INTAMIN
AMUSEMENT RIDES

SNOW SKI LAUNCH COASTER

5224 SEA WORLD SAN DIEGO, CALIFORNIA, USA

MANUAL PART TWO – RIDE SPECIFIC MECHANICAL

CHAPTER 3 – Installation Instructions

REVISION & STATUS

REVISION NO.	DATE	STATUS	UPDATE PAGE/CHAPTER	SIGN
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CONTENT

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3 INSTALLATION INSTRUCTIONS

3.1 GENERAL INFORMATION

3.1.1 INFORMATION REGARDING THE INSTALLATION INSTRUCTIONS

These installation instructions provide important information on planning and handling the ride erection and installation. As prerequisite for working safely, all specified safety notes and directives must be complied with.
In addition, the local accident prevention regulations and all general safety ordinances applicable at the location of ride must be complied with.
Read the installation instructions carefully before commencing any work activities!
The Manual is part of the product and must be accessible to the personnel at all times in the immediate vicinity of the ride.

NOTE

For the understanding of this part of the Manual the author of this Manual assumes that
Part ONE: „GENERAL MECHANICAL / ELECTRICAL“
has been read, understood and is fully observed.

For a better understanding the illustrations in this Manual are not necessarily in scale and may slightly deviate from installed details/components on the ride.

3.1.2 WARNING SYMBOLS

See Manual Part ONE.

3.1.3 EXPLANATION OF SYMBOL NOTES

See Manual Part ONE.

3.1.4 LIMITATION OF LIABILITY

See Manual Part ONE.

3.1.5 COPYRIGHT

See Manual Part ONE.

3.1.6 SPARE PARTS

For Warning Information see Manual Part ONE. Spare Parts can be found in the separate Spare Parts List.

3.1.7 WARRANTY CONDITIONS

The warranty conditions are included in the sales document / contract.

3.2 GENERAL INSTRUCTIONS

3.2.1 SAFETY

NOTE

See Manual Part ONE for general safety information.

WARNING

Hazard posed by incorrect installation and commissioning!

Installation and commissioning require trained qualified personnel with adequate experience. Installation errors can result in life-threatening situations or can cause significant property damage. Therefore:

- Only have skilled, well trained and qualified personnel to execute installation and commissioning.

WARNING

General hints

Improper installation and commissioning can result in serious personal injury or property damage. Therefore:

- Prior to beginning installation, ensure that there is sufficient space to work.
- Handle open sharp-edged components with care.
- Make sure that the assembly location is clean and well organized. Components that are loosely stacked or lying around can cause accidents.
- Assemble components properly. Apply specified screw tightening torque and torque stripe on the connections.
- Secure components in a way that they cannot fall or tip over.

DANGER

Danger due to electric current!

A life-threatening hazard exists if there is contact with live components. Switching on electrical components can execute uncontrolled movements and cause serious injury. Therefore:

- Prior to starting work switch off the power supply and safeguard it from being switched on again.

DANGER

Securing against switching on.

Danger to life caused by accidental and uncontrolled switching on.

Refer to Part ONE, Chapter Safety “Securing against switching on”.

3.2.2 QUALIFICATION OF INSTALLATION COMPANY

This Manual / procedure is intended for the use by contractors well qualified in the profession which they have been hired for and with long term experience in the assembly adjustment and commissioning of such type of installations.

All installation work has to be carried out by skilled staff, being well qualified and experienced for similar installation works as required for each individual installation procedure. Beside the installation instructions, the installation staff shall make sure that the installation is made correctly, and that a proper and safe operation of the assembled components is assured. In case of lack of information, doubts or questions for appropriate installations, the supplier shall be contacted immediately for clarifications and further instructions. The supplier's instruction for sub-components and materials must strictly be followed.

The step by step installation procedures represent a simplistic guideline of the erection/ installation of the ride. The description is not complete, and cannot be complete in all details, and procedures will have to be altered depending on site conditions, material availability, encountered difficulties and other factors, for which no responsibility can be transferred to the seller.

3.2.3 NORMAL ADJUSTMENTS

Each ride is a custom-made product which is individually fabricated. Based on the engineering data, each track and column element has been factory assembled in a specially designed system, in which the geometry has been precisely monitored. This unique manufacturing method has been proven to be very accurate and represents the guaranty for an exceptionally smooth ride. In addition to that, all track mounted installations like, locking mechanism, friction wheels, track switch, sensors etc. are designed to guaranty an optimal and safe vehicle handling and monitoring. Nevertheless, certain adjustments/adoptions/cutting/re-welding and/or shimming might be necessary as a result of changed demands and/or built up of tolerances over extended distance/time and/or foundation settings.

3.2.4 EQUIPMENT AND MATERIAL

- Suitable lifting equipment and transport to be available
- Rigging
- Scaffolding
- Hydraulic jacking gear
- Winches
- Portable welding equipment
- Surveying equipment
- General measuring alignment equipment (gages, optical lasers)
- Miscellaneous hand tools, wrenches, pry bars, etc.
- Torque wrenches
- Anchor bolt installation equipment
- Grouting equipment & grout
- Shim stock
- Painting equipment & paint
- Generators, compressors, drilling and other power equipment
- Way communication radios

3.2.5 DOCUMENTATION

- Ride Installation Manual with all instructions
- Survey & data sheets
- Layout drawing / plan of foundation
- Connection instructions
- Section transition requirements
- Work permits and certificates

3.2.6 WORKSITE CONDITIONS PRE-CONDITION

- Excavation of the site to local building codes and regulations
- Mark positions of foundations as per drawings
- Preparation of foundations
- Clearance of site (rubble/dirt/debris)
- Component deliveries and storage
- Heavy plant acquisition (crane/temporary platforms/winches etc. for equipment requirements
- Utility power including compressed air and water
- Read and observe local safety codes and regulations.
- Read and observe this and all other sections of the Manual.
- Have appropriate assembly and sub-assembly drawing at hand.
- Prepare storage area for heavy and bulky parts (track elements, columns, cabinet, trains)
- Prepare protected, conditioned, and dry storage area for sensitive parts (cabinets, junction boxes, operation panels, pneumatic material etc.)

3.2.7 ADVISORY SERVICE

Mechanical and electrical engineers from the seller can be on site, if requested, to advise and give support to the installation contractors and to ensure that all necessary safety requirements are being met as well as advice for site acceptance testing. They can also inspect the general condition of the ride and advise the required tests needed to calibrate critical system parts and ensure that the ride is operating to the owner's and the seller's satisfaction prior to public operation.

During the installation and commissioning of the ride mechanical & electrical Acceptance Test Plans (ATP) must be followed as per the instructions contained therein. All tests carried out must be properly documented and signed by the responsible person. The project manager from the seller will need this feedback information prior to final commissioning and release for public operation.

3.2.8 BOLTS & NUTS

The following contains general notes, unless otherwise indicated on assembly and sub-assembly drawings.

WARNING

The use of bolts/nuts with property class 12.9 is not allowed as per standard EN 13814.

CAP SCREWS

Cap screws must be tightened to the torque values as listed on the following tables. Do not tighten cap screws beyond and below the recommended values as listed. This will damage the connection and seriously compromise the integrity of the structural support.
When permanently installed cap screws and locknuts are disassembled for repair or adjustment, it is recommended to replace them.

TORQUE WRENCH

Always use a torque wrench when checking or tightening bolt connections. This is the only reliable method for ensuring proper bolt connection tightness and integrity. Torque wrenches must be calibrated regularly, at least twice per year.

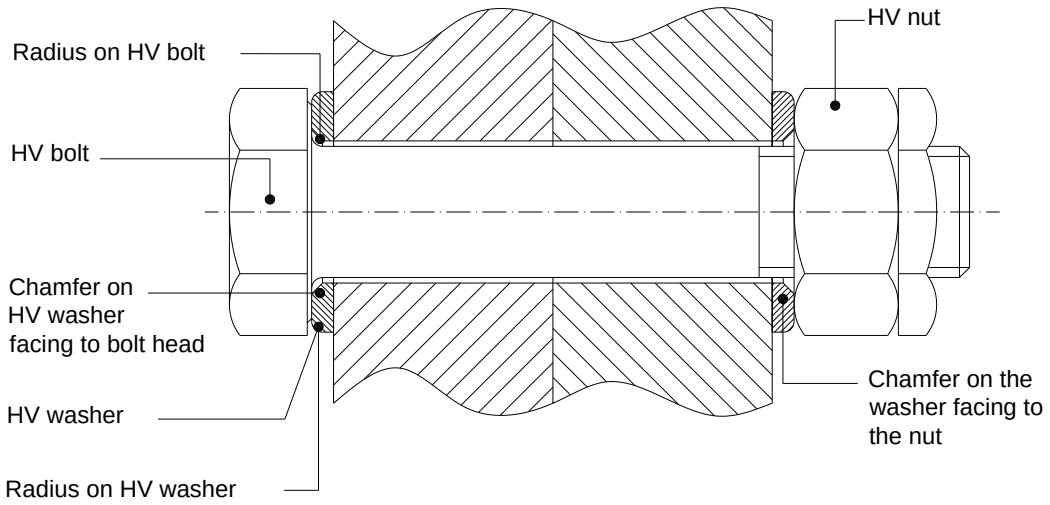
STANDARD BOLTS/NUTS

All bolt connections shall be connected according to the specific drawing. Torque bolts/nuts with torque rate indicated on specific drawings. Bolt connections not using self locking nuts shall be secured with LOCTITE 242. Bolt connections must be torque striped.

STRUCTURAL HV BOLTS/NUTS AND HV WASHERS

Delivery: Structural high strength HV bolts will be delivered hot dip galvanized in dry condition. Structural high strength HV nuts will be delivered hot dip galvanized and might be already impregnated with Molidium Di-Sulphide (MoS_2), (TZN Molykote dipped). If the nuts are lubricated no additional lubrication is required and/or allowed for the installation of dry hot dip galvanized HV bolts with MoS_2 impregnated (TZN Molykote dipped) HV nuts.
If the HV nuts are not impregnated with MoS_2 (TZN Molykote dipped) limited MoS_2 (TZN Molykote) paste lubricant should be applied on dry hot dip galvanized structural HV bolts. Re-apply paste lubricant if the HV nuts have been stored on-site for longer than 3 months.

Installation: The installation direction of the hot dip galvanized HV washers must be as shown on the sketch. The bolts have a radius towards the bolt head. The washer is chamfered at one side inside. The washer has a radius at the outside at the same side to clearly identify the inner chamfer. If the washer is installed the wrong way the edge of the washer is digging into the radius of the bolt head. The result is a reduced strength of the bolt and damages to the bolt could be caused.



NOTE

On high strength structural HV bolts, the chamfer of the washer must always face either to the bolt head or to the nut. Incorrectly installed washers will reduce the strength of the bolt and might even cause the bolt to snap.

Torque: Bolt connections lubricated with MoS_2 (TZN Molykote) must be torqued with a reduced torque rate in accordance with the specific drawings.

WARNING

If lubricated bolt connections are torqued without the specified reduced torque rate, then bolts could get over-torqued and damaged.

Replacement:

WARNING

Structural high strength bolts/nuts (10.9) must be replaced by new ones after each removal. The same size and grade as originally installed must be used.

NOTE

Note that bolts/nuts with property class 10.9 are not always and exclusively high strength structural HV bolts/nuts.

STAINLESS STEEL BOLTS

Where stainless steel fixing bolts, nuts, washers etc. are used in conjunction with or for the securing of material of the same type, or where stainless steel bolts, nuts and washers are used together, it is necessary to use a suitable lubrication or anti-seize type product to inhibit the possibility of the occurrence of cold welding.
As an example, a Molidium Di-Sulphide (MoS_2) based lubricant would be a suitable form of prevention.
In addition to the routine maintenance schedules listed in the supplied Maintenance and Operations Manuals, lubrication of all stainless steel fixings should be performed on a regular basis. It will be necessary as well, to clean and re-apply the lubricant routinely to ensure the condition and strength of all stainless steel fixations.

RE-TORQUEING

After the first 100 hours of operation 100% of all structural connections on track and column and vehicles must be retorqued and torque striped. After re-torqueing, structural bolts on the track to track connection must be secured with the self-locking counter nut (DIN7967) according to the specific drawings.

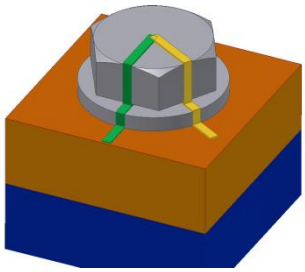
TORQUE STRIPE OF STRUCTURAL & STANDARD BOLTS / NUTS

Once a bolt has been torqued it will be necessary for a bolt torque stripe to be added to the nut / thread/washer/part to confirm that the bolt has been torqued.
All bolt connections have to be torque striped with

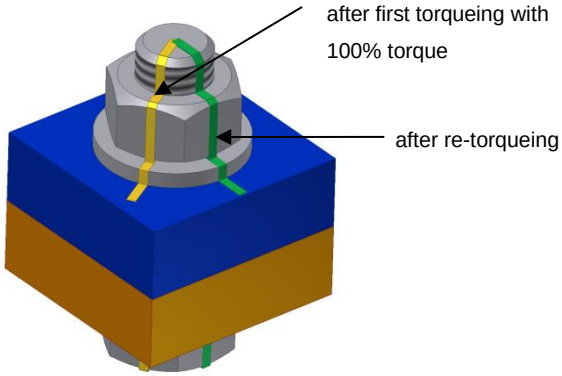
- yellow color marker (torque seal as shown below) at 100% torqueing and with
- green color after the re-torqueing(torque seal as shown below).

Torque rate in accordance with the specific drawing.

Example for proper torque stripe



Top view: screwed in bolt



View from below: bolt with lock nut

Example for torque stripe material

TORQUE RATE FOR METRIC BOLTS

Tightening torques are provided for bolts with metric threads. Tightening torques for bolts with slightly oiled/MoS_2 surface used with matching grade nuts are as indicated.

NOTE

Be certain, before tightening that threaded parts are not aluminum, brass or any other soft alloy.

Bolt connections lubricated with MoS_2 (TZN Molykote) must be torqued with a reduced torque rate in accordance with the specific drawings.

WARNING

If lubricated bolt connections are torqued without the specified reduced torque rate, then bolts could get over-torqued and damaged.

Tightening Torques in [Nm Newton-Meter]

Size	Property Class 8.8		Property Class 10.9		High Strength HV 10.9
	oiled	MoS_2	oiled	MoS_2	MoS_2
M 8	26	21	36	29	29
M 10	51	42	72	58	58
M 12	89	72	125	101	101
M 16	215	174	305	245	245
M 20	420	340	590	475	475
M 22	570	455	800	640	640
M 24	725	580	1020	820	820
M 27	1070	855	1510	1210	1210
M 30	1450	1160	2050	1640	1640
M 36	2530	2030	3560	2850	2850

3.2.9 USING LOCTITE

All bolt connection not using self locking and/or lock nuts must be secured with LOCTITE 242 (**except high strength HV bolt connections**).
For the application of LOCTITE the supplier's instruction must strictly be followed. Prior of using LOCTITE, the referring hole and screw has to be carefully cleaned with the cleaner of the type LOCTITE 7063, and then the LOCTITE 242 has to be applied properly (all according to supplier's instructions).
For bolt connections with LOCTITE the tightening torques for "oiled" versions from the Intamin torque rate table apply.
Should bolts that have been secured with LOCTITE reveal to be loose (e.g. broken torque stripe) they need to be completely removed for adequate cleaning, according to supplier's specification, before being properly re-tightened with a new application of LOCTITE.
In case of repeated loosening the cause needs to be analyzed and remedy needs to be sought.

3.2.10 BRASS BUSHING/SHAFT CONNECTION

When fitting brass bushing, it is necessary to follow the steps below. Follow the seller's recommended instructions, where supplied, during the installation procedures. As a rule of thumb, installation guidelines are:

- Ensure that the bushing is fitted properly and in the correct position and orientation (line up with grease fittings)
- Use a sparing amount of relevant LOCTITE compound or similar locking agent to secure the bushing in place. Ensure that the locking agent does not interfere or inhibit the properties of applied lubrication or inhibit the function of the bushing.
- Apply grease on bushing before assembly of shaft. Apply grease on shaft bushing area and anti-fretting corrosion grease in other areas before assembly. Grease bushing/shaft through grease fittings after assembly.

The use of brass bushing assemblies in combination with hardened steel shafts is common and state of the art. They are subject to wear, mainly occurring on the replaceable bushings but also on the shafts. Proper maintenance can only be assured through periodic disassembly of components with following steps typically to be followed:

- Replace shaft in case following inspections are not satisfactory:
- bearing surface - smoothness, very smooth
- bearing surface - wear rate ≤ 0.2 mm in diameter
- guiding part of shaft - wear rate ≤ 0.1 mm in diameter
- guiding part of shaft - signs of wear or use
- crack inspection
- Replace bronze bushing in case the following inspections are not satisfactory:
- bearing surface - smoothness, no major scrapes
- bearing surface - wear rate ≤ 0.5 mm in diameter
- bonding of bushing - signs of loosening

Incorrectly fitted bushing or un-lubricated components will result in severe damage, expensive repair cost and downtime. Ensure that the bushing is fitted as per the seller's recommendations, is adequately lubricated during the initial installation phase and that regular inspections are maintained during the first few hours of operation to ensure that the bearing is properly seated and functioning correctly.

3.2.11 TOUCH UP PAINT

During handling, shipping, unload and installation of steel structures like track and column elements minor damages on the painted surface of such structure are inevitable. Therefore after final erection touch up paint will be necessary on the structural work.

Procedure

- Remove rust and surface impairments by grinding the area of the scratch mark with a flap wheel or buff.
- If the scratch mark is on the running surface and it is like a grove, it must be welded and ground flush to the surface. In this case the repair work must be performed upon agreement with the seller.
- After grinding immediately apply primer. For type of primer see below table.
- Paint the primed area. For type of paint see below table.
- For color type refer to the chosen Color System.
- Follow the instructions of the paint supplier.

Primer	Interseal 670 HS Layer thickness; 100 µm Thinner GTA220
Top Coat	Interfine 878 or 979, UV resistant paint Layer thickness; 75 µm Thinner GTA007

3.2.12 CONCRETE & GROUT

For the erection and installation of the columns a foundation is necessary. Below the recommendations for the foundation are listed:

Concrete

NOTE

- Concrete specifications according to DIN 1045-1.
- Reinforced concrete, minimum strength classification C25/C30.
- Minimum compressive strength of concrete f_{ck}=25 N/mm^2 at the time of first load application.
- Reinforcement with at least 40 mm protective concrete coverage.
- Refer to requirements of concrete supplier.

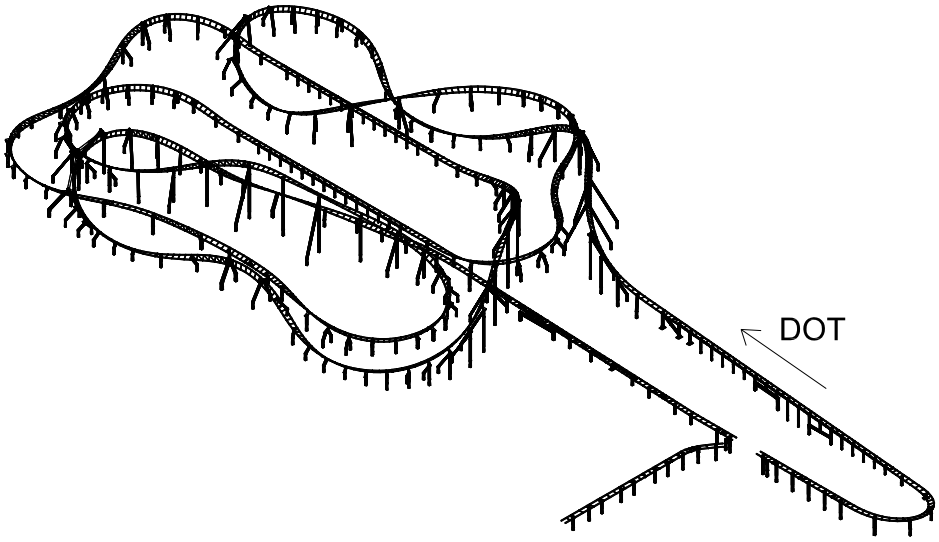
Grout

NOTE

The space between steel and concrete has to be completely filled up with a rigid, non shrinking and pressure resistant grout with the following minimum requirements:

- formulated for deep section grouting (for concrete foundation only)
- non shrinking type, shrinking compensation and expansion
- free flow to fill even narrow gaps
- high bond strength to steel and concrete
- good fatigue and impact resistance
- minimum compressive strength of grout at the time of load application must be observed and depends on curing time, strength development and other factors. It must not be less than f_{ck}=30 N/mm^2 at the time of first load application / pre-stressing.
- Refer to requirements of the grout supplier.

3.3 OVERVIEW RIDE LAYOUT



3.4 OVERVIEW STRUCTURE COMPONENTS

Component	Description
Foundation	Concrete box (pocket) foundations for most of the layout, and anchor bolts for the switch and some station columns are prepared by the owner according to the foundation coordinates supplied by the seller.
Column Footing	The column footings are part of the individual columns. They are fixed in the foundation enclosures by filling the pocket with grout. Column footings of the switch and few others are fixed with anchor bolts and grout.
Column	All supporting columns are located in a span of approx. 3 to 10 m depending on the specific loads. All columns are of bolted design for the connections column to track.
Track	The track construction consists of tubular running rail pipes. The running rails are connected to each other with a number of horizontal and diagonal braces at a gauge of approx. 750 mm. The track sections are bolted together on site.
Launch 1, Launch 2 and Launch 3 Track	The track in the launches section contains the mounting supports for the friction wheel drives.
Brake Track	The track in the brake section contains the mounting supports for the fix and movable brakes as well as the mounting supports for the friction wheel drives.
Station Track	The station track runs through the load/unload area.
Maintenance Track	Before the station area, a separate track section exists for accommodation of one train for maintenance purposes.
Catwalks	In Launch 1 and brakes area, catwalks are built for evacuation.
Switch & Interlocking Device	Between the Brakes track and Station Track, a movable track exists to connect the Maintenance Track with the ride track. Additionally, the Interlocking Device guarantees the correct positioning of the Switch Track.

3.5 INSTALLATION & ERECTION PHASES AND PROCEDURES

Phase		Procedure	
A	Site Preparation General	A 1)	Zero Datum Points
		A 2)	Foundations
		A 3)	Site Preparation
		A 4)	Installation Preparation
B	Structure Erection	B 1)	Overview Column Footings
		B 2)	Overview Marking of Footings
		B 3)	Overview Track – Column Connections
		B 4)	Overview Track – Track Connections
		B 5)	Overview Coordinates
		B 6)	Erection Sequence
		B 7)	Installation Procedure for Structure
		B 8)	Track Joint Check after G-Force Measurements
		B 9)	Catwalk Installation
C	Mechanical Components Assembly	C 1)	Pneumatic System
		C 2)	Gates
		C 3)	Collector
		C 4)	Brakes
		C 5)	Friction Wheel Drives
		C 6)	Switch & Interlocking Device
		C 7)	Switches & Sensors
D	Train Assembly on Track	D 1)	Train Installation onto Track
		D 2)	Train Adjustment
E	Installation Close Out	E 1)	Pull Through Test
		E 2)	Ride Cycling
		E 3)	G-Force Measurements
		E 4)	Final Hand-Over of the Installation
F	Appendix	F)	Installation Acceptance Test Plans

A) SITE PREPARATION & INSTALLATION PREPARATION

DRAWINGS

5224-01-0001	Plainview / Layout
5224-01-0002	Track Profile
5224-01-0003	Foundation Coordinates
5224-01-0004	Columns 3D Overview

A1) ZERO DATUM POINTS

The zero datum points (fix points) of altitude must be established prior carrying out any other installation.

Pre-conditions

- Exact drawings must be available for the specific local layout and the ride's relevant position.
- The place of installation must be prepared as specified in the corresponding drawing.
- The availability of calibrated measuring instruments (transit) and suitable equipment for permanent processing of reference points must be guaranteed.

Procedure

1. Use the construction site local coordinate-system (COSY) or establish a local COSY.
2. Set the origin of the COSY in x-y-z; x= 1000,000 m; y=1000,000 m; z=0,000m.
3. The accuracy of all coordinates is Millimeter [mm].
4. Establish a fix-point-system (FPS) around and within the construction site. The FPS must be geometrically balanced covering the construction site and it must be also multiple redundant, which means that anyone is able to calibrate themselves in this FPS.
5. At least four fix points are required. Fix points inside the construction site should be placed at exposed objects by using ground marks or geodetic reflection tapes. Fix points outside the construction site should be placed on higher positions (e.g. buildings, masts, etc.) by using geodetic reflection tapes. It must be ensure, that the distance to the reflection tapes are within the reflector-less EDM capacity of the used Tachymeter (see attached picture for reflection tape).

6. Ground marks should be geodetic nails or cross signs made by portable cutters. Each ground mark on the foundations has to be identified by using spray cane or a waterproof pen (see attached picture for geodetic nail).

7. The leveling zero points must be established redundantly, as written above.
8. After all zero datum points are established, these fix points have to be integrated into the foundation layout, which was sent by INTAMIN to the customer.

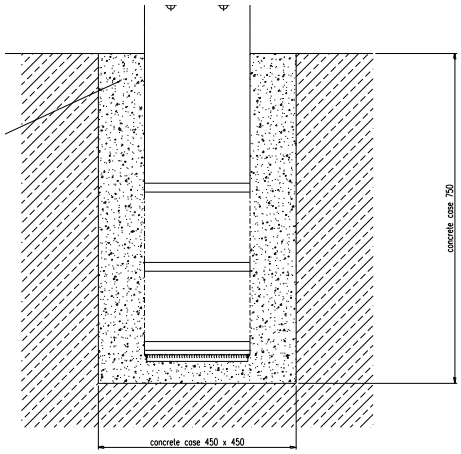
- Acceptance Test Plan

A2) FOUNDATIONS

Overview Foundation Size

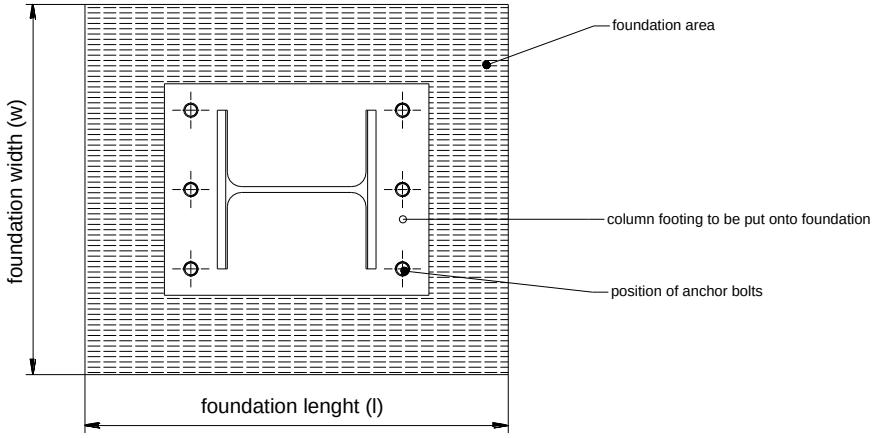
Concrete foundations will provide the basis for the individual columns. The size of the foundation (width w times length l) must be large enough to accommodate the column footing completely.

a) Foundation Size for Ride Columns
Concrete pocket foundations must be prepared according to the specifications given on drawing 5224-03-0001.



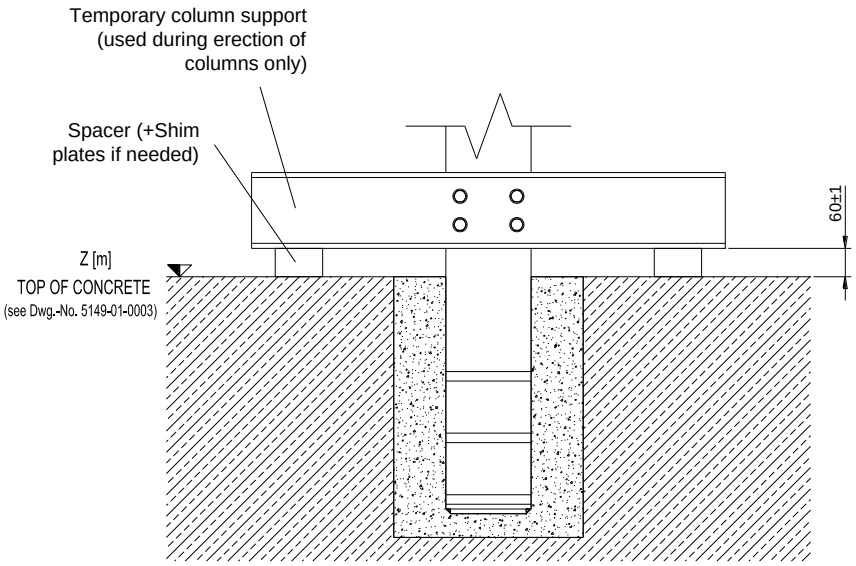
b) Foundation Size for Switch Columns and ride columns in station
Concrete foundations will provide the basis for the columns for the switch. The size of the foundation (width w times length l) must be large enough to accommodate the column footing completely.

example for foundation area for column with anchor bolts



Overview Foundation Height

The height of the z coordinates for the top of concrete of the column footings differs from column to column due to this customized roller coaster. Z-levels for each column foundation are given in drawing 5224-01-0003.
To adjust height differences, columns are to be leveled by shims and will be grouted after final adjustment. According to the sketch below 60 mm are foreseen for shimming and or leveling.

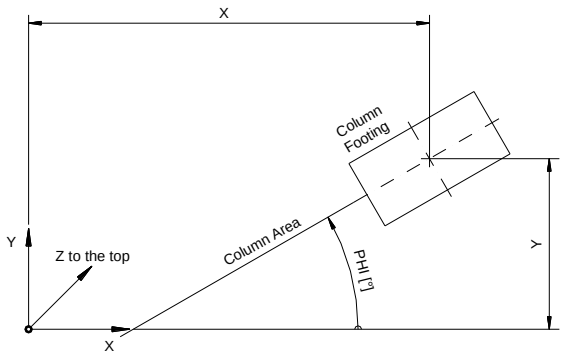


NOTE

Wooden wedges, grouting equipment and grout are not within scope of supply.
Steel shims for height adjustment are within the seller scope of supply.

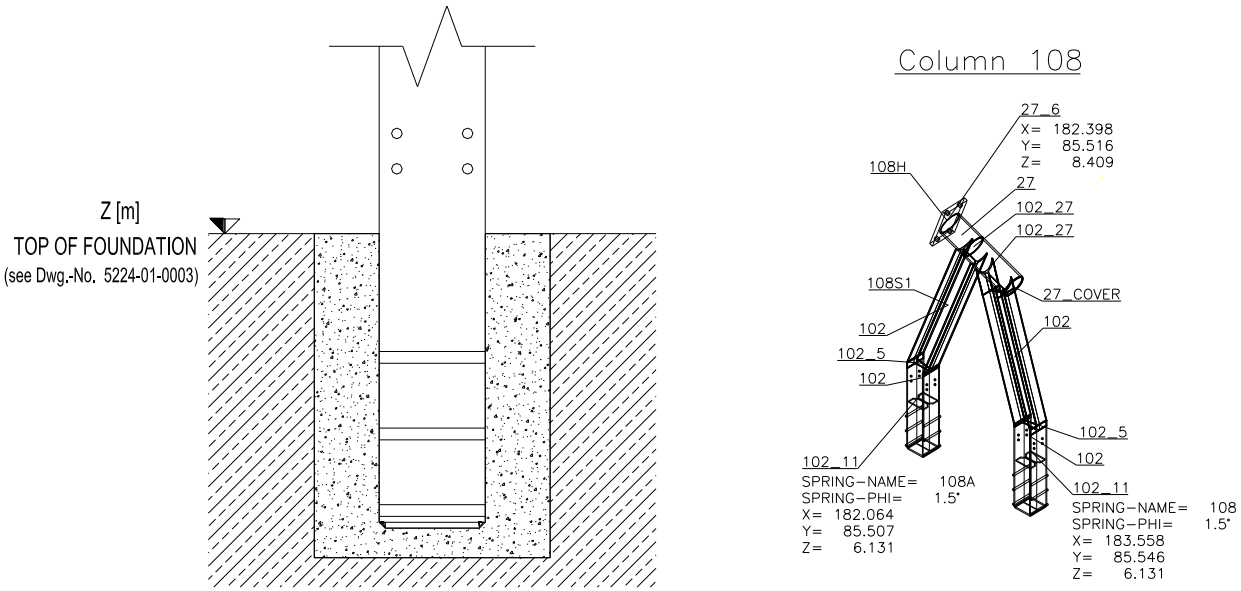
Overview Foundation Coordinates and Tolerances

The foundation positions are defined by x, y, z coordinates. The allowed tolerances for setting the center of pockets and especially for setting the anchor bolts is defined for x, y, z coordinates with +/- 5 mm. The center coordinates as well as the rotation angle of the anchor bolt pattern are defined on drawing 5224-01-0003.

