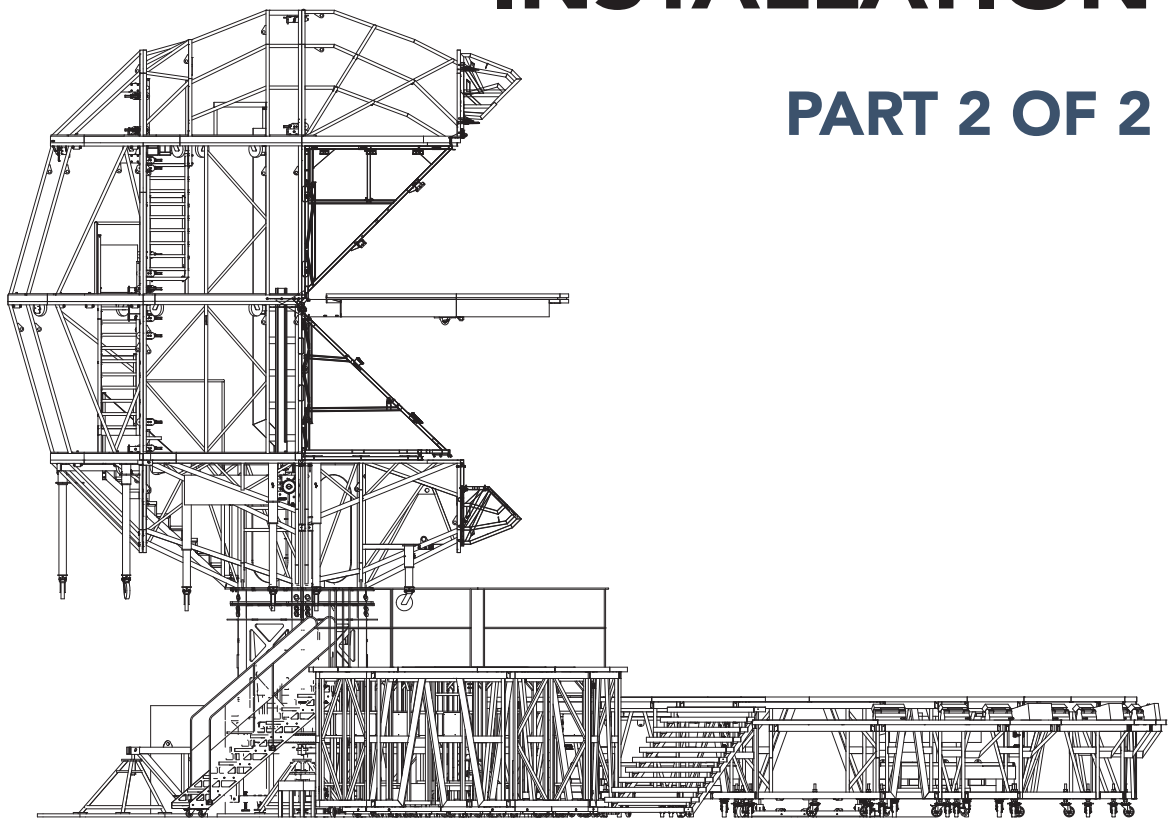
www.brilliantstages.com

USER MANUAL

TAKE THAT 2019
GREATEST HITS TOUR
MACHINERY INSTALLATION

PART 2 OF 2



This product is intended for professional use only.
Read this entire document before installing, operating or using the product.

User Manual Part Number: 18PRP16 Release V2 - Part 2 of 2
Release Date: March 2019

Original Instructions
Take That 2019 - Greatest Hits Tour - Machinery Installation
Release V2 - Part 2 of 2
Release Date 2019-03

Other functions or configurations not described in this document may be available. However, this fact shall not constitute an obligation to supply such functions or configuration with a new product or when servicing.
We have checked that the contents of this document correspond to the product described.
There may be discrepancies, nevertheless, no guarantee can be given that they are completely identical to the product.
The information contained in this document is reviewed regularly and any necessary changes will be included in the next edition.
We welcome suggestions for improvement.
Brilliant Stages intends this document, whether printed or electronic, to be provided in its entirety.

NOTE: This user manual comes in two parts. This is part 2 of 2.

1.1 GENERAL INFORMATION

WARNING

Before installing and commissioning the machinery installation, you must read all safety instructions and warnings carefully, including all of the warning labels attached to the equipment.

CAUTION

Make sure that the warning labels, signs and markings are kept in a legible condition and replaced if they are missing or damaged.

1.2 READ IT FIRST

NOTE: This user manual comes in two parts. This is part 2 of 2.

It is extremely important to read ALL of the safety information and instructions provided in this manual, and any accompanying documentation before installing and operating the products described herein.

Read all cautions and warnings during installation and use of this product.

Keep this user manual for future reference.

WARNING

This product is designed for professional use and to ONLY be used by a competent person.

CAUTION

In the eventuality, the contents included in the instructions are not sufficiently clear or apparently incomplete, it is mandatory to get in contact with Brilliant Stages Ltd using the contact details as listed in this user manual.

IMPORTANT: The user shall thoroughly read this and any accompanying manuals. The user shall familiarise him or herself with all of the safety information and instructions provided in this user manual, as well as in manuals of other products used for the installation, handling and operation of the product.

NOTE: Refer to the Contact section for information to get in touch with Brilliant Stages.

1.3 CONTACT

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1.4 USE FOR INTENDED PURPOSE ONLY

The equipment may be used only for the application stated in the manual, and only in conjunction with the devices and components recommended and authorised by Brilliant Stages.

WARNING

If the user feels that this manual has left any questions unanswered or that the answers provided within this manual are unclear, it is the user's responsibility to consult Brilliant Stages.

1.5 IDENTIFICATION

BRILLIANT STAGES

This user manual pertains only to the product with the serial number as shown below:

Product Name: Take That 2019 - Greatest Hits Tour

Machinery: Sphere and Travelator Lift

Serial Number (User Interface): NIS-MK2.2-18752-030

The user interface serial number has been assigned as the sphere and travelator machinery installation serial number.

NOTE 1: The machinery installation's Declaration of Conformity will use the same number.

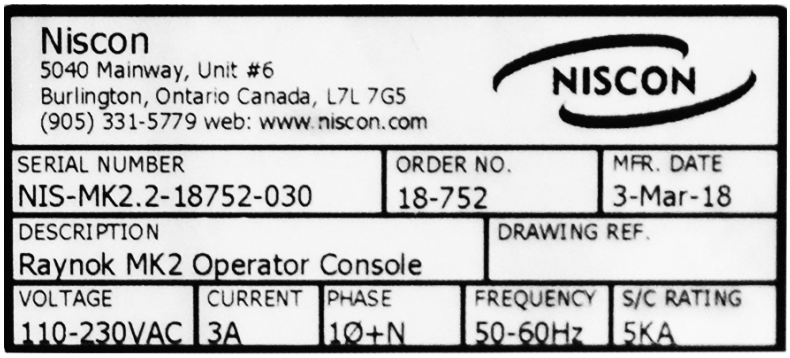

Figure 1: User Interface ID Plate.

NOTE 2: The piano lifts are independent stage machinery and have a separate ID Plate and serial number.

2. TABLE OF CONTENTS

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CONTINUED FROM PART 1

5.6 LEVEL 4

The sphere is separated into four different frame levels with the fourth level forming the top level of the sphere. This level consists of four different sections:

- 4A
- 4B
- 4C
- 4D

5.6.1 LEVEL 4A

Level 4A forms the US rear portion of Level 4 on the sphere.

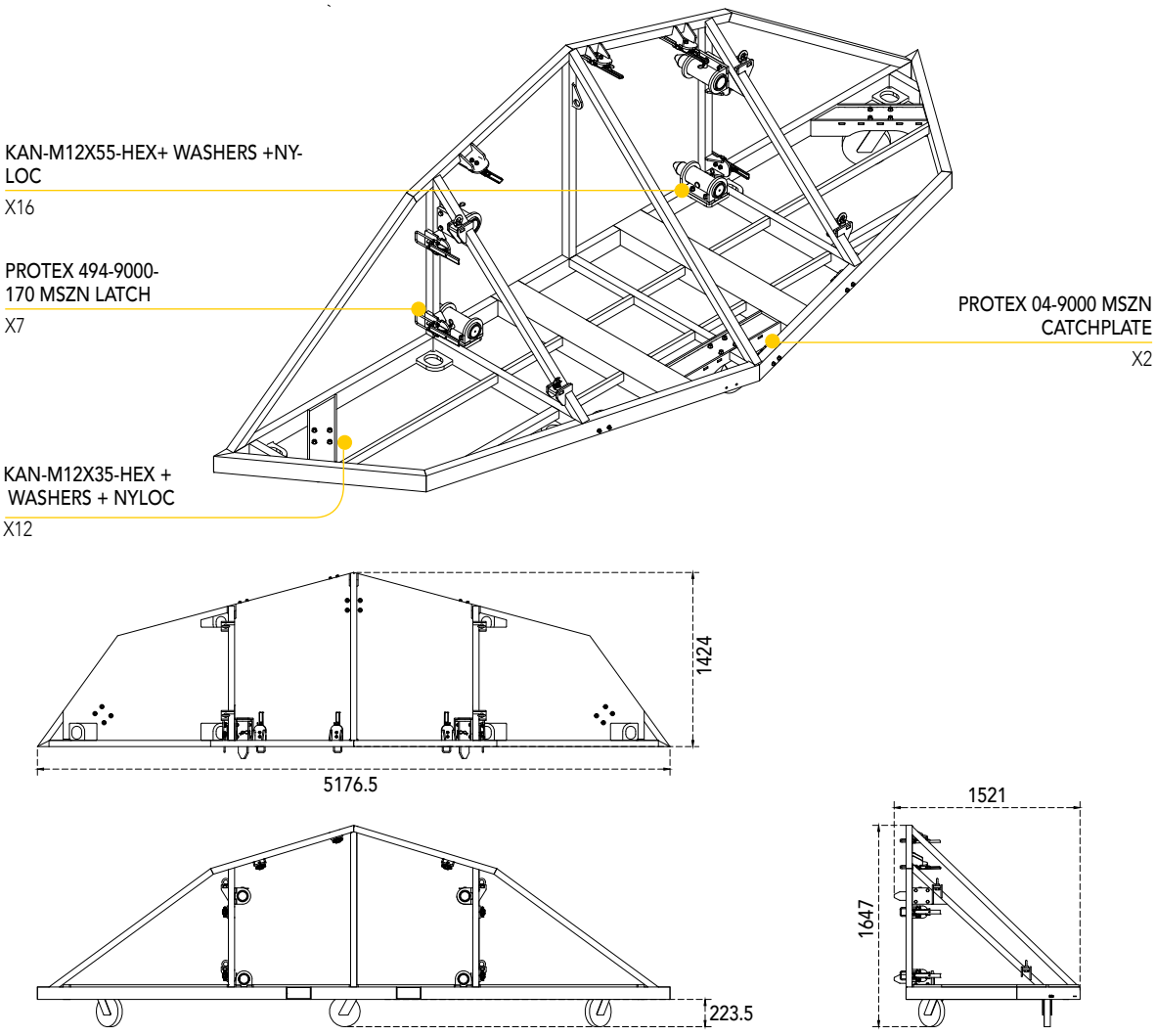


Figure 54: View of Level 4A and its measurements in mm.

5.6.2 LEVEL 4B

Level 4B forms the US rear middle section of Level 4 and houses the winch pulley that allows level 4C to be assembled.

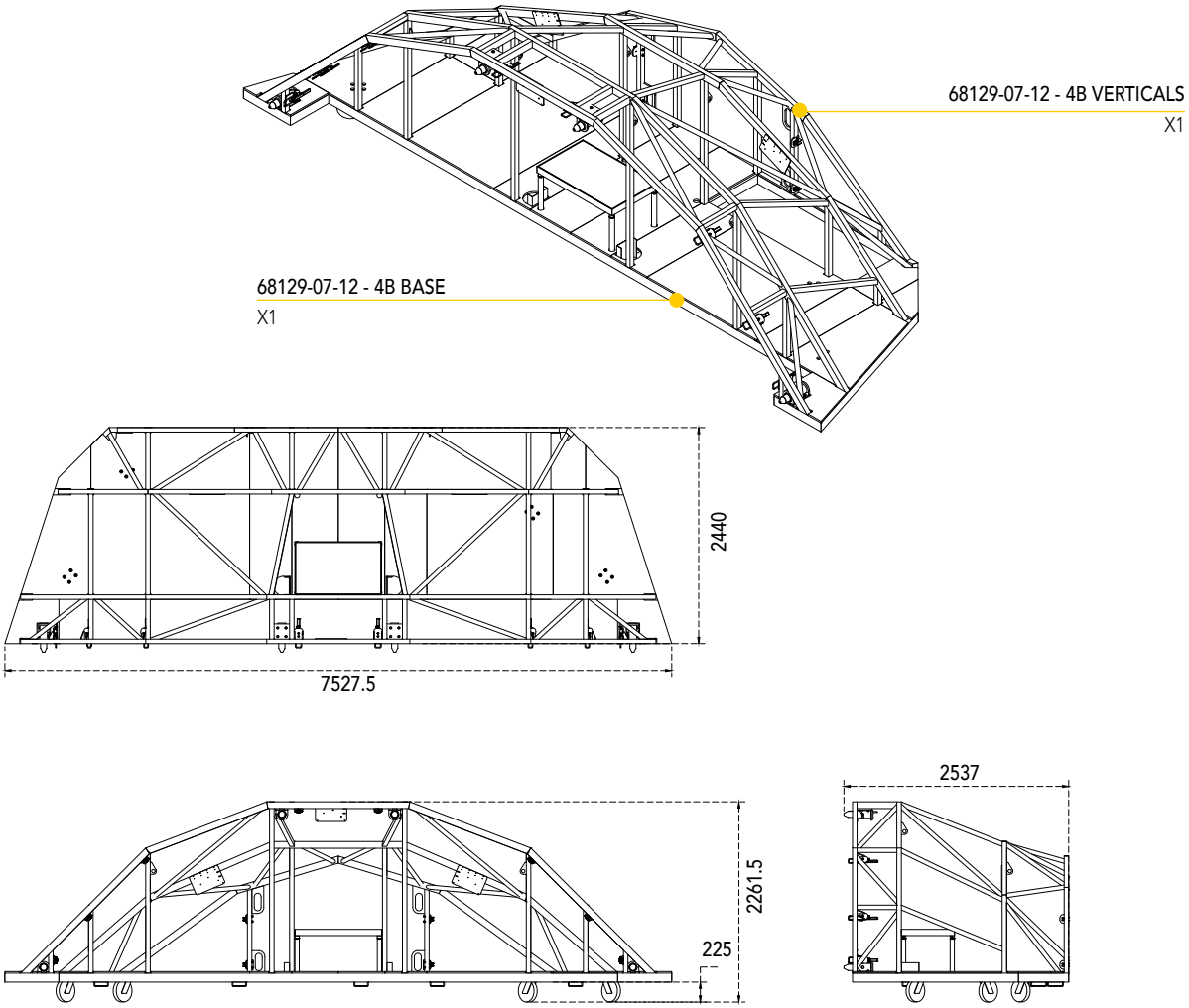


Figure 55: View of Level 4B and its measurements in mm.

5.6.3 LEVEL 4C

Level 4C serves as the part of the DS front middle portion of the sphere.

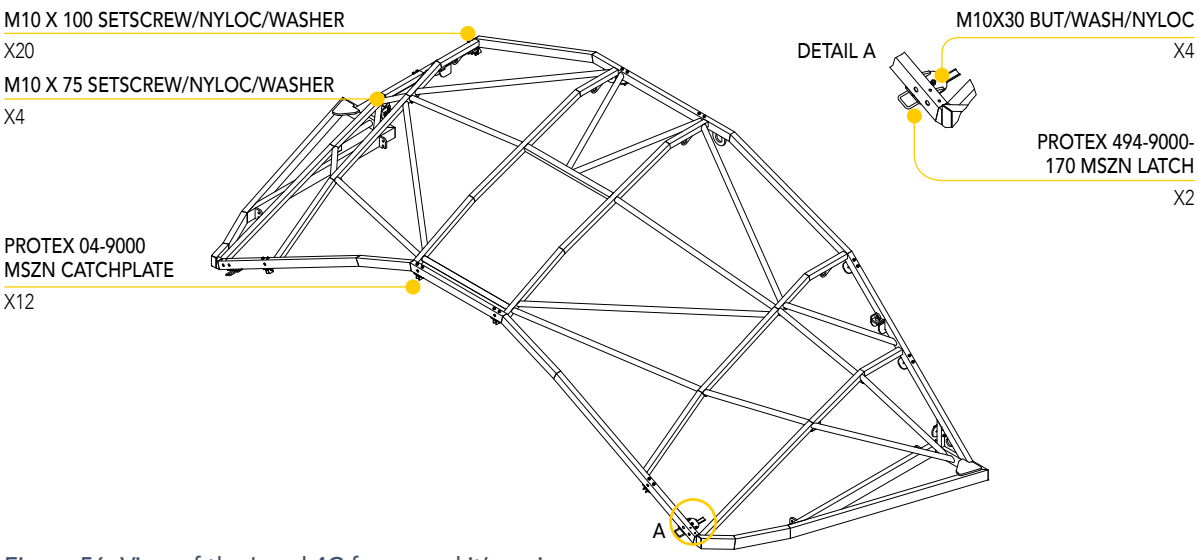


Figure 56: View of the Level 4C frame and it's main elements.

