diagram</li><li>• Cable list of all planned power connections including cable type, start and end point and the associated system</li></ul></li></ul> |

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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|     | <ul style="list-style-type: none"><li>• Calculations for the design of relevant system components, e.g. gearbox, rope diameter, drum diameter, etc</li><li>• Load plans with the magnitude and direction of the loads introduced into the structure as well as strength and stability verifications</li><li>• Static analysis for all load-bearing components</li><li>• Electrical connection values of the systems</li><li>• Thermal loads of the technical systems</li><li>• Circuit diagrams</li><li>• Terminal diagrams</li><li>• Spare parts lists</li><li>• Parts lists</li><li>– Component documentation:<ul style="list-style-type: none"><li>• Data sheets for all components (motor, gearbox, shafts, bearings, travel sensors, limit switches, switches and buttons, indicator lights, etc.)</li><li>• Data sheets for the cables</li><li>• Device documentation</li></ul></li><li>– User information and instructions:<ul style="list-style-type: none"><li>• Comprehensive and detailed system description in which the integration of all system components and their interaction is described in detail</li><li>• Operating instructions for the control system and all individual systems</li><li>• Maintenance instructions</li><li>• Maintenance instructions</li><li>• Safety instructions for emergency operation</li><li>• Information on decommissioning, dismantling and disposal</li></ul></li></ul> |

### Approval of the documentation:

All documentation must be submitted to the client and the theatre consultant for approval. Before the documents are reproduced, the entire documentation must be submitted for review as early as possible but no later than the date specified in the schedule.

The client and the theatre consultant will check all documents for general compliance with the specifications of the tender documents and the relevant standards and regulations. The content is checked for up-to-dateness and compliance with the installed systems and equipment. Once the check has been completed, the documentation is provided with an inspection note. Documents and drawings that have not been approved must be revised in accordance with the comments of the client or theatre consultants and resubmitted for approval.

At least 20 working days must be allowed for the review of the documentation by the theatre consultant and client.

The contractor is responsible for coordinating the approval of the documentation.

Approval does not release the contractor from responsibility for the correctness of the content of all documentation. The contractor's liability for damage to the systems that is attributable to incorrect information in the documentation must not be waived by the approval of the documentation by the client. However, by approving the documentation, the client confirms that the scope of the documentation meets his requirements.

## Technical Tender Specifications

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| No. | Description |
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### 2.2. Work on Hourly Rate

If required by the client, the contractor is obliged to provide work services that are not part of this Tender Specification, but might be required for carrying out the building measure due to changes or unexpected events. Such services must be invoiced as Work on Hourly Rate.

The contractor must get written order from the client to carry out the work on hourly rate.

The execution of Work on Hourly Rate must be documented daily with Hourly Rate Reports. Hourly Rate Reports must be filled out for every working day.

Hourly Rate Reports must clearly show the following information:

- Name of the contractor (company)
- Designation, place and location of the construction site
- First and last name, exact professional designation and position of the employee allocated for hourly work
- Number of hours worked on that day by every individual employee, specifying the starting and end times and breaks
- Exact description of the executed works
- Date and signature of the Contractor

The unit prices include all expenses such as wages and salaries, non-wage labor costs, surcharges, wage-related and wage-dependent costs, other social costs, overhead costs, risk, and profit.

Surcharges for overtime, night, and Sunday work will only be paid separately upon written instruction from the client or the construction management.

The contractor is not entitled to hourly wages.

Work must be allocated to people with regards to their skill level. It will not be accepted that work suited for unskilled workers are billed as work by a Senior Mechanic.

#### 2.2.1. Senior Mechanic

As described above

#### 2.2.2. Mechanic

As described above

### 2.3. Training

#### 2.3.1. Training dates

##### 1. General Description:

This item comprises the Training on the Stage Machinery System for the operating personnel of the Theatre.

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The contractor must provide training that is tailored to the systems being built. The training must include all the information and procedures necessary for the safe operation of the systems.

The user has put together two user groups:

- Operators
- Mechanical engineers

Completion of the training is a prerequisite for acceptance by the client.

### 2. Specifications:

The following content must be included in the training.

- General introduction to the system and explanation of all system parts:
  - Explanation of the basic functions of all system parts
  - Explanation of the basic components of all system parts
  - Explanation of the documentation
- Training on safety devices and measures in an emergency:
  - Explanation of possible dangers when using the systems and preventive measures to protect against injury based on the risk analysis
  - Operation in emergency mode
  - Carrying out an emergency lowering
- Training on maintenance and repair:
  - Explanation of the test log
  - Training in error detection, error diagnosis and error correction
  - Explanation of the maintenance plan with regular maintenance work and recurring tests
  - Carrying out visual inspections of the systems
  - Training in carrying out technical tests and inspections
  - Training in carrying out maintenance work and simple repairs

The hours specified in the Cost List are minimum values. The aim of the training is for all participants to be able to operate the systems safely and carry out simple maintenance and repair work. If the bidder considers longer periods to be appropriate, this must be taken into account and explained in the offer.