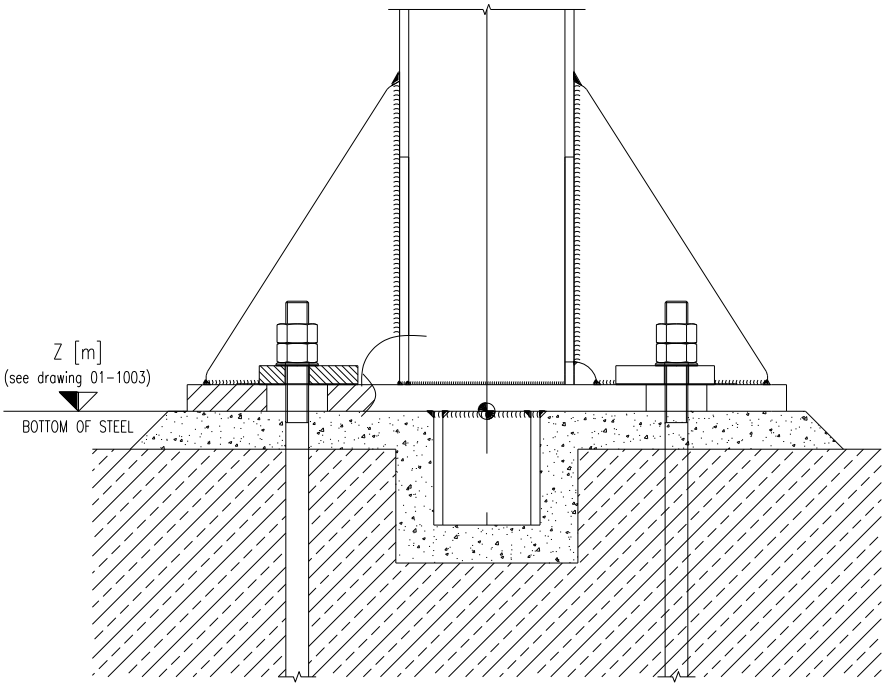


X X-coordinate of center of column belongs to track-coordinate system
Y Y-coordinate of center of column belongs to track-coordinate system
Z Z-height of bottom of steel column footing belongs to track-coordinate system
PHI[°] angle for orientation of foundation belongs to X-axis of track-coordinate systems

For taking measurements on the column footings, reference points with coordinates are defined for each column. These coordinates and the rotation angle phi are provided on the drawing 5224-01-0003, Foundation Coordinates.
As the column footings (except columns for the switch and some in the station) are placed directly into the concrete pocket (concrete case), the z-level of the foundation coordinates for the footings mean top of foundation. From this defined z-level the measurement for placing the column into the concrete pocket is taken later on.



For the switch columns and in general the columns with anchor bolts footer, the foundation coordinates are the Bottom Of Steel (BOS) values.



NOTE Note that these tolerances differ from the adjustability tolerance during installation, which can be found under the title “Foundation Tolerance

Compensation” in procedure “Column Erection” in this document. The adjustability tolerance shall compensate inaccuracies of both concrete and steel work as well as displacements due to temperature variation during erection.

Procedure and Measurements

1. Establish one or several zero datum points from to which all foundation points of the ride can be referenced to.
2. Mark and identify all foundation points by means of spray cane in accordance to the drawings.
3. Permanently mark all foundation points and orientation lines with a cross, large enough to clearly overreach the foundation surface.
4. Make the concrete case foundations according to drawing 5224-03-0542/0543/0551/0552/0553.
5. Make the concrete foundations for the switch columns and the applicable columns in the station and set the anchor bolts according to drawing 5224-03-0002/0522/0532.
6. Verify the pocket size (w, l) to be large enough to accommodate the entire column footing.
7. Verify height of anchor bolts to be sufficiently above the concrete foundation (for the switch and anchor bolts design footers).
8. Prepare wooden support and potential shims on the foundation to have the top of column head plate at the required height.
9. Verify the foundation center coordinates as well as the exact orientation by measuring x and y coordinates and angle φ. Verify the correct height level by measuring the z coordinates as height of shim plates (TOF). Compare the data with the corresponding drawing.
10. Send the filled out ATP to the seller prior to commencing the erection of the structure.

- Acceptance Test Plan

NOTE

All measurements from the datum point(s) to all other columns and foundations, during the installation, shall be recorded and shall be re-checked against actual site conditions at least once a year after installation has been completed.

A3) SITE PREPARATION

Pre-conditions

The following must be available:

- Access to the site
- Auxiliary materials
- All buildings ready and cleaned to install electrical cabinets and wheel
- Crane places and access road suitable for crane loads
- All show area/station/buildings must be accessible from top to install column and track equipment.
- Cable channels, conduits ready and cleaned
- Electricity, light installed/available on the working places.
- Operating air-condition in the electrical room according seller specifications.
- Internet access in the electrical room
- Office for advisor with infrastructure (e.g. internet access)
- All work permits for our workforce and that of the subcontractors must be available.

Procedure

- Establish of the rules (including safety regulations) for the building site and work in accordance with the present instructions, the local regulations and the rules of the park.
- Establishing and preparation of the material storage area, deposition area, pre-assembly area and crane access to the actual point of installation.
- Preparation and making freely available of all drawings and documents required for the installation. One original of each drawing must be kept at the site office.
- Establish a daily log book for the ongoing documentation of progress and all non conformities.

- Acceptance Test Plan (ATP)

A4) INSTALLATION PREPARATION

Pre-conditions

- Conditions of the site must correspond to the specifications on the applicable drawings.
- The zero or datum point(s) must be established prior carrying out any other installation.
- Check that all ducts/channels for electric and pneumatic lines are laid out in accordance with the drawings and in conformation with the local regulations.
- All relevant assembly drawings and other documentation must be available.
- Ensure that the correct tools and means of access are readily available.

Procedure

- Study all drawings and documents to ensure that the entire installation procedure and work sequences are correctly understood and planned.
- Make sure the curing time of the concrete foundations has expired.
- Verify that foundations are horizontal throughout and that they are free of uneven sections and impurities.
- Ensure that all components, fastening devices and handling equipment are immediately available in the required size, quality and quantity.
- Assure that cranes and lifting equipment of the correct quality and size to allow safe installation are available from the point of access and crane places to be prepared to bear the load and working load.

- Acceptance Test Plan (ATP)

B) STRUCTURE ERECTION

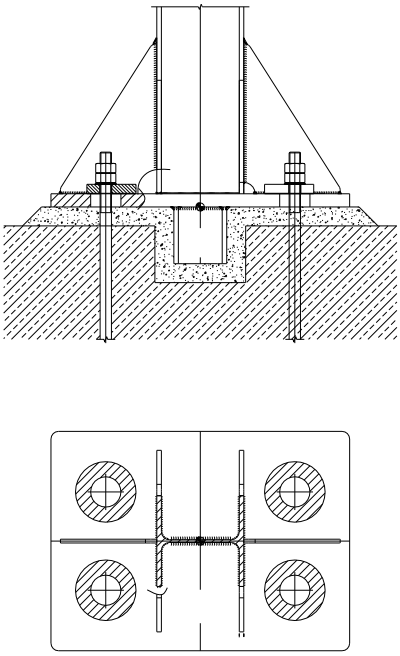
DRAWINGS

5224-01-0001	Planview / Layout
5224-01-0002	Track Profile
5224-01-0003	Foundation Layout
5224-01-0004	3D Overview
5224-02-7000/7050	Two pipe track Typical track drawing
5224-02-1110 to 1120	Assembly Track S01 to S02
5224-02-1210 to 1250	Assembly Track M01 to M05
5224-06-1110 to 1140	Assembly Track B01 to B04
5224-07-1110 to 1330	Assembly Track L11 to L33
5224-03-0132 to 0773	Column Connection Details and footings
5224-03-1000 to 1029	Column 3D drawings
5224-04-0001	Station Layout
5224-13-0214_STOSS_OFF280_REV0.xlsx	Listing of track joint coordinates 280mm above top of track level

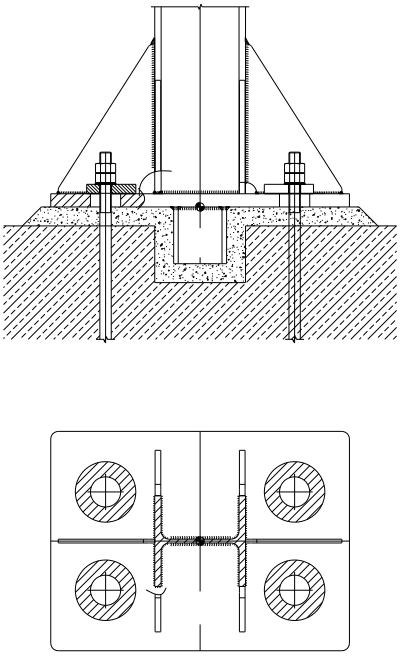
B1) OVERVIEW COLUMN FOOTINGS

5 different column foot types are used for the columns according following principle overview:

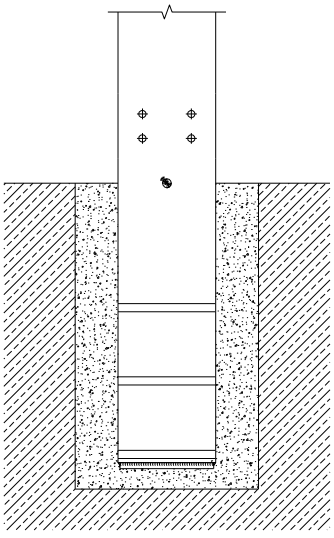
Column footing type #522
(Item 102_12)

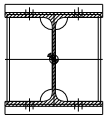


Column footing type #532
(Item 112_12)

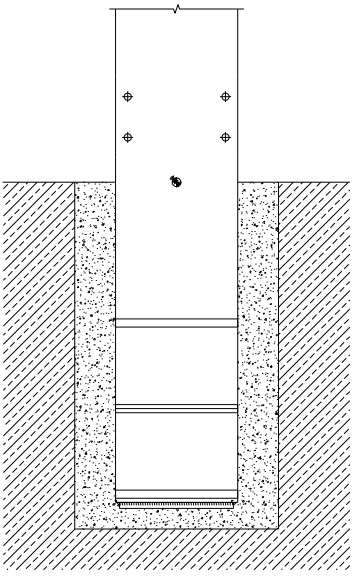


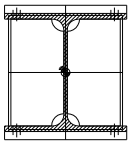
Column footing type #542
(Item 102_11)



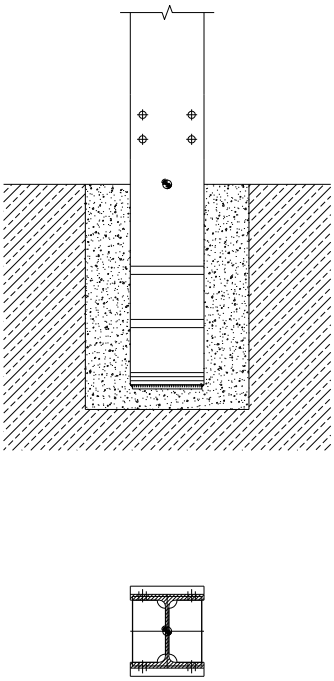


Column footing type #543
(Item 103_11)

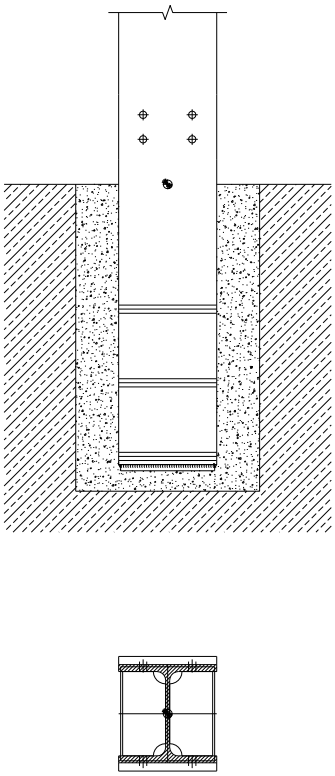




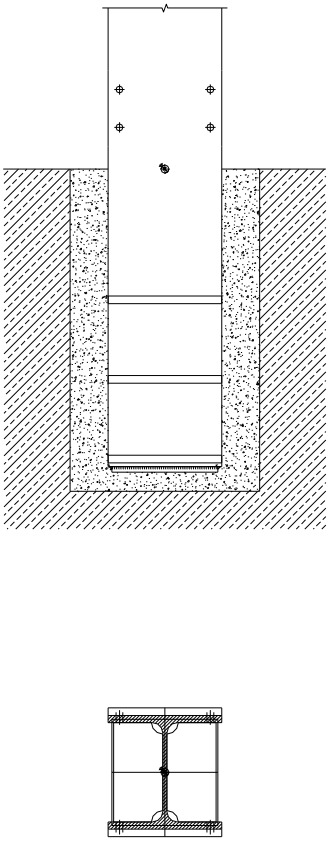
Column footing type #551
(Item 111_11)



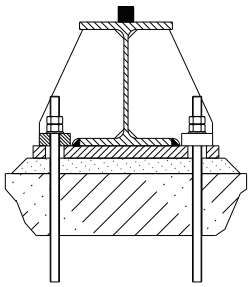
Column footing type #552
(Item 112_11)

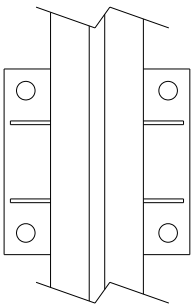


Column footing type #553
(Item 113_11)



FOOTING TYPE 5 (SWITCH)

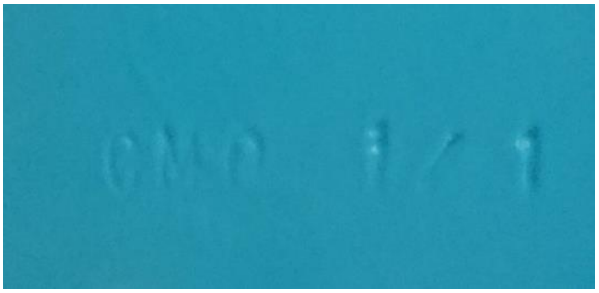




B2) OVERVIEW MARKING OF COLUMNS

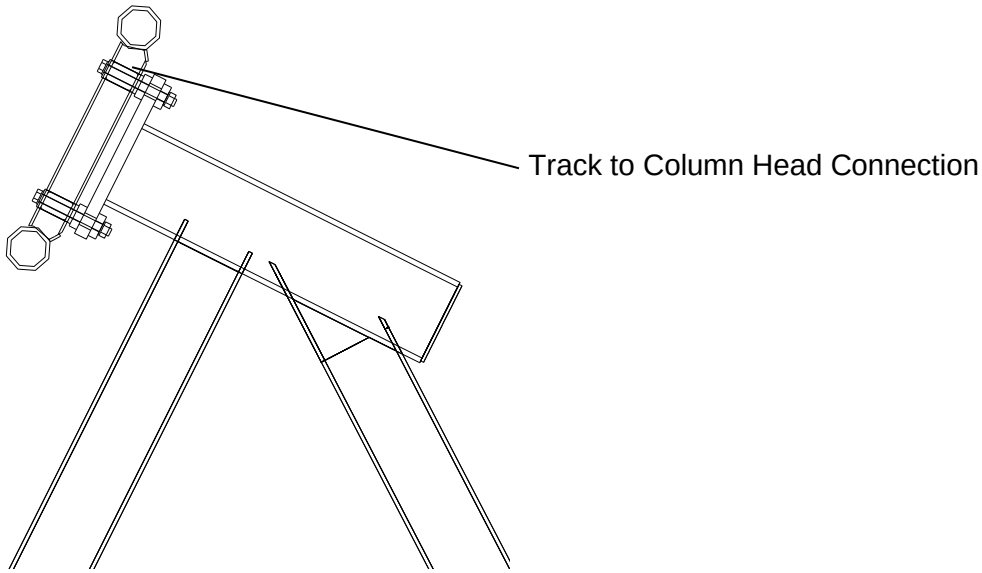
All columns are manufactured as single piece column. For identification reasons a label with the column number is attached to each column.

Example of column CM10:



B3) OVERVIEW TRACK-COLUMN CONNECTIONS

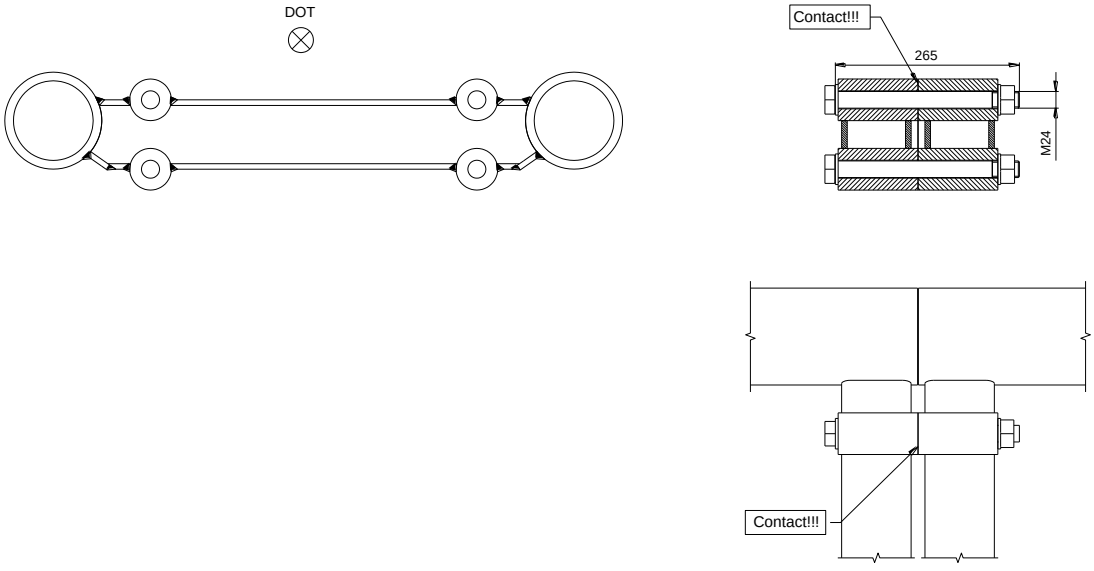
Column head system



B4) OVERVIEW TRACK-TRACK CONNECTIONS

The ride consists of 2 pipe track sections.
Below an example for the track connection is given. Details of the track to track bolt connections are shown in the drawing 5224-02-0700.

2-pipe track connection



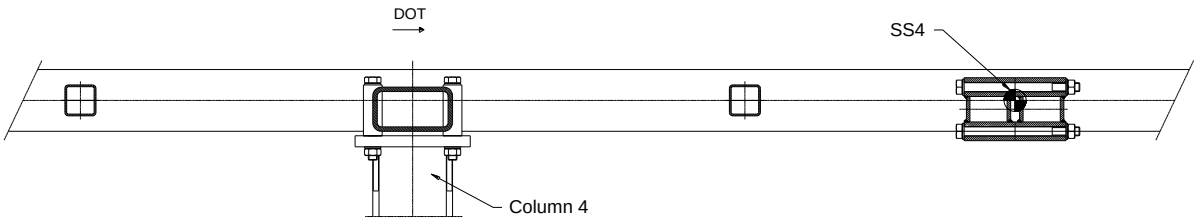
B5) OVERVIEW COORDINATES

B5.1) Definition of reference points

For taking measurements on the foundations, on the track as well as on the columns, reference points with coordinates are defined. These coordinates are provided in the following listings:

- 5224-01-0003 (foundation coordinates) drawing;
- 5224_FOUNDATION_LOADS_REVX.xlsx and 5224-13-3001 Switch foundation loads Rev.- (for the switch);
- 5224-13-0214_STOSS_OFF280_REV0.xlsx (track to track connections - 280 mm above top of track in correspondence to track joint J0XX points and map to visualize the deviations);
- column drawings (column to track connections - column head SP points)

The file **5224-13-0214_STOSS_OFF280_REVX** provides for each **track joint** SS typical reference points with their x, y and z coordinates. The number of the track joint SS point has no relation to the track element number. It is deducted from the column number which is closest to the track joint. Some column numbers have no track joint in their surrounding and therefore the SS points are not consecutively numbered. Some numbers are not allocated, while others might have two values (e.g. SS7 and SS7.2).



TR = Center of Track

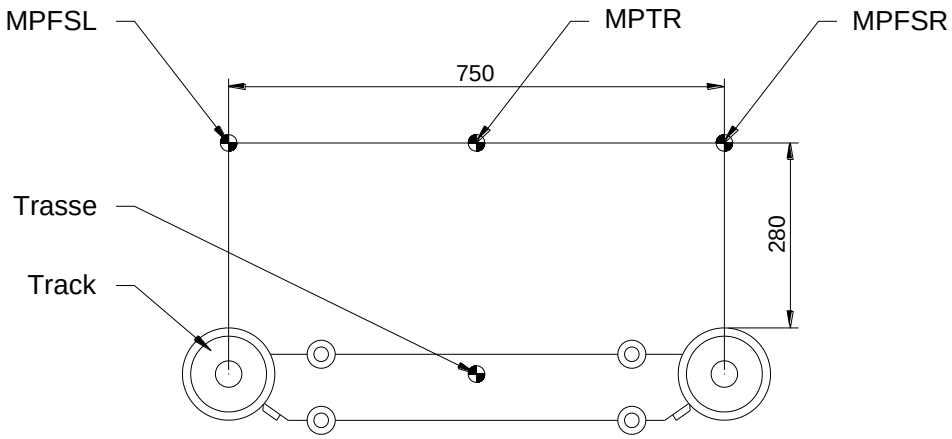
As coordinates on the track surface cannot be measured directly, points for measuring are defined 280 mm above the top of track. These points can be measured with a special device which has to be fitted to the track:

MPTR = 280 mm above center of track

MPFSL = 280 mm above track pipe left in direction of travel

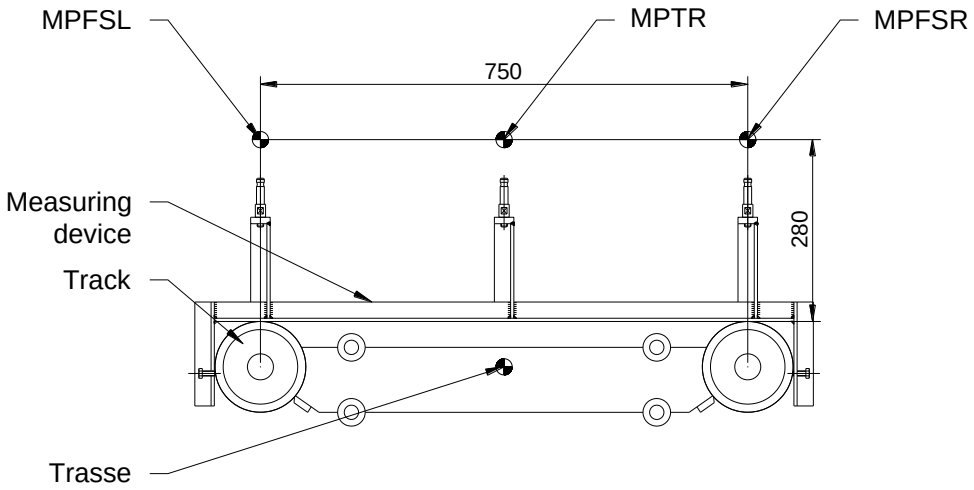
MPFSR = 280 mm above track pipe right in direction of travel

View in direction of travel (DOT)



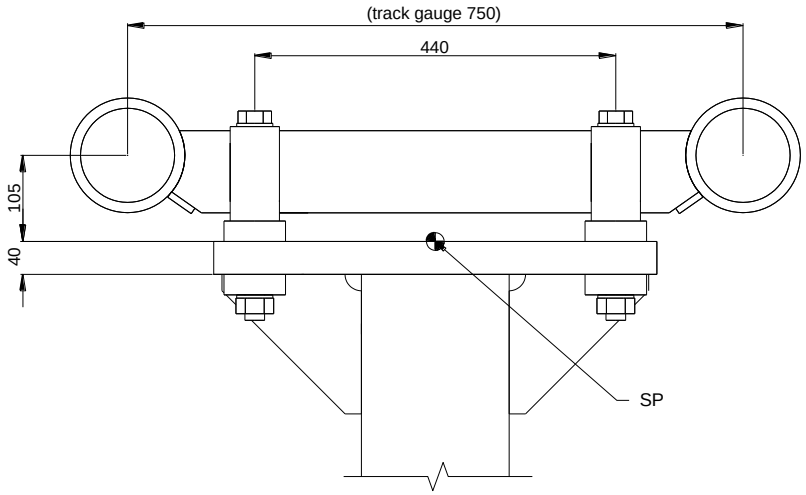
The measuring device has to be fitted to the track checking the centering using feeler gauge

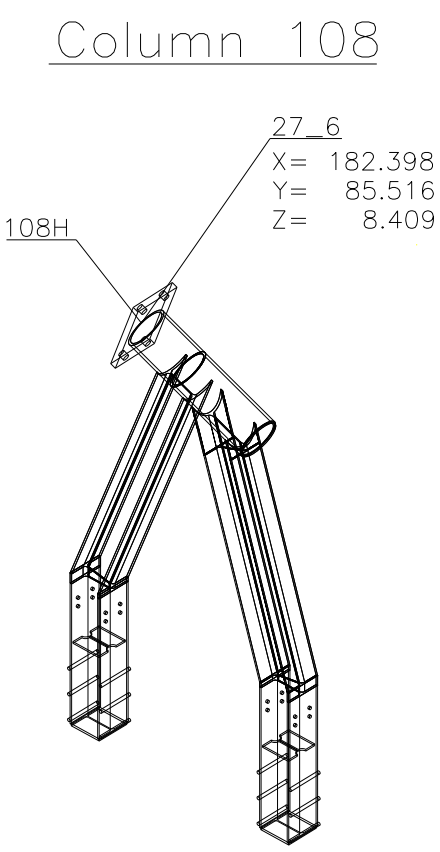
View in direction of travel (DOT)



Example for the evaluation of the column head coordinates and of the track joint coordinates

The **column drawings** provide for each individual **column to track connection** the reference point SP with its x, y and z coordinate.
The point SP is on the upper edge of the column head flange.





B5.2) Tolerances for column coordinates

When a column with anchor bolts footer design is set, the anchor bolts must be tightened to 10% of the nominal torque. The coordinates of the reference point SP of the column head must be checked.

The maximum deviation from the prescribed coordinates at the reference point SP of the column head is 3 mm in x, y and z direction per 10 m height of the element.
I.e. height of support 30 m:

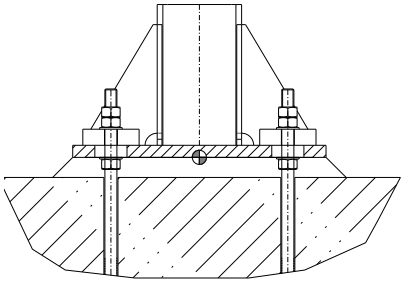
Max. allowed deviation for coordinates of reference point SP	
x=30/10 x 3 mm =	9 mm
y=30/10 x 3 mm =	9 mm
z=30/10 x 3 mm =	9 mm

B5.3) Tolerance Compensation

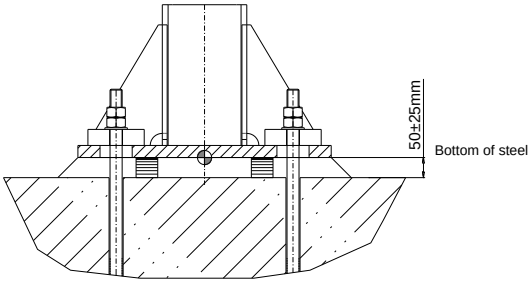
Foundation Leveling & Shimming at anchor bolts footers

Leveling and alignment of the structure is essential and must be carried out by adding or removing shim plates under the column footing. To ensure proper distribution of grout, a nominal 50 mm gap (+/- 25 mm) between the column footing and the concrete foundation is required if no other indications are given on the drawings.

wrong leveling



correct leveling

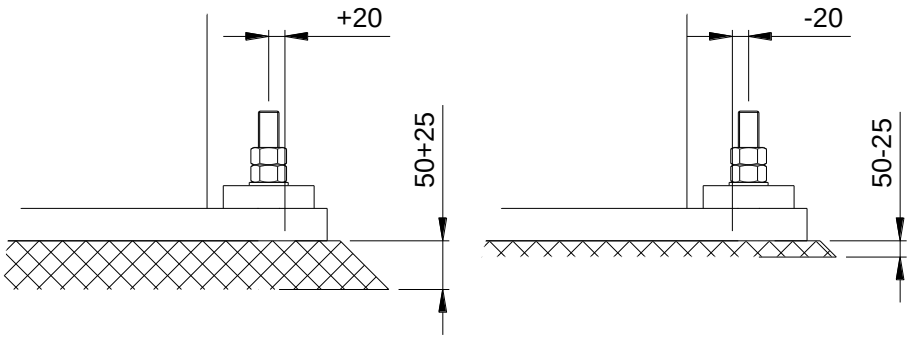


NOTE

- Only shim plates are allowed for leveling column. Never use nuts and plates for leveling.
- Wrong leveling (as shown above) does not allow proper torque of anchor bolts and acting forces cannot be transferred as intended into the foundation.
- Wrong leveling can lead to moving foundation footings and/or broken anchor bolts.
- Shim plates are not within Intamin scope of supply.

Foundation Tolerance Compensation at anchor bolts footers

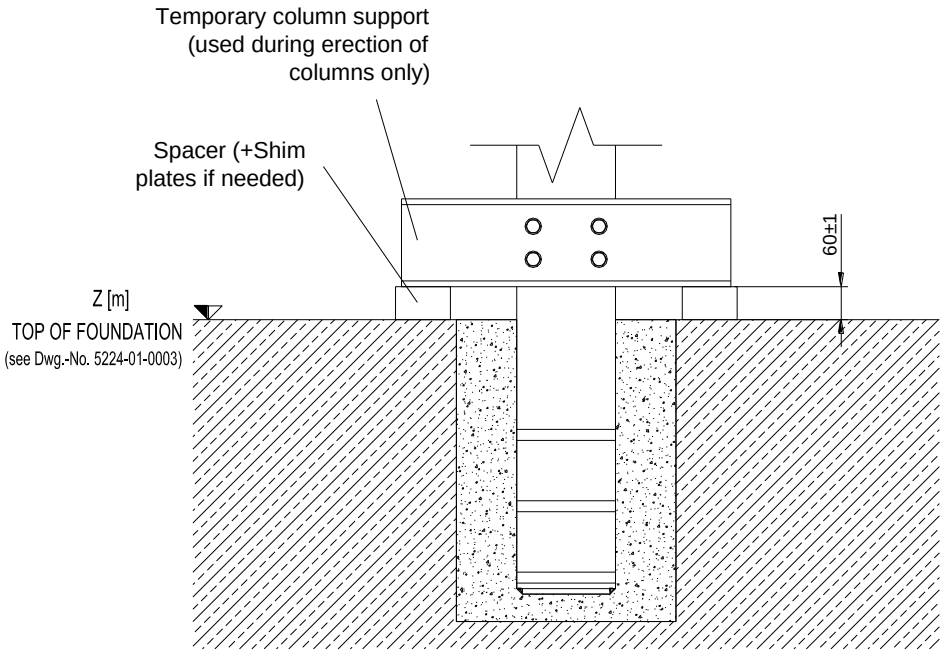
Column footings are designed in such a way that certain erection tolerances, built up tolerances over extended distance and/or foundation settings can be compensated within the connection. If necessary, cut the edge of the washer (e.g. chamfer) to avoid contact of washer with column pipe or weld seam.



Column Footing
shown with max. horizontal tolerance of +20mm
and max. vertical tolerance of +25mm

Column Footing
shown with max. horizontal tolerance of -20mm
and max. vertical tolerance of -25mm

Foundation Leveling & Shimming at Pocket Foundation Footings



B6) ERECTION SEQUENCE

It is recommended to erect the ride structure in the following sequence:

Sequence	Section
1	Station to Launch 1, Launches 2-3, Brakes and maintenance
2	Launch 1 to beginning of Launch 2
3	Launch 2 to beginning of Launch 3
4	Launch 3 to Brakes

For overview see drawings:

- Layout 5224-01-0001
- Track Profile 5224-01-0002
- Foundation Coordinates 5224-01-0003
- Station 5224-04-0001

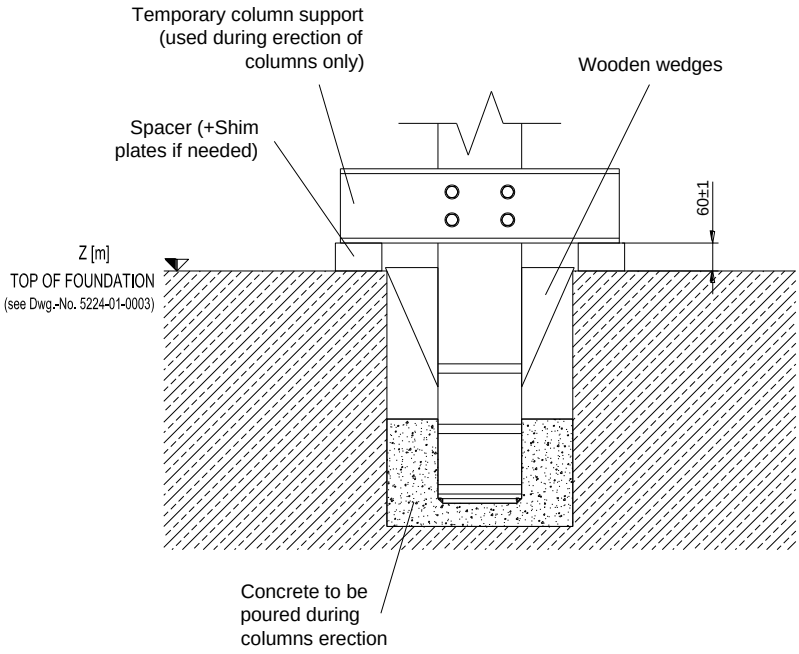
B7) INSTALLATION PROCEDURE FOR STRUCTURE

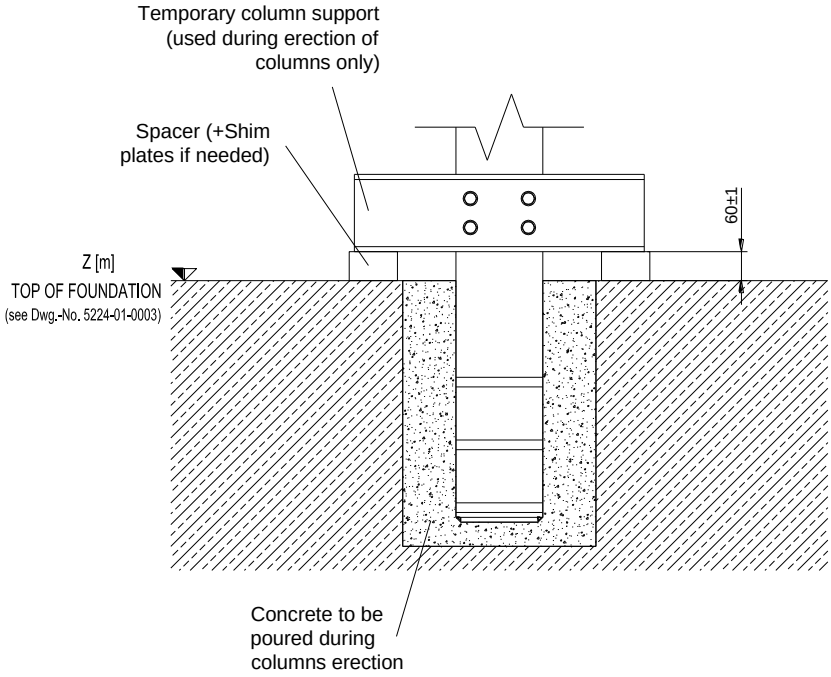
B7.1) PRE-CONDITIONS FOR STRUCUTURE INSTALLATION/ERECTION

- The curing time for the concrete foundations must have expired. The foundations must be horizontal / even throughout and not feature any uneven areas. Concrete and column flange must be free of impurities.
- The procedures A1) „Zero Datum Points" and A 2) "Foundations" must be completed and the protocol must be submitted to the seller for verification.
- The place of installation must under all circumstances correspond to the specifications in the documents and the applicable drawings.
- Check that all components, steel parts, fastening means, etc. are of the correct type for the particular part of system.
- Ensure that the correct tools and means of access are readily available.
- Ensure that heavy equipment as crane, forklift, sky worker etc. is available.
- Keep the applicable layout and assembly drawings ready at hand.
- Define all interface positions and make them accessible.
- Determine exact installation position of the individual column and track members.
- Ensure that the components to be installed are clean / free of damage i.e. bent, free of fastening carriers, lifting tools, etc.