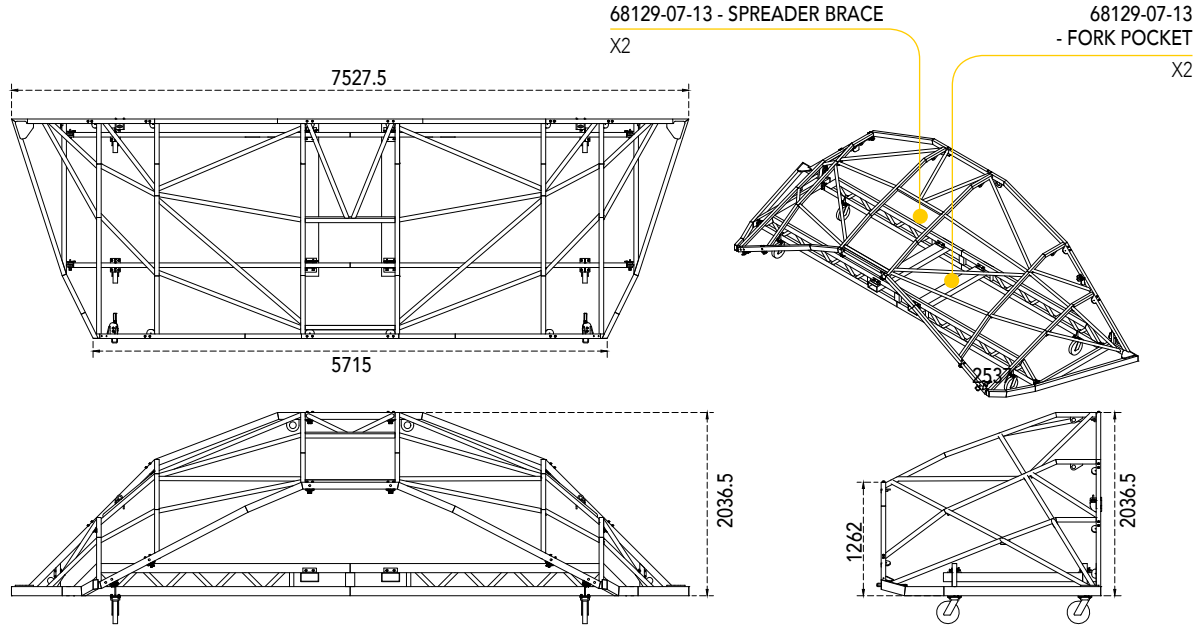
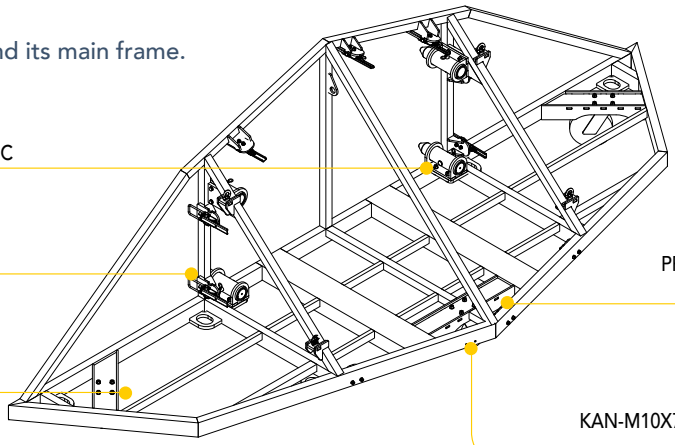


Figure 57: View of Level 4C's measurements in mm.

5.6.4 LEVEL 4D

Level 4D is the DS front portion of the sphere that structures part of the upper platform (Upper D) portion of the mouth. This section of Level 4 also consists of two frames for this section.

Figure 58: View of Level 4D and its main frame.



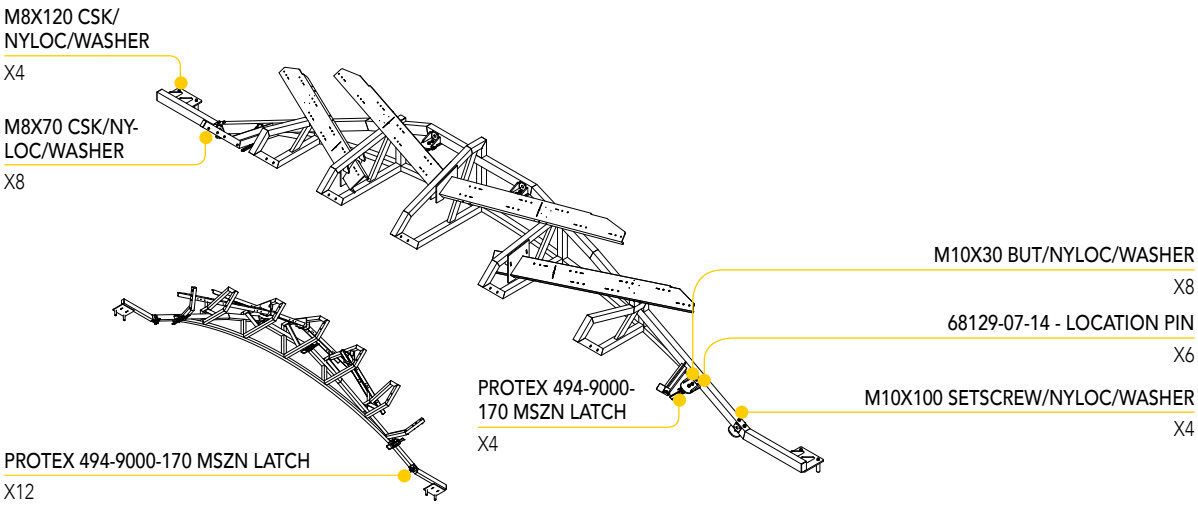


Figure 59: View of Level 4D and its secondary frame.

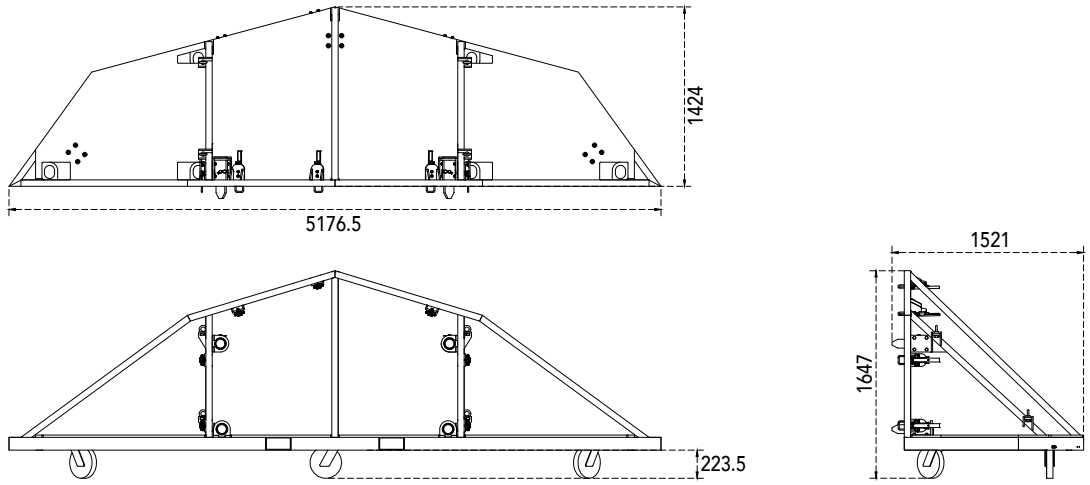


Figure 60: Measurements of the main frame for Level 4D in mm.

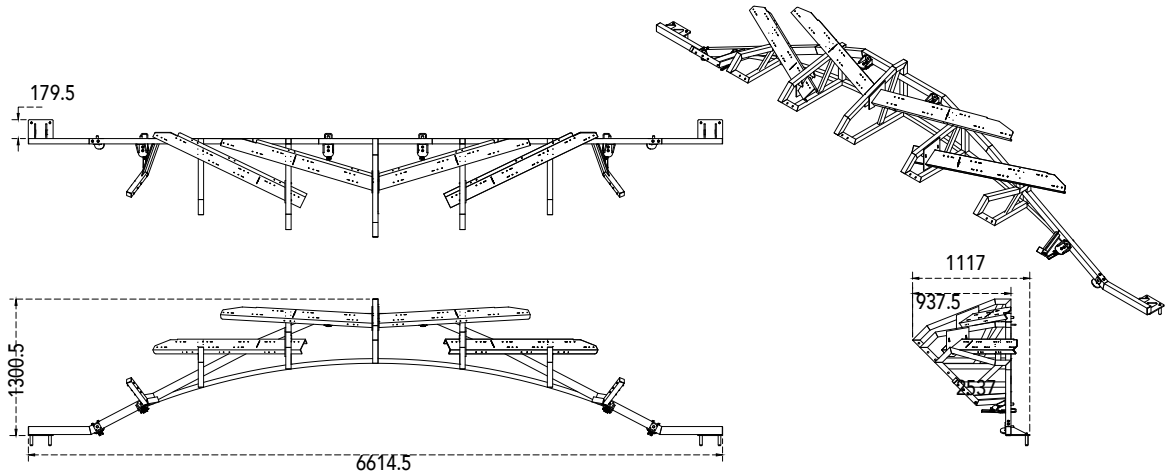


Figure 61: Measurements of the secondary frame for Level 4D in mm.

5.7 UPPER AND LOWER D

The Upper D and Lower D are two semicircular automated platforms located in the mouth of the sphere.

5.7.1 UPPER D

Platform

The automated platform is housed in the 3C area of the sphere and is fitted with three revolving doors to allow for artists and performers to have access to the 3C area.

The Upper D can pivot on its Y axis from a vertical position to a 45 degree US position.

The pivoting movement is made possible by the Serapid mechanism installed in Level 2B.

When the Upper D is in vertical position, the three rotating doors are perpendicular to the 3B module floor and the circular landing platforms are horizontal and aligned with the 3B floor.

When the Upper D is in a 45 degree US position, the landing platforms are pivoted 45 degrees upward and the access to the door is obstructed.

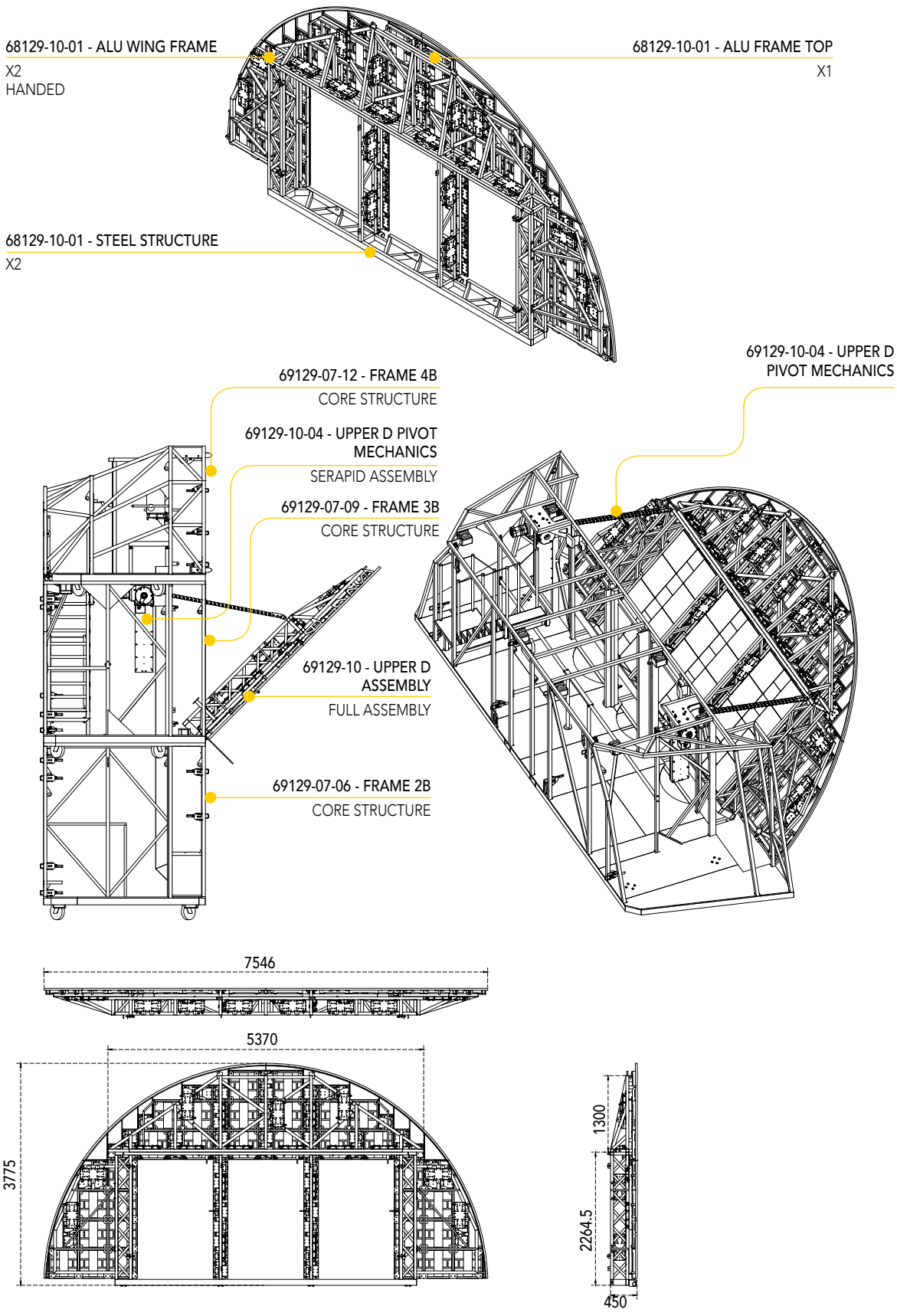


Figure 62: View of the Upper D's structure and its measurements in mm.

Revolving Doors

There are two sets of doors in the sphere which are the front door and back door. Please see the drawings below:

Front Door

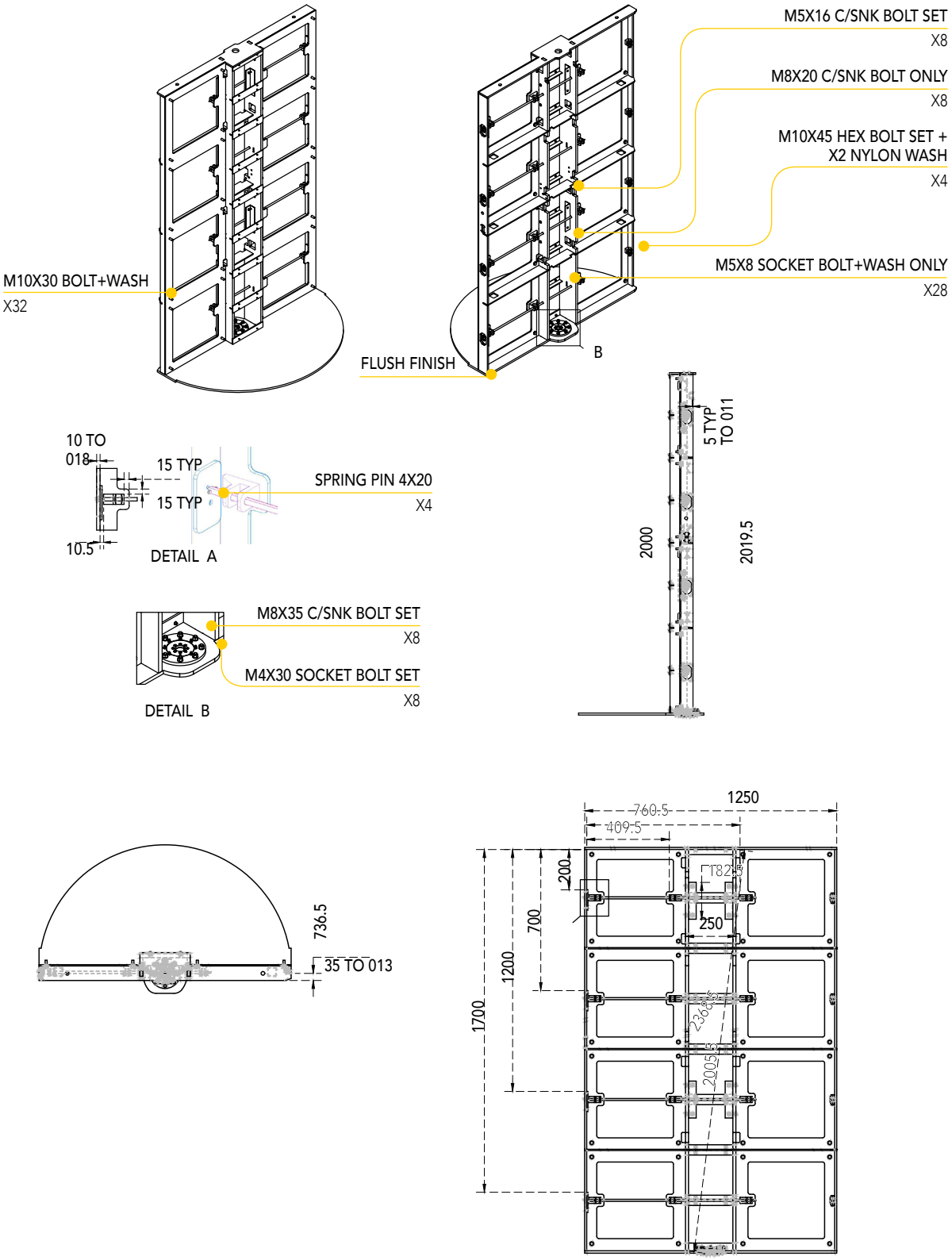


Figure 63: View of the front door and its measurements in mm.