Most of the training must be carried out on the installed systems.

At least 6 people must be able to attend the session.

The contractor must submit a detailed training plan to the client for review 12 weeks before the training and have it approved by the client. The training plan must explain the content and procedure of the training and include the training materials provided to the participants.

A participant list signed by all participants must be handed over to the client after completion of the training.

### 3. Scope of works:

## Technical Tender Specifications

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- Development of a training schedule for all relevant systems divided into user groups
- Preparation of the training documents
- Submission of the training schedule and training documents to the client for approval
- Realisation of the training
- Submission of the signed list of participants, the training schedule and the training documents as part of the technical documentation

To simplify the later billing of the services actually provided, the following prices are requested in the price list:

- Hourly Rate per Person for On-site Training
- Travel Expense for Outward and Return Journey per Trip and Person for On-site Training
- Accommodation Cost per Night and Person for On-site Training
- Catering Cost per Day and Person for On-site Training
- Hourly Rate per Person for Online Training

### 2.4. Standby Technical Support

#### 2.4.1. Standby Dates:

##### 1. General Description:

This item comprises the Standby Technical Support for the operation of the stage machinery systems specified in this tender.

##### 2. Specifications:

After the user training, acceptance and hand-over of the Stage Machinery System, the contractor must allocate qualified employees to support the technical staff of the theatre in the operation of the systems for rehearsal and performances.

Shows and rehearsals may not take place on consecutive days. The Contractor must accept individual dates in a total period of 2 months.

8 working hours must be calculated per rehearsal / performance, including late shifts.

The employees must be familiar with the installed mechanical systems.

##### 3. Scope of works:

- Coordination with the user on the date and time periods for the required Technical Standby Support
- Provision of qualified personnel on the agreed dates

To simplify the later billing of the services actually provided, the following prices are requested in the price list:

- Hourly Rate per Person for Standby

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                          |
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|     | <ul style="list-style-type: none"><li>– Travel Expense for Outward and Return Journey per Trip and Person for Standby</li><li>– Accommodation Cost per Night and Person for Standby</li><li>– Catering Cost per Day and Person for Standby</li></ul> |

### 2.5. Maintenance Contract

#### 2.5.1. Maintenance Contract

Subject of the Maintenance Contract are all the systems listed in this Technical Tender Specifications.

Maintenance must be carried out in accordance with the requirements of EN 17206 and the European Machinery Directive 2006/42/EC.

The Maintenance Contract comprises maintenance work to maintain the unlimited functioning of the systems. Most important, the safety of all systems must be maintained at any time.

With regards to the maintenance instructions of the documentation, a maintenance plan needs to be prepared, that is listing all systems and components that require frequent maintenance work and individual maintenance intervals. The contractor is fully responsible for the completeness of this maintenance plan. If any systems or components get damaged due to inappropriate maintenance intervals, all incurred cost for repair must be borne by the contractor.

According to this maintenance plan, all mechanical and electrical systems must be inspected and all necessary maintenance work performed at least once a year. In particular, all safety-related systems must undergo a thorough inspection.

A maintenance log must be prepared for all tests. The maintenance log must include in any case, but not limited to, the following information:

- Date
- Name of the person that performed the works
- Test results for each tested component / system
- Performed maintenance work for each tested component / system
- Detailed description of defects for each tested component / system
- Notes of a potential shutdown of systems as result of defects
- Notes for the required replacement of parts earlier than the next maintenance date
- Confirmation of successful maintenance of all systems
- Signature

The maintenance log may be part of the inspection book described in the section 'Documentation'. If not, it must be filed in the inspection book.

In addition to these recurring inspections, the contractor is obligated to be available for emergency maintenance and repairs. Availability is subject to the specifications listed in the preliminary remarks.

Technical personnel, tools, measuring instruments and all aids (e.g. lubricants, cleaning agents, etc.) required to carry out the maintenance work must be provided by the contractor.

## Technical Tender Specifications

| No. | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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|     | <p>If significant defects are discovered, the contractor is obligated to notify the client immediately in writing. This information must include a detailed description of the defects, their impact on the functionality of the equipment, any resulting restrictions on theatre operations, and any consequential damage to other equipment.</p> <p>In addition, the contractor must describe all necessary repair work and submit a quote for it</p> <p>Services may only be outsourced to third parties with the client's consent. The subcontractor must demonstrate its expertise in performing the required maintenance work. Liability and responsibility for contract fulfilment remain with the contractor and cannot be transferred to the subcontractor. The client is entitled to refuse to engage the subcontractor if there are reasonable doubts about its qualifications. A subcontractor's approval may be revoked for the same reasons at any time during the term of the contract. In this case, the contractor must provide a replacement immediately.</p> <p>Warranty claims are not waived by the obligations arising from this maintenance contract.</p> <p>The contractor must submit its draft maintenance contract along with this quote.</p> <p>The term of the maintenance contract is five years.</p> <p>The maintenance contract is specified as an option. After acceptance, the client decides whether to commission the contractor with maintenance.</p> <p>The contractor has no right to require the client to sign the maintenance contract.</p> |