B7.2) COLUMN ERECTION

1. Pre-assemble each column on ground. Tighten at 30% of the torque indicated in 5224-03-0013 the column to column bolts.
2. Place the column into related pocket(s).
   Fix the columns with the temporary column supports and wooden wedges (refer to drawing 5224-03-0001 and to the sketch below) to ensure that they do not move during the concrete pouring process. Remove the wooden wedges only when the curing time of the first pouring of concrete is completed to avoid undesired movement of the column. Then fill the rest of the pocket.





3. Nominal position of columns in Z direction for column footing type 1, 2, 3 and 4 is defined by 60 +/- 1 mm between bottom of temporary frame and top of concrete, for nominal value of top of concrete pocket.
4. Adjust if necessary (by checking ATP coordinates in x, y and z direction) using shim plates of 2-5 mm;
5. Measure the coordinates of the reference point SP and compare to the value stated in the column drawing. If necessary, adjust angle and height of the column by shimming the column footing with shim plates. Refer to procedure B5.3)-Tolerance Compensation.

- Acceptance Test Plan (ATP)

B7.3) TRACK SECTIONS PREPARATION ON GROUND

NOTE

The friction wheel drives in the launch1, launch 2, launch 3, brake, station and maintenance area may either be installed onto the corresponding track elements on ground, or after the complete erection of the track.

- If relevant, install the friction wheels into the launches, boost, brake and station track elements, while the track elements are on the ground level. Refer to procedure C 3) “Friction Wheel Drives”.
- Make sure that the left and right types of the friction wheels drives and the friction wheel drives with the free spinning clutch are correctly supplied. Therefore the friction wheel drives must be carefully selected for each location in the system according the relevant track drawings.
- Before mounting the track on to the column check that all connections are correctly installed.

B7.4) TRACK INSTALLATION

1. Temporarily mount the track sections onto the column head. Install and pre-tighten the bolt connections. Torque the bolts to 30% of the nominal torque rate after adjusting the track and column.

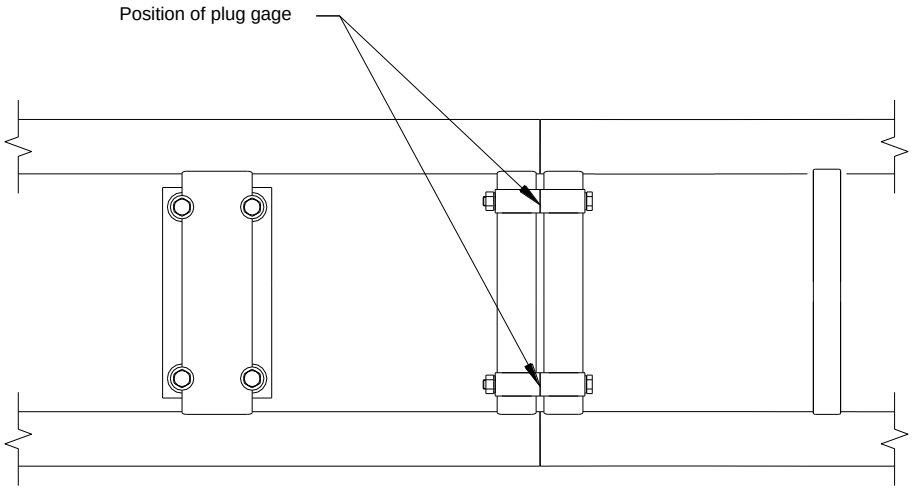
Using Plug Gage

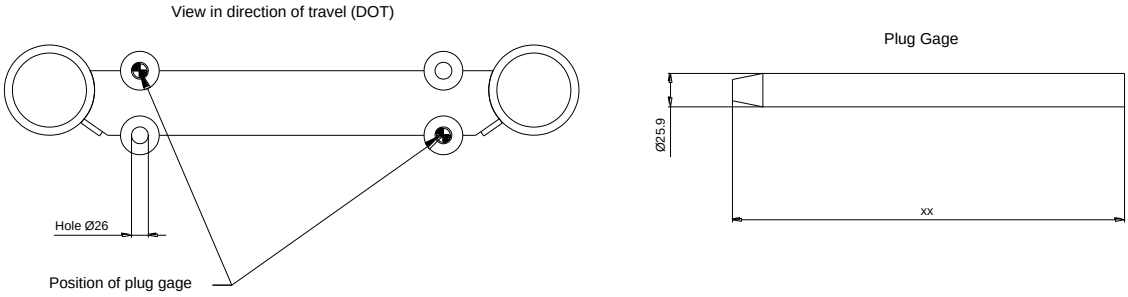
NOTE

Use plug gages for perfect fit of the running rails prior to snug fasten and torqueing of the track bolts. The size of the plug gage depends on the actual bore diameter of the track bolt hole. Recommended are plug gages in increments of 0.1mm. Refer to the sketch below.
Plug gages must fit tightly into the hole, use a hammer if necessary.
Remove paint in the hole if necessary.

2. Place one plug in the bolt hole top left and the other one in the bolt hole bottom right when looking at the track joint in direction of travel.

The two plug gages will keep the track elements at the most accurate position when the other bolts are tightened.





Connecting two Track Elements

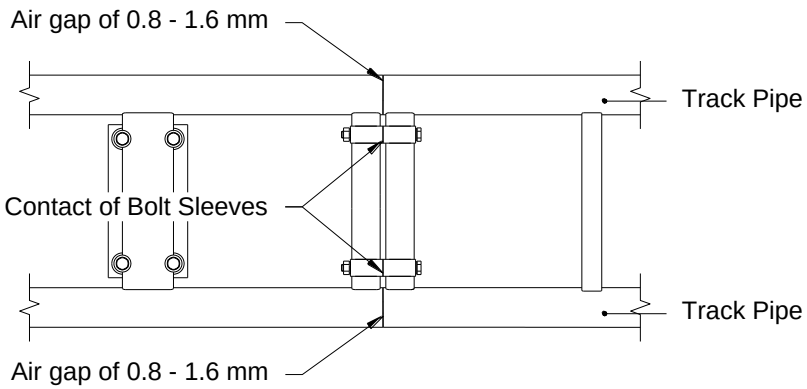
The sketch is showing a typical track to track connection, which is designed to be held together by four bolts. On the bolts connections the bolt sleeves / bushes must have perfect contact on all four connection points while running track pipes must have an air gap of 0.5 to 2 mm.

NOTE

The track connection is designed in such a way that there is always a gap of 0.8 mm to 1.6 mm between the adjacent running track pipes. The track joint shall only have contact at the sleeves of the bolt connections.

NOTE

Do not torque the bolts at the torque indicated in the drawings before adjusting the structure!



3. Snug fasten the track connection bolts, check for 0.8 to 1.6 mm air gap (see sketch above) at the running tube joints, check the transition section, and adjust if necessary.
4. Torque the track to track connection bolts (50% of the value), check the air gap. If necessary adjust the column height by shimming to allow perfect contact on the track to column connection. If a gap or a deviation is detected on this connection proper shimming is indispensable prior snug fastening the bolts.
5. Install at minimum a section of 5 track elements and check the track to track connections for proper fit as well as the track to column connections for proper alignment. Measure the “Offset” coordinate at each track joint by using a measuring device attached to the track at each track joint SS. Compare the measured value with the listing **5224-13-0214_STOSS_OFF280_REVX.xlsx** according chapter B5.1 of this manual.
6. The maximum deviation from the prescribed coordinates at the reference point of the track joint (I.e. “offset” coordinate) is 3 mm in x, y and z direction per 10 m height of the element. I.e. height of track 10 m:

Max. allowed deviation for coordinates of reference point “Offset”:	
x=10/10 x 3 mm =	3 mm
y=10/10 x 3 mm =	3 mm
z=10/10 x 3 mm =	3 mm

NOTE

For track close to ground a tolerance of 1-2 mm is allowed.

7. If the coordinates are not within the specified tolerance range, readjust the column height or the column to track connection and repeat the measurements.
8. During the erection send the list of measurements to the seller for verification.

- Acceptance Test Plan (ATP)

B7.5) TRACK CONNECTION SMOOTHNESS

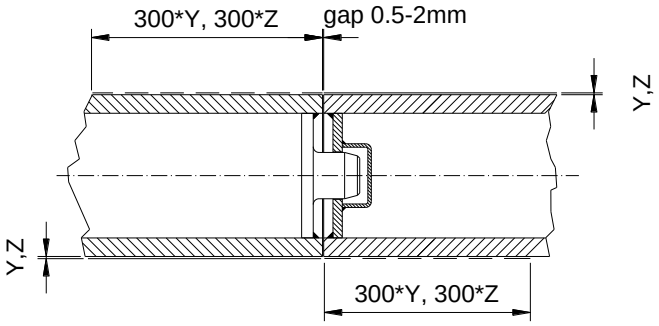
For final adjustment check track to track connection before torqueing the bolts for a smooth transition in lateral direction and height (Y, Z). If a deviation |Y|, |Z| ≥ 0.5 mm is observed the following must be carried out:

- Re-check the connection installation while loosening and taking out the upper left and lower right bolt in DOT and checking proper alignment with a new, not scratched plug. If the plug gage does not fit in, the remaining bolts must be loosened, too and the connection can be re-adjusted.

NOTE

It is not allowed to use bolts already torqued to specification on drawing twice.

- Should the tracks have been installed with the closest matching plug gage and still the transition is out of the acceptable range as outlined, i.e. if the deviation is not a question of improper alignment, then seek advice from the seller. **Only upon agreement with the seller**, the track joint must be smoothened out by grinding over a length of 300 times the deviation (300*Y, 300*Z).



- Acceptance Test Plan (ATP)

B7.6) BOLT CONNECTIONS

Bolt connections must be tightened and torqued in accordance with the torque rate shown on the specific drawing. Bolt connections not using self locking nut must be secured with LOCTITE 242 (except high strength HV bolt connections).

- After checking the track to track connection for a smooth transition (y, z) according to procedure B7.5) of this manual and checking/adjusting the track to column connection, the bolts (except anchor bolts for the switch) can be torqued to the specified torque rate according the specific drawings.
- Torque stripe the connection with yellow color at 100% torqueing.

- Should the tracks have been installed with the closest matching plug gage and still the transition is out of the acceptable range as outlined, then the track tubes need to be ground. Smoothen the deviation according to procedure B7.5) of this manual.

NOTE

After installation of the column and track structure and after aligning the complete structure, all bolt connections (except anchor bolts for the switch) have to be torque with the torque rate according to the specific drawing and striped with yellow color at 100% torqueing.

- Acceptance Test Plan (ATP)

B7.7) CONCRETE POURING

1. Prepare the correctly aligned and properly fixed column footings for being embedded in concrete.
2. Clean hollow spaces and all grouting apertures adequately, remove impurities, etc.
3. Wrap the columns by plastic foil up to 1.5-2m in height to avoid contamination.

NOTE

Remove pouring contamination at steel in wet condition. Dried pouring will damage paint layers during removing.

4. Use a grouting quality suitable for the specific application. For recommendations see chapter 3.2.12 Concrete and Grout of this Manual.
5. Mix and pour the grouting in accordance with the suppliers specifications.
6. Allow sufficient curing time.
7. Remove the temporary column supports and return them to Intamin.

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B7.8) Grouting (for the anchor bolt design footers)

1. Prepare properly installed column footings at the switch for grouting.
2. Remove all unnecessary spacer plates and prepare the remaining shim plates so that they stay in the foundation permanently.
3. Clean hollow spaces and all grouting apertures adequately, remove impurities, etc.
4. Wrap the columns by plastic foil up to 1.5-2m in height to avoid contamination.

NOTE

Remove grouting contamination at steel in wet condition. Dried grouting will damage paint layers during removing.

5. Use a grouting quality suitable for the specific application. Mix and pour the grouting in accordance with the grout supplier’s specifications.
6. Allow sufficient curing time.
7. Cut excess lengths of anchor bolts only if absolutely necessary.
8. Torque the anchor bolts.

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NOTE

Strong glue tape my damage painted steel layers after removing, work carefully and inform Intamin about any damages during pouring and grouting.

B7.9) RE-TORQUEING OF BOLT CONNECTIONS

- Re-torque the ride structure (column and track) as outlined under chapter 3.2.8 “Bolts/Nuts” after 100 hours of operation.

NOTE

Torque stripe the bolt connections after the re-torqueing process with green color.

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B8) TRACK JOINT CHECK AFTER G-FORCE MEASUREMENTS

After installation of the entire column and track structure according to the above stated points, the quality of the erection and specially the quality of the track joints must be reviewed and/or checked. Therefore the following measurements must be carried out:

- The g-forces of the train during a ride shall be measured and subsequently the track joint quality shall be analyzed. Perform g-force measurements according to Procedure E3). All measurements (g-force, track joint measurements) have to be sent to the seller for review. The seller will advice for referring correction/ adjustments of the track installation where required.
- Where required as a result of the g-force measurements, some critical track joints have to be measured / analyzed in a more detailed way. As a result of such analyses, correction of some specific track joints could be required according to seller's instructions.
- Measure the track joints according the procedure as outlined below. If corrective re-adjustment is not possible anymore the track joints must be smoothened where required, after approval of the seller.

Track Joint Measurements

The transition of the referring track joints shall be checked by comparing the radii of the joining tracks by measuring the depth of the track to a straight edge. Check the track joints with a straight edge of 1m and a depth gage with an accuracy of 0.1 mm. The tracks are measured in before/at/after/ the track joint at different locations and the measurements are to be recorded.
Tools required:

- Track Joint Measuring Device
- Depth gage accuracy of 0.1 mm

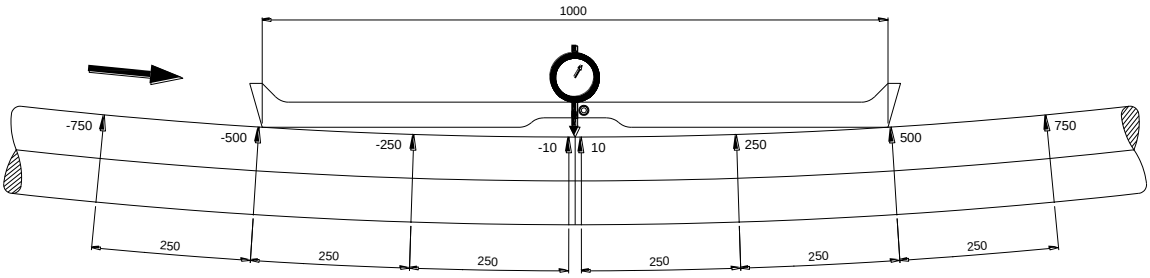
Procedure

For illustration see sketches below.
Orientation of the track joint measuring device:

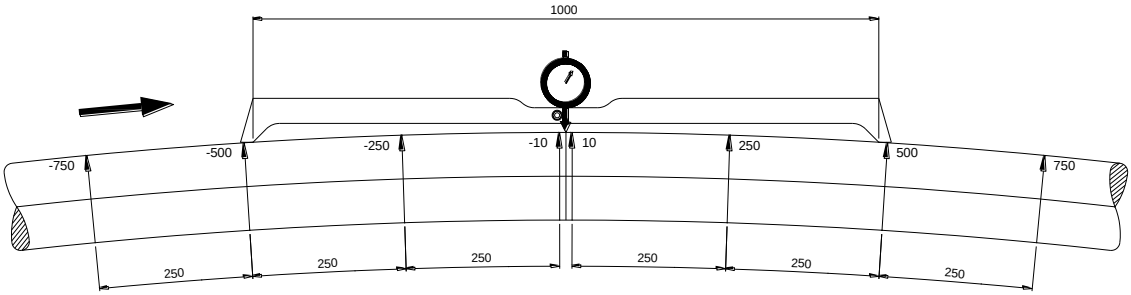
- in valley sections: the straight side towards the track
- in hill sections: the side with legs towards the track

1. Place the middle of the track joint measuring device on the track joint 10 mm after the transition on the right rail.
2. Place the depth gage in the middle of the track joint measuring device.
3. Measure the depth from the straight edge to the top of the rail.
4. Record the measurement.
5. Move the track joint measuring device 250 mm from the track joint in direction of travel and measure the depth from the track joint measuring device to the top of the rail in the middle of the track joint measuring device again. Record the measurement.
6. Move another 250 mm and follow the procedure step 2 through 4 until 6 points up to the point of 1500 mm from the track joint have been mesured.
7. Move the middle of the straight edge on the track joint 10 mm before the transition and follow the procedure step 2 through 6 against the direction of travel.
8. Check the transition of the track joint of the left rail and follow the procedure step 1 through 7.

Measuring of concave tracks (valley)



Measuring of convex tracks (hill)



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B9) CATWALK INSTALLATION

OVERVIEW

A catwalk is foreseen along the launches and brake track section. The catwalk in the brake section is accessible via the station and the ground level.

The catwalk in the launch 1 is accessible by the stairs at ground level.

Pre-Conditions

- Check the complete delivered equipment, report any damages in writing.
- Ensure that all safety measurements are taken.

Procedure

1. Pre-assemble the catwalk elements and railing according to the above mentioned assembly drawings.
2. Attach the pre-assembled catwalk parts to the catwalk support elements.
3. Bolt connections. Check all bolt connections. Torque all bolts with 100% of the torque rate indicated on the specific drawing. Bolt connections not using self locking nuts or threaded inserts must be secured with LOCTITE 242.

- Acceptance Test Plan.

C) MECHANICAL COMPONENTS INSTALLATION

C1) PNEUMATIC SYSTEM

DRAWINGS

5224-04-0001-1/4	Pneumatic Schematic, Gates boxes (4 Sheets)
5224-09-0005-1	Pneumatic Schematic, Switch box(1 sheet)
5224-09-0006-1/4	Pneumatic Schematic, Waiting brakes box (4 Sheets)
5224-09-0007-1	Pneumatic Schematic, Launch 2 Brakes (1 sheet)
5224-09-2000	Pneumatic Lines overview
5224-09-2001	Pneumatic Control box installation

The following specifications shall give an overview of the technical requirements for the pneumatic system of this specific ride. Functionality and durability of the pneumatic components depend much on the loads acting on components and the environmental conditions. Temperature rates defined in this document must be kept, otherwise damages on seals or other elements / components may occur.
The pneumatic units are designed and built according to acknowledged safety regulations.

C1.1) GENERAL TECHNICAL DATA

Medium	Compressed air
Max. operating temperature cylinders	-10°C to +80°C
Max. operating temperature valves	-10°C to +50°C
Pressure range	1 – 10 bar (1psig=0.0689bar)
Operating pressure	6 bar (switch and gates) 9 bar (launch and waiting brakes)

NOTE

- For more information see document 5224-Final pneumatic package and documentation.
- Clear pipes of dust and blow them out before first operation.
- Installation work of the pneumatic system must be done in accordance with the instructions of Norgren, which can be found in Manual Part TWO, Chapter 7, Third Party Documentation.

C1.2) AIR QUALITY

The quality of the compressed air is very important for the proper function of the pneumatic system. Therefore the demanded air cleanliness level as well as the dryness must be in accordance with ISO 8573 and the given quality levels on drawing 5224-04-0005-page 2.

Air quality	
Dirt Particle Size	40 µm (class 3)
Water Pressure Dew Point	- 20 °C (class 3)
Oil contamination	< 1 mg/m^3 (class 3)

If the air is in poor condition, it may cause malfunctions in the system or may damage valves, compressors, pressure switches and cylinders.

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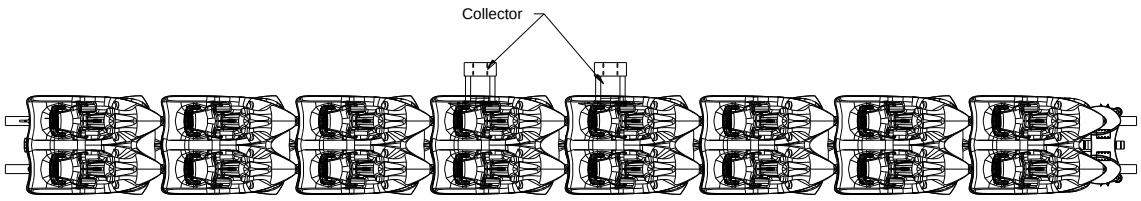
C2) COLLECTOR

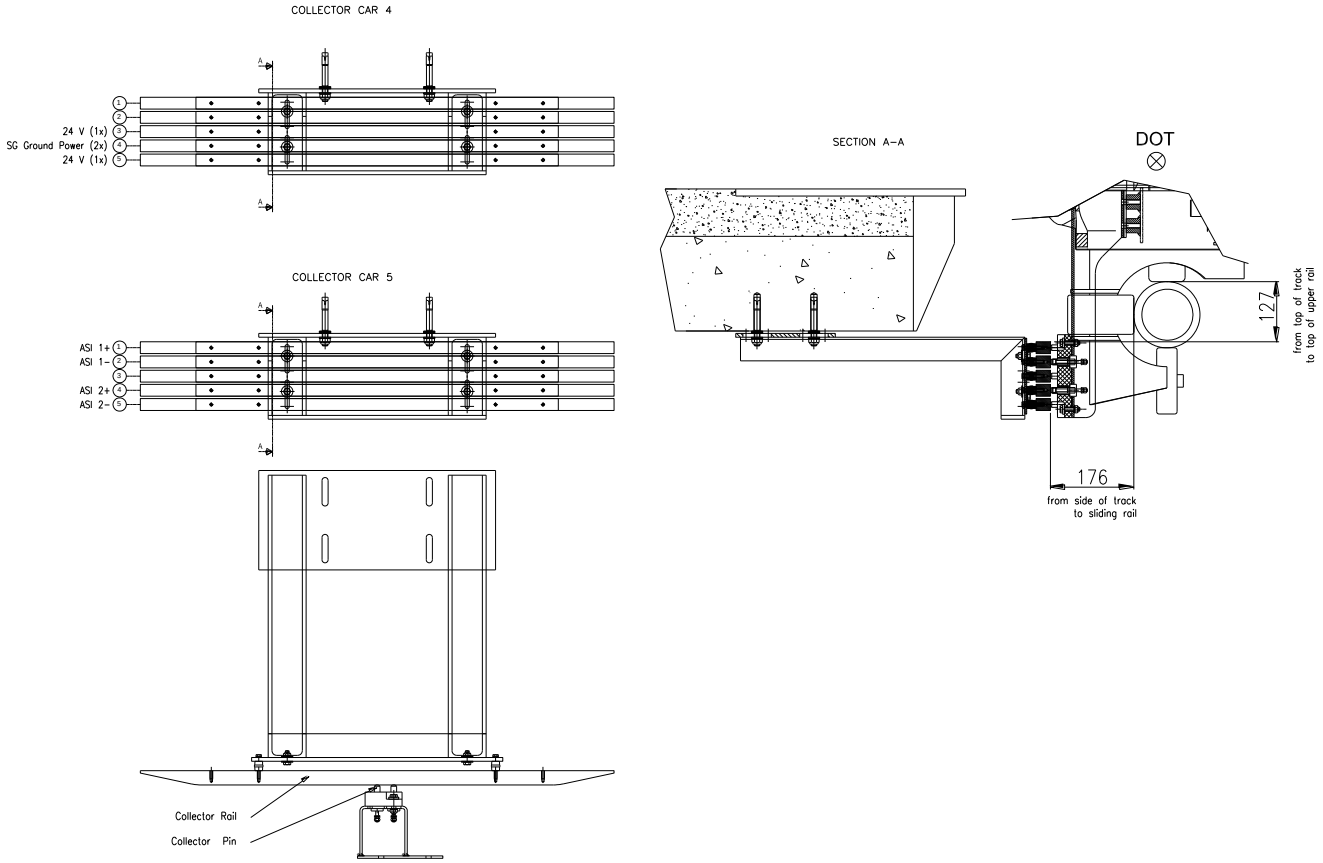
DRAWINGS

5224-04-0001	Station Layout
5224-04-4000	Collector

OVERVIEW

The collectors are to be installed under the station platform at the final load/unload position of car no. 4-5.





C2.1) PRE-CONDITIONS FOR MECHANICAL INSTALLATION

- Ensure that all electrical lines are installed at the correct location within the installation area in accordance with the electrical installation instructions.
- Check the complete delivered equipment, report any damages in writing.
- Ensure that all safety measures are taken.

WARNING

- Major current can flow as soon as the current collectors are connected. For this reason no conducting parts may be placed on the copper rails.
- Do not step onto the collector.

C2.2) INSTALLATION

1. Fit the current collector under the station platform as per drawing.
2. Ensure that the collector is horizontal throughout.
3. Move the train to its exact loading / unloading position.
4. Newly adjust the collector if necessary.
5. Bolt connections. Check all bolt connections. Torque all bolts with 100% of the torque rate indicated on the specific drawing. Bolt connections not using self locking nuts must be secured with LOCTITE 242.

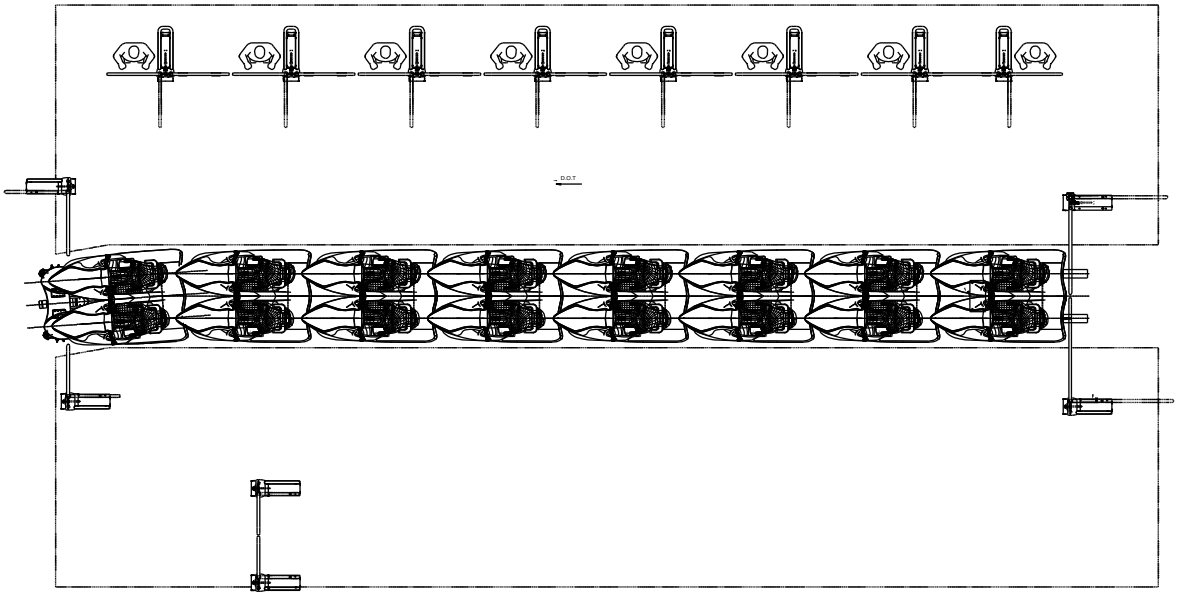
- Acceptance Test Plan (ATP)

C3) GATES

DRAWINGS

5224-04-0001	Station Layout
5224-04-0001-1/4	Pneumatic Layout, Gates (4 sheets)
5224-04-9200	Gates Assembly
5224-04-9201 to 9208	Gate 1 to Gate 8

The gates prevent the access to the station platform when the train is moving. The rotating fences open, once the train is in normal position for loading the train.



C3.1) PRE-CONDITIONS FOR MECHANICAL INSTALLATION

- Ensure that all parts as mentioned above are on hand.
- Damages on parts must be documented in writing.
- Ensure that all electrical lines are installed at the correct location within the installation area in accordance with the electrical installation instructions.
- Ensure that all pneumatic lines for connecting the gates are installed at the correct location within the installation area in accordance with the pneumatic installation instructions.
- Ensure that proper tools and access equipment is available and on site.
- Prepare the platform with holes for the structure (to be done by others) and supply the data of position and width of the platform (including the holes) to the seller for review prior to the installation of the gates.

C3.2) INSTALLATION

- Perform the ø100 holes into the concrete platform.

- Set the anchor bolts according to detail Y of drawing 5224-04-2000 except the anchor on the top of the grouting for the fix fences which will be installed after the grouting is performed.
- Install the base frame onto the foundation. For measures and positioning see drawing 5224-04-2110.
- Insert the rotating fence in the base frame.
- Grout the top of the station platform.
- Assemble the channel 1 to10 assemblies according to the above listed assembly drawings and check for the correct positioning of the mechanical parts.
- Install the channel 1 to10 assemblies on the bottom of the platform using the supplied anchor bolts.
- Connect the channel assemblies to each other with the guide bars (pos. 2 on each of the above listed assembly drawings).
- For installation details, measures, gaps and shimming refer to drawing 5224-04-2000/2110.

NOTE

- Before attaching the cylinder to channel 3, 4, 5, 6, 7, 8, 9 and 10, make sure that the locking bolt (pos. 7 on 5224-04-2400/2500/2600/2601/2800/2801) is locked.
- Also, do not tighten the bolt connections firmly, before the all channel assemblies are connected to each other with the guide bars (pos. 2 on the above listed assembly drawings). Only if all channel assemblies are properly positioned and connected to each other, the bolt connections must be finally tightened.

- Install the position switches to the channels 2, 3, 4, 5, 6, 7 and 8 and wire them according to the electric schematics.
- Align the rotating fences with the screw (pos. 14-15 on 5224-04-2200, pos. 18-19 on 5224-04-2300/2400/2500/2600/2601/2800/2801/2900/2901) to the correct position, before fine tuning of the cylinders is made.
- Fix the rotating fence according to detail Y on 5224-04-2000.
- Install the provided anchor bolts for the fix fences according to detail Y on 5224-04-2000.
- Position and attach the fix fence parts (pos. 14, 15 and 16 on 5224-04-2000) from top to the station platform using the supplied anchor bolts.
- Install all pneumatic lines and valves according to the pneumatic scheme (5224-04-0001-1/4).
- Carry out a function test. Check all sensor settings and run any readjustments until all positions are served correctly and properly.
- Check all bolt connections. Torque all bolts with 100% of the torque rate indicated on the specific drawing. Bolt connections not using self locking nuts must be secured with LOCTITE 242.

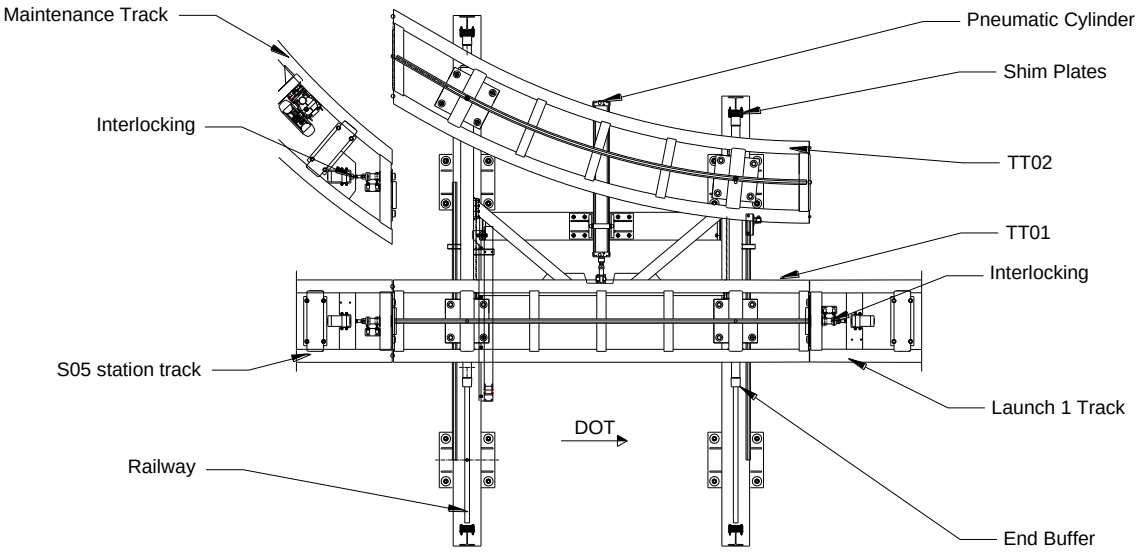
- Acceptance Test Plan (ATP)

C4) SWITCH & INTERLOCKING

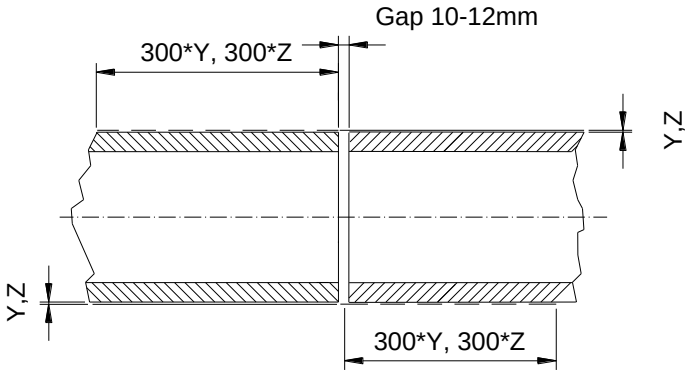
DRAWINGS

5224-05-3000	Assembly Switch
5224-05-3100	Assembly Interlocking
5224-05-3200	Assembly Interlocking Maintenance Track

OVERVIEW



Track connection smoothness at switch



C4.1) PRE-CONDITIONS FOR MECHANICAL INSTALLATION

- Ensure that all safety measures are taken.
- Check the complete delivered equipment, report any damages in writing.
- Ensure that all pneumatic air supply lines are installed at the correct location within the installation area in accordance with the pneumatic installation instructions.
- Ensure that all electrical lines are installed at the correct location within the installation area in accordance with the electrical installation instructions.
- Ensure that all safety measures are taken.