Back Door

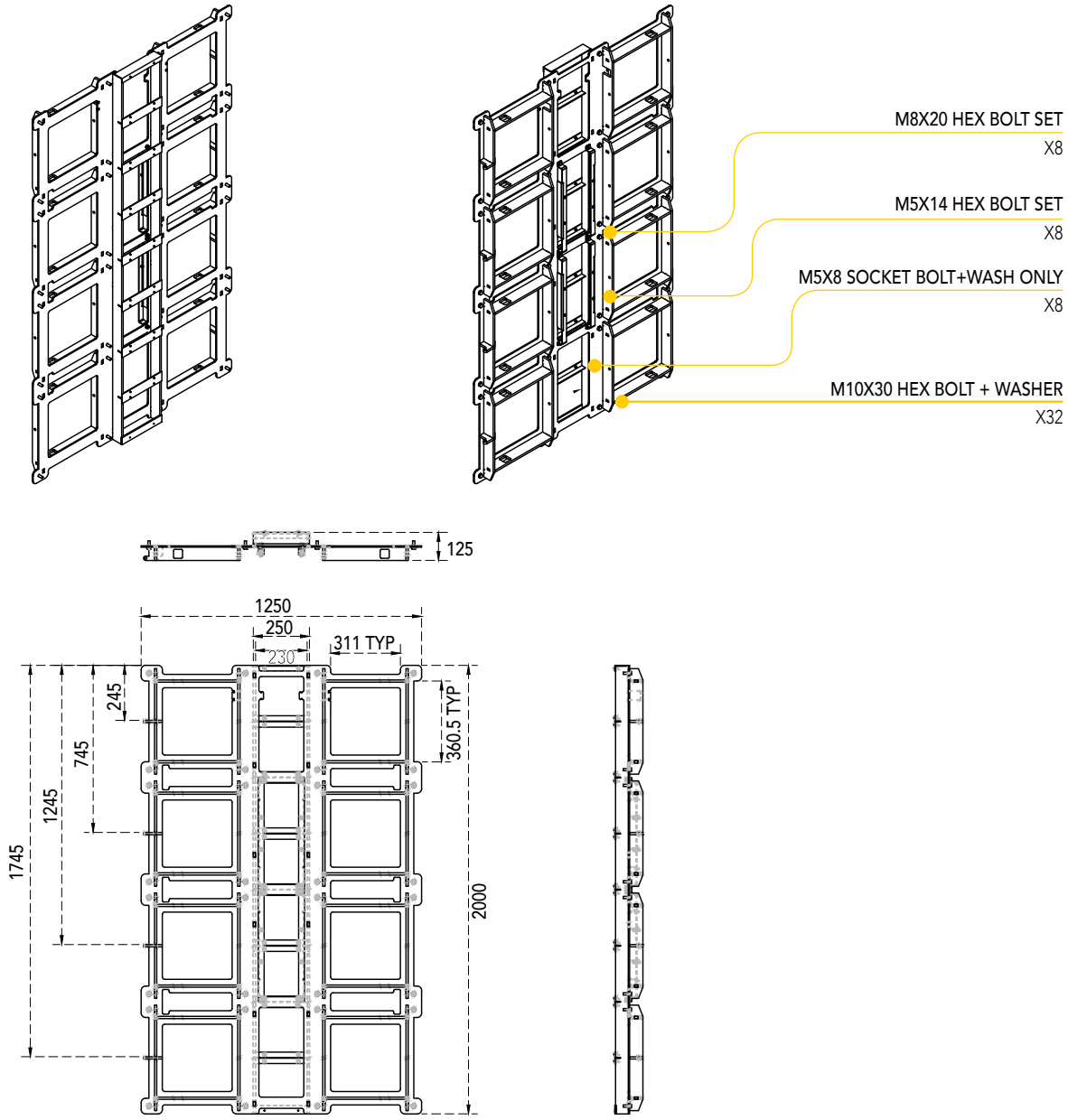


Figure 64: View of the back door and it's measurements in mm.

5.7.2 LOWER D

Platform

The automated platform is housed in the 2C area of the sphere and it is designed to act as a stage lift, lowering artists from the 3rd level to the 2nd level so it can be levelled with the travelator lift when it is in the max UP position.

The Lower D is driven by two independent Serapid mechanisms, one acting on the US side of the Lower D and the second acting on the DS side of it.

The US Serapid mechanism is located in the 1B module.

The DS Serapid mechanism is located in the 1C module.

Lower D Positions

The Lower D can assume three positions:

1 - horizontal, max UP

In this position, the Lower D is horizontal and parallel to the stage with the US and DS Serapid mechanisms fully extended and with the platform levelled to the 3rd level sphere floor.

When the Lower D is in this position, the Upper D is in a vertical position and the performers are allowed to access it from the Upper D revolving doors.

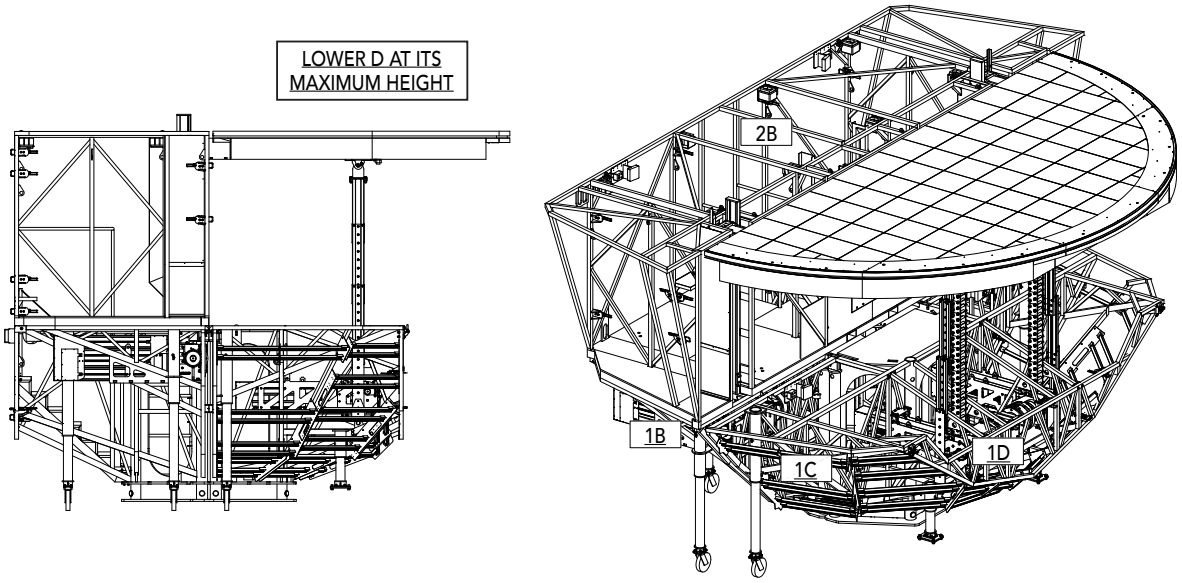


Figure 65: View of the Lower D platform in the max UP position.

2 - horizontal, max DOWN

In this position, the Lower D is horizontal and parallel to the stage with the US and DS Serapid mechanisms fully retracted and with the platform levelled to the 2nd level sphere floor.

When the Lower D is in this position, the performers are allowed to access the fully extended travelator lift.

In the max DOWN position, the performers can also have access to the Lower D through a door located in the central part of DS side of module 2B.

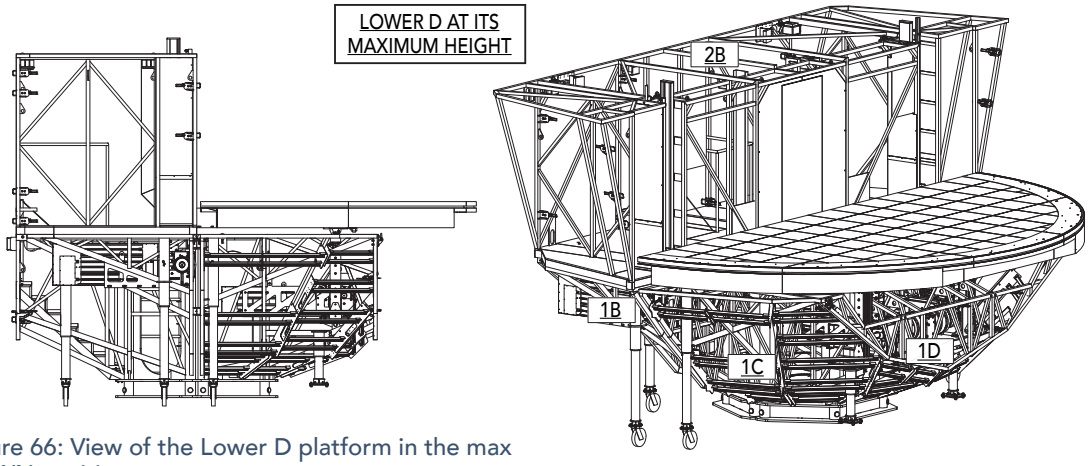


Figure 66: View of the Lower D platform in the max DOWN position.

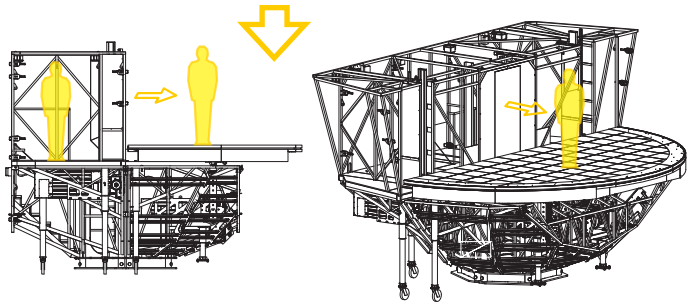


Figure 67: View of the door and a how a performer would access it when the Lower D is in max DOWN position.

NOTE: When the Lower D is in a horizontal position it acts as a stage lift, moving performers up and down from the 2nd to 3rd levels or vice versa.

3 - tilted 45 degrees

In this position, the Lower D is tilted 45 degrees, with the US Serapid mechanism fully extended and the DS Serapid mechanism extended with a max inclination of 22 degrees from the vertical axis.

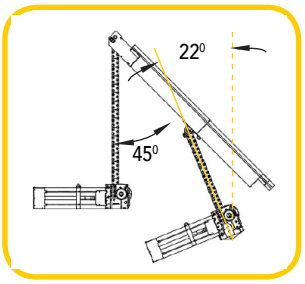


Figure 68: Lower D DS Serapid mechanism max vertical inclination.

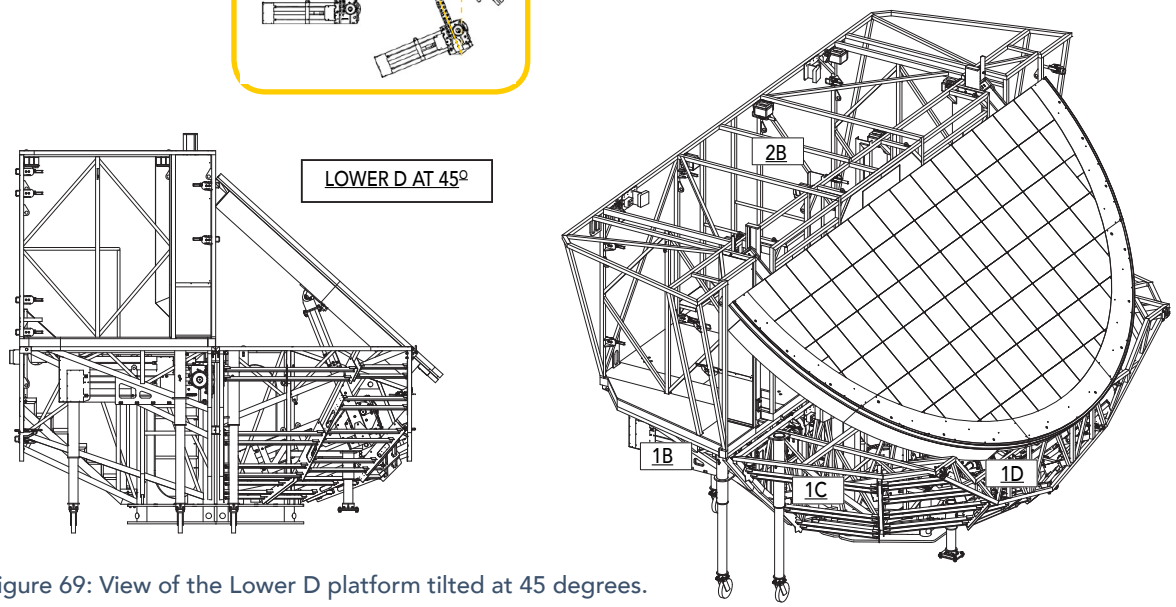
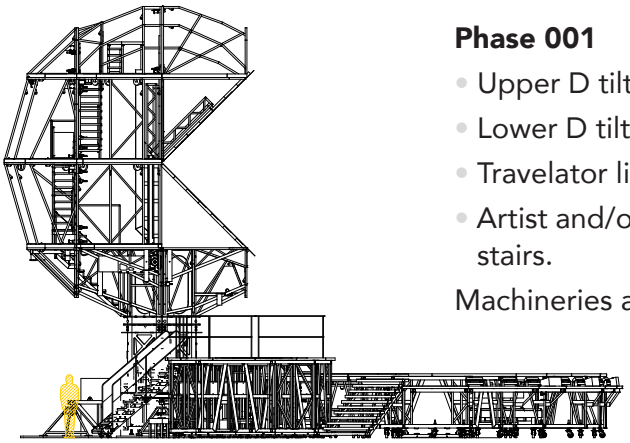


Figure 69: View of the Lower D platform tilted at 45 degrees.

5.7.3 SCENIC MOVEMENT

A common scenic movement related to the Upper D and Lower D - in combination with the travelator lift - is represented in the following sequence:



Phase 001

- Upper D tilted at 45 degrees.
- Lower D tilted at 45 degrees.
- Travelator lift - fully retracted position.
- Artist and/or performers reaching module 3B using the stairs.

Machineries are at rest.

Figure 70: View of the machinery in Phase 001.

Phase 002

Status

- Upper D tilted at 45 degrees.
- Lower D tilted at 45 degrees.
- Travelator lift - fully retracted position.
- Artist and/or performers stand by in module 3B.

Scenic Movement:

- Upper D pivots from 45 degrees to vertical position.
- Lower D tilts from 45 degrees to horizontal max UP position.

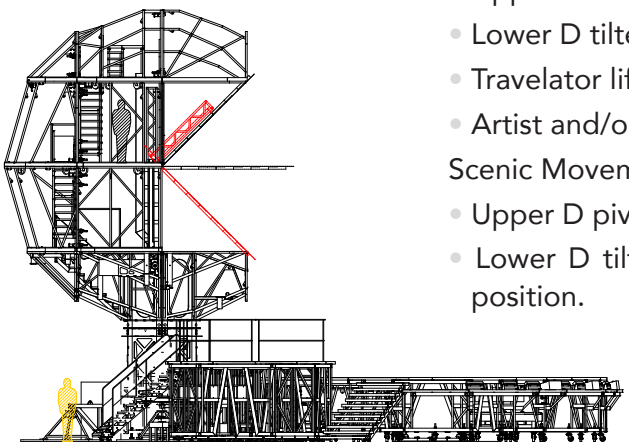


Figure 71: View of the machinery in Phase 002.

Phase 003

Status

- Upper D in vertical position.
- Lower D in horizontal max UP position.
- Travelator lift - fully retracted position.
- Artist and/or performers move to Lower D using revolving doors.

Machineries are at rest.

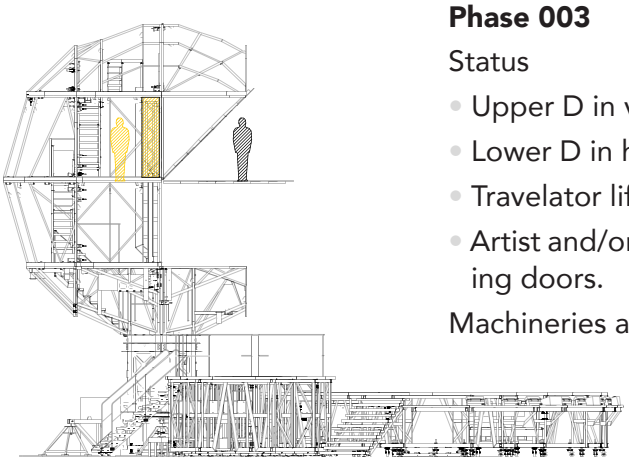
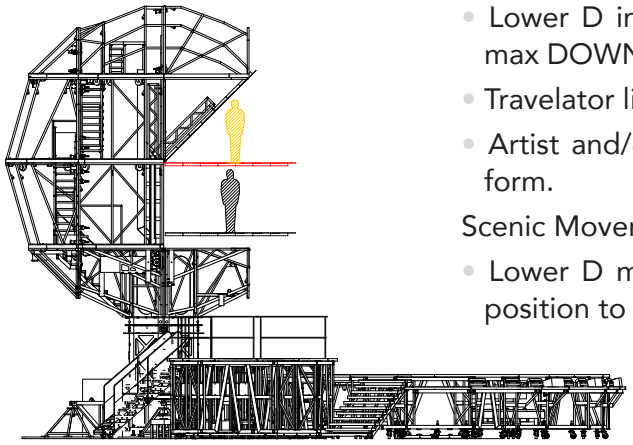


Figure 72: View of the machinery in Phase 003.



Phase 004

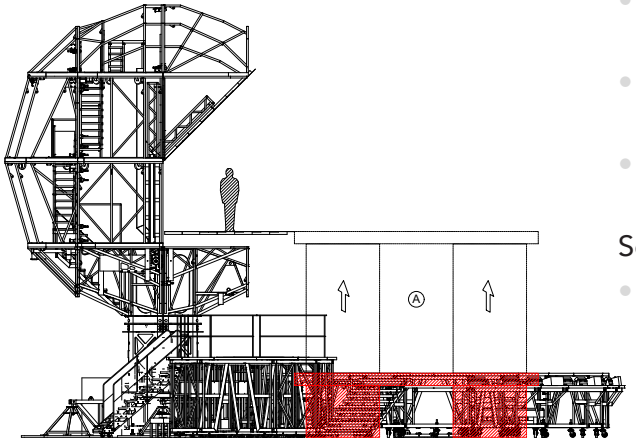
Status

- Upper D in vertical position.
- Lower D in horizontal max UP position to horizontal max DOWN position.
- Travelator lift - fully retracted position.
- Artist and/or performers stationary on Lower D platform.

Scenic Movement:

- Lower D moves DOWN from the horizontal max UP position to the horizontal max DOWN position.

Figure 73: View of the machinery in Phase 004.



Phase 005

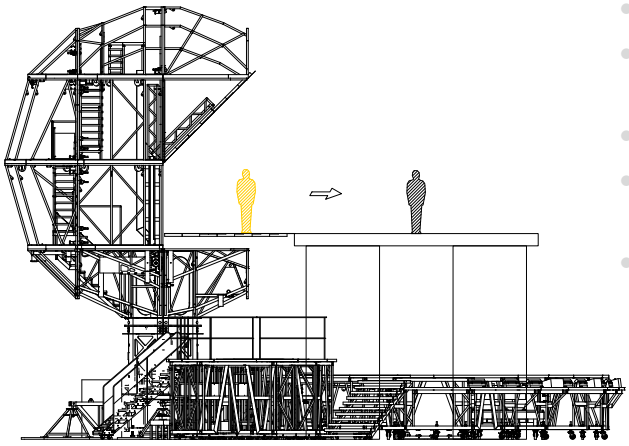
Status

- Upper D in vertical position.
- Lower D in horizontal max DOWN position.
- Travelator lift - from fully retracted to fully extended position.
- Artist and/or performers stationary on lower D platform.

Scenic Movement:

- Travelator lift moves UP from a fully retracted to a fully extended position.

Figure 74: View of the machinery in Phase 005.



Phase 006

Status

- Upper D in vertical position.
- Lower D in horizontal max DOWN position.
- Travelator lift - fully extended position.
- Artist and/or performers moving from the Lower D platform to the travelator lift.
- Machineries are at rest.

Figure 75: View of the machinery in Phase 006.

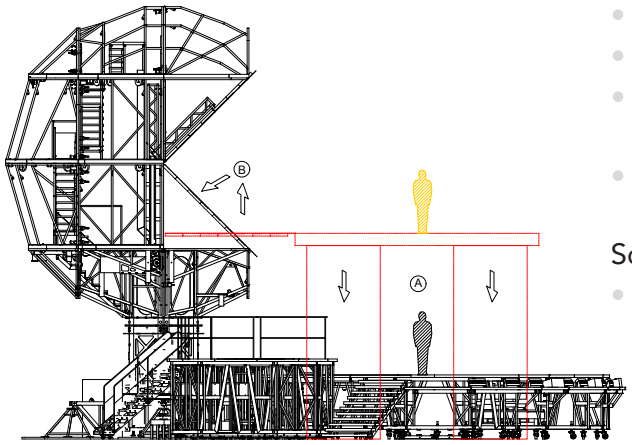


Figure 76: View of the machinery in Phase 007.

Phase 007

Status

- Upper D in vertical position.
- Lower D in horizontal max DOWN position.
- Travelator lift - from fully extended to fully retracted position.
- Artist and/or performers stationary on travelator lift.

Scenic Movement:

- Travelator lift moves DOWN from a fully extended to a fully retracted position.

Phase 008

Status

- Upper D in a vertical position.
- Lower D in a horizontal max DOWN position.
- Travelator lift - fully retracted position.
- Artist and/or performers walking on the travelator lift.

Scenic Movement:

- Travelators in motion with the travelator lift in a stationary position at stage level.

5.8 PIANO LIFTS

The piano lift assembly is comprised of a passive scissor lift assembly to passively guide the lift as it it lowered and raised, and a Serapid scissor lift assembly powered by an AC servo motor to raise/lower the platform and base.

Two piano lifts are located in the main stage - SR and SL - in front of the sphere as a part of the stage assembly. Each lift will be stored underneath the stage on the left and right side, and will be lifted up through the stage floor during the show.

The piano lift will move from arena level to stage level.

NOTE: Please refer to the drawings in the Overview section for the location of each piano lift as they will appear on stage.

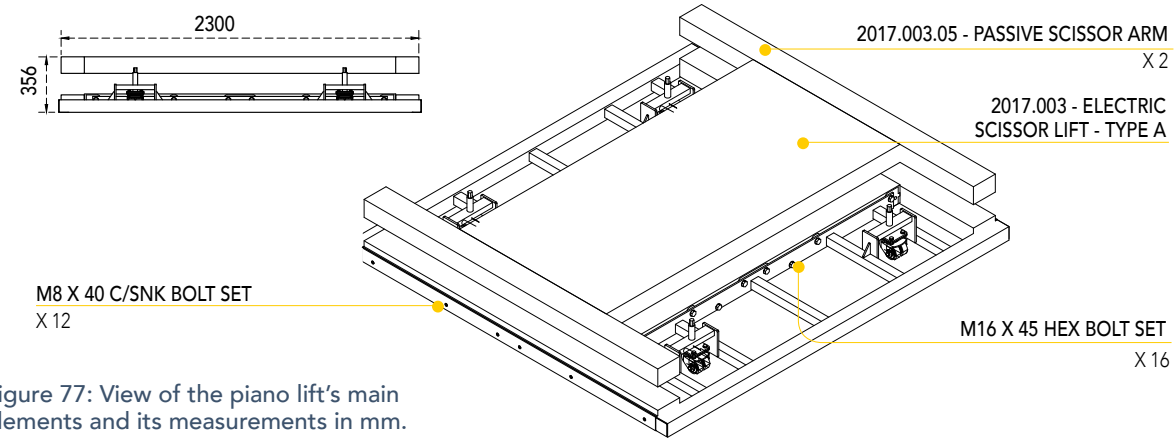


Figure 77: View of the piano lift's main elements and its measurements in mm.

5.9 TRAVELATOR LIFT

The travelator lift consists of three Brilliant Stages travelators, integrated into a platform lifted by two Brilliant Stages Electric Scissor Lifts - Type B that are located in the centre of the main stage.

The lift will move from stage level to above stage level, to reach a maximum height of 4,050 m.

For more detailed information of the Travelator and Electric Scissor Lift - Type B, please refer to the related product manuals.

NOTE: Please refer to the drawings in the Overview sections for the location of the Travelator Lift on the main stage.

5.9.1 TRAVELATOR ELEMENTS

NOTE: Please refer to the Brilliant Stages Travelator's user manual for more information on its main elements and section 7.3.1 in this manual.

5.10 MAIN STAGE & TECH BUNKER

The stage assembly for the sphere consists of the main stage and the tech bunker, which is situated in between the stage and the sphere.

NOTE: Please refer to the Overview section for figures of the main stage and technical bunker.

5.10.1 MAIN STAGE

The stage acts as the main platform for the artist(s) during the show and also serves as storage for the piano and travelator lifts used in the show. There are three apertures in the stage. The piano lifts can be raised from arena level to stage level, and the travelator lift travels from stage level to above stage level.

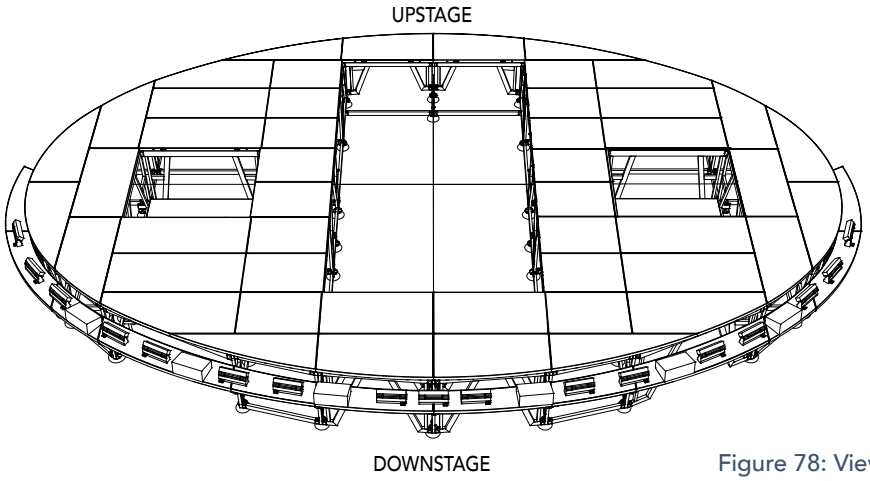


Figure 78: View of the piano lift apertures in the main stage.

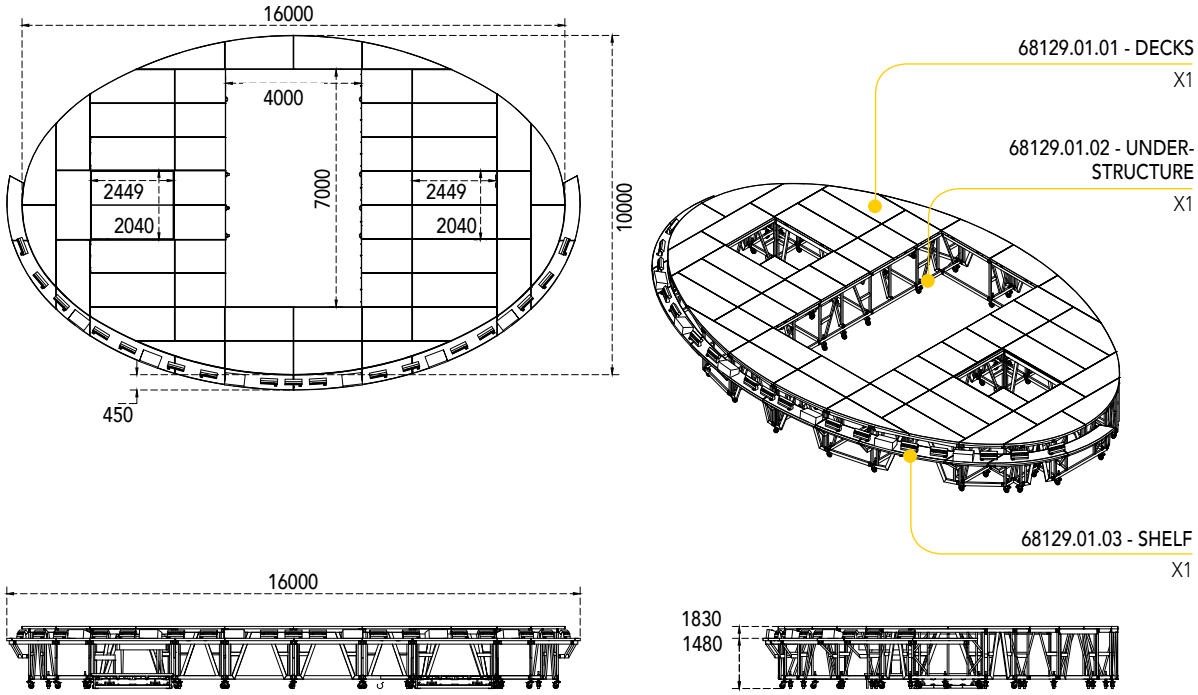
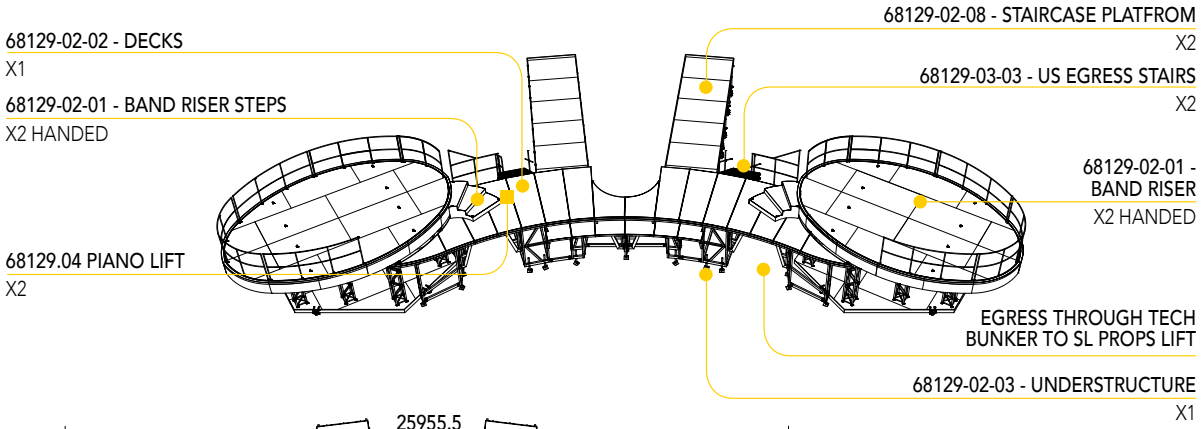


Figure 79: View of the piano lift apertures in the main stage and the stage's measurements in mm.

5.10.2 TECH BUNKER

The tech bunker serves as part of the stage platform, and houses the control stations, core, and other elements used to run the show.



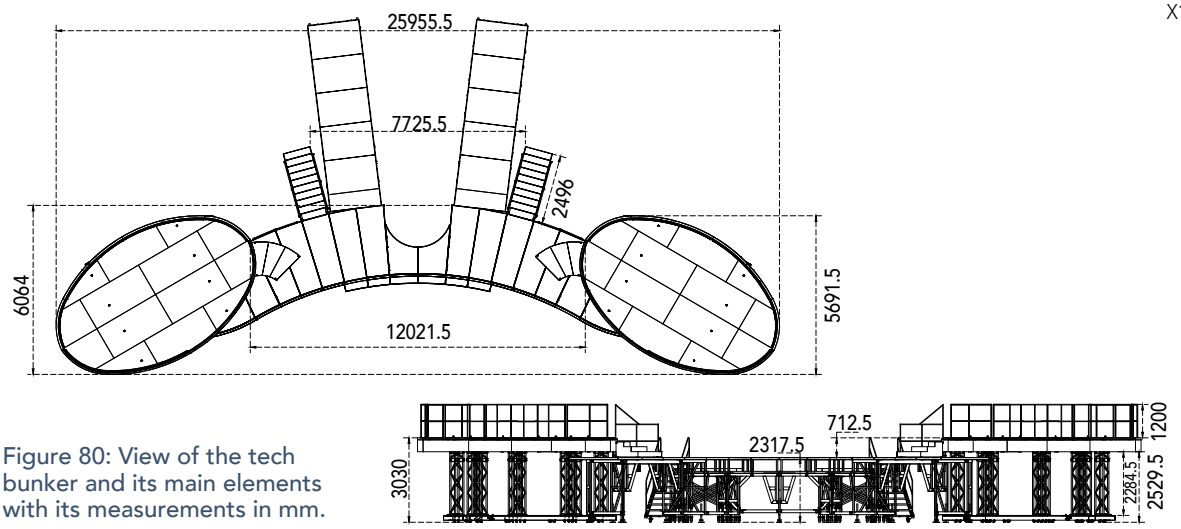


Figure 80: View of the tech bunker and its main elements with its measurements in mm.

MAIN INFORMATION

Sphere

Rotate

Axis Name ..... Sphere Rotate
Axis Location ..... Sphere Base
Max Deceleration Torque ..... ≈18.5 Nm
Motor Drive ..... SEW 7.5 kW AC Servo
Actuator Type ..... SEW CMPZ71S 2.65 hp/2 kW
Primary Reduction ..... Stober C713 222:1
Secondary Reduction ..... Rodriguez RG&P 120:16
Maximum Speed ..... 1.8 rpm

Upper D

Axis Name ..... Upper D Pivot
Axis Location ..... Sphere Interior
Max Capacity ..... 1600 kg (2x)
Motor Drive ..... SEW 7.5 kW AC Servo (2x)
Actuator Type ..... SEW CMP71S 2.65 hp/2 kW (2x)
Primary Reduction ..... Stober K514 149:1 (2x)
Secondary Brake ..... 2x Mayr Silenzio 300 (2x 2)
Limit Box ..... TER 15:1 (2x)
Secondary Encoder ..... Kubler (2x)
Encoder PT M1 60:60 (2x)
Drive Pitch ..... 188 mm
Cable Diameter ..... Serapid RB60 (2)
Maximum Travel ..... 45 deg (1.8 m)
Maximum Speed ..... 0.1 m/s
Show Load Placeholder ..... 650 kg (2x)

Lower D

Axis Name ..... Lower D SL Pivot
Axis Location ..... Sphere Interior
Max Capacity ..... 5400 kg
Motor Drive ..... SEW 7.5 kW AC Servo
Actuator Type ..... SEW 100S 10.7hp/8 kW
Primary Reduction ..... SEW KA97 176:1
Secondary Brake ..... Mayr 4 x 1300 (2x 2)
Limit Box ..... TER 15:1
Limit PT ..... Belt 63:25
Drive Pitch ..... 76.4 mm
Cable Diameter ..... Serapid LL80 (2)
Maximum Travel ..... 2 m

Maximum Speed ..... 0.14 mps
Show Load Placeholder..... 3440 kg

Axis Name ..... Lower D US Lift
Axis Location ..... Sphere Interior
Max Capacity..... 5400 kg
Motor Drive ..... SEW 7.5 kW AC Servo
Actuator Type ..... SEW 100S 10.7 hp/8 kW
Primary Reduction ..... SEW KA97 176:1
Secondary Brake ..... Mayr 4x1300 (2x 2)
Limit Box ..... TER 15:1
Limit PT ..... Belt 63:25
Drive Pitch ..... 76.4 mm
Cable Diameter ..... Serapid LL80 (2)
Maximum Travel ..... 2.76 m
Maximum Speed ..... 0.14 mps
Show Load Placeholder..... 3440 kg

NOTE: Main information for the Electric Scissor Lifts - Type A and B, and Travelator can be found in their product user manuals.

MEASUREMENTS

Sphere

Height..... 12374.5 mm
Diameter..... 4285 mm

Piano Lift

H fully extended..... 1830 mm
H fully retracted..... 427 mm
L..... 2020 mm
W ..... 2430 mm

Travelator Lift

H fully extended..... 5885 mm
H fully retracted..... 1830 mm
L..... 7000 mm
W ..... 4000 mm

SELF-WEIGHT

SELF-WEIGHT - Structural Modules

Values are rounded to the kg.

Module 1A	348 kg
Module 1B	2462 kg
Module 1C	2303 kg
Module 1D	29 kg
Module 2A	375 kg
Module 2B	1656 kg
Module 2C (x2)	57 kg
Module 3A	334 kg
Module 3B	1479 kg
Module 3C (x2)	57 kg
Module 4A	58 kg
Module 4B	466 kg
Module 4C	137 kg
Module 4D	29 kg
Total weight of the core modules	9792 kg

DEAD LOADS - Modules + LED skin + LED tiles

Values are rounded to the kg.

Base	2220 kg
Core	4835 kg
Module 1A	1190 kg
Module 1B	5756 kg
Module 1C	5073 kg
Module 1D	417 kg
Module 2A	2065 kg
Module 2B	2941 kg
Module 2C (x2)	777 kg
Module 3A	2035 kg
Module 3B	2742 kg
Module 3C (x2)	798 kg
Module 4A	1000 kg
Module 4B	2088 kg
Module 4C	1800 kg
Module 4D	390 kg
Upper D	2550 kg
Lower D	1100 kg
Total Dead load	39777 kg (400kN)

NOTE 1: 1D, 4D, 2C & 3C are all based on estimations.