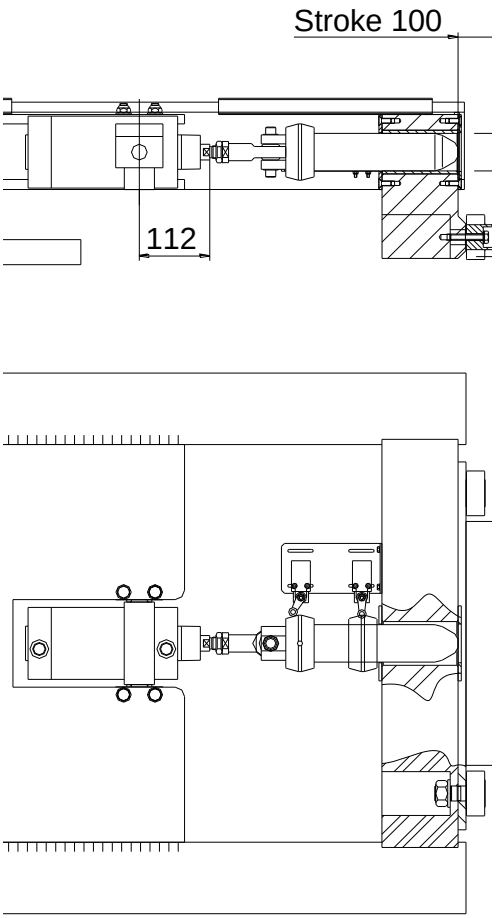
C4.2) INSTALLATION OF SWITCH

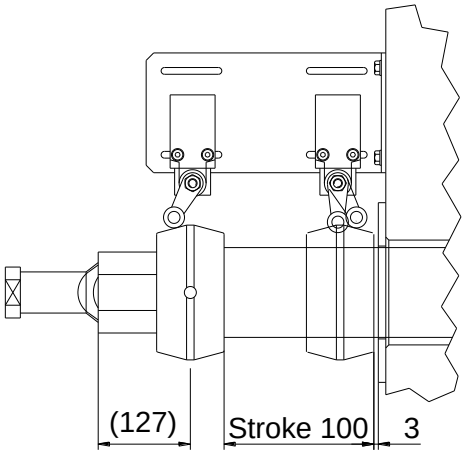
1. Place the right and the left railways on top of the respective columns. Assemble the cross beam and the K frame. Check for parallelism, height and distance of the running surfaces, tighten bolts.
2. Pre-assemble the complete wheel frames and the pneumatic cylinder.
3. Connect the wheel boxes with plates and bolts. Fasten bolt connections.
4. Install the pneumatic cylinder with its supports to the frame. Fasten bolts.
5. Connect the air lines according the pneumatic schematics.
6. Lift the track element TT01 onto the rails. The level of the track element must be adjusted by using shim plates.
7. Lift the track element TT02 onto the rails. The level of the track element must be adjusted by using shim plates.
8. Install the catwalk.
9. Attach the proximity switches at the appropriate position to the rails.
10. Connect the electrical lines in accordance with the electrical schematics.
11. The stroke of the pneumatic cylinder is 1500 mm. Check in both positions of the cylinder, fully extended and retracted. Check the alignment of the neighboring track sections and adjust alignment of tracks. Check the height of the neighboring track and adjust with shims.
12. Check the alignment of the locking devices at both end positions and adjust if necessary by adding/removing shims at the end-buffers.
13. Check the gap between at the transition of the switch tracks and the adjacent track sections. The correct gap at each transition is 10-12 mm. Refer to the sketch.
    This procedure may be repeated when temperature is rising due to thermal expansion of the steel structures
    If necessary increase the gap, cut the end of the track for the length required, touch up the paint and repeat the installation procedure. Check again the gap and if is necessary repeat the procedure.
14. After alignment fasten bolts/nuts and torque according to the specific drawings. Bolt connections must be torque striped.
15. Move the switch to the standard cycling position.
16. Move the switch several times between the positions and readjust by using shims if necessary.

C4.3) INSTALLATION OF INTERLOCKING

1. Move the switch to one of the both end position.
2. Install pneumatic cylinder with locking bolt with all necessary details.
3. Connect the pneumatic lines in accordance with pneumatic schematic.
4. Connect the electrical lines in accordance with the electrical schematics.
5. Visually check proper movement of the locking pin inside the guiding support. Visually check locking pin for damage, scrap marks and jumped front part.
6. Visually check the fully extension of locking pin by moving the pin pneumatically in and out. Follow all safety information to avoid dangerous situations.
7. Grease pin and guiding support.
8. Check the end position switches for correct wiring and correct function.
9. Bolt connections. Check all bolt connection. Torque all bolts with 100% of the torque rate indicated on the specific drawing. Bolt connections not using self locking nuts must be secured with LOCTITE 242.
10. Check the guide rollers for correct moving into the guiding slots.

Interlocking Device





C5) BRAKES

DRAWINGS

5224-04-0001	Layout Station
5224-06-0001	Brake Overview
5224-06-1110	Assembly Track B01
5224-06-1120	Assembly Track B02
5224-06-1130	Assembly Track B03
5224-06-1140	Assembly Track B04
5224-06-6000	Magnet brake fix assembly
5224-06-6500	Magnet Brake movable assembly

C5.1) OVERVIEW BRAKE

The eddy current brakes will decelerate the incoming train from its high speed to the speed required in the station area.
Fix eddy current brakes are used for this ride and the strong permanent magnets in the track are fix mounted

WARNING

Safety Information!

Eddy current brakes are equipped with strong magnets. For safety regulations refer to Manual Part ONE, Chapter 2, Safety Regulations and especially to Chapter 2.7, Magnetic Hazards.

WARNING

- A strong magnetic flux exists within the vicinity of the magnetic bars, which causes a strong attraction.
- Never put fingers between the magnets.
- All steel tools must be held tightly, and must be guided slowly and carefully in the vicinity of the magnet.
- Never move large ferrous objects of more than 10 kg closer than 10 cm within the vicinity of the magnet. Never place magnetic bars on any ferrous surfaces or ferrous workbenches. Never place magnetic bars within less than 30 cm to unsecured ferrous objects.

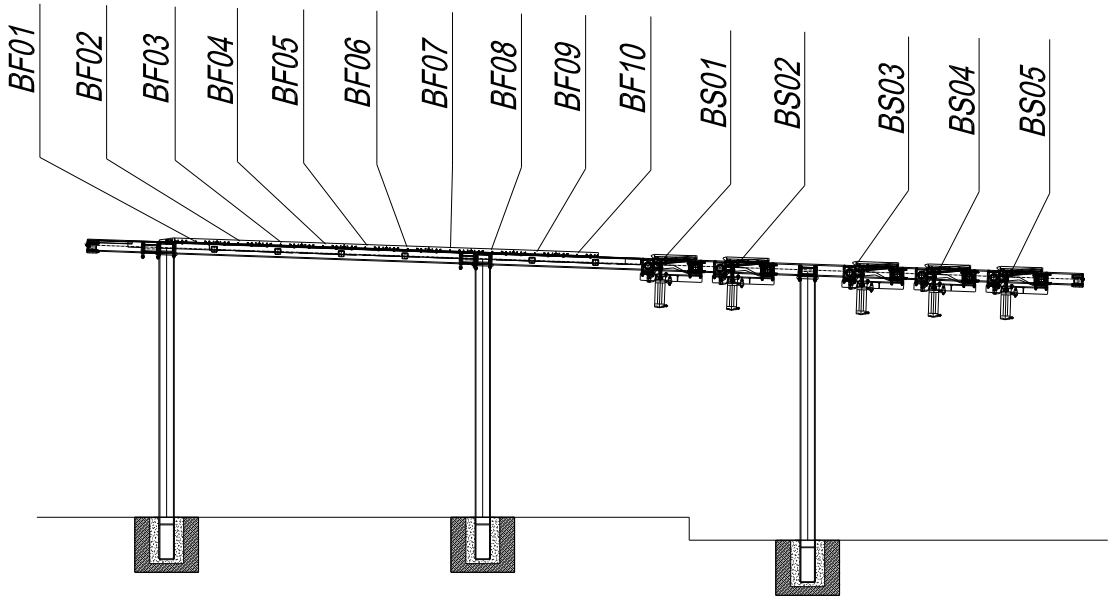
C5.2) PRE-CONDITIONS FOR MECHANICAL INSTALLATION

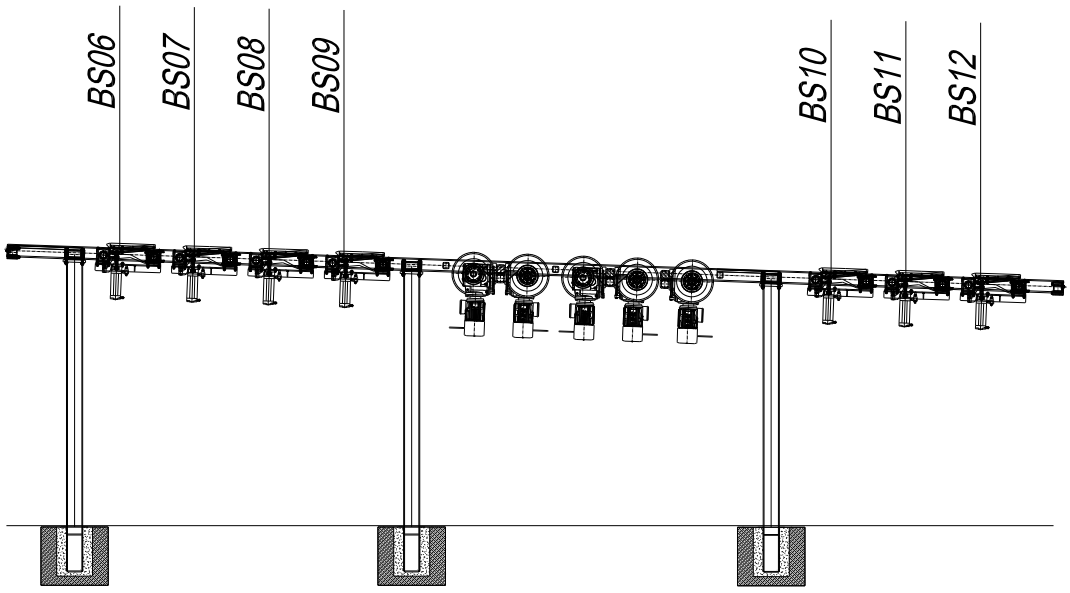
- Ensure that all safety measurements are taken.
- Check the brakes and brake magnets and report any damage in writing.

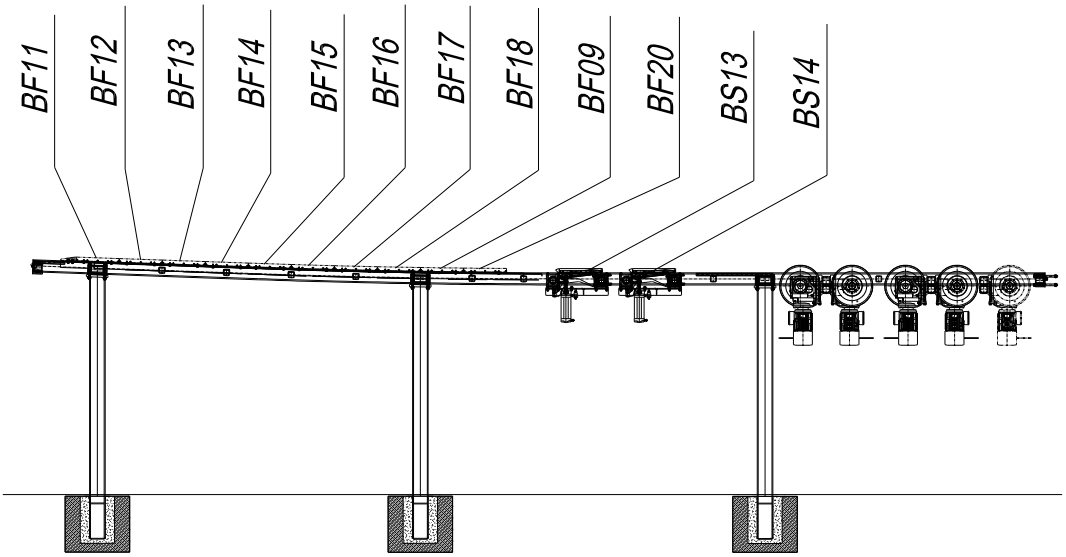
C5.3) BRAKES TO BE INSTALLED

The following brakes have to be installed according brake overview 5224-06-0001:

10x	Magnet Brake Fix and 5x Magnet Brakes movable	in track B01
7x	Magnet Brakes movable	in track B02
10x	Magnet Brake Fix and 2x Magnet Brakes movable	in track B03



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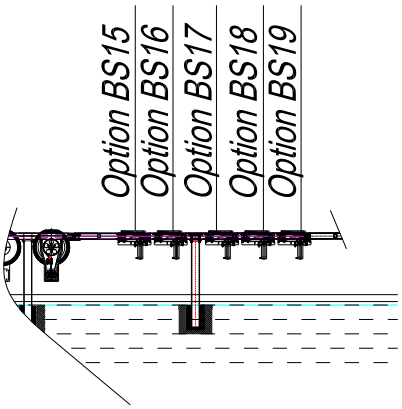
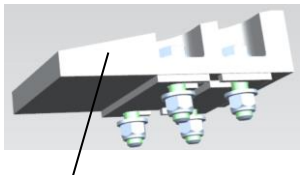
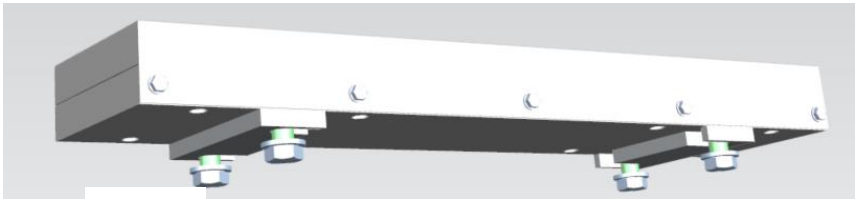
BS14


Option BS15
Option BS16
Option BS17
Option BS18
Option BS19

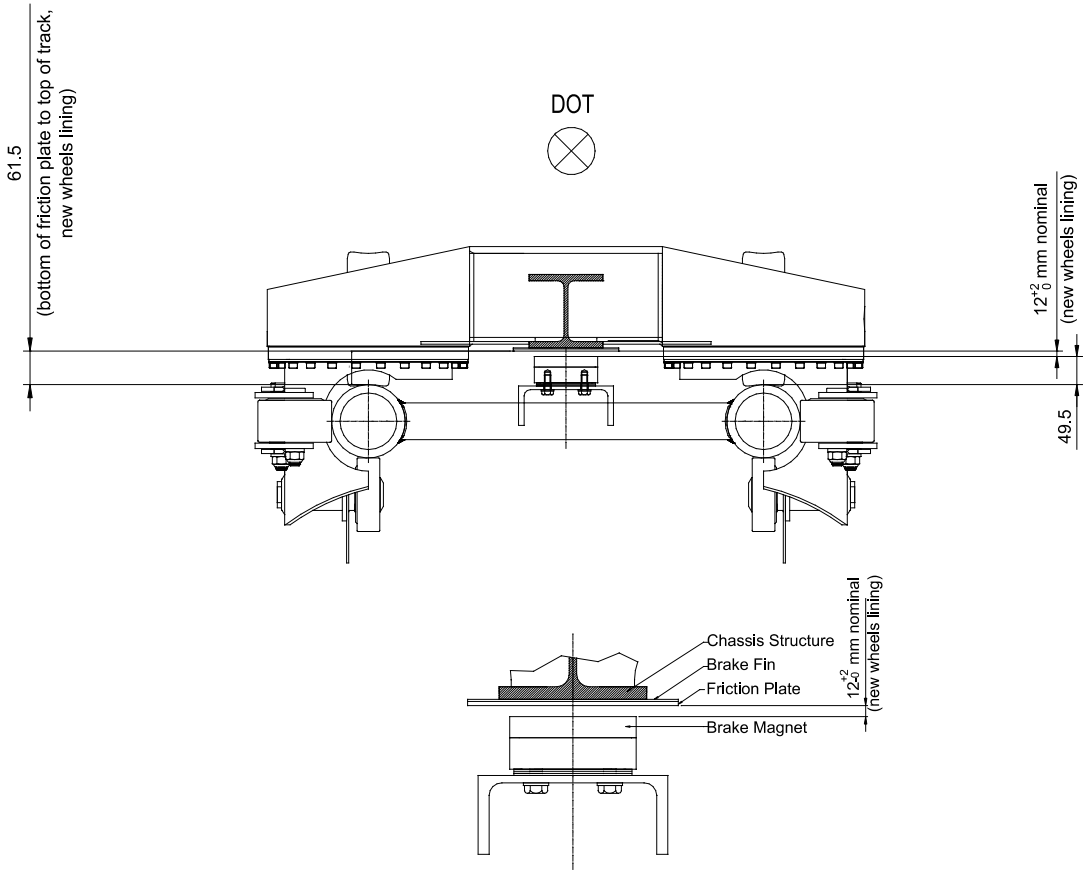
Magnet brake fix



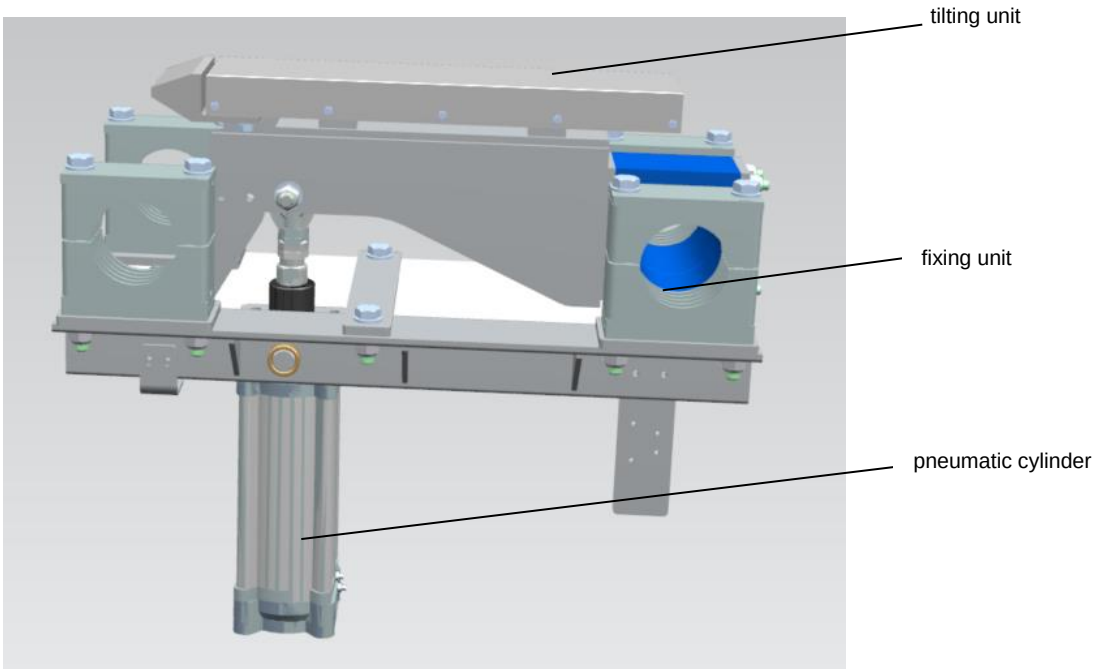
guiding

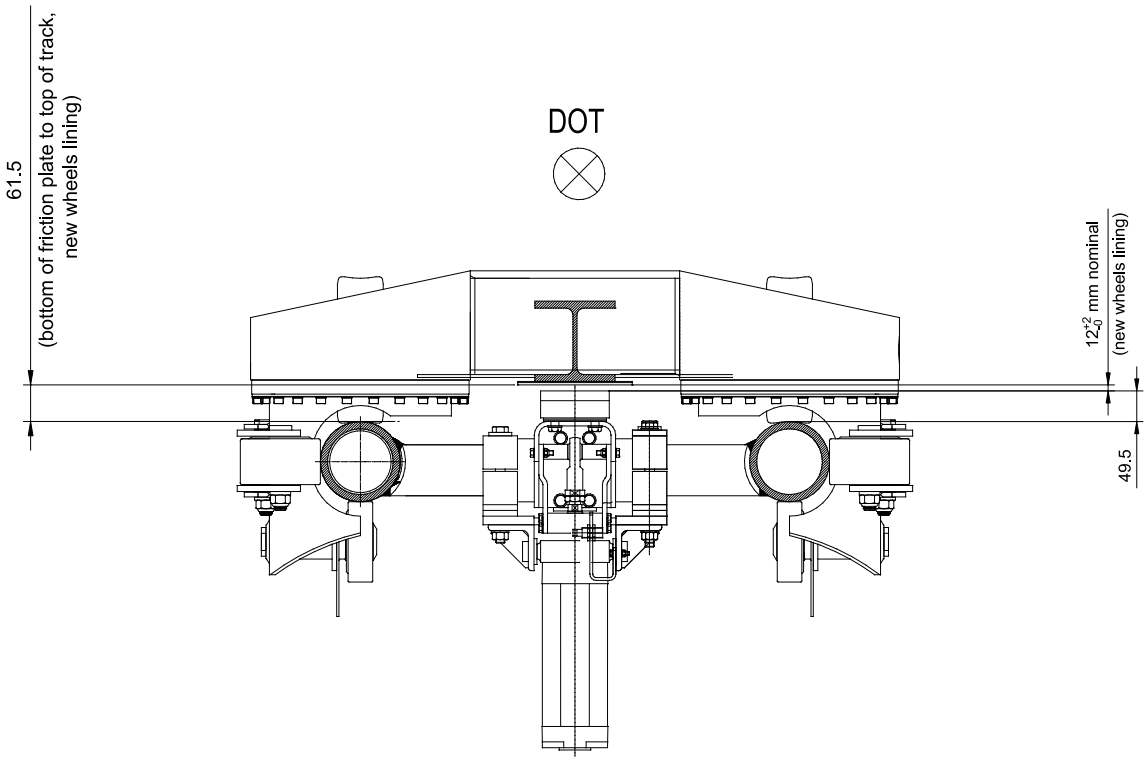


fix brake



Magnet brake movable





C5.4) INSTALLATION OF FIX MAGNET BRAKE

1. Mount the brake magnets to the track according drawing 5224-06-6000. Bolt brake magnet to the brake base plate at track element B01/B02.
2. Align the brake magnets according the measurements on the corresponding drawing (consider the measures in the sketches above).

3. Dimension check: To guarantee a smooth and proper function of the eddy current brakes the following dimensions must be check and recorded:
   - Brake magnet must be symmetrical in the middle of the track. Acceptable tolerance +/-0.5 mm.
   - Distance between top of track and top of brake magnet must be 49.5 mm. Acceptable tolerances +/-0.5 mm.
   - Distance between surfaces of friction plates and top of magnet must be 12 mm. Acceptable tolerances +/-0.5 mm.
4. Bolt connections. Check all bolt connections. Torque all bolts with 100% of the torque rate indicated on the specific drawing. Bolt connections not using self locking nuts must be secured with LOCTITE 242.

C5.5) INSTALLATION OF MOVABLE MAGNET BRAKE

1. Pre-assemble movable parts of the brake unit and bolt brake magnets to the movable lever according to drawing 5224-06-6500.
2. Mount and bolt the movable magnet brake assembly onto the brake base plate of the track elements B01, B02 and B03.
3. Pre-assemble pneumatic cylinder, installing the plastic bush to ensure the correct stroke between rod eye head and cylinder body.
4. Install pneumatic equipment in accordance with drawing 5224-06-3000, check minimum gap steel to steel of 30 mm according sketch.

NOTE

- Pay attention to the angular and longitudinal deviation of the pneumatic cylinders.
- Wrong or improper installation may cause damages to the cylinder and could lead to a system failure.

5. Mount one inductive sensor per brake according to the drawings 5224-06-6500.
6. Run the air lines of each pivoting brake according to the pneumatic scheme 5224-09-0006-1/4 and 5224-09-0007-1.
7. Assure that the brake units are in the up position (braking position) when the cylinder is not activated.

NOTE

Proper function of pneumatic system

It must be guaranteed that the pneumatic system is functioning properly while operating the ride to support the cylinder mounted spring. If the hose connection on the piston side of the cylinder is for any reason leaking or damaged then the ride must immediately be put out of operation and the pneumatic system must be repaired.

8. Dimension check: To guarantee a proper function of the pivoting brakes the following dimensions must be check and recorded:
   - Brake magnet must be symmetrical in the middle of the track. Acceptable tolerance +/-0.5 mm.
   - Distance between top of track and top of brake magnet must be 49.5 mm. Acceptable tolerances +/-0.5 mm.
   - Distance between surfaces of friction plates and top of magnet must be 12 mm. Acceptable tolerances +/-0.5 mm.
9. Bolt connections. Check all bolt connections. Torque all bolts with 100% of the torque rate indicated on the specific drawing. Bolt connections not using self locking nuts must be secured with LOCTITE 242.

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C6) FRICTION WHEEL DRIVES

DRAWINGS

5224-04-0001	Station Layout
5224-06-0003	Overview Friction Wheels
5224-06-7001	Assembly Friction Wheel 6.3 Kw
5224-06-6000	Assembly Friction Wheel 6.3 Kw free spinning
5224-06-7002	Assembly Friction Wheel 3.0 Kw
5224-07-7700	Rim Transmission

C6.1) OVERVIEW FRICTION WHEELS

A number of friction wheels are to be installed into the track to accelerate, move, decelerate and hold the train. They are installed after the eddy current brakes in the brake and station area. They are used to move the trains from the brake section/waiting area to the station area for load/unload, to move the trains to and from the maintenance track and to move the trains to the launch area and are adjustable in height to overcome tires wear.

Another kind of friction wheels, with a different drive system, are used to accelerate the trains in Launch 1 and Launch 2.
The friction wheels in launch sections are fix installed and not adjustable in height.

C6.2) PRE-CONDITIONS FOR MECHANICAL INSTALLATION

- Check the complete delivered equipment, report any damages in writing.
- Ensure that all safety measurements are taken.
- Ensure that all electrical lines are installed at the correct location within the installation area in accordance with the electrical installation instructions.

NOTE

Installation work of the friction wheel gear motors must be carried out by authorized staff only.

Follow the installation instructions of Leroy Somer (for friction wheels in brake, station and maintenance area) and of OEMER (for friction wheels in launch sections), which can be found in Manual Part TWO, Chapter 7, Third Party Documentation.

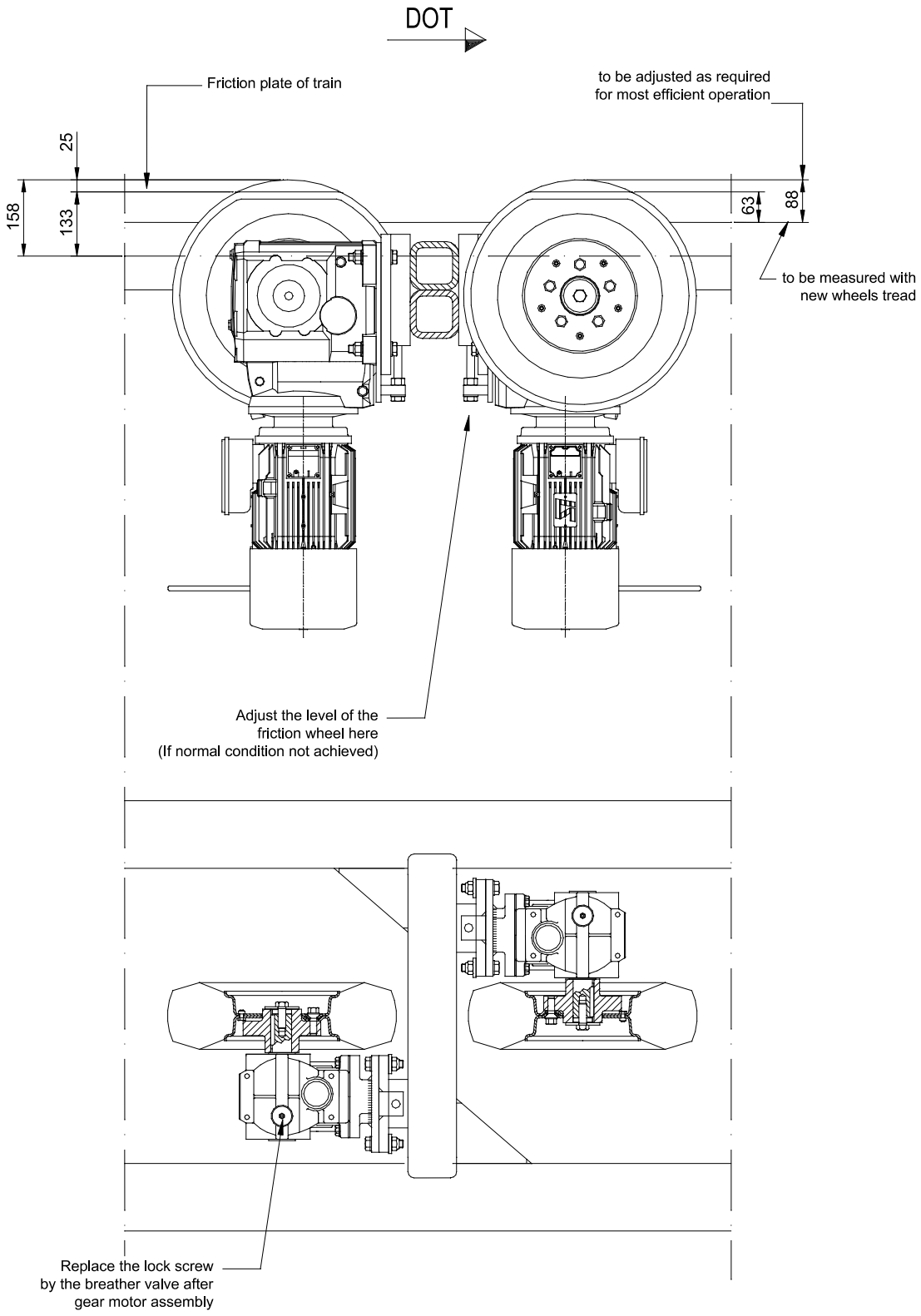
WARNING

Safety Information!

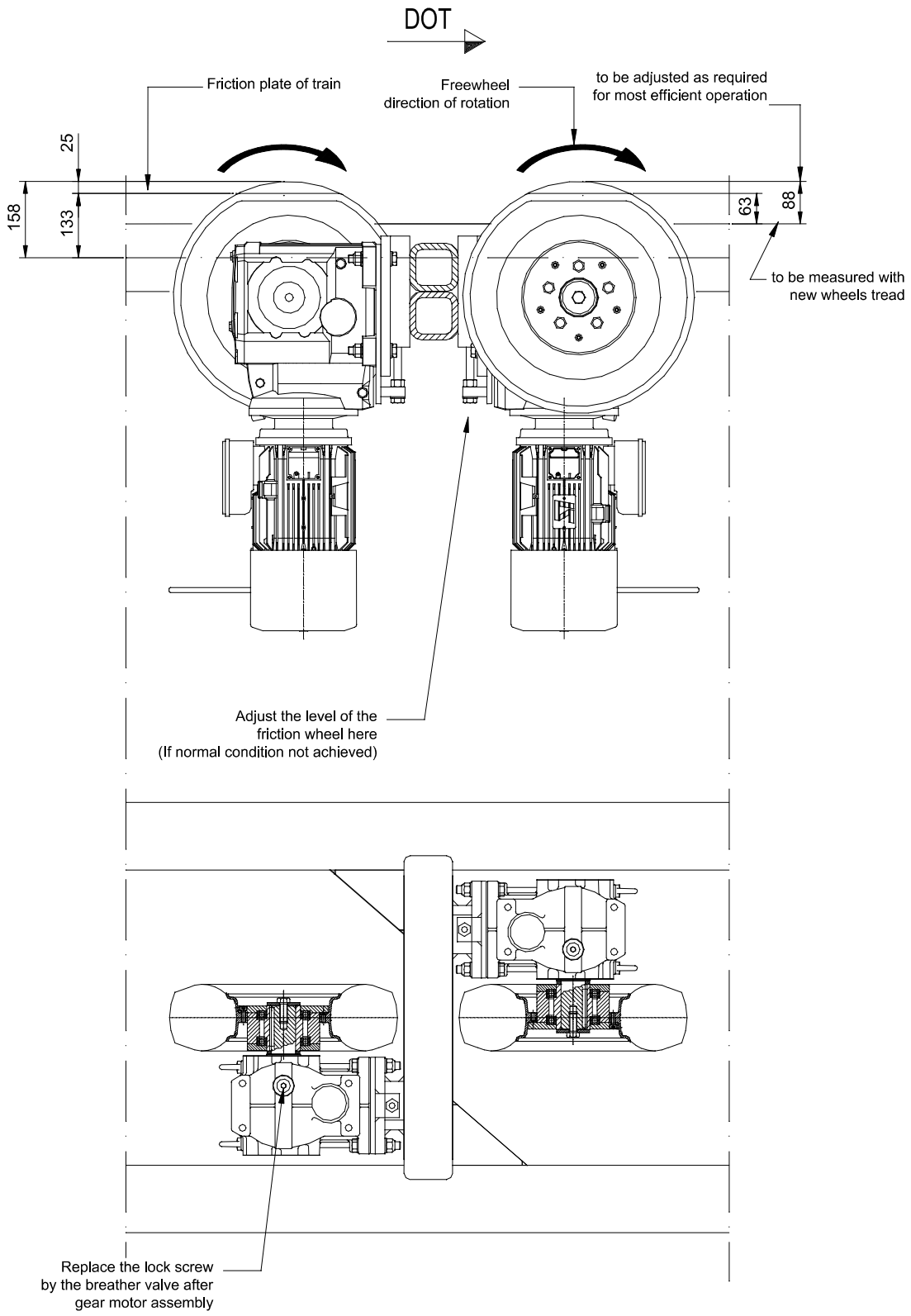
- Stay clear of rotation parts.
- Always turn off and lock out power prior to servicing the equipment.
- Always re-verify motor rotation directions after reconnection of motor leads.
- Consider the right polarity when making wiring connections to motor brake.
- Consult electrical manual for proper connection details.