NOTE 2: Mechanics weight to be added to 1B, 1C, 4B.

NOTE 3: Cables and LED tiles weights are not included.

7.1 ASSEMBLY

Modulift Assembly (Rigging Truss):

Use the modulift assembly to assemble the sphere.

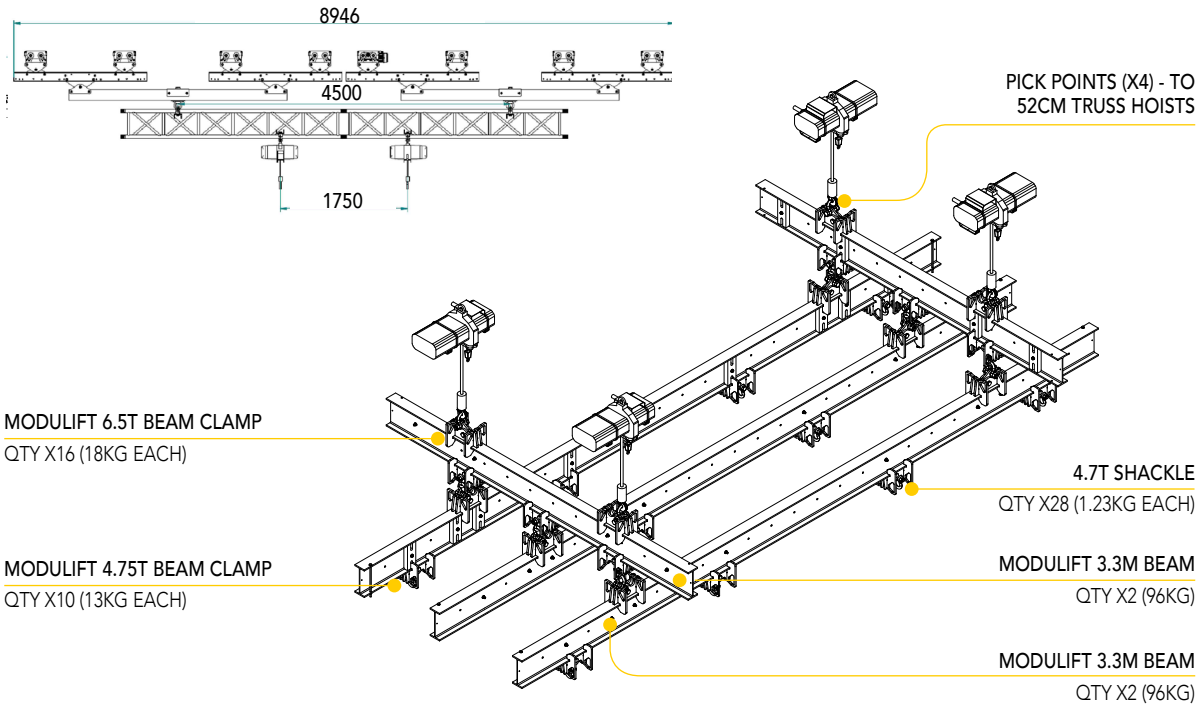


Figure 81: View of the modulift assembly.

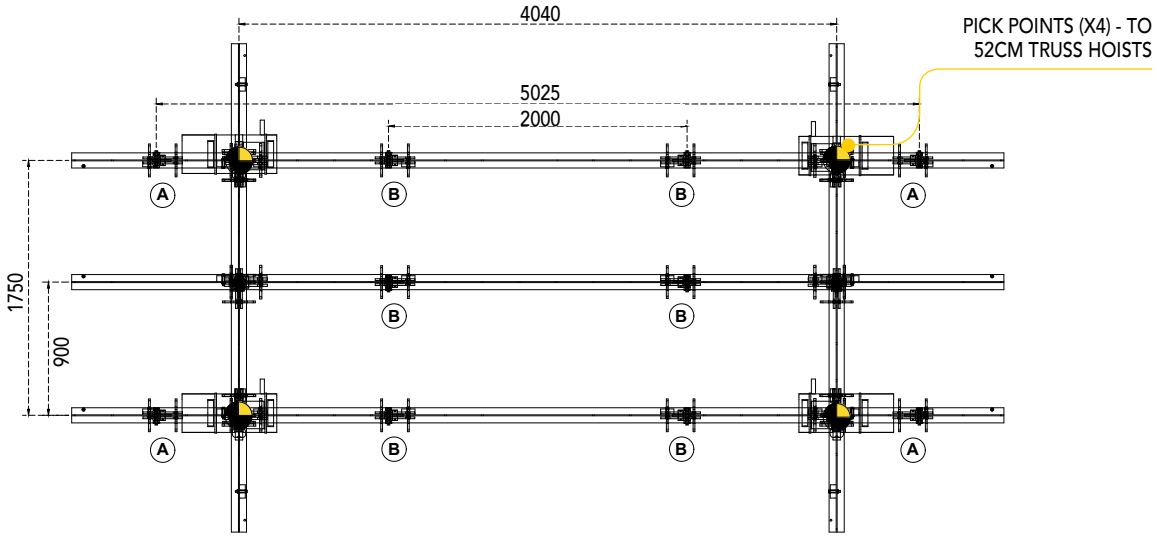


Figure 82: The modulift and its measurements in mm.

7.1.1 POSITION THE BASE AND CORE

WARNING

During the installation phases, make sure the hazard zone is free from any unauthorised people.

WARNING

All people - installers and operators included - working on the assembly of the product must wear adequate PPE protections.

1) Instal the rigging truss making sure it is installed before the base is positioned.

NOTE: The rigging truss installation is carried out by a third party: make sure the installation drawings are always available.

2) With the rigging truss, place the base (hub) onto a level area.

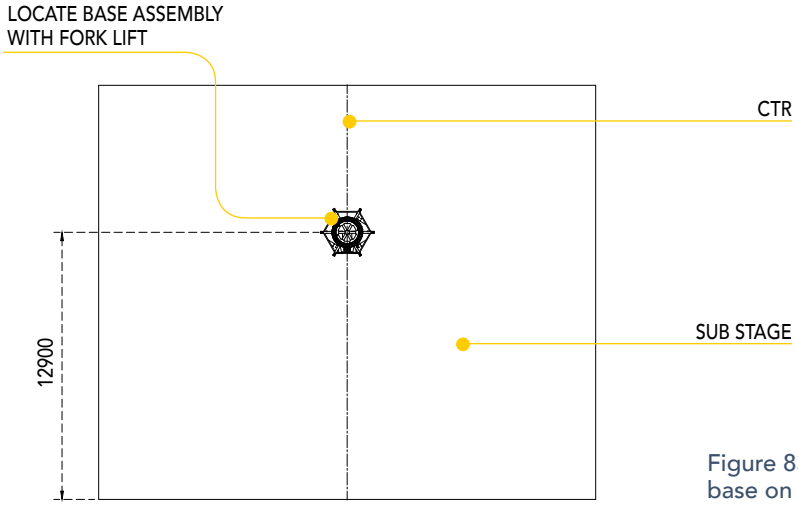


Figure 83: The location of the sphere's base on stage.

3) Lift and place the core onto the base with the rigging truss.

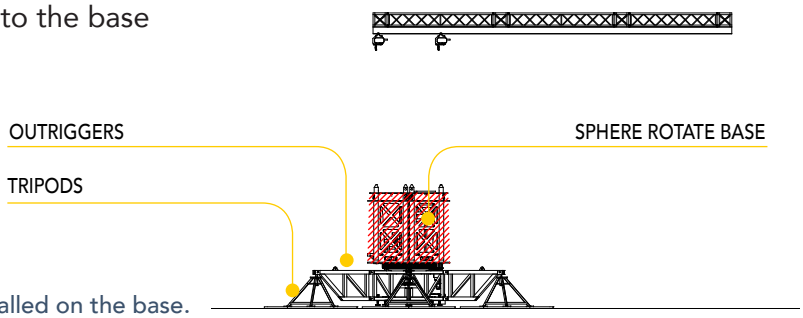


Figure 84: The core being installed on the base.

4) If they are not already installed, add the floor pads to stabilise the base and core.

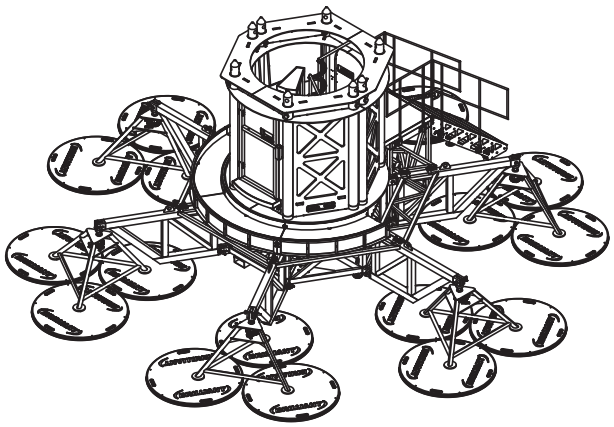


Figure 85: A view of the base and core after the floor pads have been added.

DANGER

The base and core must be perfectly levelled before carrying out the rest of the installation.

DANGER

The base tripods must be adjusted and each tripod must be load-bearing.

WARNING

Lifting operations must be carried out by a competent person.

WARNING

Do not manually lift or manually transport the product/machinery.

7.2 SPHERE ASSEMBLY

The assembly and installation of the sphere can begin once the core, base and outriggers (hub assembly) are in place. The sphere has four levels that are separated into sections, and will need to be installed with the rigging truss.

7.2.1 SPHERE ASSEMBLY:

STEP 1:

Use the rigging truss to lift module 1B and attach it to the neck core.

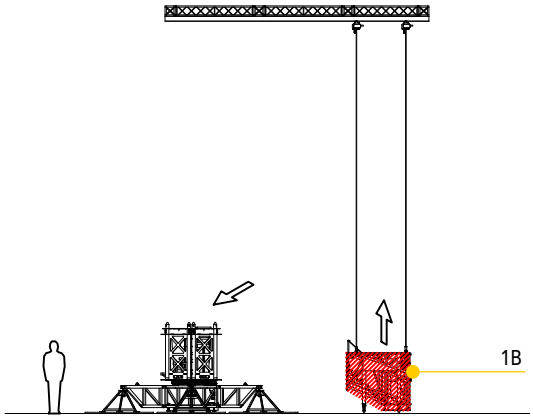


Figure 86: Module 1B being lifted by the rigging truss.

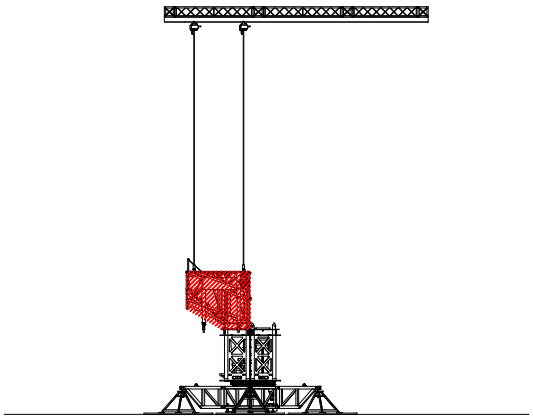


Figure 87: Module 1B being attached to the neck core.

STEP 2:

Use the rigging truss to lift module 1C and attach it to module 1B and the neck core.

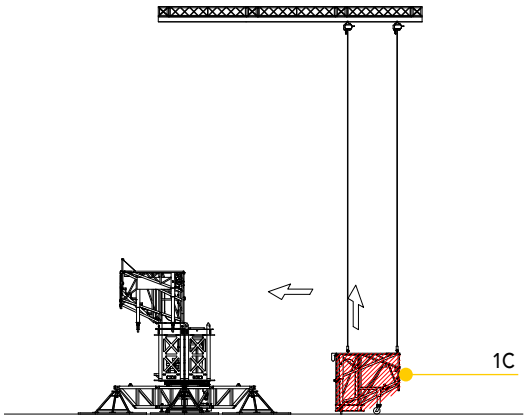


Figure 88: Module 1C being lifted with the rigging truss.

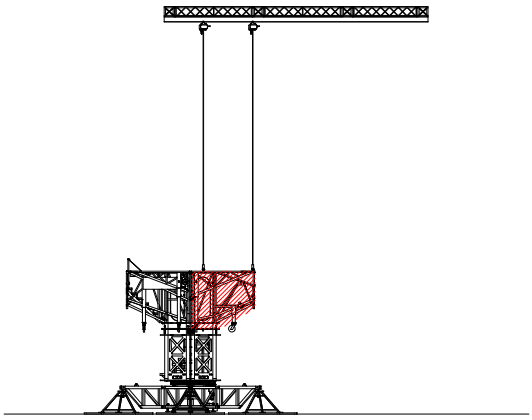


Figure 89: Module 1C being attached to the neck core and module 1B.

STEP 3:

Use the rigging truss to lift module 1A and attach it to module 1B.

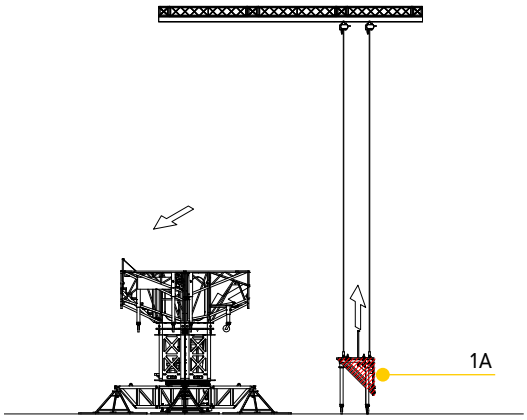


Figure 90: Module 1A being lifted with the rigging truss.

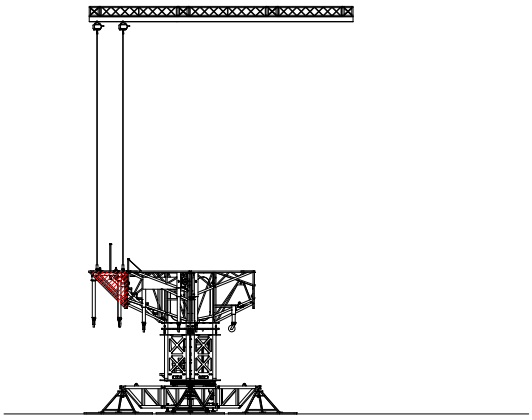


Figure 91: Module 1A being attached to module 1B.

STEP 4:

Use the rigging truss to lift module 2B and attach it to module 1B.

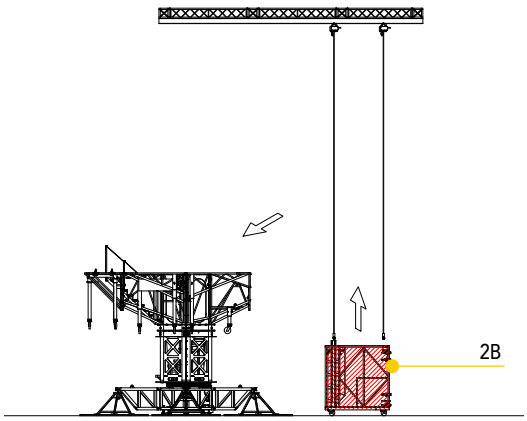


Figure 92: Module 2B being lifted with the rigging truss.

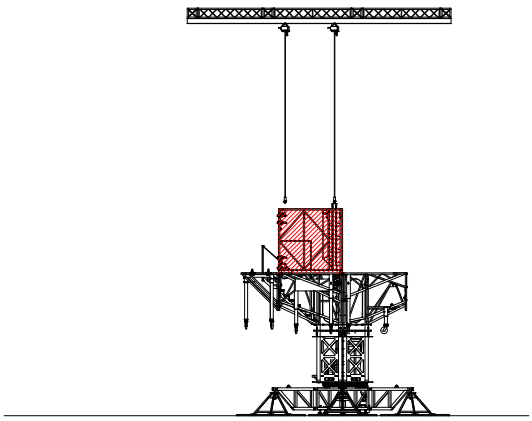


Figure 93: Module 2B being attached to module 1B.

STEP 5:

Use the rigging truss to lift module 2A and attach it to module 1A and module 2B.

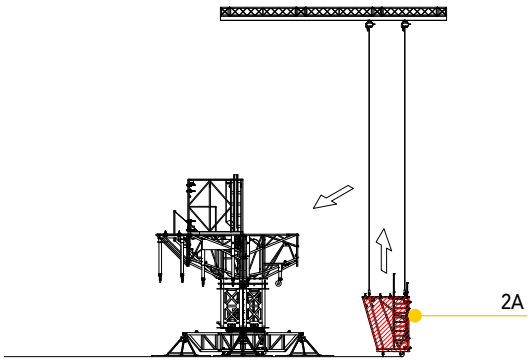


Figure 94: Module 2A being lifting with the rigging truss.

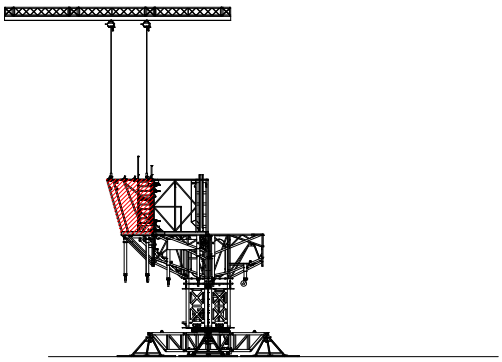


Figure 95: Module 2A being attached to module 1A and module 2B.

STEP 6:

Use the rigging truss to lift module 1D and attach it to 1C.

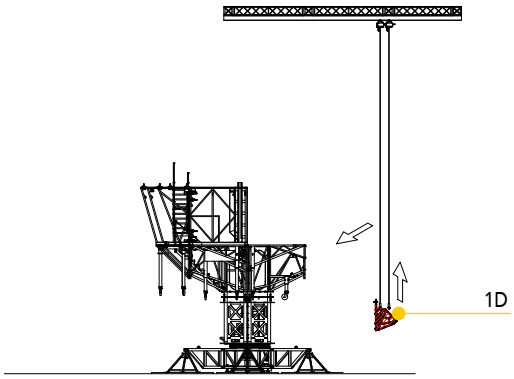


Figure 96: Module 1D being lifted with the rigging truss.

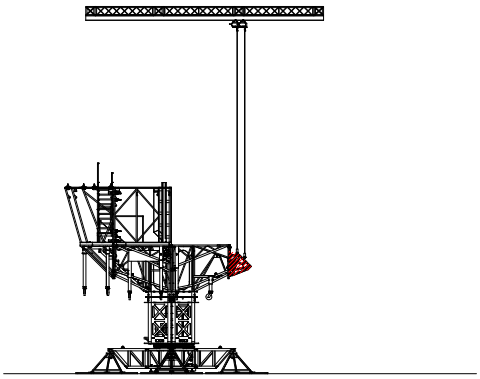


Figure 97: Module 1D being attached to module 1C.

STEP 7:

Use the rigging truss to lift the Lower D platform and attach it to modules 2B, 1C and 1D.

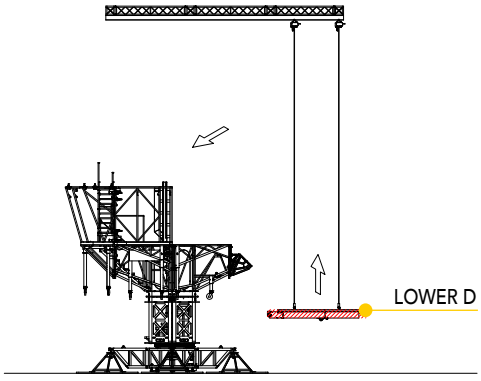


Figure 98: The Lower D platform being lifted with the rigging truss.

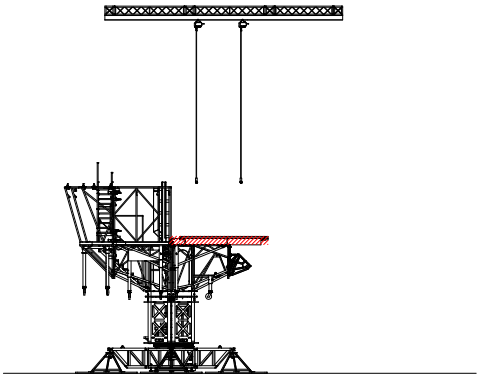


Figure 99: The Lower D platform being attached to modules 2B, 1C and 1D.

STEP 8:

Use the rigging truss to lift module 2C and attach it to modules 2B and 1C.

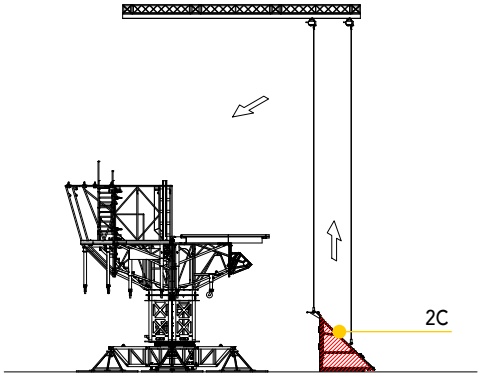


Figure 100: Module 2C being lifted with the rigging truss.

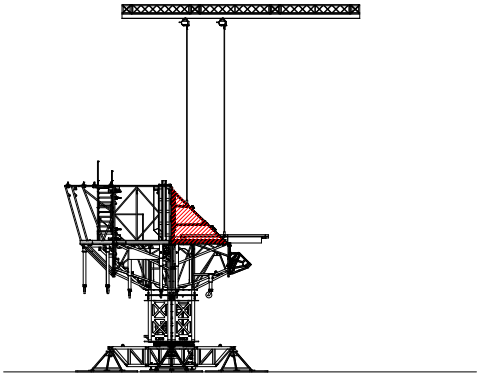


Figure 101: Module 2C being attached to modules 2B and 1C.

STEP 9:

Use the rigging truss to lift module 3B and attach it to module 2B.

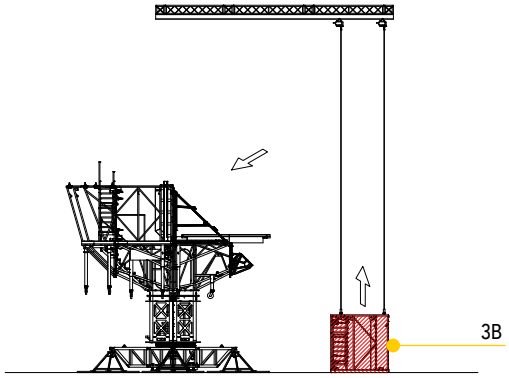


Figure 102: Module 3B being lifted with the rigging truss.

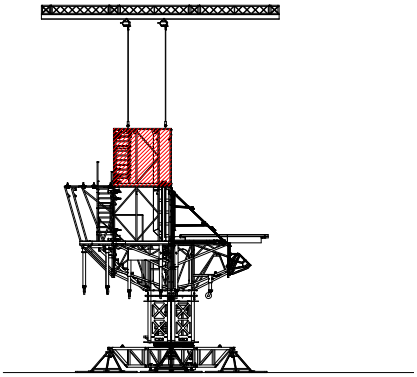


Figure 103: Module 3B being attached to module 2B.

STEP 10:

Use the rigging truss to lift module 3A and attach it to modules 3B and 2A.

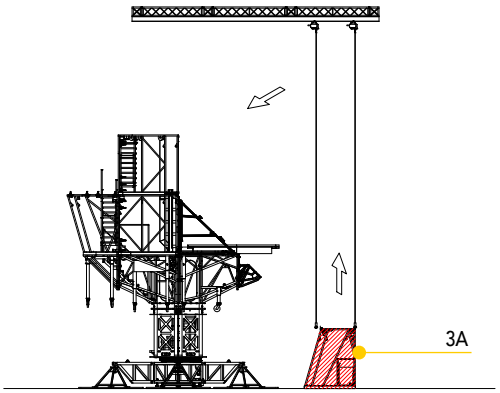


Figure 104: Module 3A being lifted with the rigging truss.

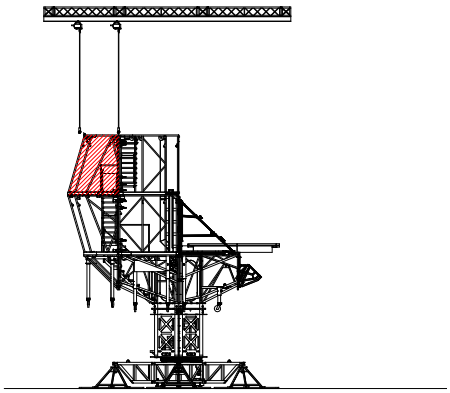


Figure 105: Module 3A being attached to modules 3B and 2A.

STEP 11:

Use the rigging truss to lift module 4B and attach it to module 3B.

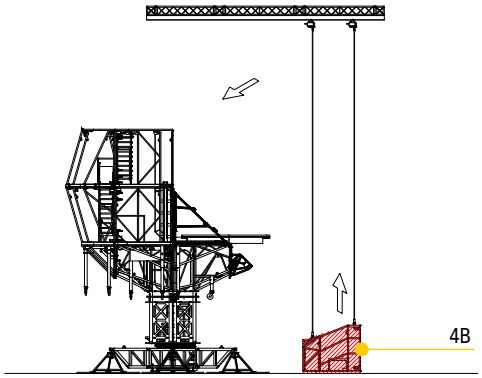


Figure 106: Module 4B being lifted with the rigging truss.

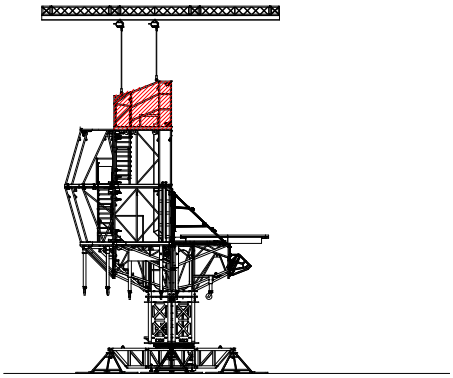


Figure 107: Module 4B being attached to module 3B.

STEP 12:

Use the rigging truss to lift module 4A and attach it to modules 4B and 3A.

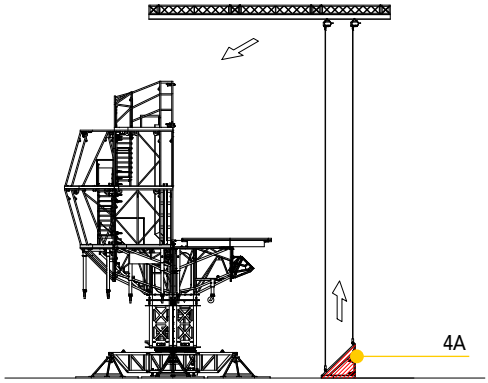


Figure 108: Module 4A being lifted with the rigging truss.

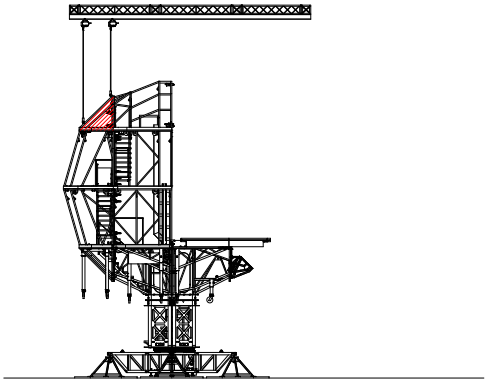
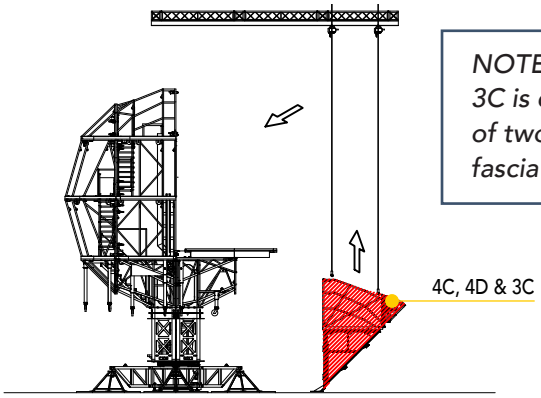


Figure 109: Module 4A being attached to modules 4B and 3A.

STEP 13:

Use the rigging truss to lift modules 4C, 4D and 3C and connect them to module 4B if they are not already attached to module 4B.



NOTE: Module 3C is comprised of two side fascia pieces.

Figure 110: Modules 4C, 4D and 3C being lifted with the rigging truss.

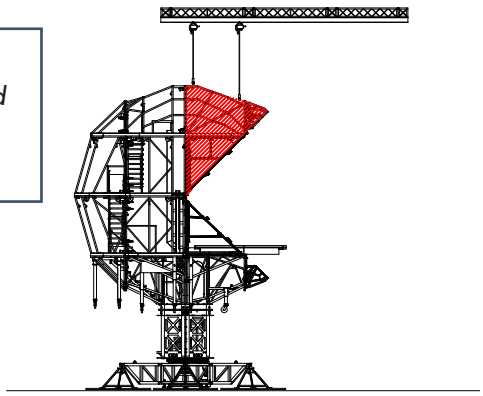


Figure 111: Modules 4C, 4D and 3C being attached to the sphere. Module 3C is located under module 4C's position.

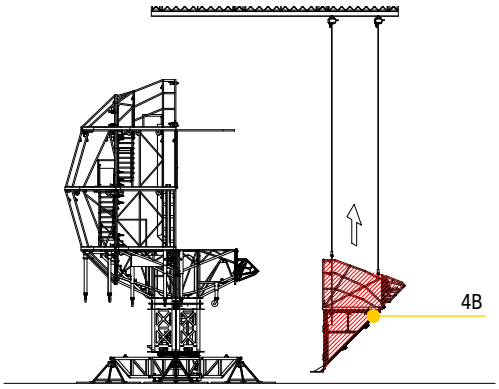


Figure 112: Module 4B being lifted with the rigging truss while modules 4C, 4D and 3C are attached to it

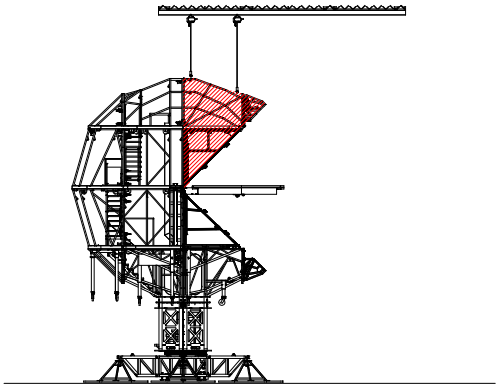


Figure 113: View of modules 4C, 4D and 3C attached to module 4B and in position.

NOTE: The Upper D comes in two sections. One section travels attached to module 3B and the other section travels attached to module 4B. Both Upper D sections are connected when module 4 B is attached and connected to module 3B.

7.3 TRAVELATOR LIFT AND PIANO LIFTS

7.3.1 INSTALLING THE TRAVELATOR LIFT

To instal the travelator lift, please refer to the user manuals for the following for further information.

- Electric Scissor Lift - Type B
- Travelator - Type A

7.3.1.1 Travelator Lift Assembly

The travelator lift comes in one configuration. Please see below:

Travelator Lift Assembly Stages:

1) The spacer sets the maximum and minimum width between the base carts.

2) The bridge section is lowered in at an angle onto the end frame.

3) It is then secured using a toggle latch that is positioned S/L and S/R of the bridge.

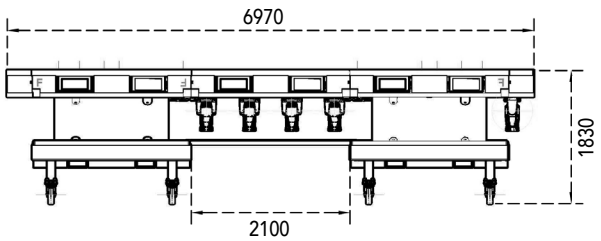


Figure 114: Measurements of the travelator lift in mm.

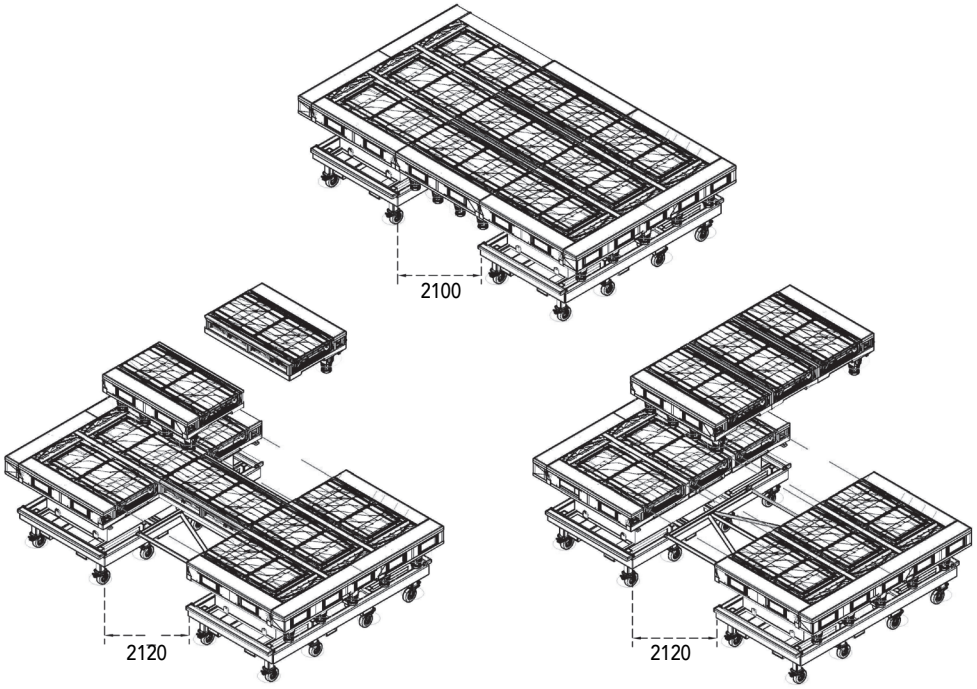


Figure 115: View of assembly stages for the travelator lift.

Travelator Lift - Fully Assembled:

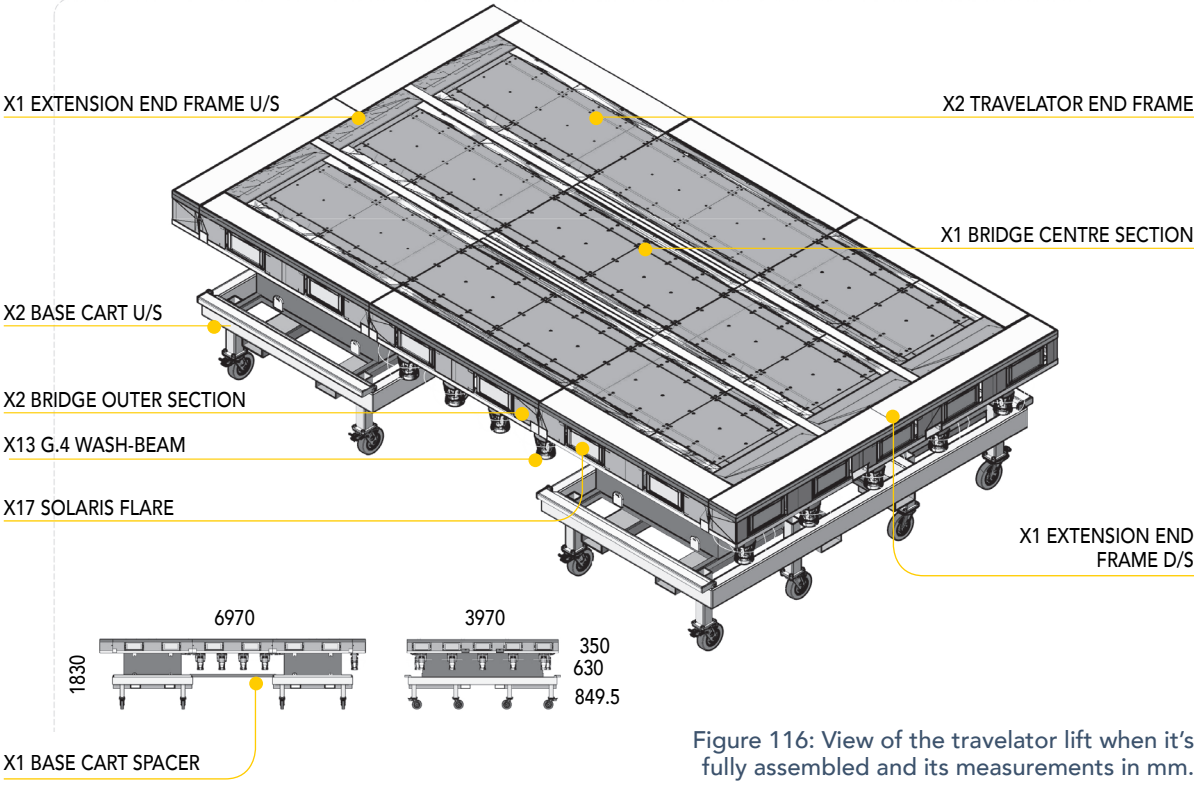


Figure 116: View of the travelator lift when it's fully assembled and its measurements in mm.