C6.3) INSTALLATION OF FRICTION WHEELS IN BRAKE AND STATION AREA

Friction wheels in the brake and station area (6.3 kW motor)



Friction wheels in the brake and station area (6.3 kW motor) with free spinning clutches



Procedure for 6.3kW motors and 3.0 kW friction wheels without free spinning clutch.

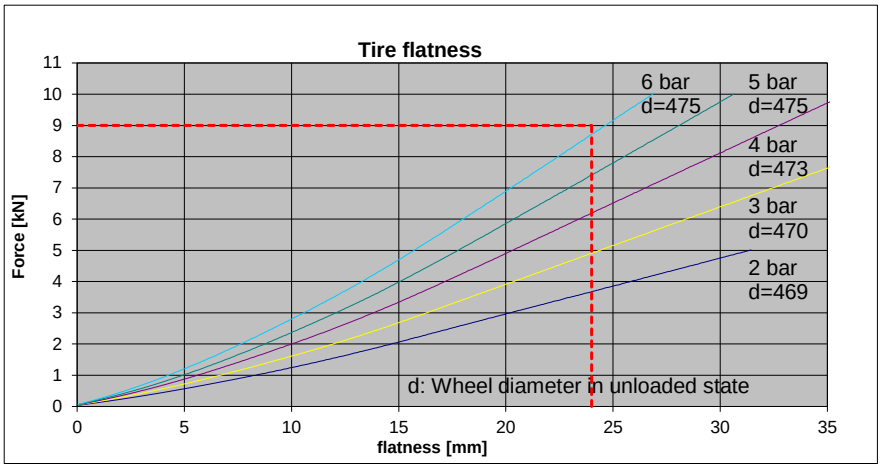
1. Mount the wheel hub on the gear motor unit.
2. Mount the gear motor unit onto the specific track section.
3. Connect electrical motor cables. Check direction of rotation.
4. For friction wheel with free spinning: Check the spinning direction of the free wheel.
5. Check if the oil is filled in the motor at the appropriate level.

Oil to be used

FUCHS	KLÜBER	SHELL	MOBILE
Renolin Unisyn 220	Klübersynth EG4-220	Omala HD HD-220	Mobil SHC 630
Oil quantity		See gear box type plate	

6. Check visually all cables and connections.
7. Check the vertical distance between top of friction wheels and top of track:
   88+/-1 mm. Adjust if necessary.
8. Bolt connections. Check all bolt connections. Torque all bolts with 100% of the torque rate indicated on the specific drawing. Bolt connections not using self locking nuts must be secured with LOCTITE 242.
9. Tire, Pressure
   The tires of the friction wheels must be inflated to the required minimum level of pressure. The pressure must be checked and recorded for each individual unit.

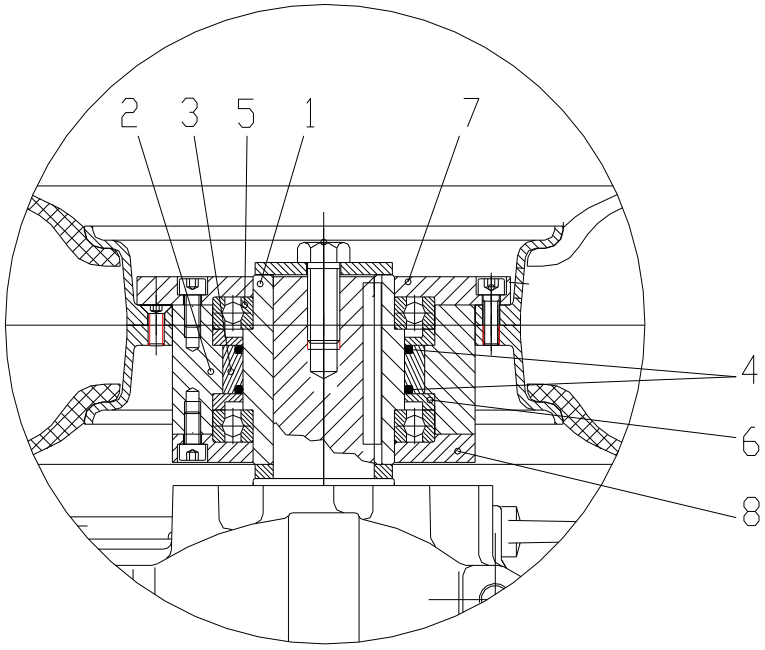
Tire	Carlisle USA Trail 5.7-8
Pressure	3 bar



Procedure for 6.3kW motors friction wheels with free spinning clutch

1. Mount the wheel hub and clutch on the gear motor unit according following procedure:

Pos. 1-Inner race
Pos. 2 Outer race
Pos. 3 Cam
Pos. 4 Springs
Pos. 5 Bearings
Pos. 6 Side plate
Pos. 7 Reworked flange E1
Pos. 8 Flange E2



a. Clean the surface of both ends of the outer race pos. 2 and the contact surface of the flanges
b. Check direction of rotation using the arrow indicated on the inner race of the clutch and attach the reworked flange E1 pos. 7 and E2 pos. 8 to clutch
c. When installing sprockets, gears and other equipment to the clutch, fix them on the surface of the outer race pos. 2 and screw the bolts into the E1 flange pos. 7.
d. When mounting the clutch onto the shaft **apply pressure to inner race pos. 1 but NEVER to the outer race, or cam pos. 3 and springs pos. 4 will be damaged (see below).**

The installed clutch model No. MZEU50 is pre-greased and requires no lubrication, Do not add any grease, only maintenance of the lateral bearings is necessary. Never use lubricants containing Extreme Pressure additives (e.g. polysulfide, Molybdenum compounds etc.), nor an excessive quantity of grease. Recommended grease types for clutch model No. MZEU50 are:

Oil Company	Ambient Temperature	Ambient Temperature
	-5 °C ~ +40 °C	-40 °C ~ +40 °C
Esso	Beacon 2	Beacon 325
Mobil	Mobilux Grease No. 2	Mobil Temp SHC 100
Shell	Alvania Grease No. 2	Alvania Grease RA
BP	Energrease LS2	Energrease LT2
Total	Multis 2	Aerogrease 22

The operational temperature range is -40°C to +40°C.

2. Mount the gear motor unit onto the specific track section.
3. Connect electrical motor cables. Check direction of rotation.
4. Check if the oil is filled in the motor at the appropriate level.

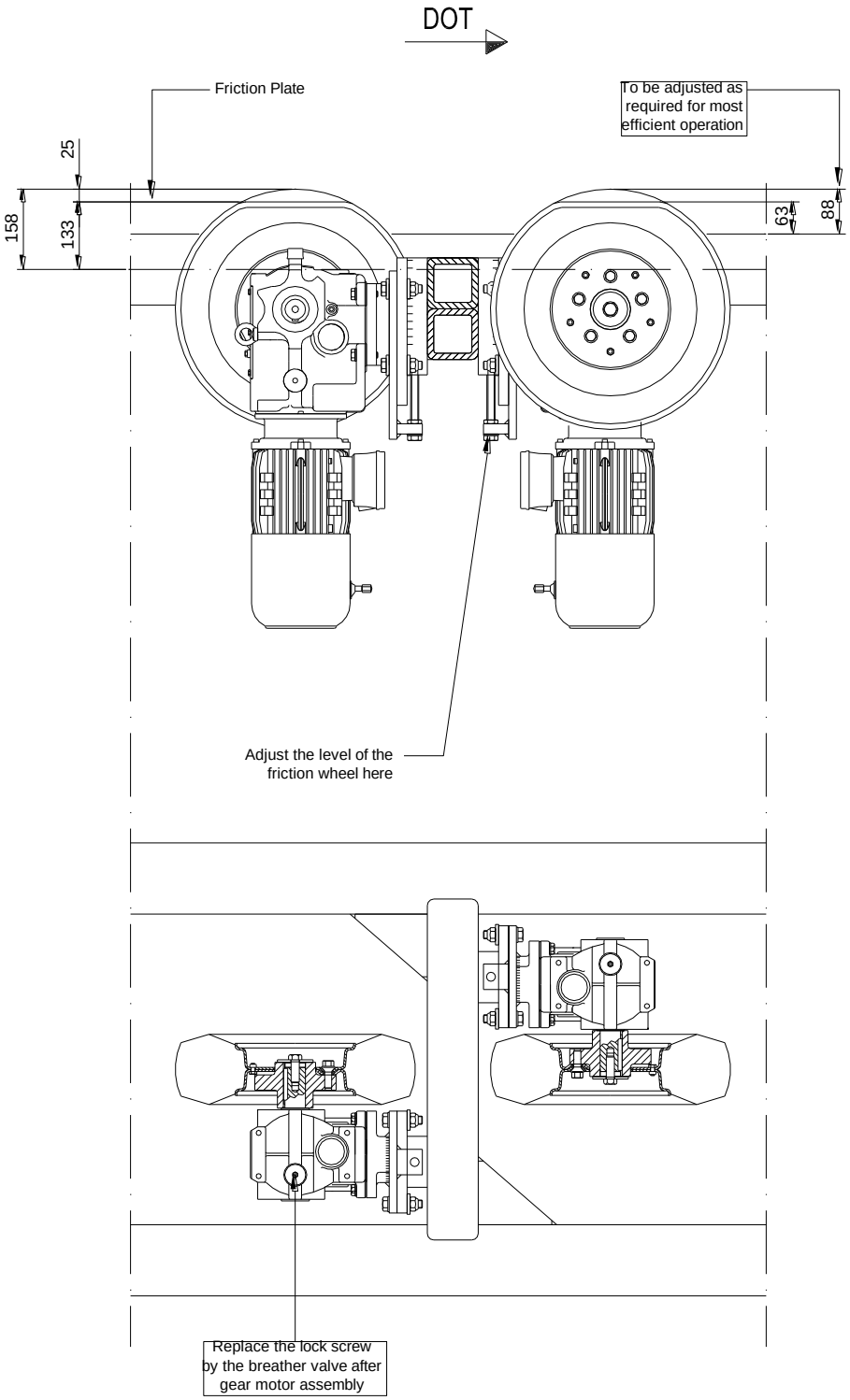
Oil to be used

FUCHS	KLÜBER	SHELL	MOBILE
Renolin Unisyn 220	Klübersynth EG4-220	Omala HD HD-220	Mobil SHC 630
Oil quantity		See gear box type plate	

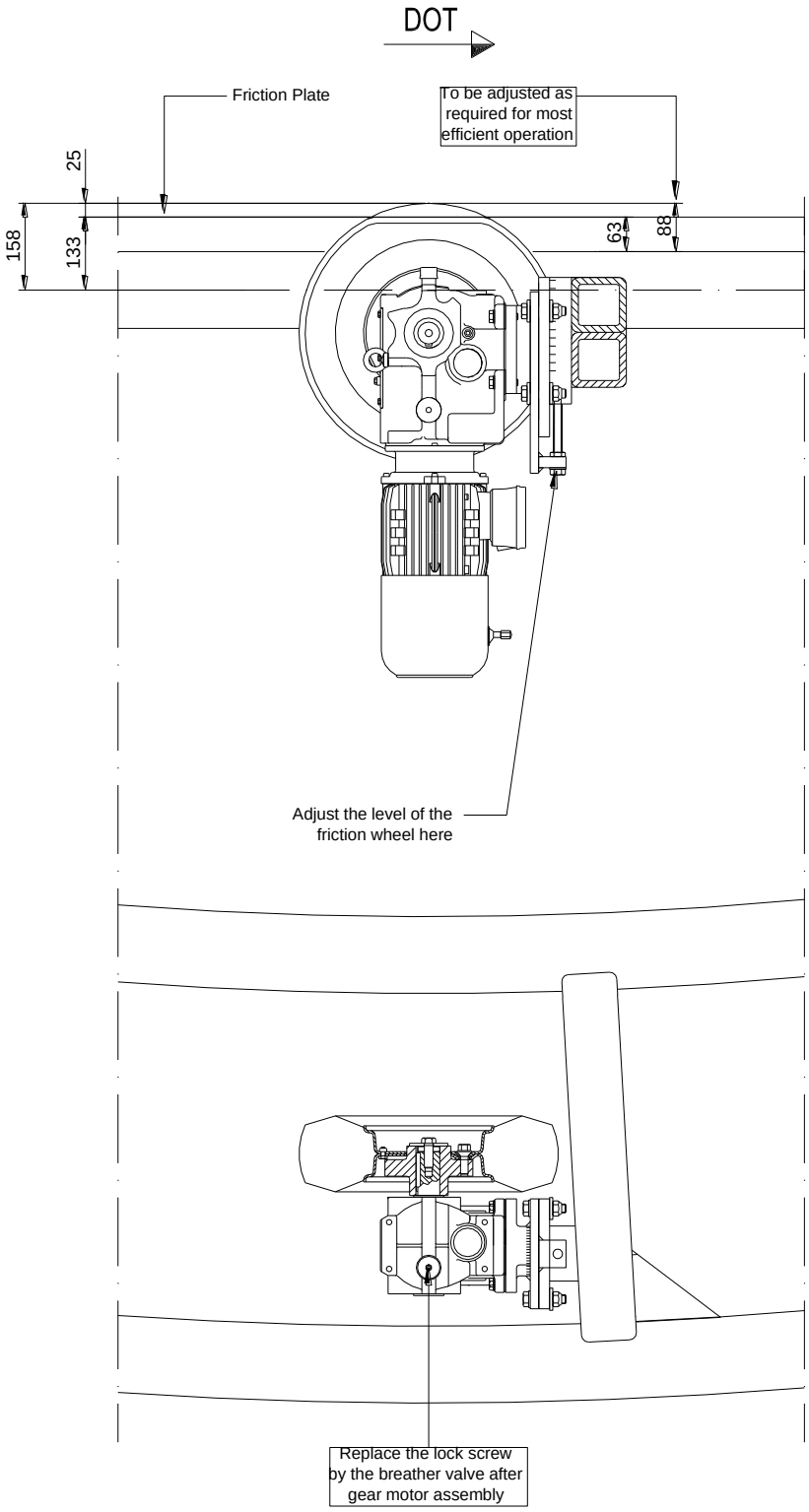
5. Check visually all cables and connections.
6. Check the vertical distance between top of friction wheels and top of track:
   88+/-1 mm with device 5224-11-0010. Adjust if necessary.
7. Bolt connections. Check all bolt connections. Torque all bolts with 100% of the torque rate indicated on the specific drawing. Bolt connections not using self locking nuts must be secured with LOCTITE 242.
8. Tire, Pressure
   The tires of the friction wheels must be inflated to the required minimum level of pressure. The pressure must be checked and recorded for each individual unit.

Tire	Carlisle USA Trail 5.7-8
Pressure	3 bar

Friction wheels in the maintenance area (3 kW motor)

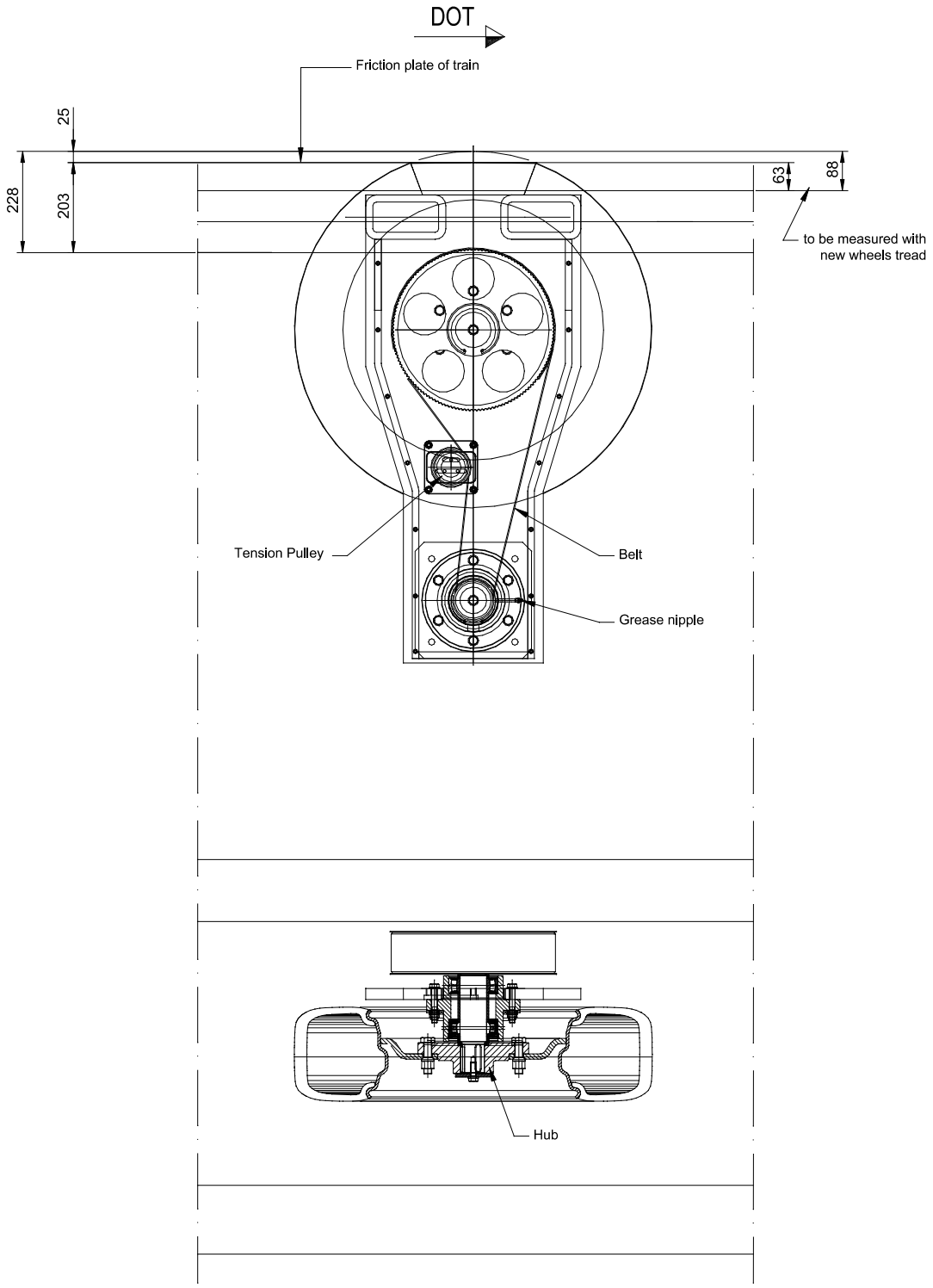


Friction wheels in the maintenance area in the curve to switch (3 kW motor)



C6.4) INSTALLATION OF FRICTION WHEELS IN LAUNCH 1 AND LAUNCH 2

Friction wheels in the launch and boost area (23.4 kW motor with timing belt)



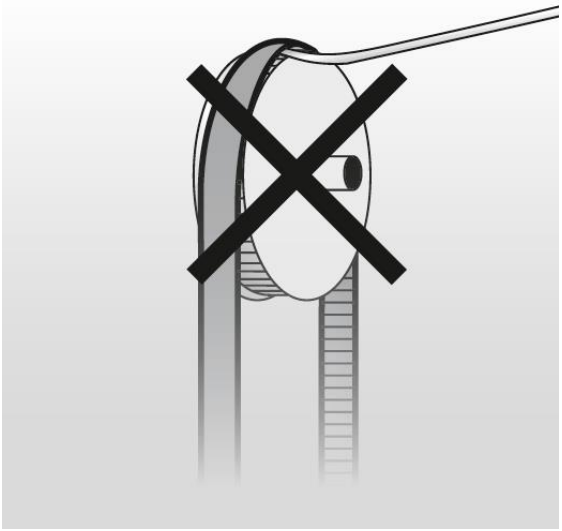
CAUTION

The timing belts of friction wheels in launch and boost must be handled with care. Refer to the mounting instructions below.

Mounting

NOTE

Timing belts must never be installed by using brute force or with the help of unsuitable tools such as tire levers.



When mounting the belt, the tensioning pulley is to be adjusted so that the belt can be placed on the pulleys without the use of force. The use of force can permanently impair the belt body in a way that is not necessarily visible. This can considerably reduce the useful service life.

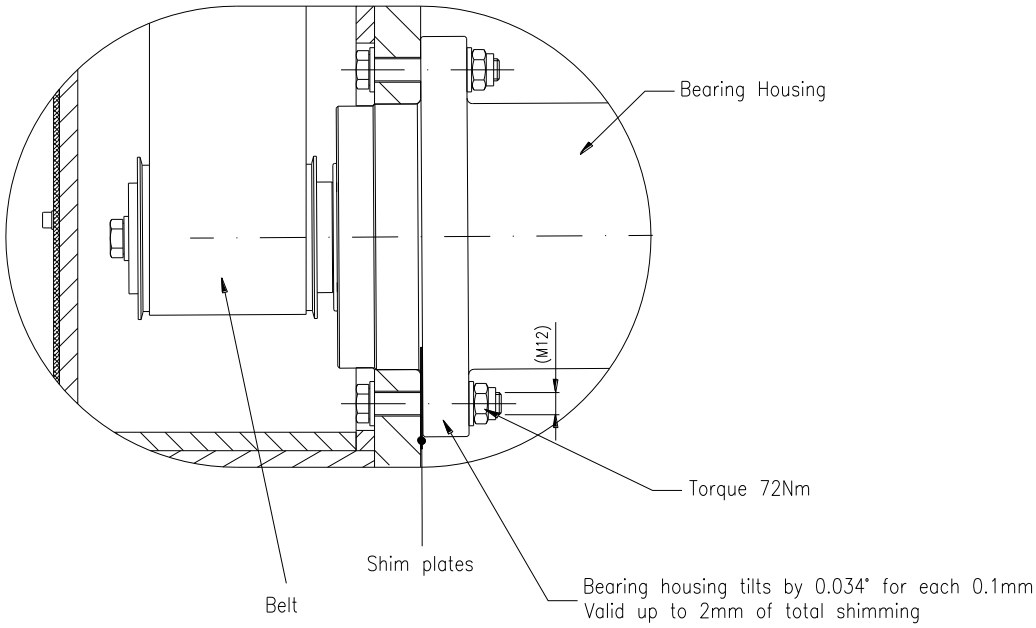
CAUTION

For friction wheels in launch sections the following alignment check must be performed. Otherwise the function of the drive may be impaired and or the pulley/belt may get damaged.

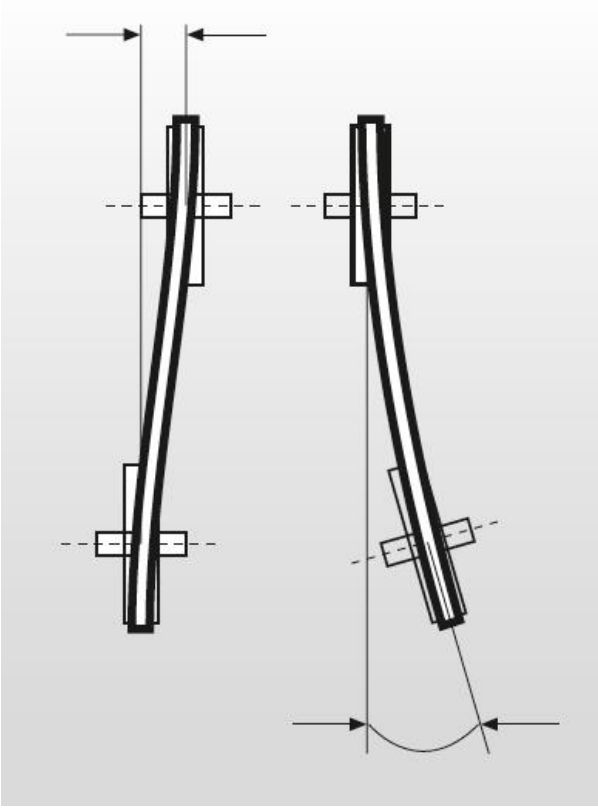
Alignment of pulley and belt

The meticulous parallel alignment of the toothed pulleys is an essential precondition for straight belt running and a long service life of the drive.
Check that out of parallel deviation does not exceed 2 mm on each drive to avoid:

- uneven distribution of tension in the cross section of the belt;
- that the belt drifts laterally across the axis of the driving pulley;
- that the belt drifts laterally to the point where it gets in contact with the side flange of the driving pulley. This causes increased noise and premature belt wear;



- Center belt by shimming the bearing housing/motor at the bottom with shims
- Belt must not rub on the pulley flanges
- Adjustment of belt to be tested in operation
- Re-adjust shimming if necessary
- Record quantity of shim in mm
- Angular deviation from friction wheel's axle of maximum ±0.15°

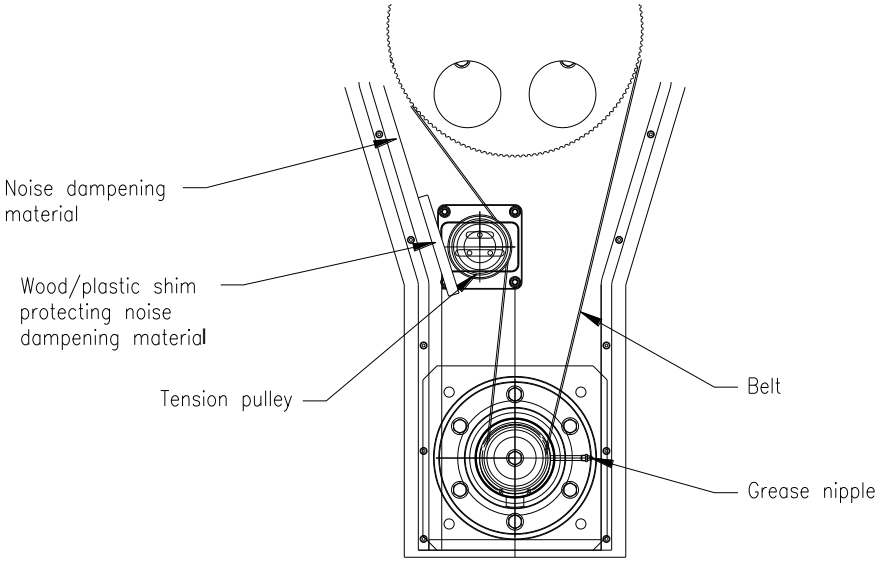


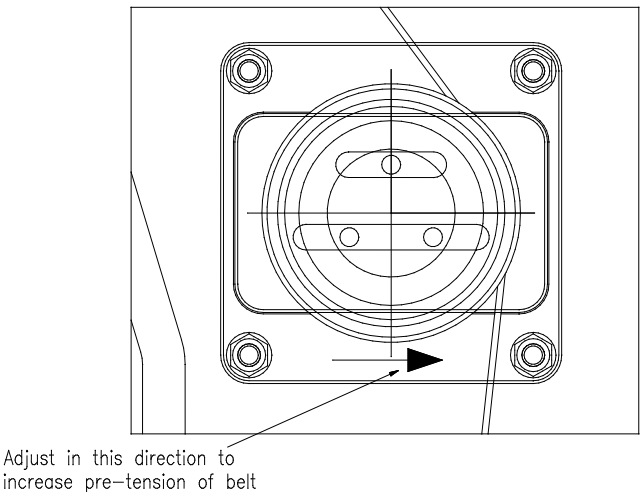
Any out-of-parallel deviation = max. 2 mm

Any out-of-true angle = max. 0.15°

Procedure

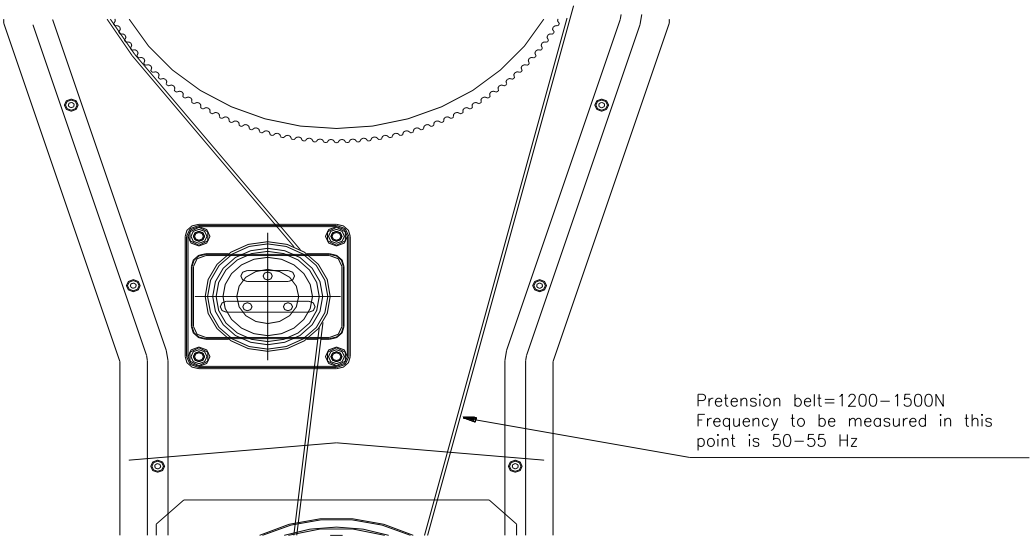
1. Mount bearing support and motor support onto housing of the specific track section.
2. Install the motor to the support.
3. Install the pulley and hub to the bearing support.
4. Place the shaft to the support. Install the toothed belt disk and the wheel to the shaft. Install the toothed pulley to the coupling. Install the tension roller to the support. Install the timing belt. New belts must be installed with a frequency of roughly 66 Hz (30% more than nominal which is 50 to 55Hz), because during first 5-10 hours of utilization it will lose up to 30% of pretension. Refer to drawing 5224-07-0010.
5. Adjust the pretension of the timing belt to 1200-1500 N moving sideways the tensioning pulley with a lever.
6. Protect with a plastic cover the noise dampening material as shown below. Refer to document Oemer spa – CT AG Carter installation.





NOTE

Adjusting of pretension of belt shall be done with the frequency measuring device VSM-1 and refers to approx. 50-55 Hz, reading the frequency on the side longest side of the belt opposite to the tensioning pulley after the belt has been put in vibration



7. Connect electrical motor cables. Check direction of rotation.
8. Check visually all cables and connections.
9. Check the distance between friction wheels and top of track: 88 +/- 1mm.
10. Bolt connections. Check all bolt connections. Torque all bolts with 100% of the torque rate indicated on the specific drawing. Bolt connections not using self locking nuts must be secured with LOCTITE 242.
11. Tire, Pressure
    The tires of the friction wheels must be inflated to the required minimum level of pressure (3 bar). The pressure must be checked and recorded for each individual unit. Refer to diagram on next page.

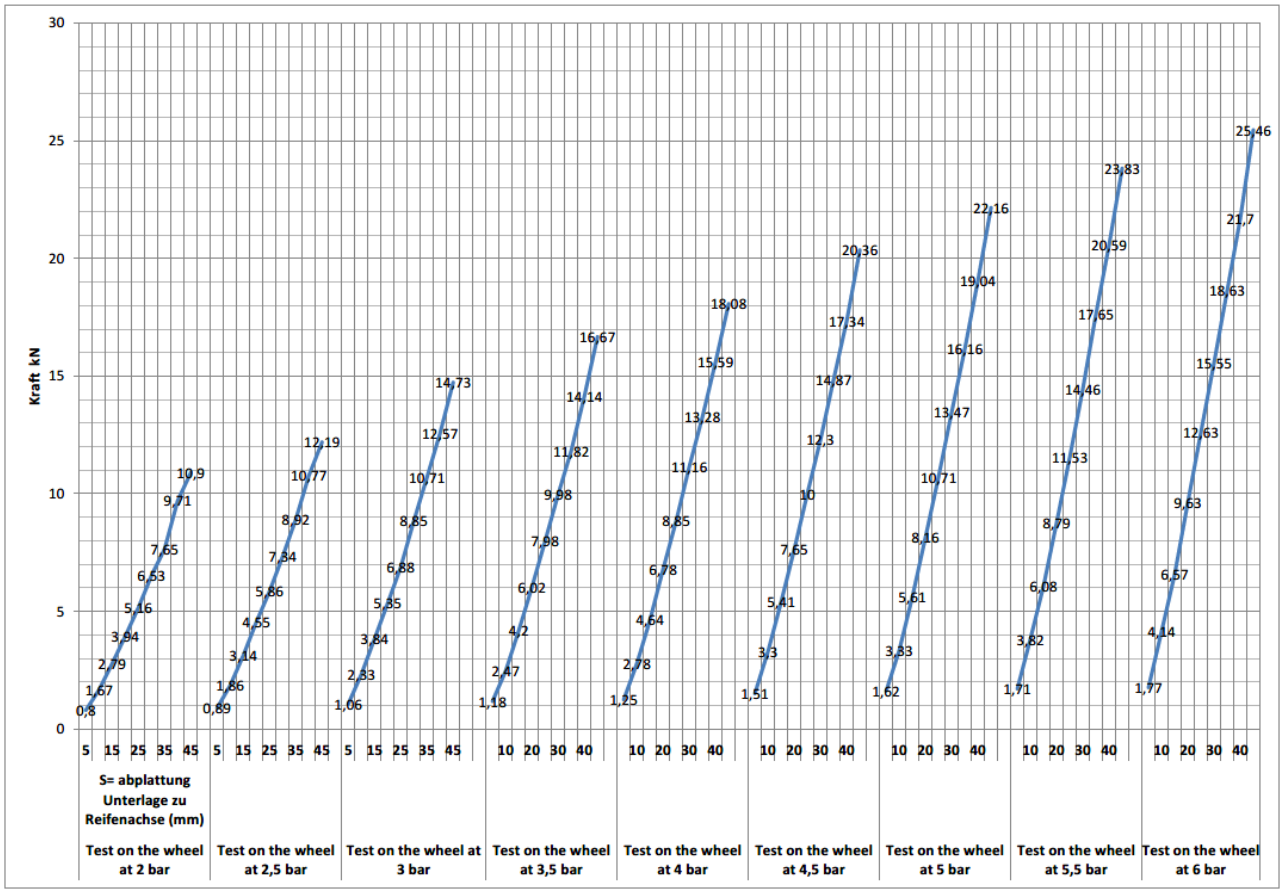
NOTE

IMPORTANT: lubricate the bearing supports before taking into operation.