7.3.2 INSTALLING THE PIANO LIFTS

To install the piano lifts and for further information, please refer to the following user manual.

- Electric Scissor Lift - Type A

7.3.2.1 Piano Lift Assembly

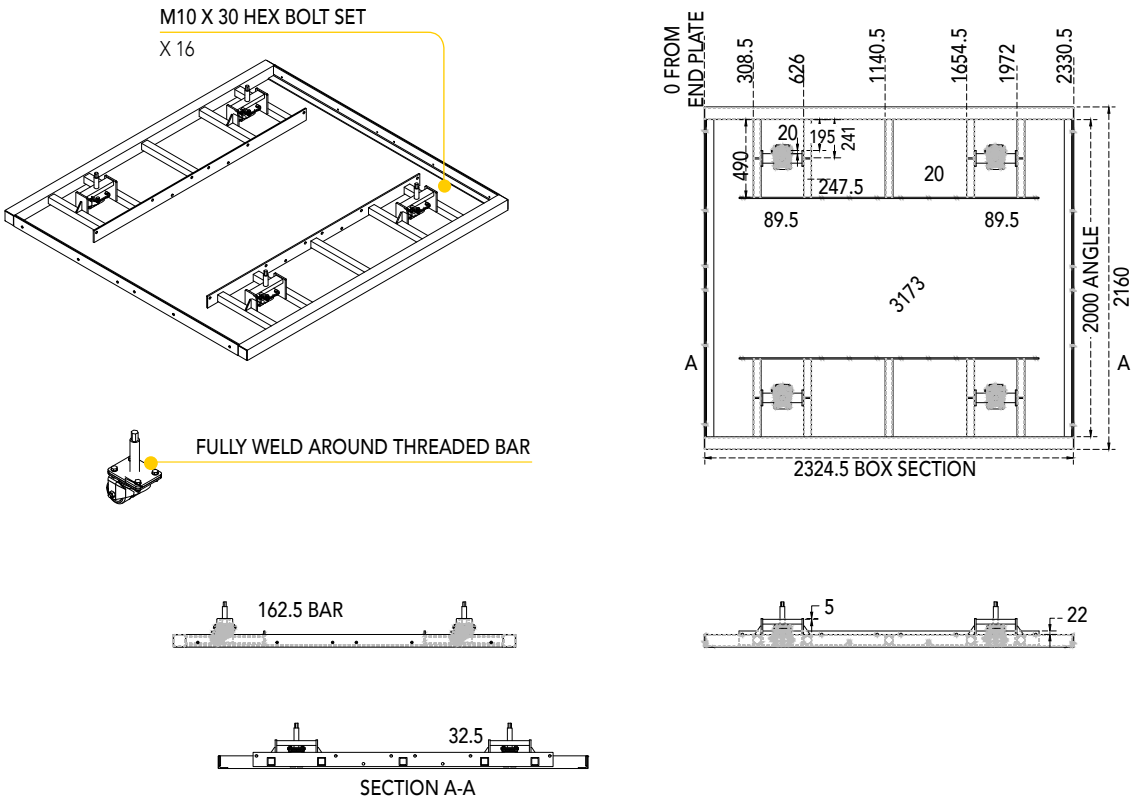


Figure 117: View of the piano lift's base and its measurements in mm.

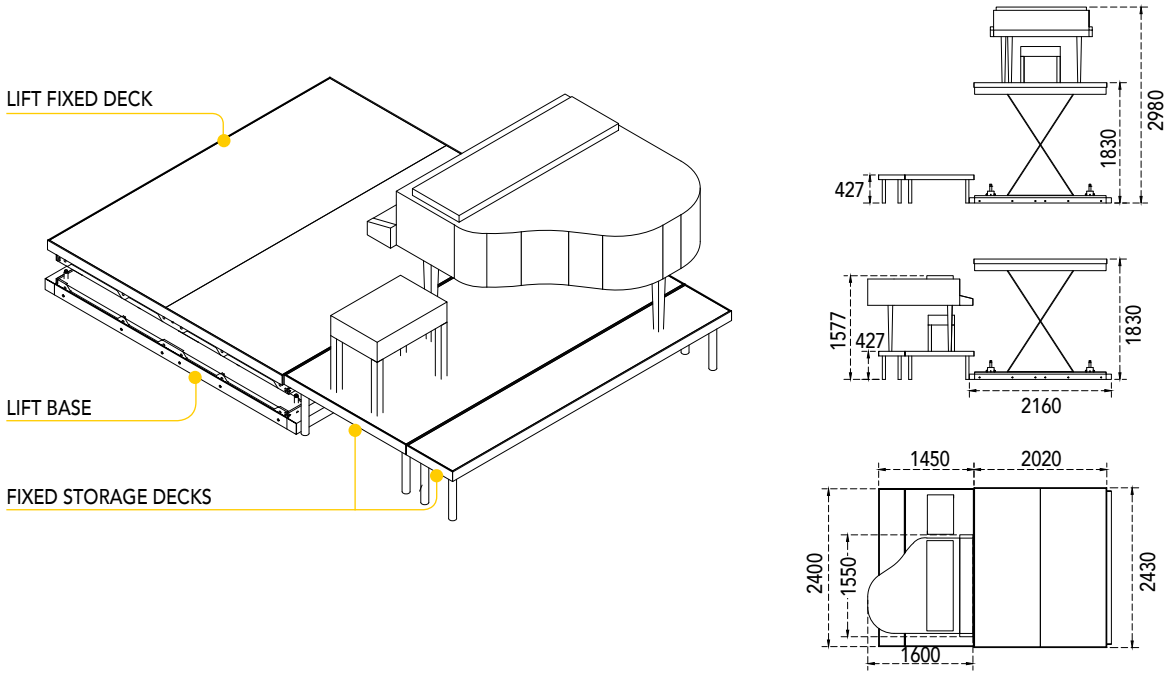


Figure 118: View of the piano lift as it will be arranged on stage and its measurements in mm.

8.1 COMMISSIONING

8.1.1 WARNINGS FOR COMMISSIONING

DANGER

DO NOT enable the GO button in any other way than described in the manufacturer's user manual(s).

DANGER

The exposed belt chain and moving parts can cause severe injury.

WARNING

DO NOT power up the product/machinery before all connection procedures are completed.

DANGER

Before operation, test the correct functioning of the overtravel, DEADMAN safety functions, and E-STOP functionality.

CAUTION

In case of performer motion, always check there is a rescue plan in place and that it has been tested.

DANGER

DO NOT allow anyone in the hazard zone during assembly, commissioning and normal operation of the product.

WARNING

All people - installers and operators included - working on the assembly of the product must wear adequate PPE protections.

8.2 SET THE SAFETY DEVICES

8.2.1 SET THE SAFETY DEVICES

8.2.1.1 Upper D Limit Switches

The Upper D SR Pivot and Upper D SL Pivot Axis come with a Primary Encoder, a Limit Encoder Box with a Secondary Encoder, and a 2 x Mayr Silenzio x 300 Safety Brake (Secondary Brake).

Motor - Primary Brake and Incremental Encoder - The SEW CMP71S 2.65 hp/2 kw Servo Motor features a brake which can hold the axle in a fixed position. The motor primary (incremental) encoder is configured to determine to what extent the rigid chain is deployed (extended or retracted) based on the motion of the motor.

To set the motor's Primary Brake and Incremental Encoder, follow the instructions present in the control system user manual.

Limit Encoder Box (Rotary Limit Switches TER 15:1 & Kuebler Encoder) - is a part of chain system and is configured to determine the extent to which the rigid chain is deployed based on the motion of the axle. It is connected to the axle through a belt assembly and can sense the rotation of the axle. The Limit Encoder also acts a limit switch, automatically stopping the motor when the chains are either fully extended or fully retracted. In total, there are four rotary switches inside of the Limit Box.

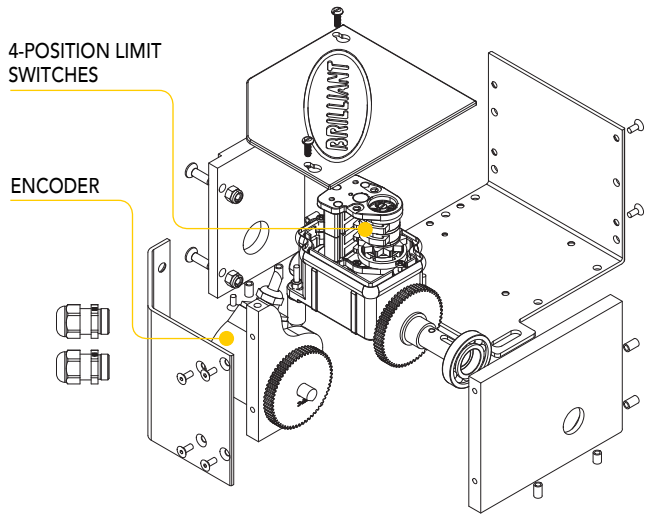


Figure 119: Exploded view of the Limit Encoder Box.

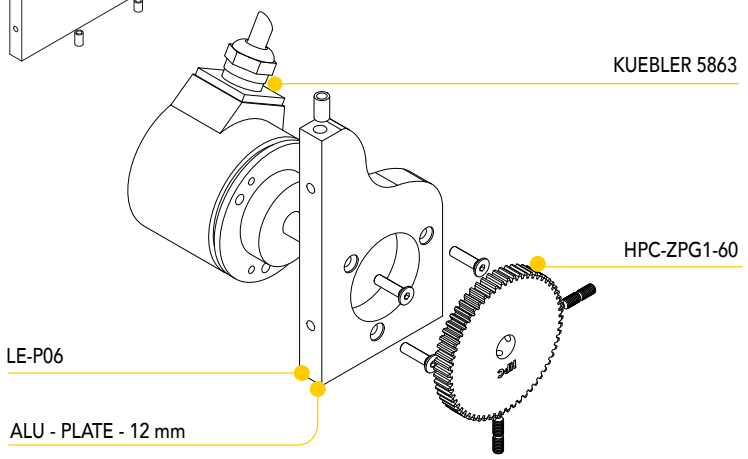


Figure 120: Exploded view of the Kuebler Encoder.

8.2.1.2 Lower D Limit Switches

Lower D DS Lift/Pivot Axis comes with a Primary Encoder, a Limit Encoder Box and Mayr 4 x 1300 Safety Brake (Secondary Brake).

> *NOTE: Motor - Primary Brake and Incremental Encoder - SEW 100S 10.7 hp/8 kw Servo Motor features a brake which can hold the axle in a fixed position.*

Lower D US Lift Axis comes with a Primary Encoder, a Limit Encoder Box and Mayr 2 x 1300 Safety Brake (Secondary Brake).

NOTE: Motor - Primary Brake and Incremental Encoder - SEW 100S 10.7 hp/8 kw Servo Motor features a brake which can hold the axle in a fixed position.

Mayr Safety Brakes (Secondary Brakes) will activate themselves if the power to the motor is cut off.

The brakes will release once the power supply is restored.

The safety brakes are configured to engage the brake gear portion of the axle.

NOTE: The Serapid system should also engage the brake if the output of the primary and secondary encoders indicate the rigid chain is deployed to a different extent.

NOTE: Please refer to the drawings of the drive system in the Element Descriptions section.

8.2.1.3 Limit Switches - Main Features

The TER Base Rotary limit switch consists of a gear motor that transfers movement through a primary input, reduction stage (worm gear and helical toothed gear), and one or more secondary output stages (pairs of straight toothed gears).

- Revolution Ratio 1:15
- Accurate adjustment of cams by means of screws.
- IP Protection Degree: Base is classified IP42.

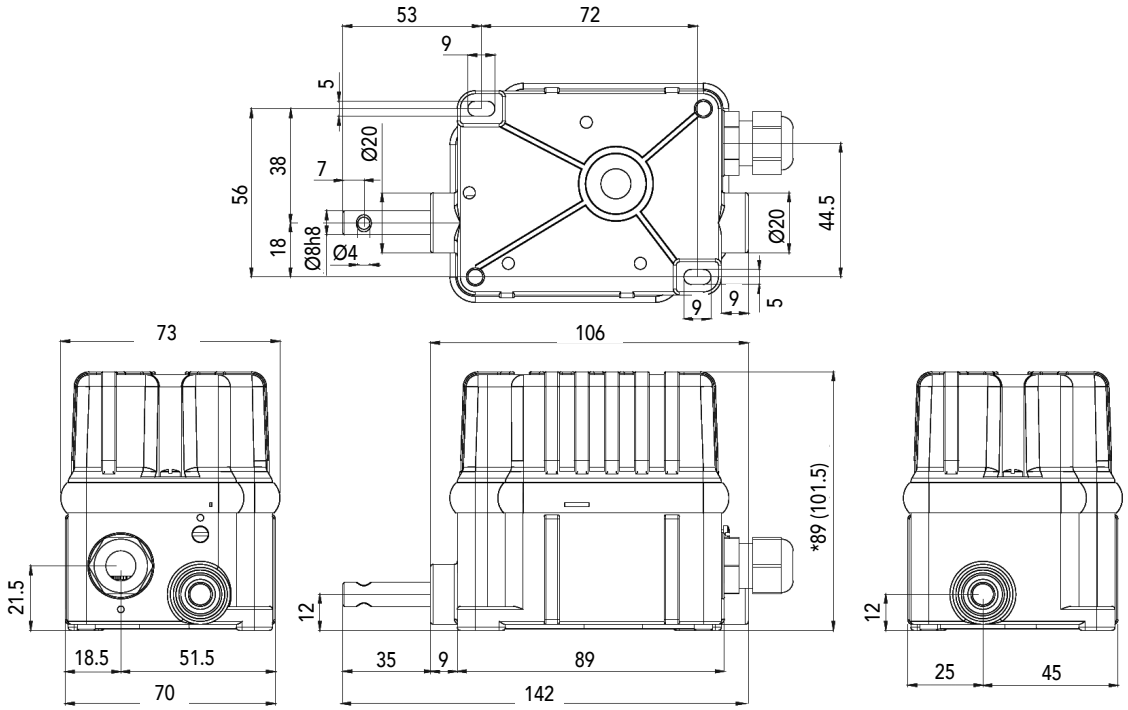


Figure 121: Limit Switch measurements in mm.

8.2.1.4 Limit Switches - Adjustment

- Loosen the fixing screw (4) and remove the cover (3.)
- Adjust the operating point of the cams. For the proper adjustment, loosen the central

screw (7) of the cam set and adjust the operating point of each single cam by turning its screw (8), (the numbers on the screws refer to the cams counting from bottom to top), and then tighten the central screw (7).

- Insert the free end of the no-drop wire (9), if used, into one of the screws (4), and then close the limit switch using the screws (4).
- Check the proper positioning of the rubber (6) in the cover (3) and tighten the screws (4) with a torque of 80/100 Nm.

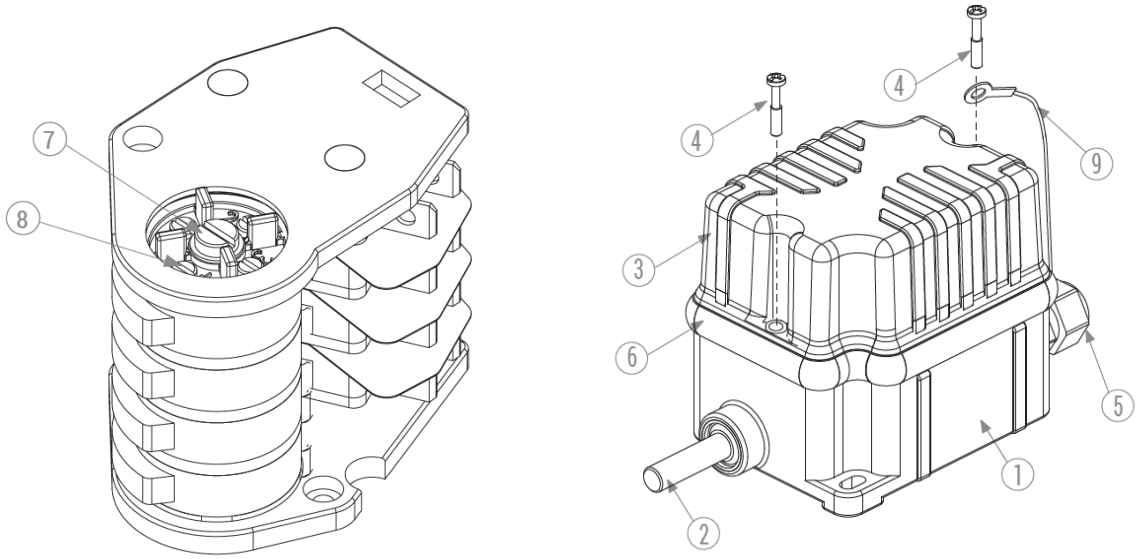


Figure 122: View of the Limit Switch and its parts.

8.2.2 INSPECT THE SAFETY DEVICES

8.2.2.1 Limit Switches - Inspection and Maintenance

The limit switch is designed for use in industrial environments under even severe climatic conditions (operational temperatures from –40°C to +80°C, suitable for use in tropical environments).

The equipment is not suitable for use in environments with a potentially explosive atmosphere, corrosive agents or a high percentage of sodium chloride (saline fog).

Oils, acids or solvents may damage the equipment; avoid using them for cleaning. Do not connect more than one phase to each switch. Do not oil or grease the control elements or the switches.

- Check the proper tightening of the screws (4) and cover (3).
- Check the proper tightening of the central screw (7) holding the cams.
- Check the wiring conditions (in particular where wires clamp onto the switch).
- Check the conditions of the rubber (6) it is between the cover (3) and the base (1), and check the tightening of the cable clamp (5) around the cable.
- Check that the limit switch enclosure (1, 3) is not broken.
- Check the alignment between the limit switch shaft (2) and the reduction gear shaft.
- Check that the limit switch is properly fixed.
- If there is an anti-moisture plug, check its condition.

8.2.2.2 Brakes - Inspection and Maintenance

There is one brake on the motor shaft and one double secondary brake on the load shaft in each lifting axis.

The secondary brake is designed as a dual circuit brake in which two brake bodies work to ensure the required torque is in a smaller package.

The braking torque in Secondary Brake Body 1 is generated via the pressure force of several thrust springs using frictional locking between both friction linings of the rotor, the Armature Disk 1, and the flange plate or the machine wall.

The braking torque in Secondary Brake Body 2 is generated via the pressure force of several thrust springs using frictional locking between both friction linings of the rotor, the Armature Disk 2 and the Coil Carrier 1.

The brakes are released electromagnetically.

The lift is equipped with a double safety (redundant) braking system.

The following inspections should be carried out at regular intervals:

- Braking torque or retardation inspection (individual brake circuits).
- Inspection of air gaps “a” braked.

The brake circuit inspection is carried out by energising the individual circuits with nominal voltage, see the Type tag.

Motor Brake Inspection:

- Permanently energise the Secondary Brakes.
- Trigger a Category 0 Stop (or an E-STOP) and inspect the stopping distance according to the machinery’s safety parameters.
  The Upper D, Lower D and Rotate machinery does not accept a Cat-0 Stop.

It should be noted that those machines shall stop at a maximum allowable acceleration.

- De-energise the Secondary Brakes.

Secondary Brake Inspection:

- Permanently energise the Motor Brake.
- Trigger a Category 0 Stop (or an E-STOP) and inspect the stopping distance according to the machinery’s safety parameters.
- De-energise the Brake Motor.

Inspection of both brake circuits:

Perform a lifting operation. Trigger a Category 1 Stop (or an E-STOP) and inspect the stopping distance according to the elevator regulations. The stopping distance must be much shorter than the stopping distance for an individual circuit.

Size	Rotor thickness New condition [mm]	Nominal air gap "a" per brake body [mm]	Maximum air gap * per brake body [mm]	Fixing screws with wrench openings and tightening torques						
				Items 8 and 8.1	SW	[Nm]	Item 12 Single circuit	Item 12 Dual circuit brake	SW	[Nm]
4	6	0,45 +/-0,07	0,6	3 x M4	7	3	3 x M4	3 x M4	3	3
8	7	0,5 +/-0,07	0,9	3 x M5	8	5	3 x M5	3 x M5	4	5
16	8,7	0,5 +/-0,07	1,1	3 x M6	10	10	3 x M6	3 x M6	5	10
32	9,95	0,5 +/-0,07	1,0	3 x M6	10	13	3 x M6	3 x M6	5	15
64	11,1	0,5 +/-0,07	0,9	3 x M8	13	30	3 x M8	3 x M8	6	36
100	12,5	0,5 +/-0,07	0,8	3 x M8	13	36	3 x M8	6 x M8	6	36
200	13,9	0,5 +/-0,07	1,0	3 x M10	16	71	3 x M10	6 x M10	8	71
300	13,9	0,5 +/-0,07	1,0	3 x M12	18	123	3 x M12	6 x M12	10	123
500	16	0,5 +/-0,07	0,9	6 x M12	18	123	3 x M16	6 x M16	14	200
800	18	0,5 +/-0,07	0,8	6 x M16	24	250	3 x M16	6 x M16	14	300
1300	18	0,5 +/-0,07	0,9	8 x M16	24	250	4 x M16	8 x M16	14	300
1800	18	0,5 +/-0,07	0,9	8 x M16	24	300	4 x M20	8 x M20	17	470

Figure 123: Table 1.

Inspection of the air gap:

Inspect air gap "a" according to Table 1. The nominal air gap must be given.

Once the maximum air gap has been reached, the rotors must be replaced. However, the brake already becomes louder at an air gap > "a" +0,2 mm.

CAUTION

On brakes with a reduced braking torque or during operation with the overexcitation, the braking function can no longer be guaranteed when the air gap > maximum air gap.

WARNING

Electrical hazard!

DANGER

Crush hazard!

Figure 124: Yellow warning labels as they will appear on the product.

8.3 POWER UP THE PRODUCT

WARNING

Follow the control system safety instructions before powering up the machinery.

WARNING

Ensure that a functional test of the product has already been conducted before allowing anyone to use the product.

DANGER

DO NOT exceed the maximum equipment load values!

NOTE: Please refer to the product/machinery's user manuals for more information on powering up and operating the product.

In this chapter, the minimum electrical H&S guidelines are listed to instal, connect and integrate the electrical equipment with the product.

9.1 CONTROL SYSTEM INTEGRATION

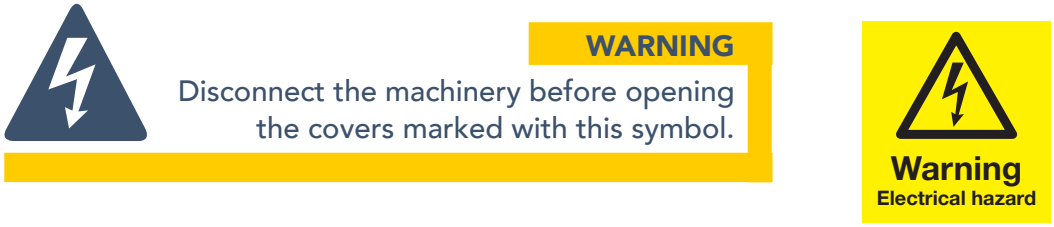


Figure 125: The yellow warning label as it will appear on the product.

The Sphere, Travelator Lift and Piano Lift are designed to be integrated with a control system, which must fulfil the electrical and functional safety requirements as follows:

- They should be in compliance with prEN 17206.
- They should be fitted with control devices designed to perform a single operation.
- They should have indicators visible from the operator's position.
- They should be fitted with safety-related switches or functions in order to permit local and remote operation of the machinery.
- They can initiate a movement only by means of pushing a DEADMAN button.
- They cannot restart automatically after trippage; even if the DEADMAN button is kept pressed.
- They should be designed NOT to function in automatic mode.
- They shall not enable more than one starting device at the time.
- They shall be fitted with a control device equipped with a means to bring it to a safe stop (DEADMAN) and an E-STOP push button to perform a Category 1 or Category 0 Emergency Stop.
- They shall be fitted with Restart prevention after an E-STOP.
- The machinery safe stop shall have priority over the Start controls, and the E-STOP system shall have priority over the machinery's safe stop.
- They should remove the energy supplied from the actuators and perform a Category 0 or 1 Stop when the E-STOP is activated, or keep the stop condition monitored.
- They should be fitted with EOT travel limitation safety functions.
- They should be fitted with wrong direction detection.
- Drives shall be fitted with a disconnecting device in accordance with EN 60947-2 and an earthing, bonding and a PELV circuit.
- The power supply should be protected by MCB and RCD.
- If more than one product is assembled together, the control system should be such to guarantee a group halt and the safety integrity of the entire assembly of machinery.
- They should have an Emergency Stop safety function that cannot be overridden by other operating modes.
- They should not allow multiple controls.

The maintenance table lists the parts and functions that MUST be tested and the necessary maintenance work. Defects MUST be reported immediately to the manufacturer, and no repairs can be carried out unless authorised in writing by the manufacturer.

10.1 MAINTENANCE INSPECTION CHECKLIST

MACHINERY INSTALLATION - TEST AND INSPECTIONS PROCEDURE	CHECKS				
	PRIOR TO USE	EVERY INSTALLATION	EVERY SIX MONTHS	MONTHLY	DAILY
Visual check of the load-bearing elements (base, scissors, platform, chains, etc.)					✔
Visual check for signs of condensation					✔
Visual inspection of the connectors and cables					✔
Visual inspection of the electrical equipment					✔
LinkLift chain (see related chapter)				✔	
Inspection of drive mechanism and LinkLift attachments			✔		
Inspection of guiding mechanism (wheels, bearings, guides)	✔				
Inspection of encoders, attachment points and EOT limits			✔		
Belt wear and tear inspection			✔		
Proof load test			✔		
Safety devices inspection (see related chapter)			✔		

10.2 LINKLIFT MAINTENANCE PROCESS

10.2.1 FUNCTIONAL VERIFICATION

Make sure a visual check is done by running the platform without the load.

The chain must not have any significant vibration and the system must not have any strange noises. Verify the absence of any unusual behaviour.

10.2.2 CHAIN VERIFICATION

Check of all the circlips.

The circlips must be correctly installed in their grooves and must not be damaged or rusted.

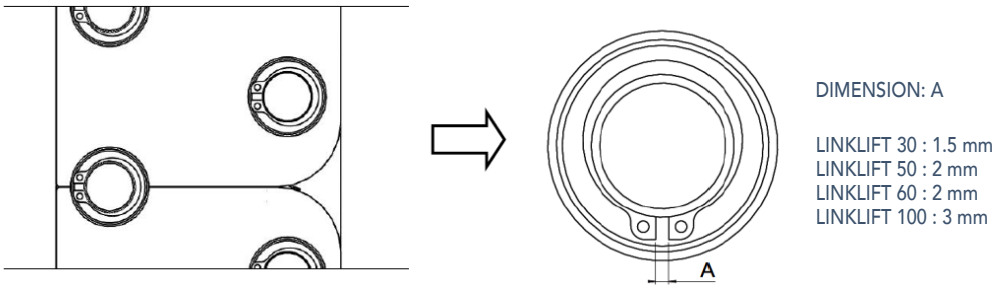


Figure 126: View of the circlips.

CAUTION

The circlips MUST be replaced after any disassembly or damage.

10.2.3 VERIFICATION OF THE LINK PLATES

Pay attention to any suspicious wear of the link plates (cracks, deformation, scarring, etc.).

Grooves in or significant wear to the links = chain and sprockets must be replaced.

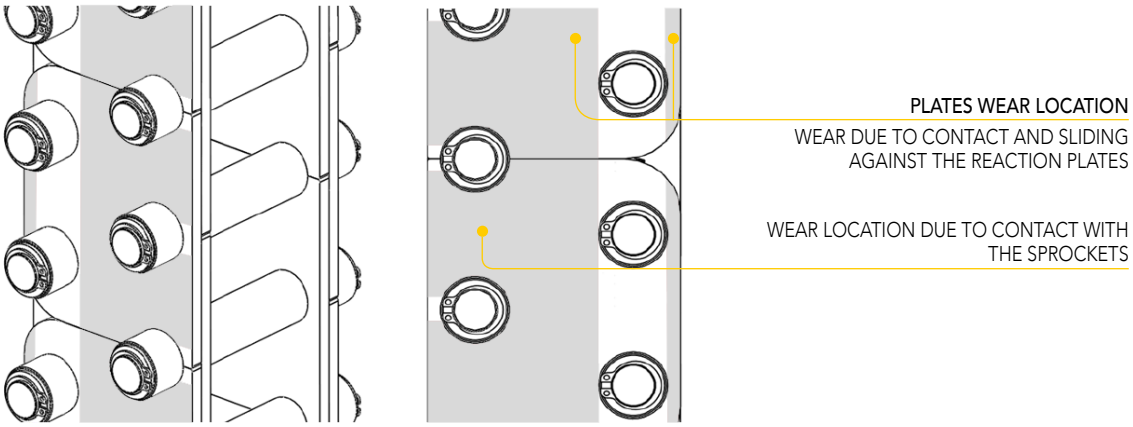


Figure 127: Closeup view of the chains and link plates.

10.2.4 VISUAL CHECK OF ALL ROLLERS

- Turn all the rollers: the rollers must be free to rotate.
- If a roller does not rotate, move the chain due to buckling and check again
- If it doesn't work, please remove the roller to verify that there is no seizing.
- Measure the diameters of 2 or 3 rollers per chain metre.
- Make sure that the roller diameters are greater than:

TYPE	LL30	LL50	LL50R	LL80	LL100	LL100R
Roller to be removed if Ø	<17.80 mm	<21.80 mm	<26.80 mm	<31.80 mm	<39.80 mm	<49.80 mm

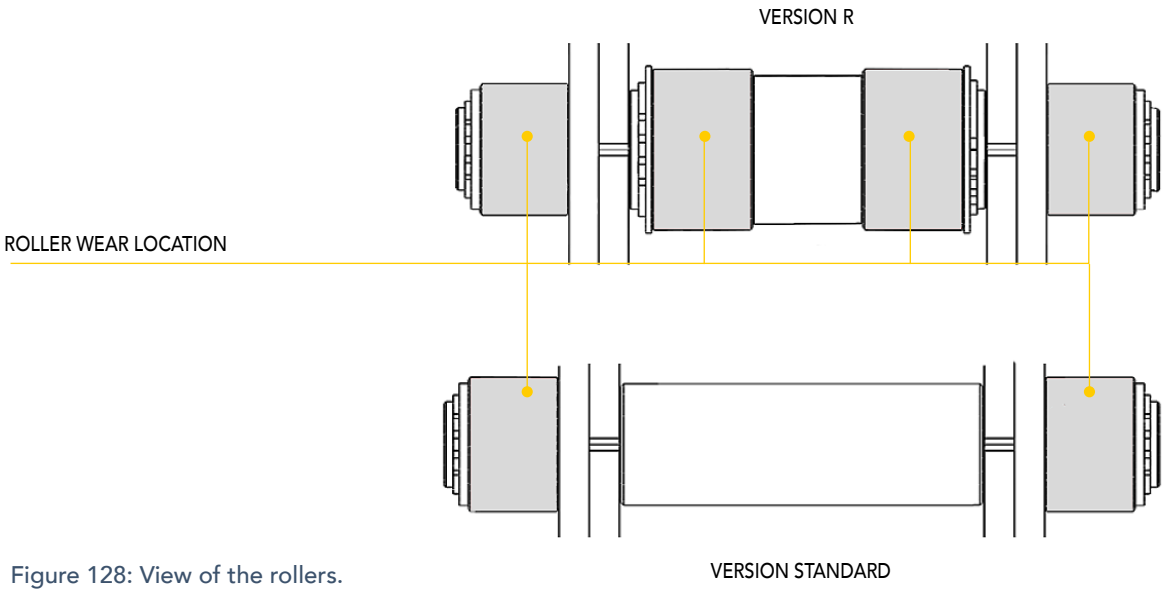


Figure 128: View of the rollers.

For any other annual inspection procedures, refer to the Serapid March 2015 / SER-000LL-M001-2 User Manual.

DANGER

Use a support to secure the platform in position during maintenance operations!

10.3 SPARE PARTS

Only original spare parts may be used. Brilliant Stages cannot be held responsible for failures and breakdowns caused by use of non-original or the wrong spare parts. In case of necessity, please contact:

Brilliant Stages Ltd
5 Langthwaite Road,
Langthwaite Business Park,
South Kirkby, Wakefield,
West Yorkshire
WF9 3AP,
United Kingdom

T +44 (0) 1462 455366
F +44 (0) 1462 436219

info@brilliantstages.com

WARNING

Use of commercial or other manufacturers' spare parts to repair the product may cause load loss. Use spare parts supplied or authorised by the manufacturer!!!

10.4 DISPOSAL

Before carrying out the demolition and disposal of the product, complete the working cycle and disconnect the power.

- Upon demolition, plastic parts must be separated from electric components and must be sent to selective refuse collections according to the regulations in force.
- With regard to metal elements and components, splitting into aluminium parts and those of other metal/alloy is sufficient.
- It is prohibited to pour rejected liquids such as oils, circuit liquids, etc. on the ground or into drainage piping.
- Components or fluids which are hazardous to health and/or environment, must be disposed of in compliance with the corresponding regulations.

EC DECLARATION OF CONFORMITY

Declaration for machinery according to Machinery Directive - Annex II A

We, **Brilliant Stages Ltd**
Hereby declare under sole responsibility that the following machinery:

Product name:	Take That 2019 – Machinery Installation
Product type/model:	Sphere and Travelator Lift
Serial number:	NIS-MK2.2-18752-030

Complies with the essential Health & Safety requirements as applied to it:

EC Machinery Directive 2006/42/EC, amended from 98/37/EC and 87/392/EC
EC Low Voltage Directive 2014/35/EU, amended from 06/95/EC and 93/68/EEC
EC EMC Directive 2014/30/EU, amended from 04/108/EC and 93/68/EC

Applied harmonised standards, in particular:

EN ISO 12100:2010 - Safety of machinery - General principle for design -Risk Assessment and risk reduction.
EN 60204-1:2006 - Safety of machinery - Electrical equipment of machines - General Requirements.
EN 60204-32:2008 - Safety of machinery - Electrical equipment of machines - Requirement for hoisting machines.
EN ISO 13849-1:2015 - Safety of machinery - Safety-related parts of control systems.
EN 62061:2005 - Safety of machinery - Functional safety of safety-related E/E/PE control systems.

Applied national and international standards and technical specifications
(or parts/clauses thereof), in particular:

DIN 56950-1:2012 - Entertainment technology - Machinery installations - Part 1: Safety requirements and inspection.

As stipulated by Annex V of the EC Machinery Directive:
CE symbol affixed to the machinery. - Technical documentation filed in manufacturer's works.

Place of issue
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28th March 2019

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Release Date: March 2019

THIS PRODUCT IS INTENDED FOR PROFESSIONAL USE ONLY.
READ THIS ENTIRE DOCUMENT BEFORE INSTALLING, OPERATING OR USING THE PRODUCT.