- Acceptance Test Plan (ATP)

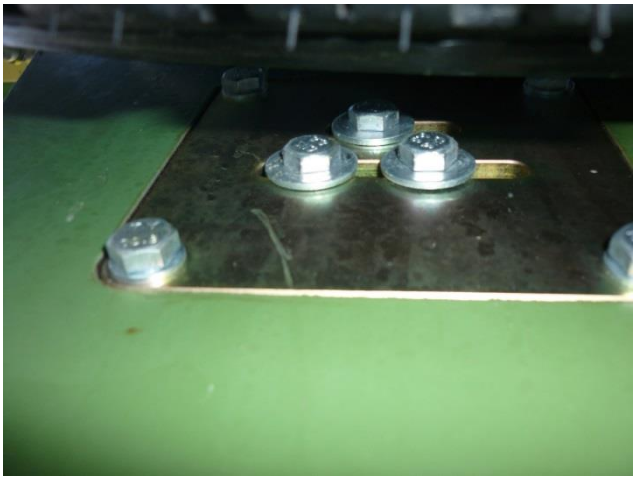
NOTE

The belt will lose up to 30% of the pretension during the first 30h of operation.



Procedure for belt replacement

1. Open drive system cover.
2. Unscrew tension pulley bolts, picture below.



3. Loosen tension pulley.
4. Remove belt.
5. Replace used belt with new one.
6. New belt must be installed with a frequency of roughly 66 Hz (30% more than nominal which is 50 to 55Hz), because during first 5-10 hours of utilization it will lose up to 30% of pretension. Refer to drawing 5224-07-7700.
7. To measure pretension follow instructions as above described for maintenance with device VSM-1.
8. Measure again belt pretension after 5-10 hours of cycling.

9. Adjust to 50-55Hz if necessary.
10. Check for side flange contact and adjust accordingly.

NOTE

Protect noise dampening material with a wood/plastic shim while using lever to shift belt tensioning pulley.

C7) SWITCHES & SENSORS

DRAWINGS

5224-09-0100	Electrical Layout
5224-09-0101	Electrical Installation
5224-09-1000	Sensor layout
5224-09-1110	Sensor mounting bracket #1
5224-09-1120	Sensor mounting bracket #2
5224-09-1130	Sensor mounting bracket #3
5224-09-1140	Sensor mounting bracket #4
5224-09-1150	Sensor mounting bracket #5
5224-09-1160	Sensor mounting bracket #6
5224-09-1170	Sensor mounting bracket #7
5224-09-1500	Operating Panel & Junction Box Installation - Overview

C7.1) OVERVIEW SENSORS & SWITCHES

Sensors and switches are to be installed on the track to detect movable parts of the ride. Sensors & switches are wired to the main control.

C7.2) PRE-CONDITIONS FOR MECHANICAL INSTALLATION

- Ensure that all parts as mentioned above are on hand.
- Damages on parts must be documented in writing.
- Ensure that all electrical lines are installed at the correct location within the installation area in accordance with the electrical installation instructions.
- Ensure that proper tools and access equipment is available and on site.

C7.3) INSTALLATION

NOTE

Electrical installation as wiring and connecting must be done in accordance with the installation instructions of INAUTEC.
See Manual Part THREE.

1. Install all the switches on and inside the track in accordance with the above mentioned drawings.
2. Bolt connections not using self locking nuts shall be secured with LOCTITE 242.

3. Install the junction boxes and operation panels according 5224-09-1000.
4. Connect the switches to the electrical cables and junction boxes.
5. Check the proper function of sensors, switches and/or transmitters.
   - Acceptance Test Plan (ATP)

D) TRAIN ASSEMBLY ON TRACK

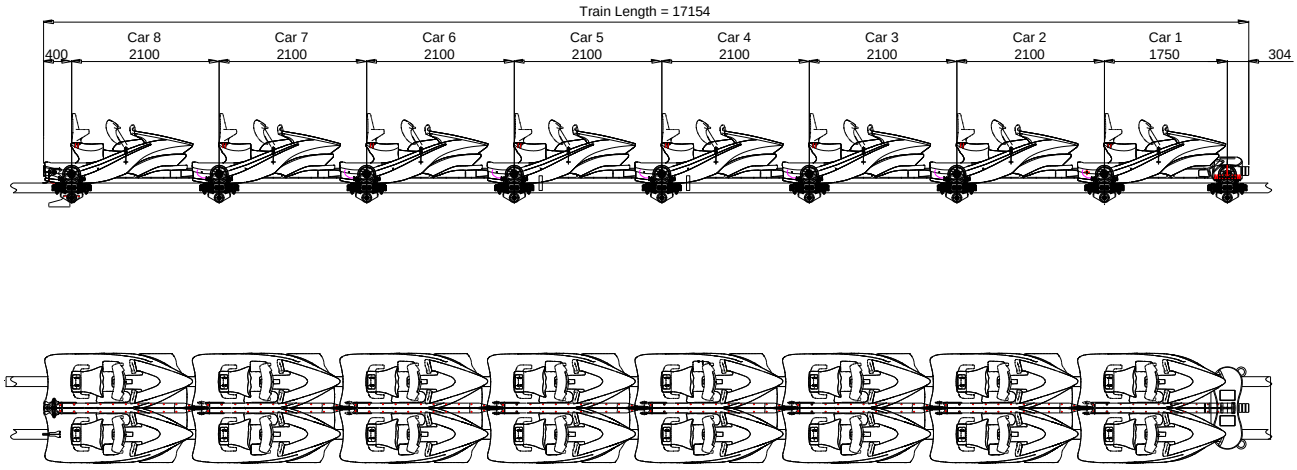
D1) TRAIN INSTALLATION ON TRACK

DRAWINGS

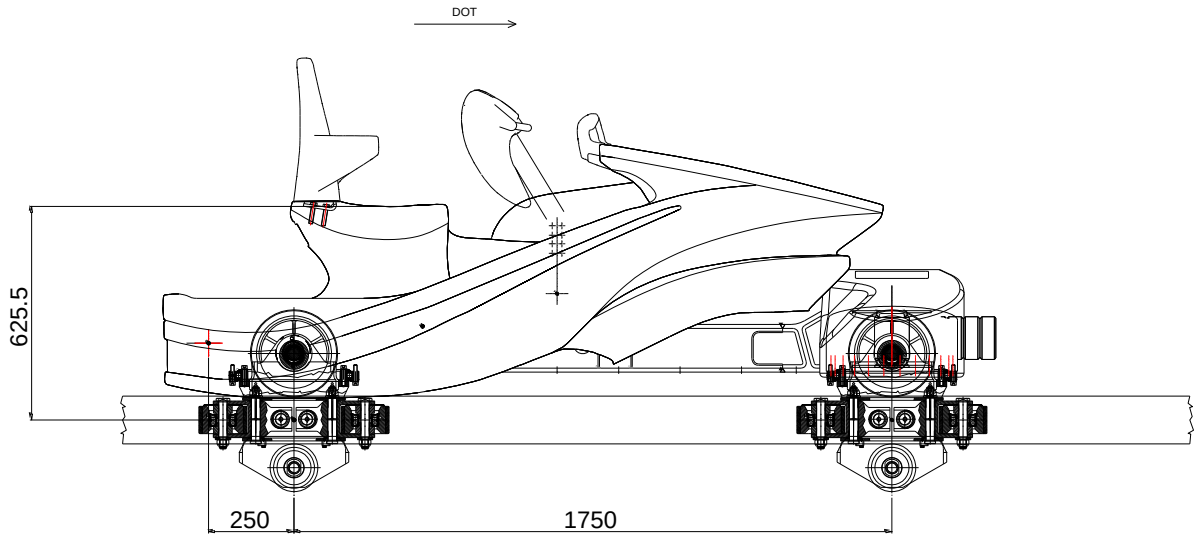
5224-08-0001	Assembly Train
5224-08-0009	Clearance Envelope Train
5224-08-0010	Vehicle 01
5224-08-0020	Vehicle 02
5224-08-0030	Vehicle 03
5224-08-0040	Vehicle 04
5224-08-0080	Front axle
5224-08-1000	Assembly Bogie
5224-08-2000	Assembly Coupling

D1.1) OVERVIEW

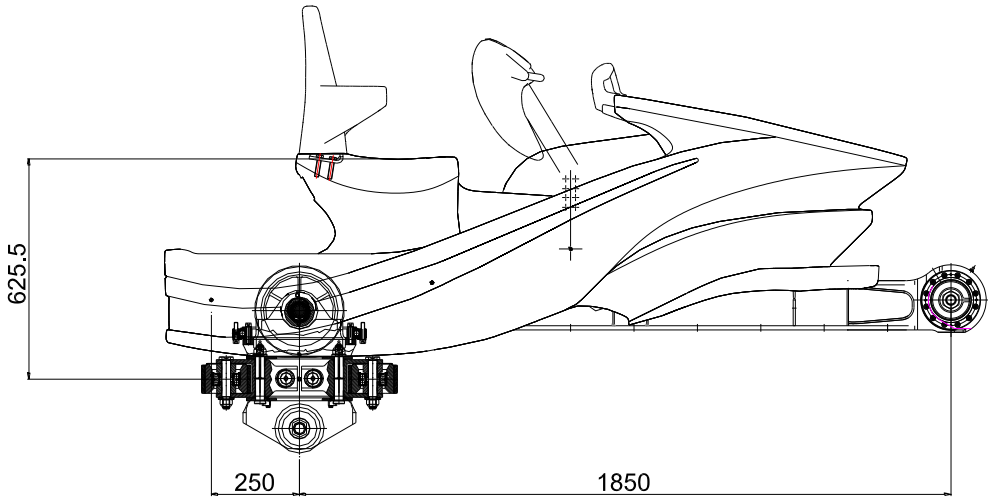
Three trains will be delivered. Each train consists of eight cars. Each four cars will be delivered on transport tracks.



Vehicle 1



Vehicle 02-03-04



D1.2) PRE-CONDITIONS

- Ensure that all safety measurements have been taken.
- Inspect all delivered equipment and report any damage in writing.

D1.3) INSTALLATION

The seller delivers the following pre-assembled main components to facilitate mounting on the track:

- 1 x Vehicle 01
- 5 x Vehicle 02
- 1 x Vehicle 03

- 1 x Vehicle 04
- FRP Covers (Fiber reinforced plastic covers, completely mounted to cars)

NOTE

Pay attention not to damage the FRP covers of the train during installation and/or commissioning.

- Protect the FRP covers with plastic film or stretch film.
- Do not step on or over the FRP covers.

Order of installation

Front Car – Car 2 – Car 3 – Car 4 – Car 5 – Car 6 – Car 7 – Car 8

Procedure

1. Place the pre-assembled cars in the order listed above on the maintenance track.
2. Insert first the front bogie, move the car further and then insert the rear bogie.
3. Connect the cars together as shown on the coupling drawing 5224-08-2000 but do not fasten the bolt connections.
4. Verify the height of cars above track. Height (top of track to bottom of friction plate) must be 61.5 +/- 1 mm. All cars must be on this level.
5. After leveling and measuring and after performing the pull through test, procedure E1), the coupling bolt connections (5224-08-2000) can be fastened as indicated on the drawing.
6. Finally fasten all bolt connections, including the coupling bolt connections according to the specific drawing. Torque bolts/nuts with torque rate indicated on specific drawings. Bolt connections not using self locking nuts shall be secured with LOCTITE 242. Bolt connections must be torque striped.

- Acceptance Test Plan (ATP)

D2) TRAIN ADJUSTMENT

DRAWINGS

5224-08-0000	Assembly Train
5224-08-0010	Assembly Vehicle 01
5224-08-0020	Assembly Vehicle 02
5224-08-0030	Assembly Vehicle 03
5224-08-0040	Assembly Vehicle 04
5224-08-1000	Assembly Bogie
5224-08-2000	Assembly Car Coupling

D2.1) PRE-CONDITIONS

- Ensure that all safety measurements have been taken.
- Ensure that the procedure “Train installation on track” was carried out professionally.
- Ensure that the train is prevented from moving by suitable device.

NOTE

Factory Adjustment!

All cars have been adjusted at the factory. However, the adjustments of the cars have to be re-checked prior of putting the cars into operation. In case that the adjustments are not anymore within the specified limits after shipment and arrival on site, following procedure must be followed for re-adjustment of the cars. Hereafter the information shall be found on adjustment procedures and future re-adjustments.

D2.2) TRAIN ADJUSTMENT PROCEDURE

Introduction

The bogies are guiding the car along the ride. The proper adjustments of the bogies are therefore very important in terms of safety, lifetime, reliability and comfort to the passengers. It also has direct influence on the lifetime of all mechanical parts. Incorrect bogie and therefore train adjustments may cause damage to track mounted components as sensors and collectors, may increase the wear of the friction wheels, load wheels, side wheels and up-stop wheels or may interfere with brake magnets that could result in major damage of the brake magnets or friction plates of the train.

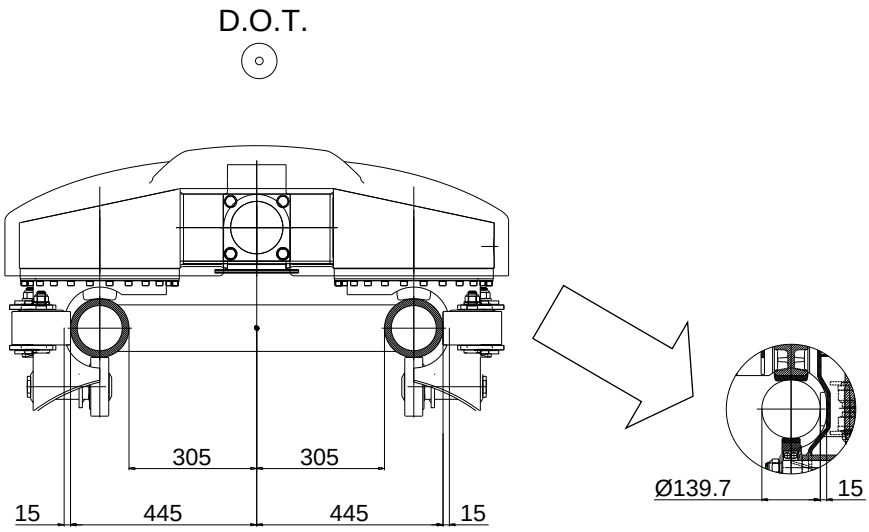
Where to do the adjustments?

For the adjustment procedure, place the train either in the station or on the maintenance track.

D2.3) HEIGHT CHECK OF CAR

- Check the height of the friction plate to be 61.5 ± 1 mm above top of track.
- Verify that the parallelity between friction plate and track surface is maintained.

D2.4) LATERAL ADJUSTMENT OF CAR

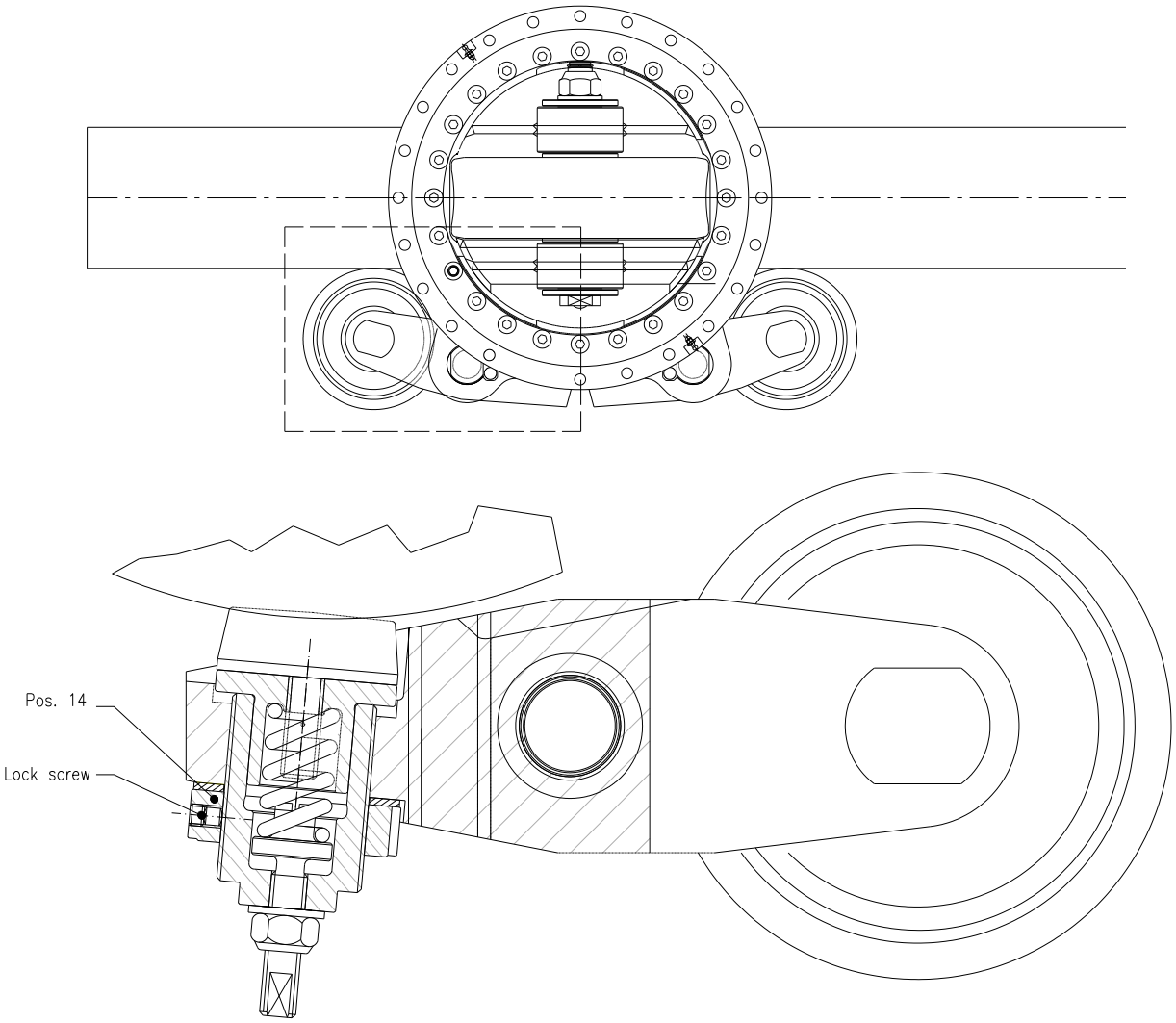


The lateral adjustment of the car is very important in terms of wear and safety. Special care must be taken to the symmetry of each car in relation to the track center because of the brakes installed on the ride.

- Check distance between bogie frame and track surface:
  Nominal value is 15 mm measured from track side surface to the vertical plate of the bogie frame.
- The difference value of left and right side should be within +/- 1 mm. If the values do not meet the requirement, the train has to be re-adjusted.
- Adjust by shimming the buffer of the side wheels.

Symmetry of Train in Relation to the Track Center

- Take measurement from the internal side of the track to the centre of car (nominal value 375 ±1 mm).
- Ascertain that the guide wheels rest on the track. This applies to both bogie arranged opposite each other.
- Loosen the lock screw at the nut item 14 (5224-08-1020/1040) and tighten pos.14 until the pretension of the side wheel is approximately 40kg when pulling the wheel perpendicularly to the track.

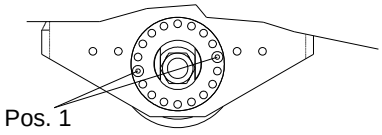


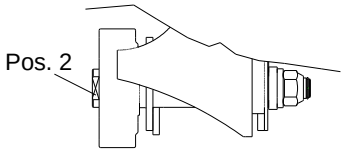
D2.5) UP-STOP WHEEL ADJUSTMENT

Pre-tension Values

The regular pre-tension for the up-stop wheels is approx. 25 kg. To adjust the upstop wheel, remove the 2 M8 pos. 1 in sketch below, and turn bolt pos. 2 with a wrench Hex. 36 to the next available 2 bores of the crown. To do this, it might be necessary to use a lever, since the nut of main axle of the up-stop wheel is already torqued.
This adjustment can be verified by turning the wheel with one hand only.

- Acceptance Test Plan (ATP)





E) INSTALLATION CLOSE OUT

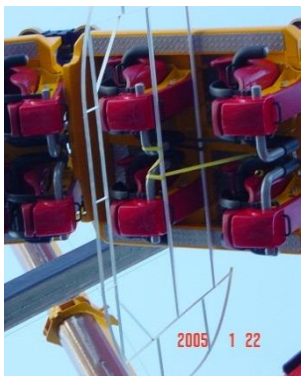
E1) PULL THROUGH TEST

DRAWINGS

5224-04-0010	Station Layout
5224-08-0001	Assembly Train
5224-08-0009	Clearance Envelope

E1.1) PRE-CONDITIONS

- Track and columns installed and torque to final torque rate.
- Columns grouted and anchor bolts torque to final torque rate.
- All mechanical components installed and aligned.
- Sensors and switches installed.
- Flags installed to the train.
- Sufficient lifting capacity (crane) must be available.
- A sufficient number of winches, pulleys, ropes, chains, turfer etc. for securing and handling must be available.
- Prepare the test train consisting of front car (car no. 1) and rear (car no. 8) with a dummy collector.
- Install a model of the clearance envelope in the middle of the middle car.
- Do not remove any FRP covers or FRP show components of the test train.



E1.2) GENERAL NOTES

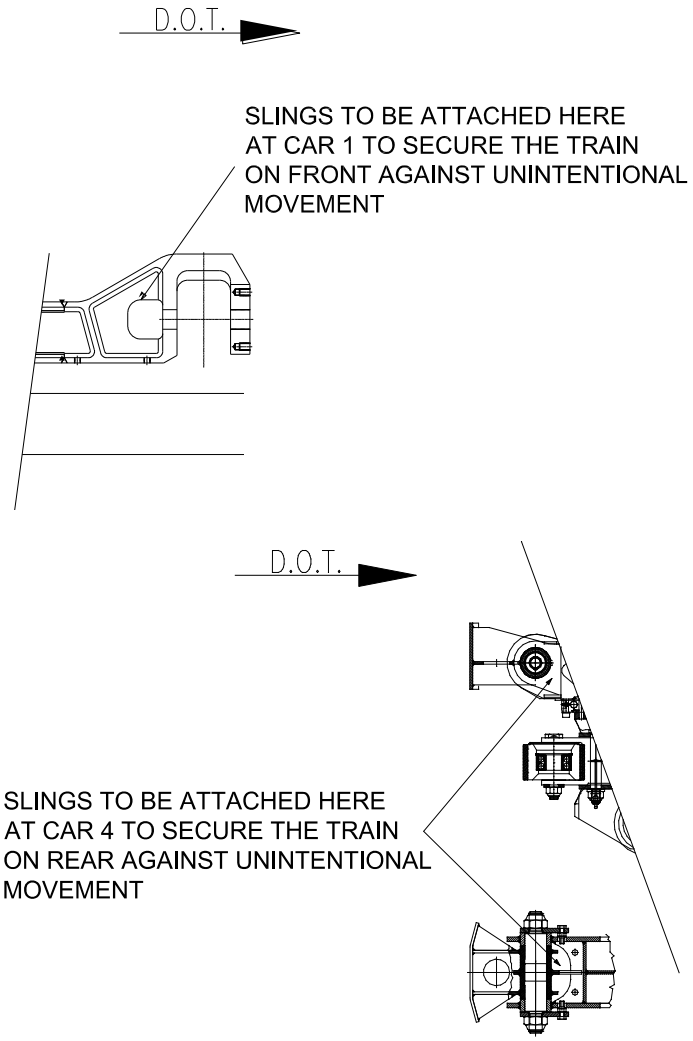
- Attach a pull rope at the front and rear of the test train.

NOTE

Attachment of Pull Rope at Front of the Test Train

Do not attach the pull rope at the front axle of the train.

- When pulling through the test train secure the train on both ends (front and rear), especially when pulling the train over a hill.



- The pull direction of the rope must be in direction of travel. The angle between rope and train longitudinal must be in a range of 5 to 20°. To ensure this condition the pull rope must be guided respectively e.g. by means of temporarily mounted pulleys.

NOTE

Rope Guiding and Rope Angle in Relation to the Train

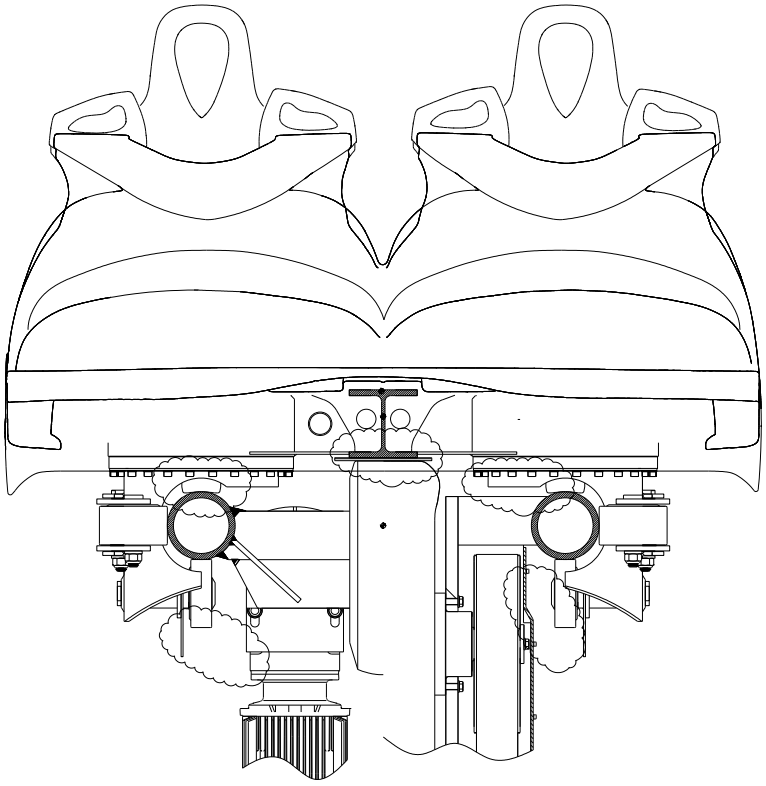
It is of importance that forces act in longitudinal direction only on the chassis. Therefore the pull angle between rope and train longitudinal direction must be in the range of 5° to 20°.

Forces acting on the chassis in different angles as mentioned above may cause damages on the chassis and/or chassis attachment point.

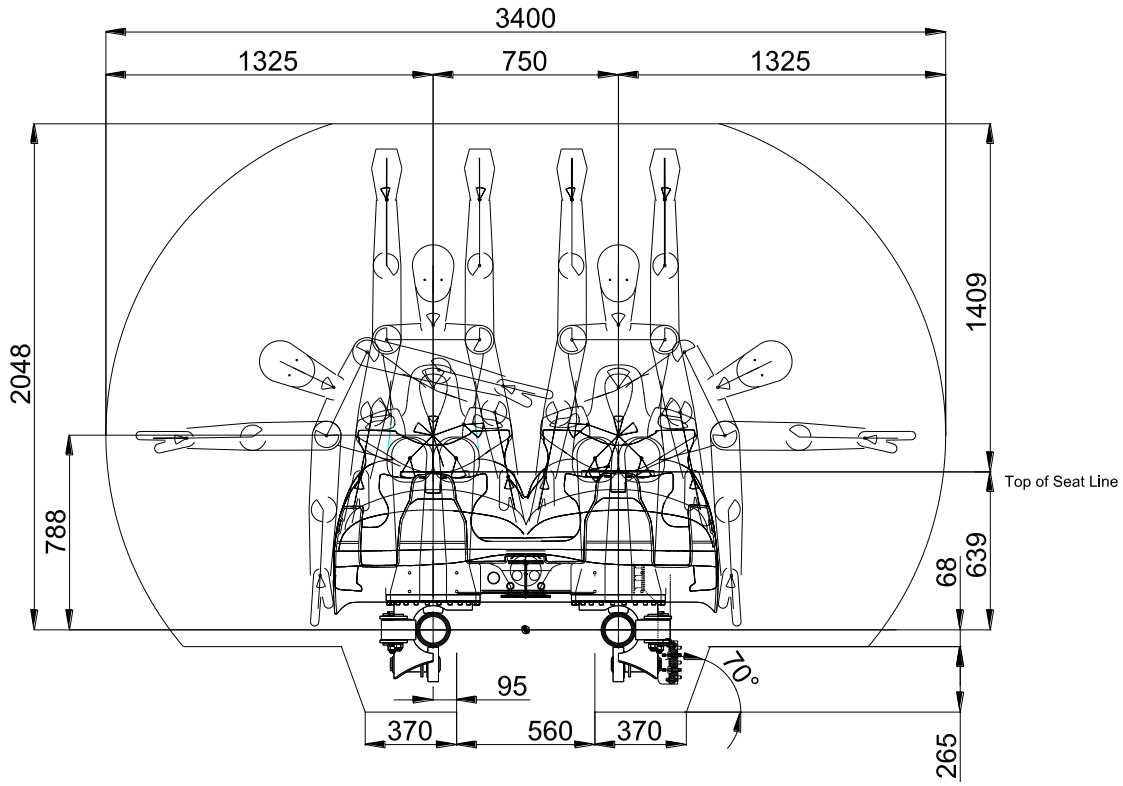
E1.3) PULL TROUGH TEST

- Pull the complete test train slowly over the entire ride.
- Check and record clearance in all tight curves, in valleys, twist and turns and on humps every 1 – 2 meters. The following clearances / data according to drawing 5224-08-0001 and according to the sketches below are of particular interest but not limited to:
- Bogie / track (Especially in fast change of banking curves and high banked curves)
- Car / track
- Train mounted friction plates to track mounted brake magnets
- Train mounted friction plates to track and friction wheel motors
- Within coupling
- Bogie wheels and bogie components in relation to chassis/FRP cover
- Flags to sensors
- FRP cover to FRP cover
- Front axle to FRP

- Area to be particularly checked during the pull through test



- The dynamic clearance envelope according to drawing 5224-08-0005 must be assured along the entire track. Therefore it is recommended to attach a suitable template of the clearance envelope in the mid of the rear car. Note that only the station platforms are allowed to be closer to the train than the specified clearance envelope. The geometry of the station platform edges in relation to the train can be seen on the drawing 5224-04-0001, and must be checked accordingly prior to train operation.



- Acceptance Test Plan (ATP)

E2) RIDE CYCLING

E2.1) PRE-CONDITIONS

- Ride completely assembled and applicable Acceptance Tests mechanical as well as electrical are finalized. Special all safety relevant tests as well as all clearance tests have been carried out, recorded and finalized so that a cyclic operation of the ride is possible
  - Availability of sand/water bags with cycles with fully loaded cars for one train (80kg per seat for fully loaded train, and 136 kg per seat in case of overloaded test ride).
  - Availability of operating staff as well as personnel and equipment for finalizing the adjustments and modifications.

NOTE

Special care must be taken that the sand/water bags will leave no impact on the seats. Therefore:

- If water bags are used, at low temperatures fill bags with a glycol mix (never use salted water).
- Pay special attention to protecting the seat padding before placing the bags into the seats.
- Secure the bags with straps to the seat.
- The weight of the bags shall be equal to expected passenger weight of 80 +/- 2 Kg.

E2.2) PREPARATION FOR RIDE CYCLING

- Confirm that all installation work is completed and that all applicable Acceptance Test Plans (ATP) and their protocols are finalized.
- Walk along the entire track and check all contact surfaces for wheels. Remove all remaining obstacles such as cover paint, sticky tape, spot welds, cables, tools, etc.
- Remove all impurities using a steel brush.
- Professionally clean the spots of all scratched areas/parts before applying touch up paint.
- Before application, the paint material should be stored at about 10-15°C.
- Interplus 356 is capable of curing at temperatures below 0°C. However, it should NOT be applied at temperatures below 0°C, where there is the possibility of ice formation on the substrate.
- Overcoating time:
  - At 0°C: 36 hours
  - At -5°C: 60 hours
- At low temperatures, it might be necessary to dilute Interplus 356 with max. 5% GTA220.
- Apply primer to the areas/parts in question.
- Apply the top coat and allow sufficient time for drying.
- Ensure and confirm that neither persons nor equipment are within the clearance envelope of the cars.

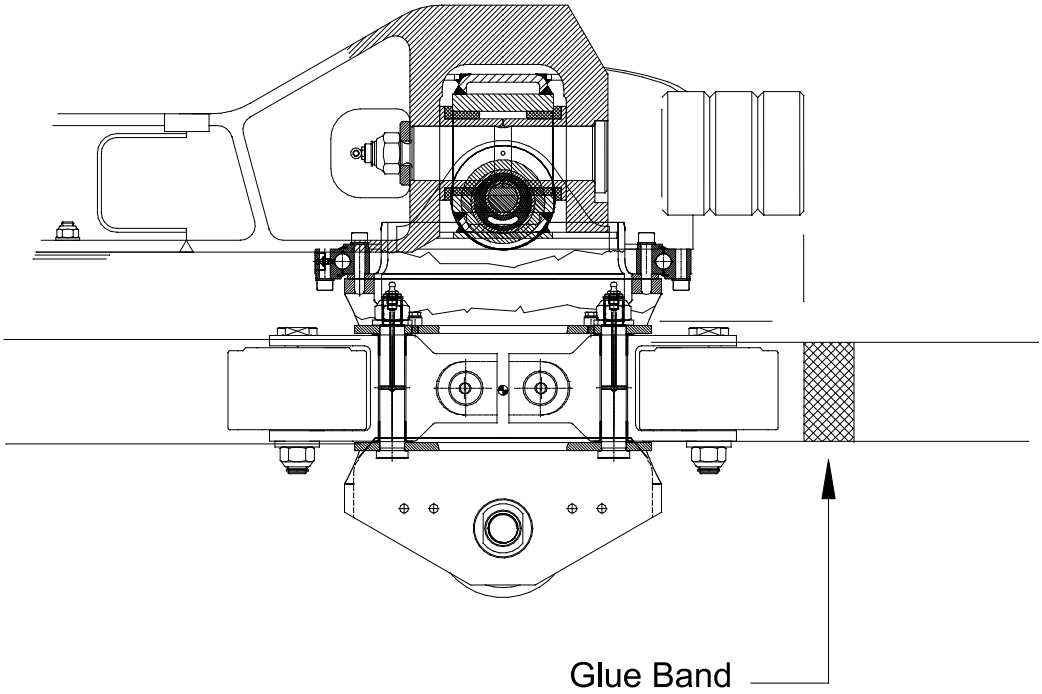
- Make adaptations and modifications where necessary.
- Load all seats of the train with water sand/water bags and secure them properly.

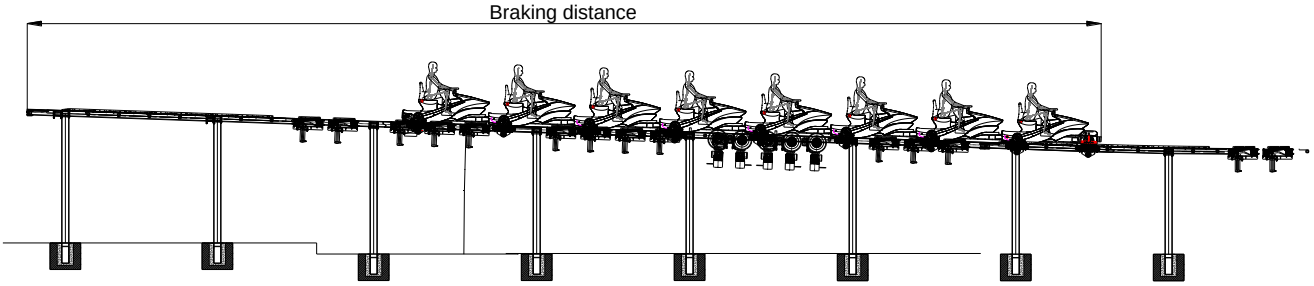
PAINT SYSTEM AND CLASSIFICATION A3.08 – C3 ACC. ISO 12944		
SURFACE PREPARATION	PROCESS:	GRINDING OF DAMAGES IN STEEL AND CORRODED AREAS
NOMINAL DRY FILM THICKNESS	160 µm	
APPLICABLE COATING SYSTEM		
PRIMER	TYPE:	INTERSEAL 670HS
	NUMBER OF LAYER:	1
	LAYER THICKNESS:	100 µm
	PROCESS:	ROLLER, BRUSH
TOP COAT	TYPE:	INTERFINE 878/979
	NUMBER OF LAYER:	1
	LAYER THICKNESS:	75 µm
	PROCESS:	ROLLER, BRUSH
THINNER	FOR INTERSEAL 670HS:	GTA220
	FOR INTERFINE 878/979:	GTA007

E2.3) RIDE CYCLING

Due to the relatively higher friction of a new ride, the train can stop anywhere on the gravity run. To minimize the chance of stopping, only trains fully loaded sand/water bags should perform the cycle. During colder months heating of wheel bearings minimize the chance of stopping.

- Cycle the ride one time; listen to the ride for abnormal noises. Perform ride inspection after the first ride cycle as outlined in chapter E2.4) within this manual prior continuing any additional ride cycles.
- Cycle the ride and perform all necessary dynamic acceptance tests as brake test, block brake test, multiple train cycling etc. according applicable acceptance tests.
- Record with glue tape band at track the brake distances in the block brake section for an empty and a fully loaded train for further reference, measuring distance from J078, to the front buffer of the train when train is running with approx. 2 m/s.





- During the period of ride cycling all daily inspections as lined out in Manual Part TWO, Chapter 4, Maintenance Instructions must be carried out by the owner's maintenance staff.
- Carry out g-force measurements as described below to verify proper installation conformity.
- After carrying out all dynamic acceptance tests, continuously cycle the ride for at least 2 days and/or 1000 to 1500 cycles (2 trains running).

E2.4) RIDE INSPECTION AFTER FIRST CYCLE

Visually Control (VC) the ride as follow

- Check for lost/loose/broken bolts/nuts on the track to track as well as on track to column and column to column connections.
- Check the track to track connections for smooth transition.
- Check the track (running surface and vertical cross beams) for scratches.
- Check the track mounted brake magnets for scratch marks on the top surface of the magnets.
- Check the bogie frame for scratch marks.
- Check the car mounted friction plates for scratch marks.
- Check the train coupling for dents marks, etc.
- Check the FRP-covers for dents, contact, scratches, cracks, etc.
- Check the sensors for contact, scratch marks, etc.

Requirements, Remedial Action

NOTE

If any abnormalities, scratched, loose/lost/broken bolts, abnormal noises, etc. are detected, the respective part /area must be inspected very carefully to find out the reason of such behavior. Re-adjust according to the specific procedure.

E2.5) RIDE INSPECTION AFTER MULTIPLE CYCLE

Daily inspection and maintenance work must be carried out according to Manual Part TWO, Chapter 4, Maintenance Instructions.

Due to reduction of friction on track and on the train, the ride is slightly changing during the first season.

NOTE

The riding-in process of the train depends on the layout, curves, turns, figures and speed. During that time a higher but normal wear on the wheels is expected.

E2.6) RIDE INSPECTION AFTER 500 HOURS and/or 5500 CYCLES (to be done by customer)

- Completely check the ride after 500 hours of operation or after 5500 cycles in accordance with Manual Part TWO, Chapter 4, Maintenance Instructions.
- Check all track joints for a smooth wheel passage and adjust where necessary (see B7.5).
- Re-check on a random basis foundation coordinates and compare with the values measured prior installation to ensure complete integrity.
- Touch up all areas of scratches with paint for corrosion protection

E3) G-FORCE MEASUREMENTS

E3.1) PRE-CONDITIONS

- Ensure that proper tools and access equipment is available and on site.

E3.2) G-FORCE MEASUREMENTS

- The g-forces of a train during the ride have to be measured and recorded. Such g-force measurements will help to verify if the tracks (and namely the track connections) have properly been aligned during the installation. Furthermore, with such measurements undue g-force peaks can be recognized and the track could be readjusted at the referring location.
- A suitable measuring device shall be used, capable of measuring g-forces in x, y, and z direction in a range of ±10g. The amplifying rate shall be 200 Hz.
- The g-forces have to be measured in the front car, in one of the middle cars and in the end car for each train.
- Attach and properly fix the measuring sensor on
- one of the two seats of the front car
- one of the two seats of car 4 and on
- one of the two seats of the last car.
- The height position of the sensor must be in the center to the seat back and 600 mm above seat area.
- The xyz axis of the sensor have to be aligned to the true xyz axis of the cars.
- Take photos of the arrangement and installation of the sensor.
- The g-forces have to be recorded along the entire ride under normal operation conditions. Such measurement logs have to be taken from an empty train and from a fully loaded train.
- In the list of g-force measurements record also the following:
  - date
  - train number
  - ambient temperature
  - ambient weather condition (rain / dry / humidity)
- All measurement logs have to be sent to the seller for review prior of handover of the system. Measurements must be filtered with 5 Hz and 20 Hz.
- For recording of g-force measurements, use the form sheet E3).

- Acceptance Test Plan (ATP)

E4) FINAL HAND-OVER OF THE INSTALLATION

E4.1) PRE-CONDITIONS

- The ride is fully operable.
- All adjustments resulting from the “ride- in adjustments” have been carried out.
- All waste material has been disposed.
- All temporary structures have been removed.
- Return / dismissal of equipment / personnel.

E4.2) HAND OVER

- Hand over the installation log containing the Acceptance Test Plans (ATP), except ATP for procedure B7.8) Re-torqueing of Bolt Connections which has to be filled in after 5500 cycles of operation.

F) INSTALLATION ACCEPTANCE TEST PLANS

F1) GENERAL

All acceptance tests shall be completed as outlined in this documentation by and under the responsibility of the installation company and the owner of the new attraction, assisted by the seller where requested and appropriate.

Under no circumstances the seller is taking any responsibility for the integral quality of the work executed by all parties contracted through others. The seller may refuse to continue to assist the test and commissioning process or refuse to give its consent for public operations in cases where it becomes obvious that some works have not been done or have been executed in an improper manner.

The purpose for these tests are to verify and confirm proper execution and completion of the installation, adjustment and connection works on one hand and to verify the functionality of specific components and the entire ride system on the other hand.

Conducting these tests shall verify that the works have been done in a proper manner and meet the requirements set in the documentation and drawings.

F2) TERMINOLOGY

The tests may be conducted in phases as the installation of the equipment is successfully completed and no more changes are scheduled.

Test sequences do not have to be completed in the sequence in which they appear in this document, except for cases where specifically required.

The test advisor shall record equipment configurations as a part of the test record where design changes have spanned the period of testing, or where the location or the equipment function is adjustable.

In the following the standard test sheets to be filled out for each individual test executed are described. In the test sheets the following topics are identified and must be specified before, during and finally after the completion of the tests:

- Project data:
  Identification of the type of test (prototype, first article, acceptance), the subject or subassembly in question, the title of test as well as the responsible person to execute and supervise the test.
- Test purpose:
  Written description of the purpose of the test. Identification of why certain aspects of an assembly are critical and what concerns shall be addressed by executing the test.
- Test configuration:
  Identification how the test shall be executed as a written description or by illustration with a sketch and/or drawing. The measuring tools (including measuring accuracy and range) and the test equipment necessary shall be defined.
- Test results: (quantitative)
  The test results shall, where ever possible, be specified in quantitative and objective measures. A table shall be prepared and inserted beforehand, identifying the values assumed in calculations, the values calculated or specified as per the design drawings and as a free column measurements taken during the test.

- Interpretation: (qualified)
  Written interpretation of the test, what conclusions can or cannot be drawn from it, what kind of other effects could be observed during testing. Conclude whether the test has been successful or not.

For each individual installation procedure in Manual Part TWO, Chapter 3 “Installation Instructions” an Acceptance Test Plan has to be recorded. The Test Number corresponds with the procedure number.

E.G.

Procedure No.A1)	: Zero Datum Points
Acceptance Test Plan number	: ATP A1)

TEST NUMBER: ATP A 1) / A 2) ☐ Prototype ☐ 1st Article ☐ Acceptance

Subject: Site & Installation Preparation Project: 5224, Snow Ski Launch Coaster

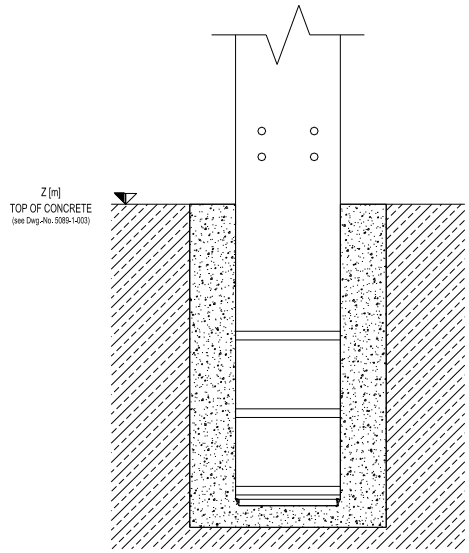
Test Title: Zero Datum Points & Foundations Resp:

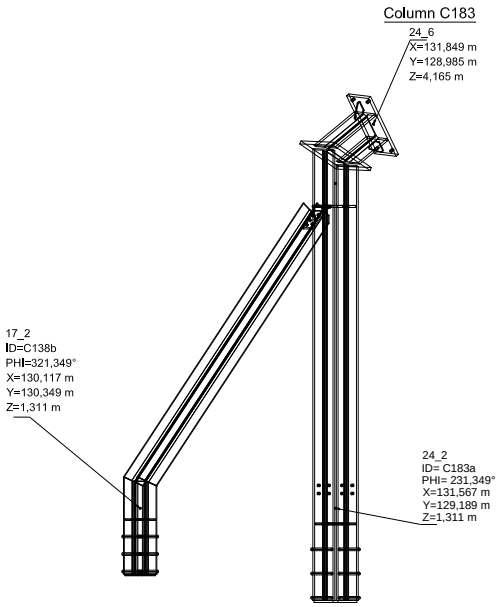
TEST PURPOSE:

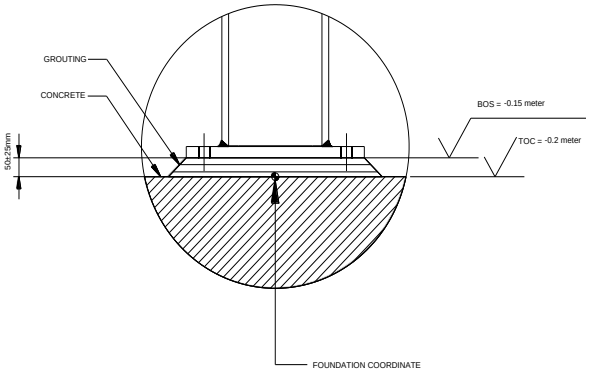
- Record coordinates of the zero datum point(s)
- Record all foundation coordinates and size

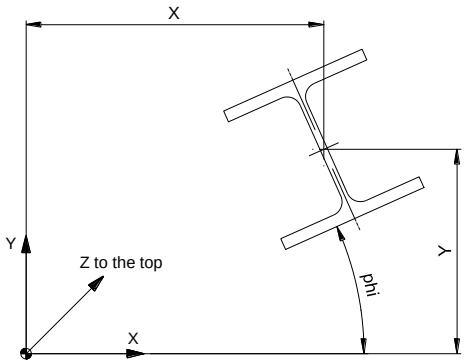
TEST CONFIGURATION: (equipment/procedure)

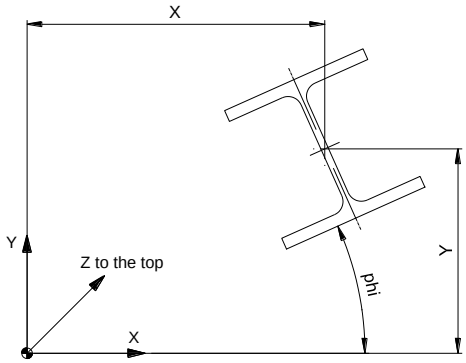
- Relevant Drawing: 5224-01-0003 Foundation coordinates











TEST RESULT (criteria) Values (pass/fail):	X [m]	Y [m]	Z [m]		△x [mm]	△y [mm]	△z [mm]	Date/ Tester
- Zero datum point no. # 1								
- Zero datum point no. # 2								
- Zero datum point no. # 3								
etc.								
Record all foundation coordinates, orientation angles φ and foundation sizes according to separate listing ATP A1)/A2)								
INTERPRETATION (qualified):								
Responsible Person: date/sign:				Responsible Person: date/sign:				

Acceptance Test Plan A 1) / A 2)

Foundation coordinates

Column No.	Coordinates			Deviation			Foundation size (w x l)	Orientation angle		Reference
	X [m]	Y [m]	Z [m]	△x [mm]	△y [mm]	△z [mm]		φ	△φ	Zero Datum Point No.

TEST NUMBER: ATP A 2) ☐ Prototype ☐ 1st Article ☐ Acceptance					
Subject: Site & Installation Preparation Project: 5224, Snow Ski Launch Coaster					
Test Title: Site Preparation Resp:					
TEST PURPOSE: - Size and location of storage area, lay down area and pre-assembly area					
TEST CONFIGURATION: (equipment/procedure)					
TEST RESULT (criteria) Values (pass/fail):					Date/ Tester
- Storage area (width x length in m)					
- Laydown area (width x length in m)					
- Pre-assembly area (width x length in m)					
INTERPRETATION (qualified):					
Responsible Person: date/sign:		Responsible Person: date/sign:			

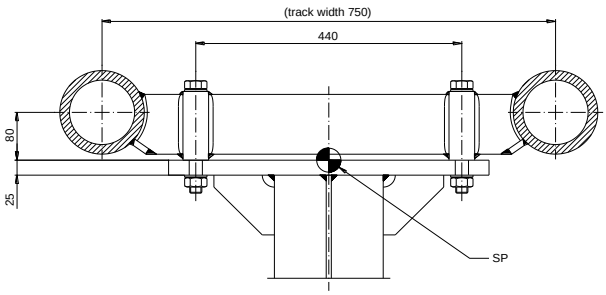
TEST NUMBER: ATP A 3) ☐ Prototype ☐ 1st Article ☐ Acceptance					
Subject: Site & Installation Preparation Project: 5224, Snow Ski Launch Coaster					
Test Title: Installation Preparation Resp:					
TEST PURPOSE:					
- Record curing time for all foundations					
TEST CONFIGURATION: (equipment/procedure)					
TEST RESULT (criteria) Values (pass/fail):	Curing time				Date/ Tester
Record curing time for all foundations					
INTERPRETATION (qualified):					
Responsible Person: date/sign:			Responsible Person: date/sign:		

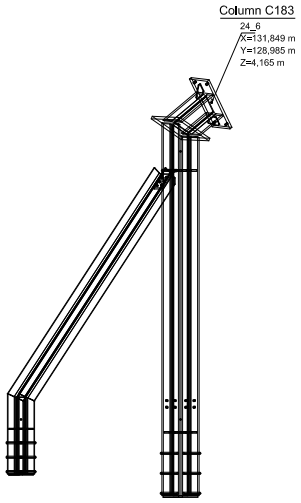
TEST NUMBER: ATP B7.2)	☐ Prototype	☐ 1st Article	☐ Acceptance
Subject:	Structure Erection	Project:	5224, Snow Ski Launch Coaster
Test Title:	Column Erection	Resp:	

TEST PURPOSE:

- Check and record column head reference point SP

TEST CONFIGURATION: (equipment/procedure)
column drawings (column to track connections - column head SP points)
The point SP is on the upper edge of the column head flange.





TEST RESULT (criteria) Values (pass/fail):	Column No.					Date/ Tester
- column head coordinates SP, see separate list ATP B7.2)						

INTERPRETATION (qualified):

Responsible Person: date/sign:

Responsible Person: date/sign:

Acceptance Test Plan B 7.2)

Column Head Coordinates SP

Column No.	SP Coordinate			Deviation			Reference
	X [m]	Y [m]	Z [m]	△x [mm]	△y [mm]	△z [mm]	Zero Datum Point No.

TEST NUMBER: ATP B7.4) ☐ Prototype ☐ 1st Article ☐ Acceptance

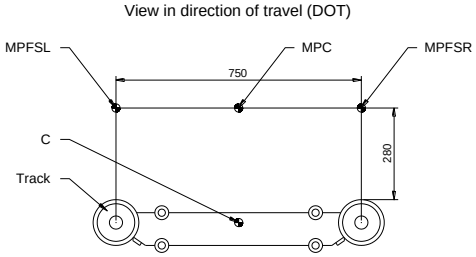
Subject: Structure Erection Project: 5224, Snow Ski Launch Coaster

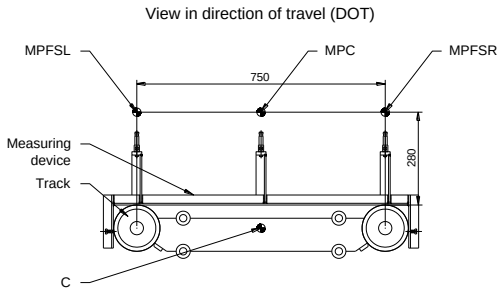
Test Title: Track Installation Resp:

TEST PURPOSE:

- Check and record track reference point J0XX at track joint

TEST CONFIGURATION: (equipment/procedure)





-coordinate listings: 5224 - Track joint coordinates 280mm above track
(track to track connections - 280 mm above track joint J0XX points)
-measuring device has to be fitted to the track checking the centering using feeler gauge

TEST RESULT (criteria) Values (pass/fail):	Co. No.	[Nm]	Pass/ Fail	Torque striped	Date/ Tester
- Track reference point J0XX at track joint, see separate list ATP B7.4)					

INTERPRETATION (qualified):

Responsible Person: date/sign:

Responsible Person: date/sign:

Acceptance Test Plan B 7.4)

Reference point J0XX at track joint

Reference Point J0XX at Track to Track	J0XX Coordinate			Deviation			Reference	Loosening and reconnection?	Shims	Deviation eliminated?	Final J0XX Coordinate			Final Deviation		
	X [m]	Y [m]	Z [m]	△x [mm]	△y [mm]	△z [mm]	Zero Datum Point No	yes /no	[mm]	yes /no	X [m]	Y [m]	Z [m]	△x [mm]	△y [mm]	△z [mm]

TEST NUMBER: ATP B 7.5) ☐ Prototype ☐ 1st Article ☐ Acceptance

Subject: Structure Erection Project: 5224, Snow Ski Launch Coaster

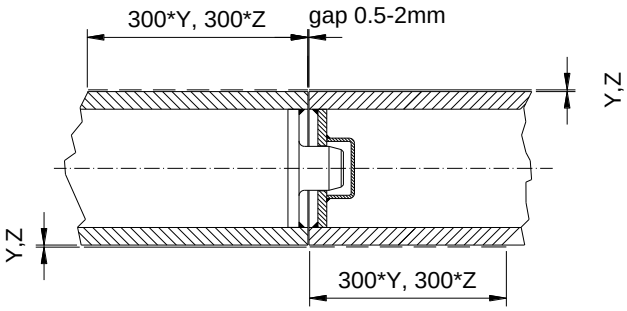
Test Title: Track Connection Smoothness Resp:

TEST PURPOSE:

- Record gap of each track/track interface
- Smoothen the transition

TEST CONFIGURATION:
(equipment/procedure)

Track to track connection:



TEST RESULT (criteria) Values (pass/fail):					Date/ Tester
Use separate listing ATP B7.4)					
- Deviation (Y,Z)					
- Re-adjust transition by loosening the track joint bolts, adjust the tubes and re-tighten bolts					
- Deviation (Y,Z) after re-adjustment					
- Grind (yes, no) if deviation re-adjustment fails criteria					

INTERPRETATION (qualified):

Responsible Person: Responsible Person:

date/sign: date/sign:

Acceptance Test Plan B7.5)

Track To Track Connection Smoothness

Track / Track Section		final check of transition right in DOT				final check of transition left in DOT				Loosing and re-connec-tion	final check of transition right in DOT after reconnection			final check of transition left in DOT after reconnection			Grinding after confir-mation of seller	Check after grinding of transition in DOT (left/right)
		gap x 0,5 - 2,0 [mm] at track joint	y=0 [yes, no] side of track	z=0 [yes, no] top of track	z=0 [yes, no] bot. of track	gap x 0,5 - 2,0 [mm]	y=0 [yes, no] side of track	z=0 [yes, no] top of track	z=0 [yes, no] bot. of track	yes/no	y=0 [yes, no] side of track	z=0 [yes, no] top of track	z=0 [yes, no] bot. of track	y=0 [yes, no] side of track	z=0 [yes, no] top of track	z=0 [yes, no] bot. of track	yes/no	y,z =0 yes, no

TEST NUMBER: ATP B 7.6) ☐ Prototype ☐ 1st Article ☐ Acceptance			
Subject: Structure Erection Coaster		Project: 5224, Snow Ski Launch	
Test Title: Bolt Connections		Resp:	
TEST PURPOSE:			
- Check bolt torque			
TEST CONFIGURATION: (equipment/procedure)			
- Torque rate according to specific drawings			
TEST RESULT (criteria) Values (pass/fail):		yes/no	Date/ Tester
- Torque column assembly			
- Torque column to track			
- Torque track to track			
- Torque stripe with yellow color at 100% torqueing			
INTERPRETATION (qualified):			
Responsible Person: date/sign:		Responsible Person: date/sign:	

TEST NUMBER: ATP B 7.7) ☐ Prototype ☐ 1st Article ☐ Acceptance			
Subject: Structure Erection Coaster		Project: 5224, Snow Ski Launch	
Test Title: Concrete Pouring and Grouting		Resp:	
TEST PURPOSE:			
- Verify correct concrete/grouting and curing time			
TEST CONFIGURATION: (equipment/procedure)			
TEST RESULT (criteria) Values (pass/fail):	Days	yes/no	Date/ Tester
- Shim plates prepared to stay permanently in foundation			
- Grouting applied, no hollow spaces			
- Curing time			
- Torque anchor bolts at switch			
INTERPRETATION (qualified):			
Responsible Person: date/sign:		Responsible Person: date/sign:	

TEST NUMBER: ATP B 7.8) ☐ Prototype ☐ 1st Article ☐ Acceptance			
Subject: Structure Erection Coaster		Project: 5224, Snow Ski Launch	
Test Title: Re-torqueing of Bolt Connections		Resp:	
TEST PURPOSE:			
- Re-torque ride structure after 100 hours of operation or at least after 6250 cycles			
TEST CONFIGURATION: (equipment/procedure)			
- Torque rate according to specific drawings			
TEST RESULT (criteria) Values (pass/fail):		yes/no	Date/ Tester
- Re-torque anchor bolts			
- Re-torque column assembly			
- Re-torque column to track			
- Re-torque track to track			
- Torque stripe with green color after re-torqueing			
INTERPRETATION (qualified):			
Responsible Person: date/sign:		Responsible Person: date/sign:	

TEST NUMBER: ATP B 9) ☐ Prototype ☐ 1st Article ☐ Acceptance				
Subject: Structure Erection Coaster		Project: 5224, Snow Ski Launch		
Test Title: Catwalk Erection / Installation		Resp:		
TEST PURPOSE:				
- Check bolt torque of bolt connections				
- Torque stripe				
TEST CONFIGURATION: (equipment/procedure)				
TEST RESULT (criteria) Values (pass/fail):	Yes, no			Date/ Tester
- Bolt torque				
- Torque stripe				
INTERPRETATION (qualified):				
Responsible Person: date/sign:		Responsible Person: date/sign:		

TEST NUMBER: ATP C 1) ☐ Prototype ☐ 1st Article ☐ Acceptance				
Subject: Mechanical Components Installation Coaster			Project: 5224, Snow Ski Launch	
Test Title: Pneumatic System			Resp:	
TEST PURPOSE: - Connection of pneumatic system, no leakage - Adjustment of cylinder cushion - Technical data requirements fulfilled - Proper function				
TEST CONFIGURATION: (equipment/procedure)				
TEST RESULT (criteria) Values (pass/fail):	Yes, no			Date/ Tester
- Connection according 5224-04-0005				
- Adjustment of cylinder cushion acc. to 5224-Design-Package-Pneumatic				
- Proper function, no leakage				
- Air quality fulfilled				
INTERPRETATION (qualified):				

Responsible Person: date/sign:	Responsible Person: date/sign:

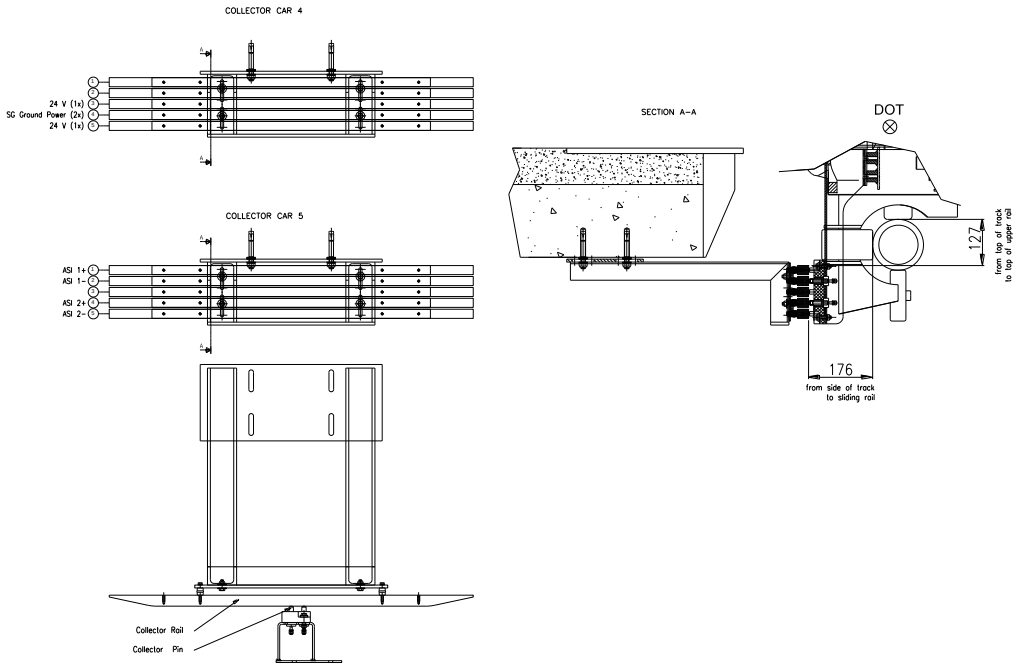
TEST NUMBER: ATP C 2)	☐ Prototype	☐ 1st Article	☐ Acceptance
Subject: Coaster	Mechanical Components Installation	Project: 5224, Snow Ski Launch	
Test Title:	Current Collector	Resp:	

TEST PURPOSE:

- Proper function of the collector

- Proper electrical connections

TEST CONFIGURATION: (equipment/procedure)



	Yes, no	Values		Date/ Tester
63 mm from top of track to top of upper rail				
88 mm from side of track				
Proper function (yes, no)				

INTERPRETATION (qualified):

Responsible Person: date/sign:	Responsible Person: date/sign:

TEST NUMBER: ATP C 3) ☐ Prototype ☐ 1st Article ☐ Acceptance						
Subject: Mechanical Components Installation Project: 5224, Snow Ski Launch Coaster						
Test Title: Gates Resp:						
TEST PURPOSE: - Check bolt torque						
- Proper movement and function of rotating fences						
TEST CONFIGURATION: (equipment/procedure)						
TEST RESULT (criteria)	Values (pass/fail):		yes/no			Date/ Tester
- Speed limit, to be open in 2 second → make video						
- Proper movement of all rotating fences						
- Proper hosing → no kind of leakage						
- Proper function of end position switches						
- Bolt torque						
INTERPRETATION (qualified):						
Responsible Person: Responsible Person:						
date/sign: date/sign:						

TEST NUMBER: ATP C 4) ☐ Prototype ☐ 1st Article ☐ Acceptance

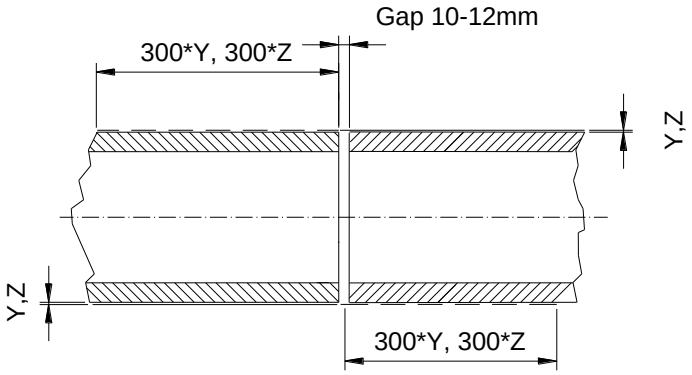
Subject: Mechanical Components Installation Project: 5224, Snow Ski Launch Coaster

Test Title: Switch Resp:

TEST PURPOSE:

- Check bolt torque of track/track connection and track/column connection
- Proper movement of switch, stroke of switch
- Transition and gaps

TEST CONFIGURATION: (equipment/procedure)



TEST RESULT (criteria) Values (pass/fail):	Gap = 10-12 mm yes, no	y,z < 0.5 mm yes,no	Grinding required yes, no	Brake edges at wheel contact areas	Date/ Tester
- Transition and gap TT1 to S05 track					
- Transition and gap TT1 to L01 track					
- Transition and gap TT2 to M01track					
- Transition and gap TT2 to L01 track					
- Proper movement of switch to both stop positions					
- Bolt torque					

INTERPRETATION (qualified):

Responsible Person: Responsible Person:

date/sign: date/sign:

TEST NUMBER: ATP C 4.1) ☐ Prototype ☐ 1st Article ☐ Acceptance

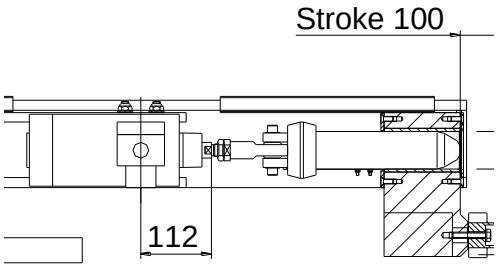
Subject: Mechanical Components Installation Project: 5224, Snow Ski Launch Coaster

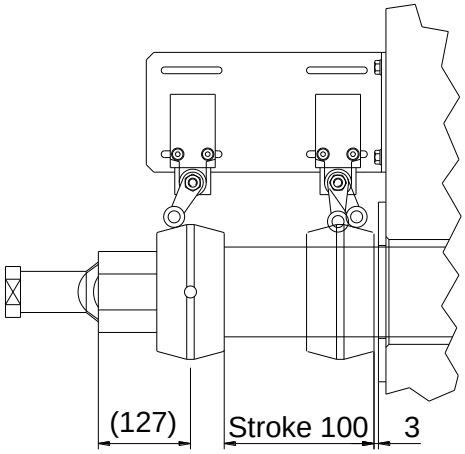
Test Title: Interlocking Device Resp:

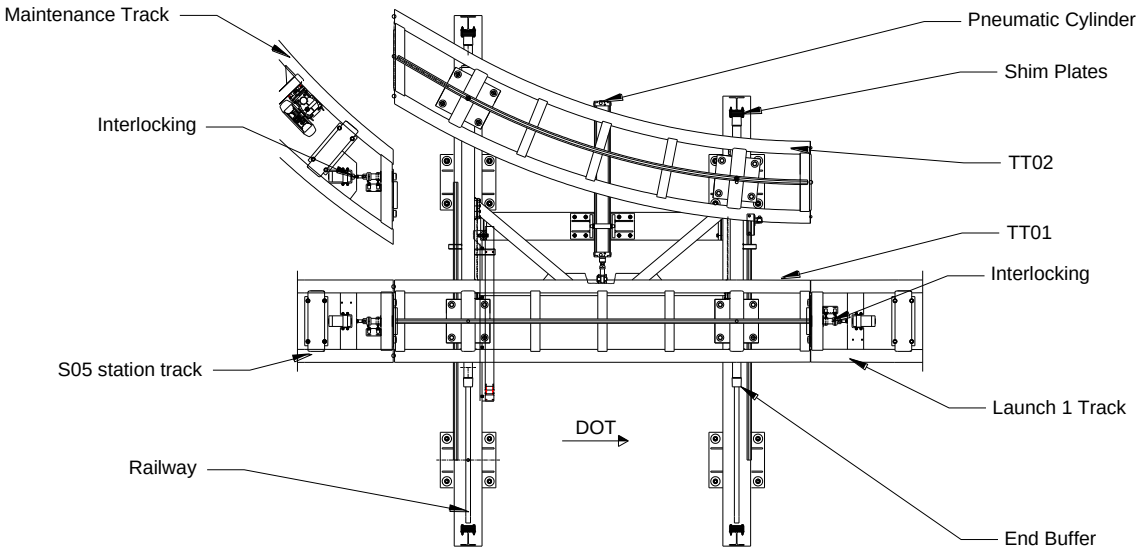
TEST PURPOSE:

- Proper movement of locking pins in all three positions
- Proper hosing (check for leakage under pressure)

TEST CONFIGURATION: (equipment/procedure)







TEST RESULT (criteria) Values (pass/fail):		yes, no			Date/ Tester
- Proper movement of locking pin into housing of brake track without clamping					
- Proper movement of locking pin into housing of station track without clamping					
- Proper movement of locking pin into housing of maintenance track without clamping					
- Proper hosing → no kind of leakage					

- Proper function of end position switches					
INTERPRETATION (qualified):					
Responsible Person: date/sign:			Responsible Person: date/sign:		

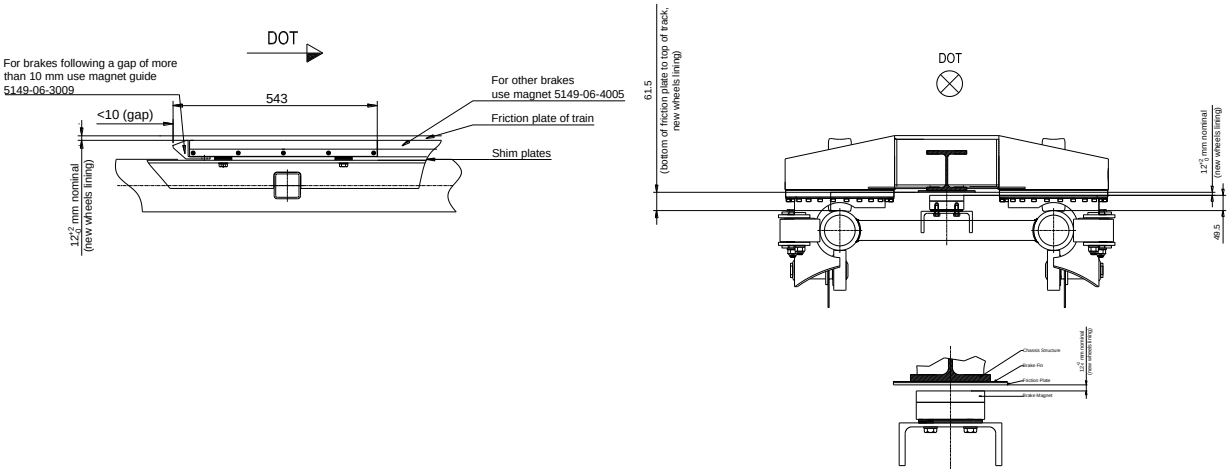
TEST NUMBER: ATP C 5) ☐ Prototype ☐ 1st Article ☐ Acceptance

Subject: Mechanical Components Installation Project: 5224, Snow Ski Launch Coaster

Test Title: Magnet Brake Fix Resp:

TEST PURPOSE:
- Position of the brake magnet
- Dimension
- Bolt torque

TEST CONFIGURATION: Brake number to be found on drawing 5224-06-0001



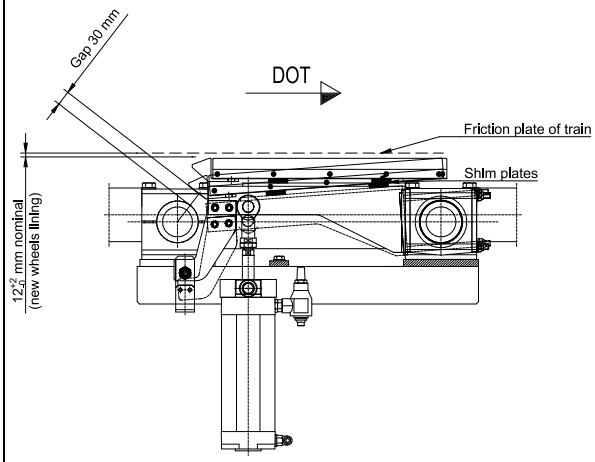
TEST RESULT (criteria) Values (pass/fail):	yes/no	Bolt torque (yes/no)	Symmetrical +/-0.5 mm	Height friction plate 61.5 +/-0.5 mm	Gap 12 +/-0.5 mm	Date/ Tester
Assembly 5224-06-4000 installed (yes/no)						
Fix brake BF01						
Fix brake BF02						
Fix brake BF03						
Fix brake BF04						
Fix brake BF05						
Fix brake BF06						
Fix brake BF07						
Fix brake BF08						
Fix brake BF09						
Fix brake BF10						
Fix brake BF11						
Fix brake BF12						
Fix brake BF13						
Fix brake BF14						
Fix brake BF15						
Fix brake BF16						
Fix brake BF17						
Fix brake BF18						
Fix brake BF19						
Fix brake BF20						

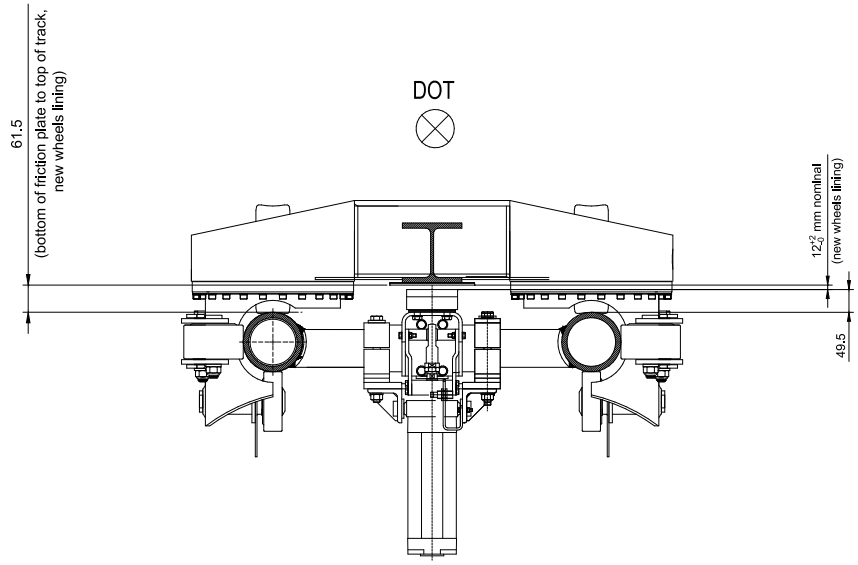
INTERPRETATION (qualified):

Responsible Person: date/sign:

Responsible Person: date/sign:

TEST NUMBER: ATP C 5.1)	☐ Prototype	☐ 1st Article	☐ Acceptance
Subject:	Mechanical Components Installation	Project: 5224, Snow Ski Launch Coaster	
Test Title:	Magnet Brake Movable	Resp:	





TEST PURPOSE:
- Position of the brake magnet
- Dimension, bolt torque
- Proper movement
- No leakage

TEST CONFIGURATION: Brake number to be found on drawing 5224-06-0001

(equipment/procedure)

TEST RESULT (criteria) Values (pass/fail):	yes/ no	Bolt torque (yes/no)	Symmetrical +/-0.5 mm	Height 53.5 +/-0.5 mm	Gap 9 +/-0.5 mm	Date/ Tester
Magnet 5224-06-3000 installed (yes/no)						
Movable brake BS01						
Movable brake BS02						
Movable brake BS03						
Movable brake BS04						
Movable brake BS05						
Movable brake BS06						
Movable brake BS07						
Movable brake BS08						
Movable brake BS09						
Movable brake BS10						
Movable brake BS11						
Movable brake BS12						
Movable brake BS13						
Movable brake BS14 (if installed)						
Movable brake BS15 (if installed)						
Movable brake BS16 (if installed)						
Movable brake BS17 (if installed)						
Movable brake BS18 (if installed)						
Movable brake BS19 (if installed)						
Proper movement						
No leakage						

INTERPRETATION (qualified):

Responsible Person:

date/sign:

Responsible Person:

date/sign:

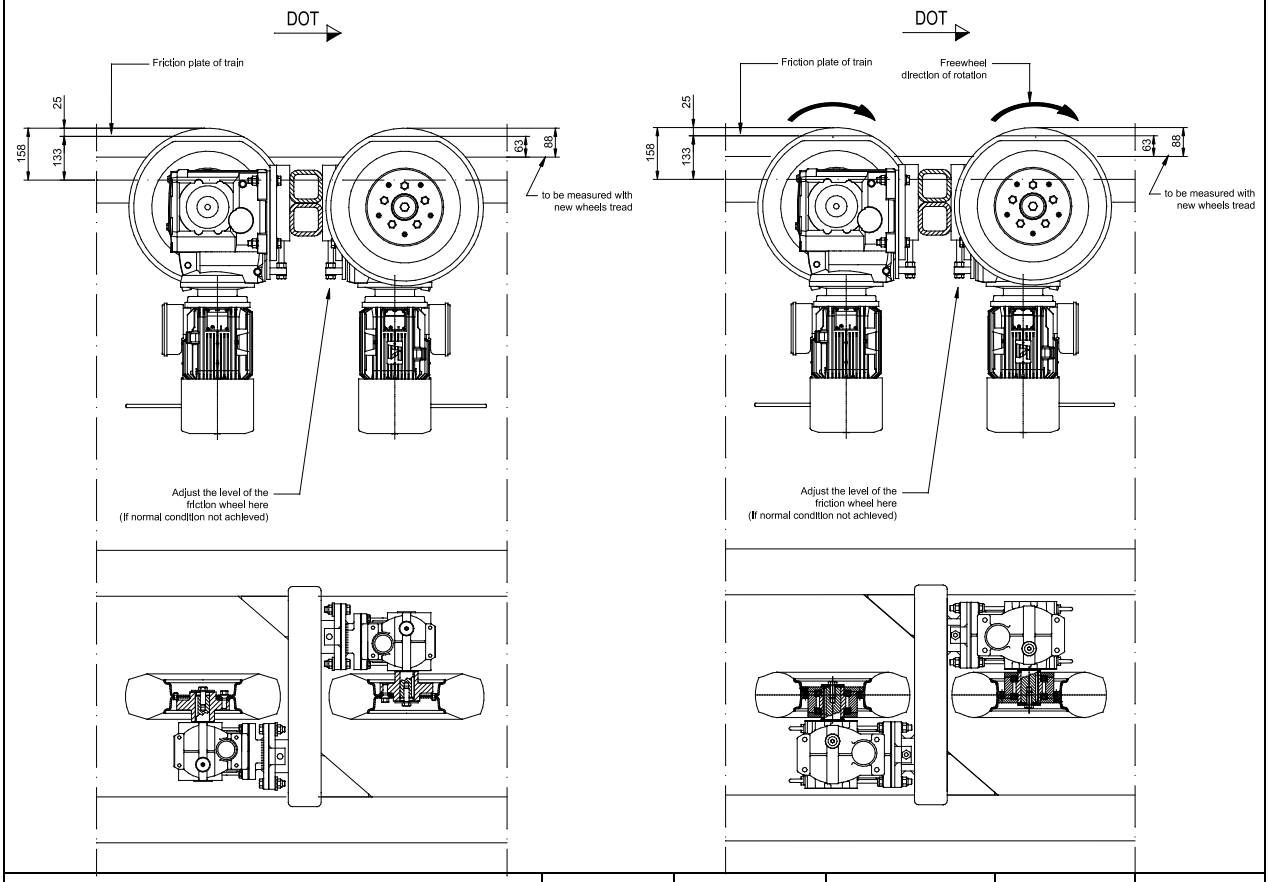
TEST NUMBER: ATP C 6) ☐ Prototype ☐ 1st Article ☐ Acceptance

Subject: Mechanical Components Installation Project: 5224, Snow Ski Launch Coaster

Test Title: Friction Wheels (brake/station) Resp:

TEST PURPOSE: Check installation and alignment of friction wheels

TEST CONFIGURATION: (equipment/procedure)
Wheel number to be found on drawing 5224-06-0003
brake and station:



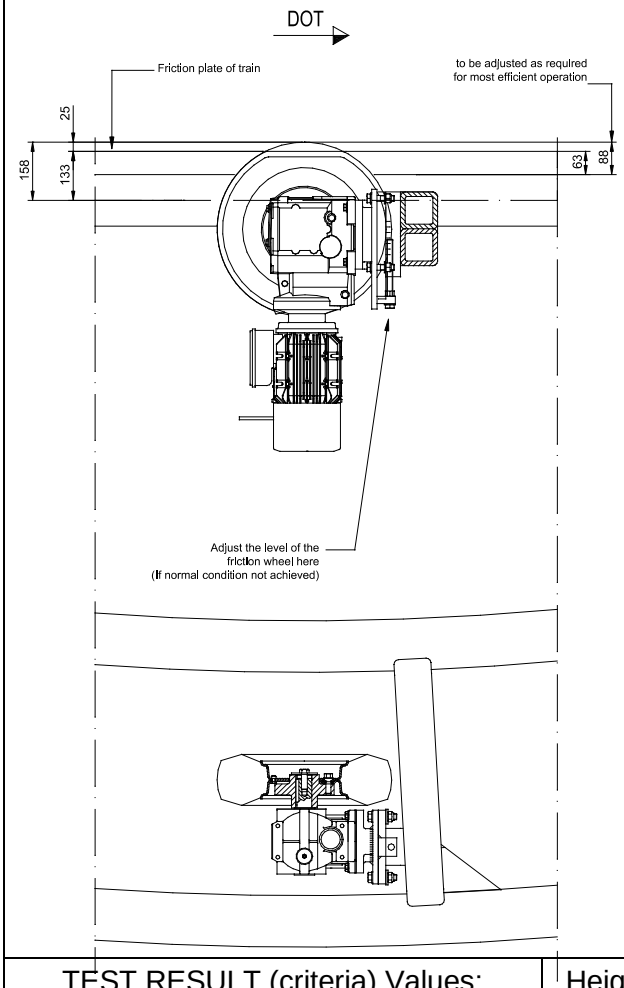
TEST RESULT (criteria) Values:	Height above track 88mm (mm)	Pressure [bar]	Oil filled in (yes, no)	Bolt torque (yes, no)	Date/ Tester
Friction wheel 6.3 kW B01					
Friction wheel 6.3 kW B02					
Friction wheel 6.3 kW B03					
Friction wheel 6.3 kW B04					
Friction wheel 6.3 kW B05					
Friction wheel 6.3 kW B06					
Friction wheel 6.3 kW B07					
Friction wheel 6.3 kW B08					
Friction wheel 6.3 kW B09					
Friction wheel 6.3 kW B10 (if installed)					

TEST RESULT (criteria) Values:	Height above track 88mm (mm)	Pressure [bar]	Oil filled in (yes, no)	Bolt torque (yes, no)	Date/ Tester
Friction wheel 6.3 kW W01					
Friction wheel 6.3 kW W02					
Friction wheel 6.3 kW W03					
Friction wheel 6.3 kW W04					
Friction wheel 6.3 kW W05					
Friction wheel 6.3 kW W06 (if installed)					
Friction wheel 6.3 kW S01					
Friction wheel 6.3 kW S02					
Friction wheel 6.3 kW S03					
Friction wheel 6.3 kW S04					
Friction wheel 6.3 kW S05					
Friction wheel 6.3 kW S06					
Friction wheel 6.3 kW S07					
Friction wheel 6.3 kW S08					
Friction wheel 6.3 kW S09					
Friction wheel 6.3 kW S10					
Friction wheel 6.3 kW L01 (if installed)					
Friction wheel 6.3 kW L02 (if installed)					
Friction wheel 6.3 kW L03 (if installed)					
Friction wheel 6.3 kW L04 (if installed)					
Spinning direction of free wheel correct (yes/no)					
INTERPRETATION (qualified):					
Responsible Person: date/sign:			Responsible Person: date/sign:		

TEST NUMBER: ATP C 6.1)	☐ Prototype	☐ 1st Article	☐ Acceptance
Subject: Coaster	Mechanical Components Installation	Project: 5224, Snow Ski Launch	
Test Title:	Friction Wheels (maintenance)	Resp:	

TEST PURPOSE: Check installation and alignment of friction wheels

TEST CONFIGURATION: (equipment/procedure)
Wheel number to be found on drawing 5224-06-0003



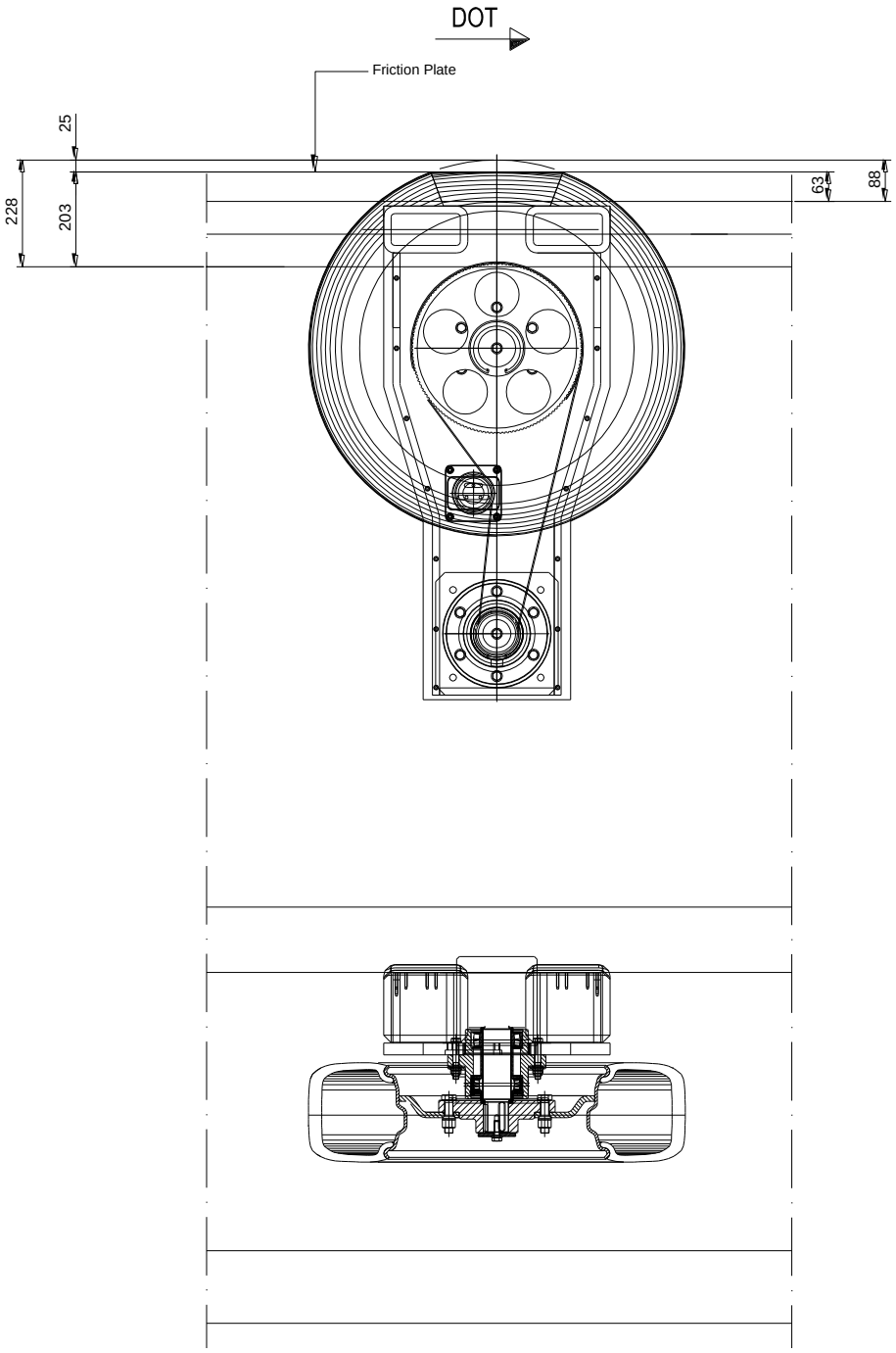
TEST RESULT (criteria) Values:	Height above track 88mm (mm)	Pressure [bar]	Oil filled in (yes, no)	Bolt torque (yes, no)	Date/ Tester
Friction wheel 3.0 kW M01					
Friction wheel 3.0 kW M02					
Friction wheel 3.0 kW M03					
Friction wheel 3.0 kW M04					
Friction wheel 3.0 kW M05					
Friction wheel 3.0 kW M06					
Friction wheel 3.0 kW M07					
Friction wheel 3.0 kW M08					
Friction wheel 3.0 kW M09					
Friction wheel 3.0 kW M10					

TEST RESULT (criteria) Values:	Height above track 88mm (mm)	Pressure [bar]	Oil filled in (yes, no)	Bolt torque (yes, no)	Date/ Tester
Friction wheel 3.0 kW M11					
Friction wheel 3.0 kW M12					
Friction wheel 3.0 kW M13					
Friction wheel 3.0 kW M14					
INTERPRETATION (qualified):					
Responsible Person: date/sign:			Responsible Person: date/sign:		

TEST NUMBER: ATP C 6.2)	☐ Prototype	☐ 1st Article	☐ Acceptance
Subject:	Mechanical Components Installation	Project:	5224, Snow Ski Launch Coaster
Test Title:	Friction Wheels (launch 1 & launch 2)	Resp:	

TEST PURPOSE:
Check installation and alignment of friction wheels
Check alignment of pulley and timing belt

TEST CONFIGURATION: (equipment/procedure)
Wheel number to be found on drawing 5224-07-0001



TEST RESULT (criteria) Values:	Timing belt aligned with shims (yes, no)	Height above track 88mm (mm)	Pressure (bar)	Pretension belt 50-55Hz (yes, no)	Bolt torque (yes, no)	Date/ Tester
LAUNCH 1						
Friction wheel 23.7 kW 01						
Friction wheel 23.7 kW 02						
Friction wheel 23.7 kW 03						
Friction wheel 23.7 kW 04						
Friction wheel 23.7 kW 05						
Friction wheel 23.7 kW 06						
Friction wheel 23.7 kW 07						
Friction wheel 23.7 kW 08						
Friction wheel 23.7 kW 09						
Friction wheel 23.7 kW 10						
Friction wheel 23.7 kW 11						
Friction wheel 23.7 kW 12						
Friction wheel 23.7 kW 13						
Friction wheel 23.7 kW 14						
Friction wheel 23.7 kW 15						
Friction wheel 23.7 kW 16						
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Friction wheel 23.7 kW 30						
Friction wheel 23.7 kW 31						
Friction wheel 23.7 kW 32						
Friction wheel 23.7 kW 33						
Friction wheel 23.7 kW 34						
Friction wheel 23.7 kW 35						
Friction wheel 23.7 kW 36						
Friction wheel 23.7 kW 37						
Friction wheel 23.7 kW 38						
Friction wheel 23.7 kW 39 (if installed)						
Friction wheel 23.7 kW 40 (if installed)						

TEST RESULT (criteria) Values:	Timing belt aligned with shims (yes, no)	Height above track 88mm (mm)	Pressure (bar)	Pretension belt 50-55Hz (yes, no)	Bolt torque (yes, no)	Date/ Tester
LAUNCH 2						
Friction wheel 23.7 kW 41						
Friction wheel 23.7 kW 42 (if installed)						
Friction wheel 23.7 kW 43 (if installed)						
Friction wheel 23.7 kW 44						
Friction wheel 23.7 kW 45						
Friction wheel 23.7 kW 46						
Friction wheel 23.7 kW 47						
Friction wheel 23.7 kW 48						
Friction wheel 23.7 kW 49						
Friction wheel 23.7 kW 50						
Friction wheel 23.7 kW 51						
Friction wheel 23.7 kW 52						
Friction wheel 23.7 kW 53						
Friction wheel 23.7 kW 54						
Friction wheel 23.7 kW 55						
Friction wheel 23.7 kW 56						
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Friction wheel 23.7 kW 73						
Friction wheel 23.7 kW 74						
Friction wheel 23.7 kW 75						
Friction wheel 23.7 kW 76						
Friction wheel 23.7 kW 77						
Friction wheel 23.7 kW 78						
Friction wheel 23.7 kW 79						
Friction wheel 23.7 kW 80						

INTERPRETATION (qualified):	
Responsible Person: date/sign:	Responsible Person: date/sign:

TEST NUMBER: ATP C 7) ☐ Prototype ☐ 1st Article ☐ Acceptance		
Subject: Mechanical Components Installation Coaster	Project: 5224, Snow Ski Launch	
Test Title: Position of Switches	Resp:	
TEST PURPOSE:		
- Proper function of all limit switches		
- Correct position of all switches according to drawings: 5224-09-0100		
TEST CONFIGURATION: (equipment/procedure)		
TEST RESULT (criteria) Values (pass/fail):	OK (yes / no)	Date/ Tester
- Correct position of all switches according to the drawings: 5224-09-0100		
- Proper function of all limit switches		
INTERPRETATION (qualified):		
Responsible Person: date/sign:	Responsible Person: date/sign:	

TEST NUMBER: ATP D 1) ☐ Prototype ☐ 1st Article ☐ Acceptance

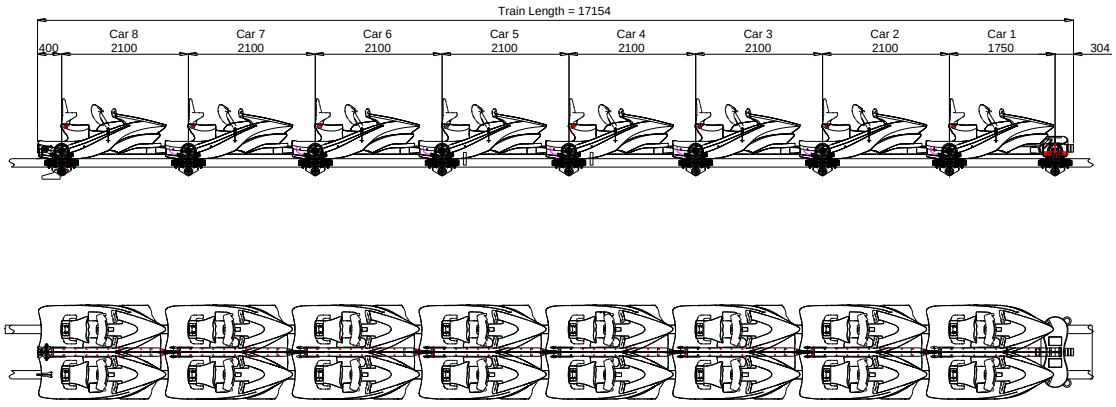
Subject: Train Assembly on Track Project: 5224, Snow Ski Launch Coaster

Test Title: Train Installation on Track Resp:

TEST PURPOSE:

- Order of cars
- Assembly of couplings

TEST CONFIGURATION: (equipment/procedure)



TEST RESULT (criteria) Values (pass/fail):	yes, no	Height above track leveled and at 61.5 +/- 1 mm top of track to bottom of friction surface(yes, no)			Date/ Tester
Order of cars					
Torque rates / stripes at coupling applied					
Position flags installed					

INTERPRETATION (qualified):

Responsible Person: date/sign:	Responsible Person: date/sign:

TEST NUMBER: ATP D 2)	☐ Prototype	☐ 1st Article	☐ Acceptance
Subject: Train Assembly on Track Coaster		Project: 5224, Snow Ski Launch	
Test Title: Train Adjustment Procedure		Resp:	

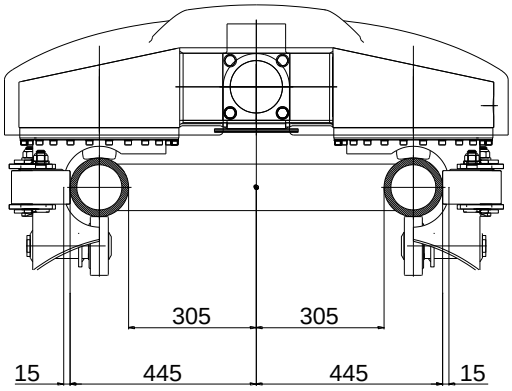
TEST PURPOSE:

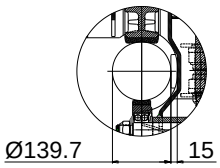
Verify factory adjustment of train

Adjustment of train (lateral adjustment; up-stop wheel adjustment)

TEST CONFIGURATION: (equipment/procedure)

D.O.T.





TEST RESULT (criteria) Values (pass/fail):					Date/ Tester
Record measurement according to separate listing					

INTERPRETATION (qualified):

Responsible Person:	Responsible Person:
date/sign:	date/sign:

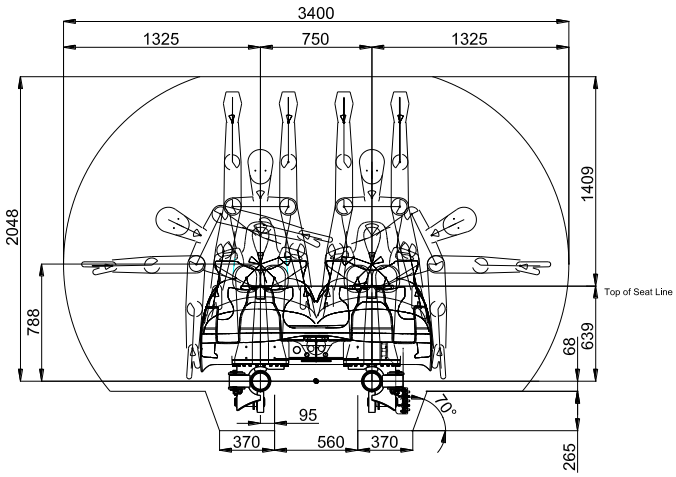
Train Number:

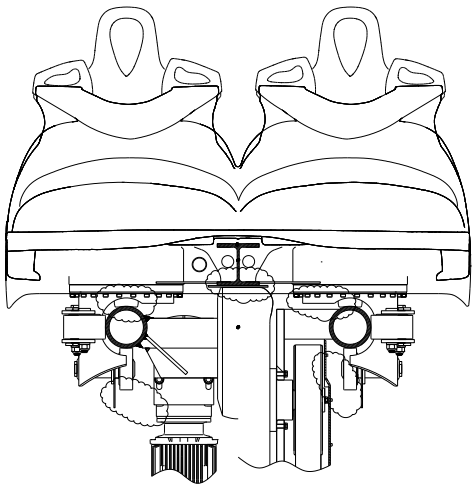
Car No.	Top of track to friction plate	Top of track to friction plate	Friction plate to center of track left side in D.O.T	Friction plate to center of track right side in D.O.T	Clearance bogie to track left side in D.O.T.	Clearance bogie to track right side in D.O.T.	Up-stop wheels pre-tension [kg]
	61.5 +/- 1mm at front of car	61.5 +/- 1mm at rear of car	375 +/- 1mm	375 +/- 1mm	15+/-1mm	15+/-1mm	25 Kg
1					Front Bogie: Rear Bogie:	Front Bogie: Rear Bogie:	Front Bogie: Rear Bogie:
2							
3							
4							
5							
6							
7							
8							

TEST NUMBER: ATP E 1)	☐ Prototype	☐ 1st Article	☐ Acceptance	
Subject: Installation Close Out Coaster		Project: 5224, Snow Ski Launch		
Test Title: Pull through Test		Resp:		

TEST PURPOSE:
- Check clearance envelope, check clearances

TEST CONFIGURATION: (equipment/procedure)





TEST RESULT (criteria) Values (pass/fail):	Track point number	Clearance envelope check OK – yes, no (identify track point if it collides)	Clearance check: Following clearances are of particular interest but not limited to (identify track point if it collides): • Bogie / track (specially in twisted track- and in launch track areas) • Car / track • Train mounted friction plates to track mounted magnets • Train mounted friction plates to track and friction wheels • Within coupling • Flags to sensors • Bogie wheels and bogie components in relation to chassis/FRP cover (especially in twisted track areas) • FRP cover to FRP cover • Front Axle to FRP	Problem solved yes/no

Test completely and successfully fulfilled over complete track length.

Responsible Person: date/sign:	Responsible Person: date/sign:

TEST NUMBER: ATP E 3)	☐ Prototype	☐ 1st Article	☐ Acceptance
Subject: Installation Close Out Coaster		Project: 5224, Snow Ski Launch	
Test Title: G-Force Measurements		Resp:	

TEST PURPOSE:

Weather Condition:	Temperature	Humidity	Wind Speed

Dispatch No.:

Lift exit speed before start of gravity run at top of lift:

Amplifying frequency:

Position of g-force device :

- On one of the two seats of the front car
- On one of the two seats of car 4 and
- On one of the two seats of the end car.

The height position of the sensor must be in the center to the seat back and 600 mm above seat mould area.

Number of sand/water bags :

Position of sand/water bags :

File name :

Ride engineer :

INTERPRETATION (qualified):

Responsible Person:	Responsible Person:
date/sign:	date/sign: