Bedienungsanleitung

Weber
Maschinenbau GmbH

Kopieren verboten

MFG: WEBBER ENG. & MFG. CO. INC.
NAME: 1001 NACHT
TYPE: NON-KIDDIE

1001 NACHT

Bedienungsanleitung

Hersteller:
ALFRED W. WEBER
Maschinenfabrik GmbH & Co.KG
Am Dammacker 9-12
D - 2800 Bremen 1

Contents

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Foreword

The stationary model differs from the travelling model in that the auxiliary hardware for erection and dismantling is not built in or, at the request of the customer, only parts of it are built in.

However, since this auxiliary hardware can be retro-fitted at any time, this operating manual is valid for both versions.

This auxiliary hardware comprises:

1. Centre Section
   - 1.1 Telescopic cylinder for erecting the tower.
   - 1.2 Pump aggregate with oil reservoir, switch box and control system.
   - 1.3 Supporting cylinders in the rear stabilisers.
   - 1.4 Pull-out support cylinders at the front.
   - 1.5 Changeover cocks and piping.

2. Transport Pallet
   - 2.1 Support cylinder with pull-out devices.
   - 2.2 Changeover cocks and piping.

Erection and dismantling of the stationary model is analogous to that of the travelling model.

To lift the components from the transport vehicles and to move them into position, it is necessary to use a crane.

Centre Section: 1 x 31 tons
Pallet with gondola: 2 x 4.5 tons

For the lifting heights and component widths either side of the hook (required length of crane jib) see the sketches in Section I/2.12.

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I. Erection and Dismantling of the Looping Swing

1. Preparation of the Ground - Stationary Model

Preparation of the ground as per Supports plan, Drawing No.
measure out the ground area exactly.
Prepare the points of support.
Determine the relevant heights:

The highest point of the ground within the area where the swing is to be erected determines the height of the supports. See also the instructions under Point I/5.

Although the surface pressure is adequate to set the swing down on normally solid ground, it is recommended to set the bottoms of the supports on a concrete base with frostproof foundations.

2. Preparation of the Centre Section - Stationary Model

2.1 Drive the centre section into position.

2.2 Use a crane to lift the centre section off the transport vehicle and to set it down on the foundations. It may be necessary to use intermediate supports in order to fold out the rear stabilisers and to lock these into position (see also 2.3.)

Overall Weight of Centre Section:

29.0 tons	Own weight
2.0 tons	Additional load (e.g. decorations)
31.0 tons	Gross weight

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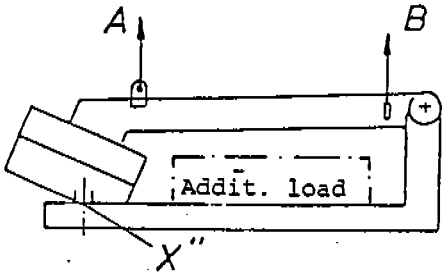
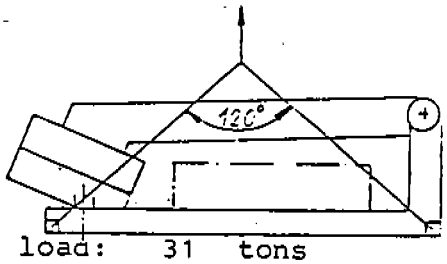
2.2.1 Possible Lifting Arrangements for the Centre Section

a) Lifting the centre section by the transport lugs on the tower

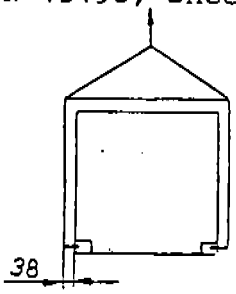


Lifting loads:
A = 2 x 9 tons
B = 2 x 6.3 tons
30.5 tons

b) Lifting the centre section by the standard container corner lifting fittings (DIN 15190, Sheet 3)



Lifting load: 31 tons



When lifting the centre section with a crane, the slings or ropes of the lifting tackle are to be arranged so that they form a spread angle of max. 120° (see sketch). The centre line of the load attachment rope must not be more than max. 38 mm away from the outer wall of the corner lifting fittings.

2.3 Swivel out the rear stabilisers and lock in position.

2.4 Undo the bolt connections between the bearing supports on the hub and the centre section (see Detail X in 2.2.1).

2.5 Attach the crane tackle to the eye lugs on the head of the tower. Required crane lifting force approx. 19000 kg (complete with booms, service platforms, decorations and cloud).

2.6 Lift the tower approx. 1.5 m. (approx. 5 feet). Turn the hub through 90°, so that the flanges for

attaching the arms point left and right.

2.7 For this purpose, use a ratchet to turn one of the electric motors by hand (the motor at bottom right seen from the back).

2.8 Then remove the ratchet and slide in the locking pin to secure the hub against turning while attaching the arms.

2.9 Attaching the Arms:
Using lifting gear, run the arms up to the flange on the hub, making sure that the identification numbers stamped into the metal on the flanges of the arms and of the hub are in agreement. This ensures that the correct arm is fitted on the correct side.

Gently engage the claw parts of the couplings in the corresponding pockets. There is no special alignment of the two coupling halves in a circular direction.

I M P O R T A N T:	Prior to joining the parts of the coupling together, check to make sure that all rubber elements are in position.

2.10 Tighten the fixing bolts between the arms and the hub using a torque spanner.

Tightening torque:	Ma = 1650 Nm
IMPORTANT:	The mating surfaces of the flanges on the arms and the hub must be free of all oil and grease.
Threads greased with MOS 4.	

2.11 Attaching the Boom Decorations:

The boom decorations consist of:
panelling encasing the swing arm
panelling encasing the counterweight

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the cloud including the supporting frame and onion-shaped decorations on the counterbalance arm.

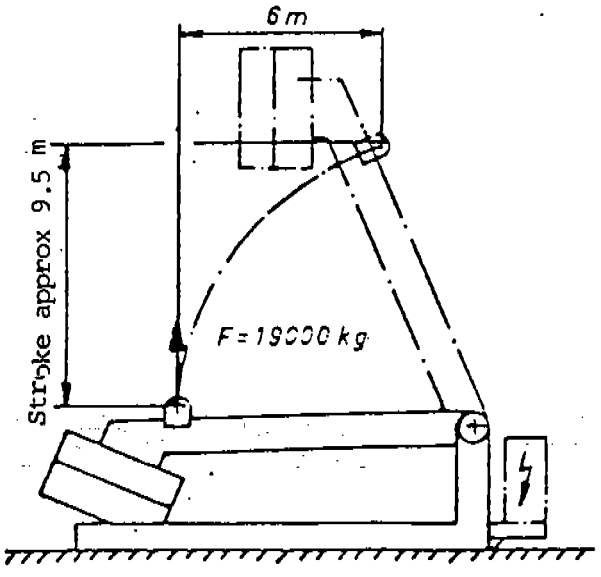
Assembly is carried out in the following sequence:

a) Lock the arms to secure them against turning further (see Point 2.7)
b) Attach the assembly platforms and railings
c) Attach the two top front panelling sections *)
d) Attach the two top side panelling sections *)
e) Attach the balcony
f) Attach the counterweight panelling sections
g) Attach the frame for the cloud
h) Attach the cloud

*) The bottom panelling sections are not attached until the "carpet" has been fitted.

2.12 Use the crane to lift the tower to a position where the outer flanges of the boom are at rightangles to the ground.

Forces and Heights for Erection:



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2.13 Fitting the Pendulum Support:

The pendulum support comprises two parts. Insert the bottom part on its bearing and bolt in position. The top part is attached to the tower. Attach a quick-release locking device of the lifting rope near the bottom mounting fixture of the pendulum support.

Connect the other end of the lifting rope to the tower, release the pendulum support from its holder. Gently lower the pendulum support on the rope and bolt together with the bottom part.

Tightening torque of the fixing bolts: Ma = 800 Nm Threads greased with MOS 4.

If the tower was not lifted high enough to be able to join together the top and bottom parts of the pendulum support, carefully raise the tower to the required height using the crane. When setting the top part of the pendulum support down on the bottom part, it is particularly important to make sure that the top and bottom parts of the pendulum support are in exact flush alignment as otherwise there is a risk of the support buckling when the load is applied.

2.14 Once the pendulum support has been completely assembled and attached, the erection crane can be removed.

2.15 Release the locking pins.

For further handling instructions, see "Travelling Model"

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1. Preparation of the Ground - Travelling Model

Preparation of the ground in accordance with the support plan, Drawing No.
Measure out the ground area covered by the swing.
Prepare the points of support.
Determine the relevant heights:

The highest point in the ground within the area covered by the swing determines the height of the supports. See also instructions under Point I/5.

2. Preparation of the Centre Section - Travelling Model

2.1 Drive the centre section in position.

2.2 Connect up the power supply for the erection aggregate: 380 V 50/60 cps.

2.3 Swing out the rear stabilisers and lock in position.

2.4 Pull out the front lifting device, swing down the supporting cylinders with foot and lock in position.

2.5 On uneven ground and depending on the height of the chassis of the vehicle, it may be necessary to support the hydraulic cylinders of the rear stabilisers with one large and one small support block (base dimensions 1200 x 1200 and 700 x 700). Make sure that the support blocks are exactly positioned on top of each other and that the contact surfaces are clean. If necessary, the cylinders of the front lifting device are supported by a small support block (base dimensions 700 x 700).

2.6 On sloping ground, the support blocks supplied with the swing must in turn be supported, e.g. by suitable shims, so that they are absolutely horizontal.

2.7 On sloping ground make sure that the additional packing under the downslope support blocks is high enough to allow the centre section to be lowered in such a way that there is still a gap of 50 mm between the centre section and the ground.

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2.8 The centre section is raised by extending the hydraulic cylinders. The front support cylinders are automatically synchronised by being connected in parallel whereas the rear stabilising cylinders are operated separately from each other.
By operating the rear cylinders separately (raising and lowering), the centre section must always be kept roughly horizontal.

2.9 Lower the centre section by the following sequence (see sketch).

2.9.1 Raise the centre section and remove the transport vehicle.

2.9.2 Depending on the ground clearance of the vehicle and the nature of the terrain, it may be necessary to push two small support blocks under the centre section at the front and lower the centre section onto these (lower the centre section at the front and the back).
Telescope the cylinders on the lifting device and push the small support blocks from the cylinders of the lifting device backwards under the centre section.

2.9.3 Push the trough-shaped support under the cylinder of the lifting device. Lower the centre section onto the supports at front and rear. Place a small support block under the cylinder of the rear stabiliser and align the supports for operation (see Point 2.10).

2.9.4 Raise the centre section and remove the support blocks from under the centre section.

2.10 Prior to lowering the centre section onto the operating support blocks, the latter are to be aligned and properly levelled using a spirit level (see support plan).

2.11 Place wooden boards (50 mm thick) on the support blocks.

2.12 Lower the centre section onto the operating support blocks.

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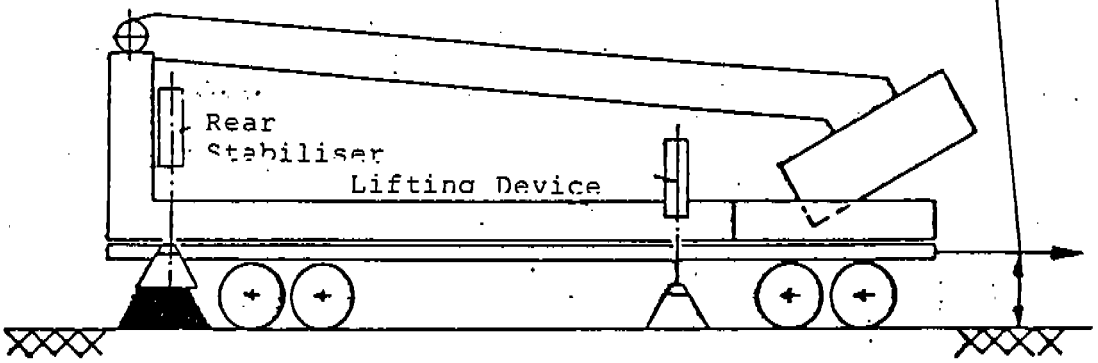
Without additional support 1100
With additional support 1600

2.9.1



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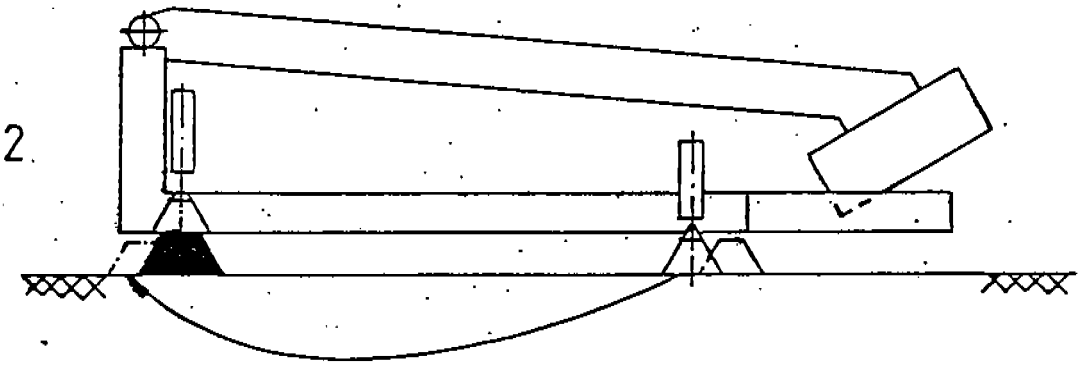

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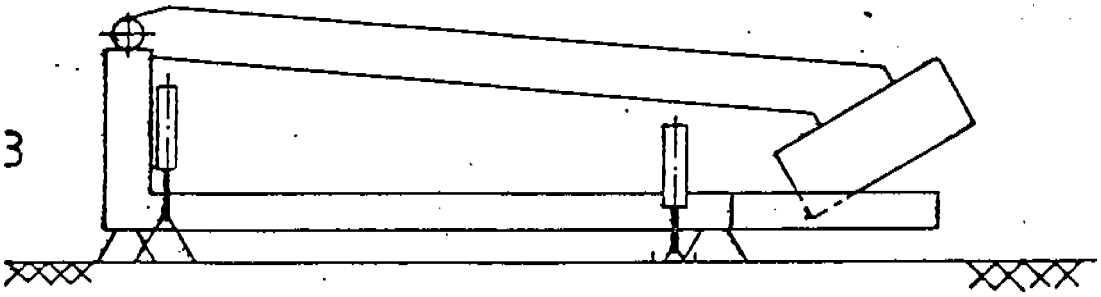

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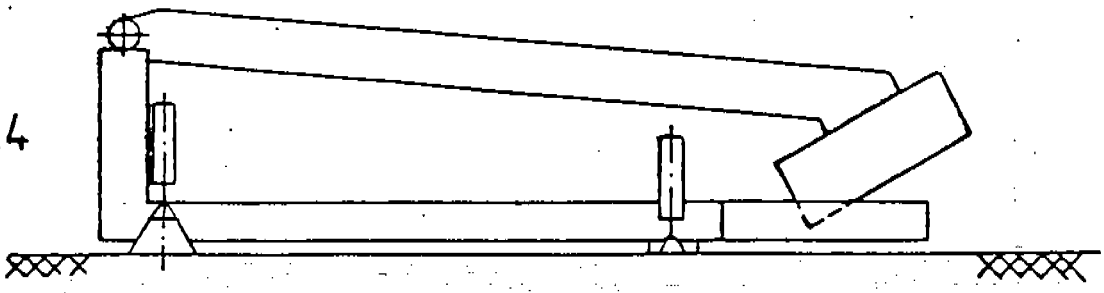

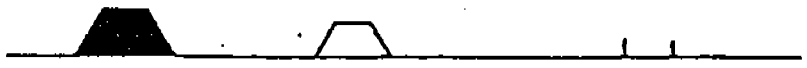

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2.13 Retract the hydraulic cylinders of the rear stabiliser as well as the front lifting device. Release and swivel the outriggers of the front lifting device.

2.14 Undo the transport securing bolts between the tower and the centre section.

2.15 On the centre section near the location of the support, there are two ball cocks.
These ball cocks must be switched over. After switching over the ball cocks, the erection cylinder is connected to the erection hydraulic system.

2.16 Raise the tower approx. 1.5 m.

2.17 Turn the hub through 90° so that the flanges for attaching the arms point tc right and left.

2.18 For this purpose, use a ratchet crank to turn one of the electric motors by hand (the motor at bottom right seen from the back).

2.19 Then remove the ratchet crank and slide in the locking pins to prevent the hub from turning while the arms are attached.

2.20 Attaching the arms:

Use lifting gear to position the arms on the flanges of the hub making sure that the identification numbers stamped into the metal between the flanges of the arms and those of the hub are in agreement. This ensures that the correct arm is attached on the correct side.

Gently engage the claw parts of the couplings in the corresponding pockets.
There is no special alignment of the two coupling halves in a circular direction.

IMPORTANT: Prior to joining the parts of the coupling together, check to make sure that all rubber elements are in position.

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2.21 Tighten the fixing bolts between the arms and the hub using a torque spanner.

Tightening torque: Ma = 1650 Nm IMPORTANT: The mating surfaces of the flanges on the arms and the hub must be free of all oil and grease. Threads greased with MOS 4.

2.22 Attaching the Boom Decorations:

The boom decorations consist of:
panelling encasing the swing arm
panelling encasing the counterweight
the cloud including the supporting frame and onion-shaped decorations on the counterbalance arm.

Assembly of the decorations follows the following sequence:

a) Lock the arms to secure them against turning further (see Point I 2.19)
b) Attach the assembly platforms and railings
c) Attach the two top front panelling sections *)
d) Attach the two top side panelling sections *)
e) Attach the balcony
f) Attach the counterweight panelling section
g) Attach the frame for the cloud
h) Attach the cloud

*) The bottom panelling sections are not attached until the "carpet" has been fitted.

2.23 Erect the tower to an upright position. To do this, extend the telescopic erection cylinder up to the stop.

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2.24 Fitting the pendulum support:
The pendulum support comprises two parts. Insert the bottom part on its bearing and bolt in position. The top part is attached to the tower. Attach a quick-release locking device of the lifting rope near the bottom mounting fixture of the pendulum support. Connect the other end of the lifting rope to the tower, release the pendulum support from its holder. Gently lower the pendulum support on the rope and bolt together with the bottom part.

Tightening torque of the fixing bolts: Ma = 800 Nm Thread greased with MOS 4.

For this purpose, to bridge the air gap, slowly lower the tower by means of the erection cylinder.

2.25 Switch off the erection aggregate.

2.26 Release the locking pins.

3. Installation of the Electrical Switch Box

3.1 Lay the two guide rails on the centre section and secure with pegs.

3.2 Place the switch box at the side of the tower on these rails. The opening for the feeder must be at the front on the cylinder side.

3.3 Roll the switch box into the middle position and secure.

Important! Do not crush cables.

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The drive units are also electrically disabled.
The weight runs back to the starting position.

The procedure for running the counterweight round to the top can be repeated.

ɔ After the system has been locked with the locking pin, it is possible to start attaching the gondola.

1 For safety's sake, switch off the system by operating the key-operated switch.

5.12 On the stationary model, the gondola linkage is now bolted onto the swing arm.

IMPORTANT:
The universal-joint shafts are fitted as follows:

1. Turn top universal-joint shafts outwards up to the stop:
   right-hand shaft to the right
   left-hand shaft to the left
2. Turn bottom universal-joint shafts to the inside up to the stop:
   right-hand shaft to the left
   left-hand shaft to the right
3. Turn bottom universal-joint shafts back by approx. one coupling pocket.
4. Join coupling halves together.
5. When the ship is properly mounted, it should be possible to move it up and down by some 1 - 3 cm at the gondola ends.
   This ensures that there is sufficient play in the teeth.
6. If the ship can be moved by more than approx. 5 - 6 cm, the couplings must be re-adjusted.

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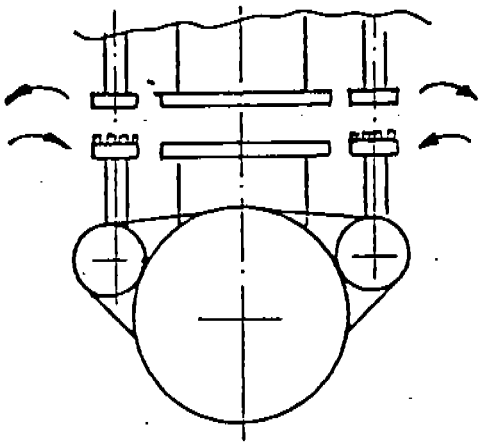

The two rotating parts of the gondola linkage are secured against each other by a locking frame.

The lugs on the locking frame lock into two holes on the flange connection between the swing arm and the gondola linkage.

After the gondola linkage has been attached with the universal joint-shaft coupling inserted without any play, the frame must be removed and the bolted connection must be completed.

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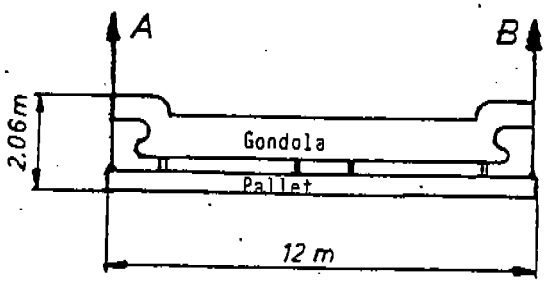
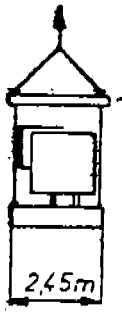
6. Attaching the Gondola-Stationary Model

6.1 Attaching the Figures

6.2 Using two cranes, lift the gondola complete with its transport pallet off the transport vehicle (without the gondola linkage).

Since the centre of gravity does not lie in the middle, the pallet must be lifted by means of a lifting crossbeam, whereby the lifting connection between the crossbeam and the crane hook must be long enough.





Crossbeam
Weights: *)
A = B = approx. 4500 kg
Gondola: approx. 4500 kg
Pallet: approx. 4000 kg
Total approx. 8500 kg

IMPORTANT: For aligning the gondola see "Travelling Model"

6.3 Bring the wheels on the transport pallet into position.

6.4 Set down the transport pallet on the rails of the centre section.

6.5 Push the transport pallet with the gondola under the swing arm.

*) When the gondola linkage is attached, the weights are increased by 2000 kg. A = B = approx. 5,500 kg with a non-central centre of gravity.

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6.6 By means of two cranes, lift the transport pallet and the gondola so that the flange of the gondola comes into contact with the flange of the boom (gondola linkage). This procedure must be carried out with the utmost caution so that no horizontal forces are applied to the boom.

IMPORTANT: The flanges should touch only lightly and as far as possible without any force behind them. Any remaining air gap will be taken up by tightening the fixing bolts.

Tightening torque for the fixing bolts:
Ma = 800 Nm
Threads greased with MOS 4.

6.7 After the flanges have been bolted together, the four fixing pins can be removed.

6.8 Then lower the transport pallet until it rests on the rails.

6.9 Bring the transport pallet into position for mounting the platform and peg in position with locking pins.

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3.4 Establish all cable plug connections.

> Important:
> All cables are numbered. The corresponding numbers are to be found on the lids of the sockets on the switch box as well as on the cables. The numbers correspond to their designations in the cabling plan. All plugs are additionally coded by pins.

Arrangement of the plugs on the switch box base:
Drawing No.: 02.C09.00/03 A1

The plugs are arranged on the switch box base in such a way that all connections that go off to the front are located on the left-hand side of the switch box and all connections to the steel structure of the centre section, to the tower etc. are located on the right-hand side of the switch box base. Three lighting sockets are located at the back of the switch box. The main feeder cable enters the switch box base at its "front" end, i.e. on the side facing the cylinder or the pendulum support.
The plugs and sockets have multiple protection against mistakes in connecting the switch box:

a) Their arrangement according to destination on a particular side of the switch box base.
b) Lettering on both the switch box base and on the cable.
c) All plugs are coded by pins in such a way that they cannot be inserted into the incorrect socket.
d) Identification colours as per drawing no.

e) The main feeder cables and the cable connections to the motors are firmly attached to the switch box by screw connections. The tightening torque for these connections must be adhered to by using a torque wrench.

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3.5 Aligning the Centre Section:

This is best done after the arms have been attached and the electrical connections have been produced.

Carry out two measurements with the spirit level:

a) lateral inclination:

Lay the spirit level in the cutout of the centre section.

b) forward or backward tilt:

Hold the spirit level under the swing arm along the longitudinal axis.

(See diagram overleaf)

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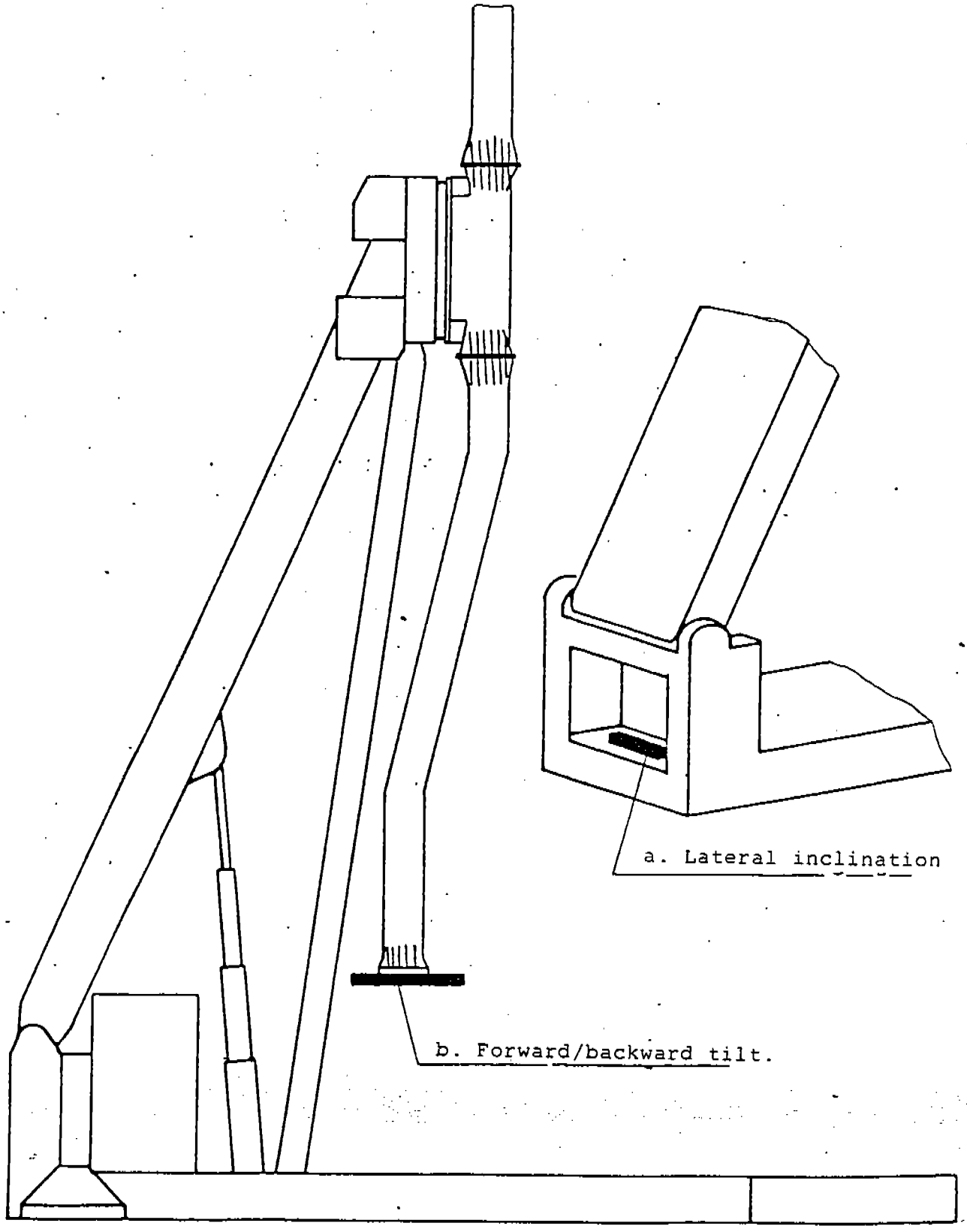

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3.6 Establish the cable screw connections:

a) For main feeder see Point I/4.
Connection via 2 parallel rubber cables:
OZOFLEX HO7 RN-F4G7O

with protective multiple earthing : each of 4 x 70 mm^2
with PE conductor networks : each of 5 x 70 mm^2

b) Motor connections
Connection via 4 pcs. 1 x 95 mm^2

c) Connect the earthing cable coming from the tower to the main busbar (switch box + G1).

I M P O R T A N T!
It is essential to make sure that the cable lugs maintain good contact. This is why the screw connection is tightened with a torque spanner.

Torques:

Main feeder: M_D = 50 Nm (M12)
Motor connections: M_D = 50 Nm (M12)
80 Nm (M16)

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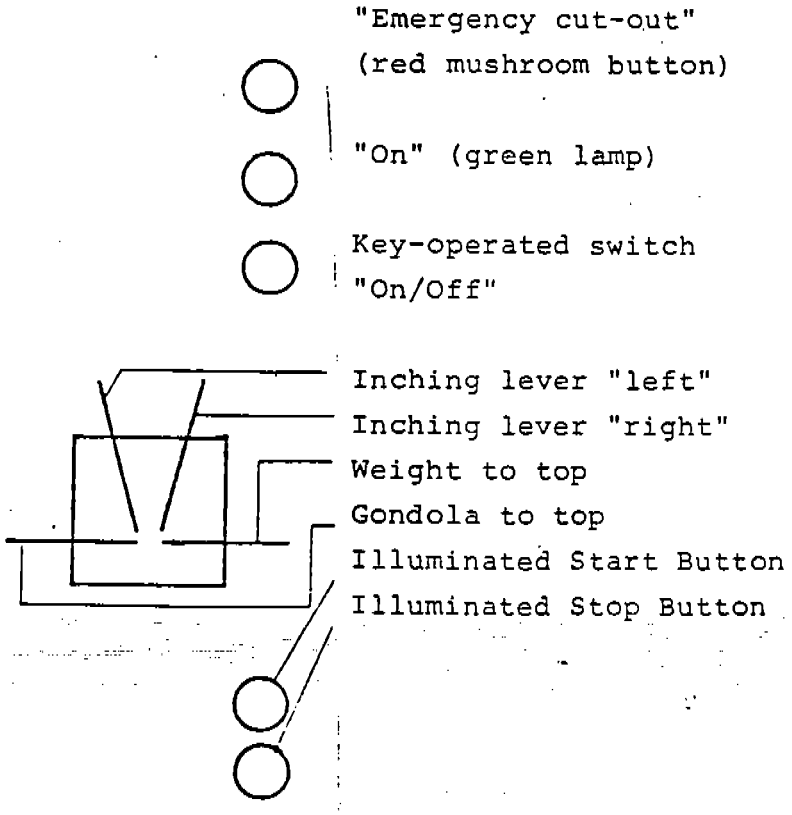
3.7 Connecting the erection control panel:
The plug must be inserted into the bottom section for +G4-X6, which is also used for the main control desk.

3.8 Main switch for drive "ON"

3.9 Manual Control Unit for Assembly and Erection



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Coding and Identification Colours of the Plugs on the Switch Box Base

Plug Designation		Coding, Plug	Colour
+ G1 - X1	16 pole	8 + 16	maize yellow
+ G1 - X2	24 pole	1 + 24	brown
+ G1 - X3	10 pole	5 + 10	black
+ G1 - X4	10 pole	1 + 5	green
+ G1 - X5	6 pole	3 + 6	green
+ G1 - X6	6 pole	1 + 6	maize yellow
+ G1 - X7	10 pole	4 + 6	black
+ G1 - X8	6 pole	1 + 6	pearl white
+ G1 - X9	- pole	-	-
+ G1 - X10	6 pole	-	grey
+ G2 - X1	3 pole	1 + 10	black
+ G2 - X2	3 pole	5 + 6	orange
+ G2 - X3	3 pole	1 + 6	maize yellow
+ G2 - X4	3 pole	10 + 5	green
+ G2 - X5	3 pole	1 + 5	red
+ G2 - X6	6 pole	1 + 3 + 6	red
+ G2 - X7	16 pole	1 + 16	pearl white
+ G2 - X8	3 pole	10 + 6	brown
+ G3 - X1	6 pole	1 + 4 + 6	brown
+ G4 - X1	3 pole	4 + 6 + 6	orange
+ G4 - X2	16 pole	8 + 16	green
+ G4 - X3	10 pole	1 + 10	pearl white
+ G4 - X4	16 pole	8 + 9	black
+ G4 - X5	16 pole	1 + 9	orange
+ G4 - X6	24 pole	1 + 12	maize yellow
+ G4 - X7	24 pole	1 + 13	black
+ G4 - X8	24 pole	12 + 13	pearl white
+ G4 - X9	16 pole	1 + 8	red

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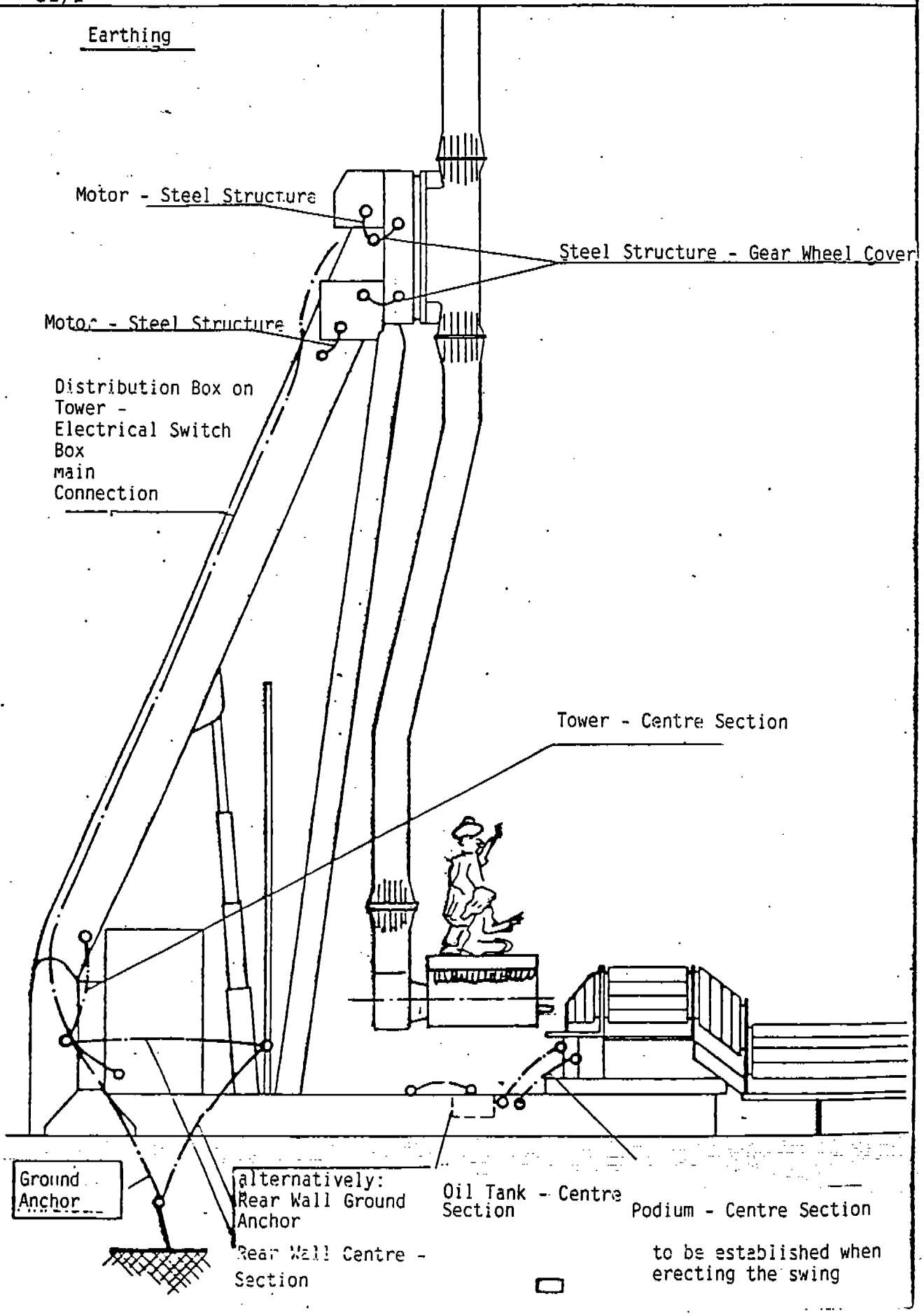
Further Cable Designations:

Shunt Distributor + K3	Poles		Coding - Housing Bottom Section
+ K3 - x 30	6		1 + 4 + 6
+ K3 - x 31	6		5 + 6
+ K3 - x 32	3	500 V	1 + 10
+ K3 - x 300	6		1 + 4
+ K3 - x 301	6		3 + 6
+ K3 - x 302	10		1 + 10
+ K3 - x 303	6		4 + 6
+ K3 - x 304	10		1 + 5
+ K3 - x 305	6		1 + 3
+ K3 - x 306	10		5 + 10
+ K3 - x 307	6		1 + 3 + 6

Shunt Distributor + K6	Poles		Coding - Housing Bottom Section
+ K6 - x 300	6		1 + 4
+ K6 - x 301	6		3 + 6
+ K6 - x 60	6		1 + 4 + 6
+ K6 - x 61	6		5 + 6
+ K6 - x 62	3	500 V	5 + 6

Shunt Distributor + K7	Poles		Coding - Housing Bottom Section
+ K7 - x 300	6		1 + 4
+ K7 - x 301	6		3 + 6
+ K7 - x 70	6		1 + 4 + 6
+ K7 - x 71	10		5 + 6
+ K7 - x 72	3	500 V	1 + 10

Control Panel + P1	Poles	Coding - Housing Bottom Section
+ P1 - x 6	24	1 + 12
+ P1 - x 7	24	1 + 13
+ P1 - x 8	24	12 + 13
+ P1 - x 9	24	1 + 8
+ P1 - x 1	16	8 + 16


Earthing
Motor - Steel Structure
Steel Structure - Gear Wheel Cover
Motor - Steel Structure
Distribution Box on Tower - Electrical Switch Box main Connection
Tower - Centre Section
Ground Anchor
alternatively: Rear Wall Ground Anchor
Rear Wall Centre - Section
Oil Tank - Centre Section
Podium - Centre Section
to be established when erecting the swing

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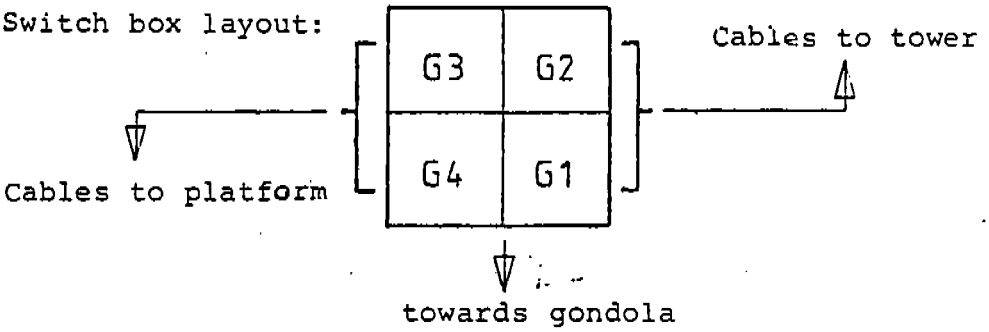
4. Connection of the Feeder Cables

Connect 2 cables of 4 x 70 mm^2 each in parallel to the busbar in the switch box.

Switch box layout:

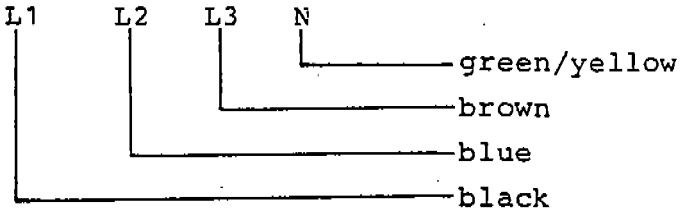


For the earthing connections in the box see the diagram earthing connections between the switch gear, centre section and tower.

A) Protective Multiple Earthing

1. Insert jumper (copper fishplate) between the N bar and the PE bar in Section G1.

2. Connection of the 4-core feeder in the right-hand rotary field.



The system is earthed via the neutral conductor of the Electricity Board.

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B) Fault-Current Protective Circuit

The structure is earthed via its own ground rod.
Earth wire circuit resistance max. 130 ohms.

Earthing line in the structure:

1) Open jumper in cabinet G1 between the N bar and the PE bar.

2) Connection of the 4-core feeder line in the clockwise rotation field

L1 - L2 - L3 - N

3) Connect earth spike to the structure.
1 x 70

5. Attaching the First Counterweight

5.1 Adjust the arms so that the counterweight arm points vertically to the bottom:

a) Selector switch "gondola to top"
b) Briefly press the "Start" button until the "On" signal lamp lights up.
c) Press the "Start" button once more (arms rotate round to the preselected position).
d) The procedure can be interrupted at any point by pressing the "Stop" button.
e) The hold brake engages when the arms are in position.
f) Insert the locking pin.

5.2 Fit the first counterweight and bolt in position.

Tightening torque Ma = 1400 Nm.

5.3 Running the first counterweight round to the top:

a) Pull out the locking pin.
b) Selector switch "Counterweight to top".
c) Briefly press the "Start" button until the "On" signal lamp lights up (if key-operated switch was

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actuated in the meartime), otherwise:

d) Press the "Start" button.
e) The arm tries to move round to the top at crawling speed. If the motion comes to a standstill, the system automatically switches to swing start and the counterweight is automatically stopped at top dead centre (TDC).

5.4 The hold brake on one of the motors automatically holds the weight securely in this position.

5.5 Slide in the locking pin.

> Important!
> Sliding in the locking pin switches off the drive and the brake.

5.6 If the locking pin is not lined up exactly enough with the perforated plate to be slid in, the position can be corrected by inching control.

5.7 Correcting the TDC position

a) Actuate the selector switch: "Inching control right" or "Inching control left".
b) Press the start button.
c) When these inching buttons for assembly work are actuated, the motors run at approx. 5 % of their maximum speed as long as the start button is pressed and develop only 35 % of their maximum torque.

5.8 Should for any reason the counterweight come to a standstill so far before or after the TDC that the hold brake cannot hold it, the brake opens again by having its power supply cut off as soon as the value of max. 2 % of max. speed is exceeded.

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6. Attaching the Gondola (Travelling Model)

After locking the first counterweight into the TDC Position, the next step is to attach the gondola.

6.1 Bolt the gondola linkage onto the side of the gondola via the connection flange of the gondola; d o n o t r e m o v e the adjusting frame.

Tightening torque for the fixing bolt: Ma = 800 Nm
Threads greased with MOS 4

6.2 Attach the figures

6.3 Release the front stabiliser and swivel to one side.

6.4 Drive the transport pallet in front of the centre section at right angles to this.

6.5 Make the electrical connections to the pump aggregate of the transport pallet:
a) Connect cable 28/+G2-X8 to the switchbox.
b) Connect the plug from the hand control unit to the switchbox on the transport pallet.

6.6 Pull out the supporting cylinder of the transport pallet, set this upright and lock in position.

6.7 Align the trough-shaped supports to the horizontal and arrange them in such a way that the rollers of the cylinders of the transport pallet stand roughly in the middle of the trough-shaped supports and parallel to the transport pallet.

6.8 Raise the pallet and remove the vehicle. When raising the pallet, make sure that it is always horizontal.

6.9 Swing the front stabiliser under the pallet and lock in position.

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6.10 Bring the wheels on the transport pallet into position.

6.11 Lower the transport pallet onto the rails of the centre section.

6.12 If on lowering the transport pallet it is found that the wheels are not aligned exactly enough over the rails of the centre section, the pallet must then be shifted to the correct position as follows:

At either end of the transport pallet there are lugs to which lifting ropes or push rods can be attached. If it is not possible to budge the pallet by hand, use the lorry. The running rollers on the cylinders must always be exactly aligned with the direction of pull!

Make sure that there is enough clear length of travel for the rollers in the trough-shaped support.

6.13 Set the pallet down on the rails in its final position and retract the supporting cylinders so far that they cannot touch the ground during the next movement of the transport pallet.

6.14 Push the transport pallet with the gondola and gondola linkage under the swing arm.

6.15 Move the trough-shaped supports to the new position and align correctly.

6.16 Extend the support cylinders once more and using these raise the gondola so far that the mounting flange of the gondola linkage comes to rest gently against the mounting flange of the swing arm.

IMPORTANT: Here, the universal-joint shafts are to be handled as described under 5.12 above.

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6.19.3 Lift the ship by means of the hydraulic cylinders and attach it in as horzontal a position as possible.

6.19.4 After attaching the carpet, check that it is lined up parallel by measuring the distance to the centre section.

If the angle of tilt is too great, repeat the attaching procedure.

IMPORTANT: Observe Section 5.2 and make sure that the couplings are put together in such a way as to be free of play.

IMPORTANT: Although it does not affect proper functioning if the gondola is attached at an angle, the footboard could strike against the platform.

6.20 Move the transport pallet into position for mounting the platform and peg it in position with locking pins.

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6.17 Two drilled holes for bolts in the flange connection between the gondola linkage and the swing arm are blocked by the adjusting frame between the two rotating parts of the gondola linkage. Now remove the frame and insert the remaining bolts.

6.18 When the gondola is finally fixed in position, lower the transport pallet and set it down on the rails. First remove the pegs on the lugs of the gondola.

6.19 Aligning the Gondola When Attaching It to the Swing Arm

6.19.1 Aligning the centre section has been completed.

6.19.2 Aligning the Gondola

a) The locking device between the two parts of the gondola linkage which can rotate in relationship to each other ensures that the top flange surface of the gondola linkage is always parallel to the gondola.

b) The swing arm must be brought to the vertical position.

This can be checked by:

1. measuring the distances from the flanges to the centre section using a tape measure, or
2. by means of a spirit level laid against the flange.

If any correction is necessary, this may only be carried out within the range of play of the locking pin at the head of the tower.

Corrective Action:

On the bottom right-hand motor as seen from the back, there is a four-squared section on the shaft of the electric motor. Turn this squared section using a suitable tool.

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7. Attaching the Second Counterweight

7.1 Key-operated switch "On"

7.2 Release the locking pins.

7.3 If the pins are jammed: Move the ship backwards and forwards by hand to take the strain off the locking pins.

7.4 To run the gondola round to the top, follow the same procedure as for running the first counterweight round to the top.

7.5 The stop brake works in the same way as for running the first counterweight round to the top and again it is important to find the exact position to be able to slide in the locking pin.

7.6 Slide in the locking pin.

7.7 As was the case when attaching the first counterweight, an uncontrolled swing down of this weight or of the gondola does not endanger the overall structure in any way.

7.8 In that case repeat the manoeuvre.

7.9 After locking the swing arm with the locking pin, bolt on the second counterweight.

Tightening torque: Ma = 1400 Nm

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8. Remaining Decorations

Attach the bottom panelling sections.

9. Running the Gondola to the Passenger Access Position

a) Release the locking pin.
b) Selector switch "Counterweight to top"
c) The gondola will stop automatically in the passenger access position (bottom dead centre).

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10. Final Installation Work

10.1 Make sure that the pallet is parallel to the gondola.

10.2 Check the distances between the pallets and the gondola.

a) The height between the footboard and the top edge of the pallet

min. 460 mm

b) The horizontal distance is automatically set correctly by pegging the pallet onto the centre section.

10.3 Place support blocks under the transport pallet in such a way that there is an air gap of approx. 5 - 10 mm between its wheels and the rails on the centre section.

10.4 Set up the platform in accordance with the drawing.

10.5 Attach the railings and panels.

10.6 Put up the cash booth.

10.7 Lay out the cables.

10.8 Connect the main control desk.

10.9 Erect the rear wall and the facade.

10.10 Attach and connect the strip lighting.

10.11 Check the fuses of all plug-and-socket and screwed connections - insofar as these are provided.

10.12 The swing is ready for operation or ready for demonstration to the local building supervisory authorities.

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11. Dismantling the Swing

Dismantling the swing is the same procedure in reverse:

11.1 Run the gondola to the top and detach the first counterweight.

11.2 Run the gondola to the bottom and detach the gondola.

11.3 Run the second counterweight to the bottom and detach.

11.4 Bring the boom to the horizontal and lock.

11.5 Detach the pendulum support.

11.6 Lower the tower.

11.7 Detach the decorations and boom.

Important:	Use locking pins for erection and dismantling work! If this is not done, the unbalanced weight of the counterweight or the gondola could cause these to swing down fast and endanger the fitters.

11.8 To lower the counterweight or to lower the gondola:

a) Actuate the selector switch.
b) Actuate the start button.
The swing starts with 10 % of the max. motor speed.
If the drive switches from driving to braking, the swing runs to bottom dead centre in the same way that it runs to top dead centre during erection.
Should the weight or the gondola not stop immediately at bottom dead centre due to momentum, it swings

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through and then swings back to stop at BDC.

Important: When the locking pin is slid in, this triggers malfunction alarm signal 16 (see malfunction alarm code).
After the locking pin has been returned to the operating position for the next step in installation work, the malfunction must be acknowledged in the switch box and the key-operated switch (On/Off) on the installation panel be actuated.

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II. Description of Function

1. General

1.1 In the pauses between operation phases, the drive motors and also the switchboard must be protected against corrosion damage by anti-condensation heaters.

1.2 To operate the anti-condensation heating, the main light on the switchboard must remain switched on.

1.3 During long periods of storage, the switchboard must remain connected to the normal lighting mains. For this purpose, remove the earthed-contact type plug in cabinet G1 and establish a connection to the lighting mains.

1.4 Also connect the motor cable +G2/X 6 to the lighting mains via an intermediate coupling.

1.5 To start operation, the main switches must be switched on:

1. For installation: the right-hand main switch.
2. For lighting and the caravan: the left-hand main switch.

2. Erection and Dismantling Control Panel

2.1 Connect the control cable for the erection control panel for erection installation on the switch box.

2.2 The control panel for erection and dismantling has one cable and one plug.

2.3 A special changeover switch from "Assembly and Erection" to "Operation" does not exist.

2.4 To run the first counterweight up to the top and also to run the gondola up to the top while the second counterweight is attached, it is necessary to actuate corresponding buttons on the erection control panel. The weight or the gondola then swings until enough energy has been stored to be able to run to BDC in a programmed curve. If the stopping position is not reached exactlty. it can be corrected by using the inching control buttons on the control panel for erection and assembly.

3. Control Desk for Swing Operation

The control desk incorporates the following functions:

a) Current and voltage monitoring for both pairs of motors
b) Diagnostic fittings for monitoring and fault finding.
c) On/Off/Stop/Start
d) Ride control buttons for swinging and looping
e) Stop at top
f) Emergency cut-out button
g) Swing curve selector switch
h) Automatic control selector switch
i) Key-operated switch
j) Light switch
k) Diverse control and signal lamps

4. Seat Safety Bars

Drawing No.

4.1 After the passengers have taken their seats, the seat safety bars are closed from the control desk in the cash booth by pressing the "Start" button.

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4.2 The hydraulic pump in the pump aggregate of the gondola starts up and the magnetic valve which is connected to the pump aggregate releases the flow of oil in the direction of "Close Seat Safety Bars", i.e. retraction of the piston rods on the actuating cylinders of the safety bars.

4.3 When all safety bars are closed, i.e. all safety bars lie snug against the passengers' bodies, the operating pressure builds up until the pressure relief valve is triggered. This pressure is then maintained so long as the hydaulic pump continues to work.

4.4 When sufficient pressure (approx. 15 bar) has been built up, this is signalled via a pressure switch.

4.5 This manometric switch has the effect of stopping the hydraulic pump after approx. 10 secs.

4.6 This signal simultaneously releases the swing for operation.

4.7 The built-up pressure will slowly decrease as a result of normal internal gap losses.

4.8 When the operating pressure has undershot a certain value, approx. 18 bar, the pump is restarted.

4.9 This restart can only occur when the gondola is in motion.

4.10 The pump then works for a preset time of approx. 10 seconds and then switches off automatically.

4.11 Securing the safety bars against inadvertent opening. The safety bars have multiple protection against inadvertent opening:

a) Pilot operated non-return valve common to all cylinders in the pump aggregate.
b) In locked condition, closed control slide valve cuts off the flow of oil.
c) Pilot operated non-return valves in every single cylinder.
d) Automatic restart of the pump whenever the pressure in the pipeline drops.

4.12 A hose break or any other leak in the system would be immediately noticeable by the pump not building up any pressure after the second start and the gondola not starting to move.

During operation, this results in a malfunction alarm.

4.13 Even then, the passengers are still out of danger because every single cylinder has its own non-return valve to isolate it from any leak.

5. Hydraulic System for Centre Section

The hydraulic system of the centre section receives its electricity supply separately and independently of the Siemens main electrical switch box.

Power supply: 380 V/50 or 60 cps.

The manual control unit controls five magnetic valves: one valve per cylinder plus a pressure build-up valve common to all cylinders.

The cylinders on the pull-out cylinder supports at the front are interconnected in such a way that the pressure

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is applied simultaneously and uniformly so that there is no danger of producing torsional stresses in the steel structure as a result of diagonal charging of the cylinders.

The cylinders are lowered (telescoped) via one-way restrictors. If the lowering speed is too great or the lowering procedure oscillates, this can be counteracted by reducing the flow rate of the one-way restrictors.

Each cylinder is fitted with a pipe break safety device so that, in the case of a hose break, the cylinder automatically stops at its current height.

Should a magnet not respond to electrical signals, every magnetic valve on every magnet has a rubber cap for emergency operation by hand. For the erection procedure, the shut-off cocks on the centre section must be switched over so that the hydraulic oil is fed to the telescopic erection cylinder.

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6. Ride Sequence and Procedures

6.1 Start:

When the start button is pressed, the seat safety bars close automatically. When the start button is pressed a second time, the gondola starts to move.

6.2 Stop:

Pressing the stop button triggers the brake. During looping, braking is triggered at top dead centre. The gondola comes to a standstill at approx. 130° on the far side of the circle and from there returns to the passenger access position, if necessary after a short return swing depending on the load. During swinging, braking starts immediately after the stop button is pressed. The gondola returns to the passenger access position after one or several swings depending on the load. As soon as the gondola has come to a standstill in the passenger access position and the stop brake has engaged, the seat safety bars open automatically.

6.3 Swinging:

There is a choice of several swinging curves with limit points at varying heights. These curves can be individually selected. The highest curve reaches the limit/reversal point at approx. 130°.

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6.4 Looping:

Looping always begins by swinging to the maximum reversal points. After these reversal points have been reached at approx. 130°, the control system releases the looping routine which is initiated by pressing the looping button.

If the swings do not reach these reversal points, the looping command is stored until they do.

Looping can be executed clockwise or counter-clockwise from the spectators' point of view.

Following looping, it is possible to select swinging or looping in the other direction by means of the button. The transition is preceded by a stop routine corresponding to the braking manoeuvre. This routine begins at TDC and ends at approx. 130°. From this point, the swing starts looping in the opposite direction or normal end-to-end swinging.

6.5 Automatic Ride Programme:

Set the automatic selector switch to programme 1, 2 or 3 and press the button. The seat safety bars close automatically.
When the start button is pressed again, one of the following routines then runs:

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Program Step	Selector Switch on 1	2	3
Swinging	until 130° are reached on the right side		
Looping clockwise	1 x	2 x	3 x
Stop at top	10 secs.	10 secs.	10 secs.
Looping counterclockwise	1 x	2 x	3 x
Stop at top	-	-	10 secs.
End of program	at BDC, gondola returns to BDC		
Open seat safety bars	a u t o m a t i c		

6.6 Passenger Access Position:

The gondola automatically returns from swinging or looping to the passenger access position. In this position it is safely held by the stop brake so that the passengers can leave and enter the gondola. An inclination of approx. 2° is permissible.

6.7 Emergency stop from looping:

If the emergency cutout button on the control desk or on the switch box is operated, the gondola is returned to the passenger access position by the shortest possible route. Braking begins when the gondola passes through TDC.

6.8 Emergency stop from swinging:

When one of the emergency cutout buttons is operated, braking does not only start at the swing reversal points but also at any point on the swing curve immediately after the button is pressed in order to return the gondola to the passenger access position by the shortest

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possible route.

6.9 Locations of emergency cutout buttons:
1 x main control desk
1 x erection control panel
2 x Siemens switch box

6.10 Power Failure:
The gondola continues to swing down and through under no load until it comes to a standstill. If the gondola is looping at maximum speed at the time of the power failure, it can be expected to continue to loop two or three more times without power until it then swings down and through without power until it comes to a standstill.

Should the emergency stop buttons fail, the key-operated switch must also be operated. The gondola will then swing down and through without power until it comes to a standstill.

6.11 The gondola stops at Top Dead Centre:
Even if there is a power failure, the seat safety bars remain closed. At the end of the counterweight arm, there is a rod between the counterweights. The prepared block and pulley tackle is attached to this and into an eye on the frame of the pallet and is then operated until the gondola starts to move.

Important: Once the gondola starts to move, all persons must leave the danger area immediately.

6.12 Emergency operation of the seat safety bars:
If the cushioned seat safety bars cannot be opened by normal operation, work the emergency pump on the safety bar aggregate by means of a detachable tubular lever.

Bedienungsanleitung

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Important!
The operating personnel must not give the go-ahead for starting the gondola until all seat upholstery and the safety bars have snugged into position.

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III. Exceptional Operating Situations and Malfunctions

1. General

The swing may not be started until all unauthorised persons are within the boundaries set aside for them.

The maintenance personnel must leave the danger area beneath the gondola before the gondola starts to move.

Persons who are in non-cordoned off areas in order to carry out maintenance and adjustment work must make sure that they have constant direct visual contact with the operator of the swing.

A code of signals must be agreed between the operator and the maintenance personnel.

Work carried out on the equipment during operation must be kept to the absolute barest necessary minimum.

To stop the gondola during operation, press the stop button.

The shortest braking distance is produced by the emergency stop button. However this should not be used with passengers in the gondola.

2. Power Failure

In the case of a power failure, the gondola continues to swing until it comes to a standstill. The seat safety bars remain closed. For instructions on how to open the seat safety bars by hand in the case of a long power failure, see Point II 6.12.

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The gondola stops in the 180° position as a result of a technical malfunction:
In this case the counterweight is at the bottom at a height of approx. 6 feet above the platform.
A group of several people must then pull or push until the gondola begins to move.

The force exerted by the people pushing or pulling is not enough:
Attach the block and pulley tackle supplied with the swing into the rod provided for this purpose between the counterweights and tauten the rope.

As soon as the counterweight starts to move, the area under the transport pallet must be evacuated immediately since otherwise there would be a danger of injury by the gondola as it swings down and through.

Important: Never stand on the centre section. Use a rope and pull from a safe distance. Keep escape routes clear.

Store the block and pulley tackle within reach (in the cash booth or under the gondola).

3. Safety Bars Fail to Open:
There is a hand pump on the safety bar aggregate of the gondola. Open the safety bars by means of this pump. In the cover of the central panel there is a slotted hole for attaching the lever of the hand pump.

The lever is detachable and should be kept in the cash booth.

Break in a Hydraulic Hose or Leak in the Actuating Cylinder of a Seat Safety Bar:
Cylinder does not leave the locked position:
Open the venting screw on the cylinder by reaching through the floor plate.

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4. Undefinable Situations

Should operating or danger situations arise in which operators consider it necessary to stop the swing immediately, this can be done by
the normal braking command
or by actuating the emergency cutout switch on the control desk.

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5. Faults

5.1 Fault Signals Programme

The faultless functioning of the electrical and some of the mechanical systems is monitored by the fault signals programme.

Despite the very high quality of the components used, it is never possible to completely exclude faults arising in the course of time.

Existing and developing faults are indicated by lamps and numbers lighting up on the control panel and in the switch box.

> If the fault signals cannot be extinguished by acknowledgement or if the fault is repeatedly indicated, then it is a genuine fault.

These faults are divided into two categories:

1) Faults which interrupt the ride:

   a) By braking the swing via the stop function.
   Fault Nos. 1, 2, 15

   b) By braking the ride via the stop function after a delay of 1 minute.
   Fault Nos. 19, 21, 25

   c) By switching off the drive and thus allowing the ship to swing to a standstill.
   Fault Nos. 3 to 7, 9 to 12, 14, 17, 18, 20, 22, 23, 24, 26, 36, 37

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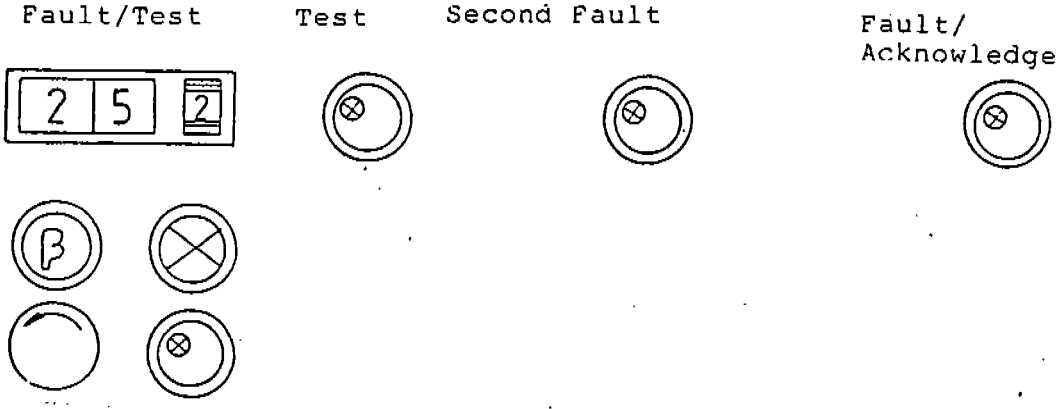
2) Faults which do not interrupt the ride:

a) It is not possible to restart after stopping.
Fault Nos. 13, 16

b) Restarting is generally possible after pressing the fault signal acknowledgement buttons.
Fault Nos. 27 to 35.

The indicating elements for fault signals are located on the left of the control panel below the indicating instruments for current and voltage.



Acknowledge/Signalling Unit

If a fault occurs, the numbers display shows a flashing number between 1 and 37 and the fault/acknowledgement button lights up.

In the case of faults Nos. 1 to 7, 10 to 14, 18, 23 to 26, 32 to 35, the "Acknowledge/Signalling Unit" lights up in addition.

If the signalled fault also triggered further faults or if several faults occur at the same time, the "Second Fault" button also lights up.

5.2 Action to be Taken when a Fault is Signalled

1. Note the number on the flashing display.

2. Press the "Second Fault" button.

3. If the flashing display now shows a different number than before, a secondary fault also exists and the fault No. is indicated as a steady light.

4. Note this number too.

5. Press the "Second Fault" button and proceed as per 2 to 4 above.

6. If, after you have pressed the "Sequential Faults" button, the number shown in the display flashes, then this is the first fault to have occurred and no further faults exist.

7. Press the buttons marked "Fault/Acknowledge" and "Acknowledge/Signalling Unit"

8. If the fault signal goes out after acknowledgement, it is possible to restart ride operations. If not, proceed according to the Fault Finding Guide.

9. Should the same fault occur several times in succession, also proceed according to the Fault Finding Guide.

5.3 Faults Test

5.3.1 Prior to first-time operation on each new site, the manager/operator of the ride must test faults Nos. 1 to 7.

For carrying out these tests there is a small counter wheel within the fault display next to the LEDs, which bears the numbers 0 to 9 and which functions as a selector switch, and to the right of this there is a button marked "Test".

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5.3.2 Test Functions

1 Angle encoder twisted

2 Fault in speed rated value

3 Fault in speed actual value

4 Control monitoring

5 Overspeed (Pulses)

6 Overspeed (speed-sensitive output voltage)

7 Start monitoring

5.3.3 Test Procedure

Set the automatic control selector switch to manual operation.

Tests 1 to 4

For tests 1 to 4, set the counter wheel to the appropriate number.

The test lamp should now flash.

Press the start button. The gondola starts to swing.

Press the test button. In tests 1 and 2, this brakes the gondola and brings it to a standstill. As soon as the gondola has stopped moving, the drive switches off automatically.

In tests 3 and 4, the drive cuts out immediately and the gondola swings free until it stops by gravity. Each test is signalled on the display as a fault, whereby the fault number must agree with the test number.

In addition, the "Fault/Acknowledge" button also flashes.

After each test is completed, press the "Fault/Acknowledge" button and select the next test number. Then proceed as before.

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Tests 5 and 6

Set the counter wheel. The test lamp starts to flash.

Press the start button.

Press the button "Looping right" or "Looping left".

After the first full revolution, press the test button.

The speed should increase.

As soon as the speed is too great, the drive should cut out.

The display should show the same fault number as the number on the counter wheel. The "Fault/Acknowledge" lamp should also flash.

IMPORTANT!
On no account must there be anybody in the gondola during these tests!

Test 7

Set the wheel to test No. 7.

Press the test button and hold it down.

Press the start button while the test button is depressed.

Keep holding the test button down until the fault No. 7 appears

On this test, the gondola will start to move only slowly after the start.

5.3.4 After completing these tests, reset the counter wheel to 0.

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5.3.5 Malfunction Alarm Code

Alarm Signal	Nature of Malfunction
1	Angle encoder twisted
2	Rated value for speed
3	Deviation in actual value for speed
4	Control monitoring
5	Overspeed (pulses)
6	Overspeed (tachometer voltage)
7	Start monitoring
8	not yet assigned
9	Overspeed in top monitoring range
10	Control voltage
11	Power supply "regulation"
12	Fault current protective switch DC drives
13	Fault current protective switch three-phase current drives
14	Phase sequence monitoring
15	Emergency cutout switch operated
16	Locking pin
17	Plug monitoring
18	Power circuit fuse, DC drive
19	Contactor, switch box ventilator
20	Contactor, Simoreg panel
21	Contactor, motor fan
22	Power contactors, DC drives
23	Exciting current monitoring
24	Hold brake monitoring
25	Motor full protective system - warning
26	Motor full protective system - switching off
27	Contactors, seat safety bar hydraulics
30	Operating time, seat safety bars

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5.3.5 Malfunction Alarm Code

Alarm Signal	Nature of Malfunction
1	Angle encoder twisted
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7	Start monitoring
8	not yet assigned
9	Overspeed in top monitoring range
10	Control voltage
11	Power supply "regulation"
12	Fault current protective switch DC drives
13	Fault current protective switch three-phase current drives
14	Phase sequence monitoring
15	Emergency cutout switch operated
16	Locking pin
17	Plug monitoring
18	Power circuit fuse, DC drive
19	Contactor, switch box ventilator
20	Contactor, Simoreg panel
21	Contactor, motor fan
22	Power contactors, DC drives
23	Exciting current monitoring
24	Hold brake monitoring
25	Motor full protective system - warning
26	Motor full protective system - switching off
27	Contactors, seat safety bar hydraulics
30	Operating time, seat safety bars

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32	Contactless limit switch, bottom summit (BDC)
33	Contactless limit switch, top left
34	Contactless limit switch, top summit (TDC)
35	Contactless limit switch, top right
36	Limit indicator
37	Speed with triggered hold brake

5.4 Fault Finding Guide

5.4.1 Abbreviations used

LED = Light-Emitting Diode

CLS = Contactless Limit Switch

BDC = Bottom Dead Centre

FCPS = Fault Current Protection Switch

5.4.2 Proceed as follows for the relevant fault signals:

Signal 01) Check the CLS at BDC for proper functioning.

As long as the gondola stands at the bottom, the red LED on the CLS and the green lamp No. 0 on plugin module -A1.5 in switch box field +G4 must be illuminated. These signals must go out when the gondola leaves BDC; if not, there is a cable break or a loose terminal or the CLS is defective.

If this is in order, check whether there are any signals from the angle encoder. For this, when the gondola is at BDC, the top 8 green LEDs in switch box field +G4, plugin location -A1059 must be out.

If one or more LEDs are on, the angle encoder is defective or twisted or there is a break in a cable.

Check the angle encoder to ensure that it is rigidly mounted. It should not be possible to turn it by hand. Check the coupling to the slipring body.

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Signal 02) Check whether the left-hand red LED B1 on PCB -A1131 in switch box field +G4 lights up briefly.

Check whether the two rows of red LEDs on PCBs -A1059 and -A1071 run parallel. If not, both PCBs must be exchanged. If this does does remedy the error, the fault may also lie in the PCBs -A1083 and -A1091, possibly also in PCB -A1131.

Signal 03) Measure whether there is any speed-sensitive output voltage (tachometer voltage). If this voltage exists, there is a fault in PCB -A1099, which must then be exchanged.

Signal 04) This faults necessitates exchanging PCB -A1107. If this does not remedy the fault, it is essential to refer back to the manufacturer.

Signal 05) If this fault occurs while the gondola is swinging
06) without any excess speed being apparent, the fault may possibly be cleared by exchanging PCB -A1107 (Fault No. 6) or PCB -A1099 (Fault No. 5).

If the speed really is too great, refer back to the manufacturer.

Signal 07) Check whether the isolators Q21/22 have been inserted in switch box field +G2.

During assembly/erection operations, make sure that the stop lamp has gone out before initiating the starting procedure.

Signal 08) Not assigned to a fault.

Signal 09) Occurs through incorrect operation by personnel when the selected curve for swinging does not correspond with the current load in the gondola.

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Signal 10) Check in switch box field +G4 whether the automatic cut-outs F93 and F94 have been inserted. If the cut-outs trigger, check for a short-circuit.

Signal 11) Check in switch box field +G4 whether the motor protection switch Q44 and the automatic cut-out F91 have been switched on.

Check the microfuse in assembly -A1011. If the LED B1 on PC Board -A1131 is lit, a supply voltage is missing. These voltages can be measured in the four jacks (red, black and blue).

Signal 12) Eliminate the earth fault and press in the fault
13) current protection switch.

Signal 14) Check whether the mains voltage is present at the correct strength on all phases.

The mains voltage can be read off in switch box field +G1. The voltmeter can be switched over to the different phases by means of a toggle switch.

Signal 15) Release the emergency cutout switch in the control desk or in switch box field +G1 or +G4.

Signal 16) Check whether the locking pin in the tower head has snugged fully home and whether the corresponding CLS is functioning. The red LED on the CLS must be lit.

Check in switch box field +G4 whether LED 4 on module-A1.5 is lit. If not, there may be a cable break or a loose connection.

Signal 17) Check plugs +G4 - X1, +G4 - X2 and +G4 - X3 to ensure that they are correctly seated.

Signal 18) Check that all phases from the mains supply are available.
Check the fuses in isolators Q21 and Q22 and exchange if necessary.

IMPORTANT: Use only original SITOR fuses.
The main switch for the drive must be switched off while the isolator is inserted.

Press the motor protection switch back in, check fuses F21.1 and F22.1 and exchange if necessary. Check the fuses in isolator Q23 and the automatic cut-out F31.

Signal 19) Check in switch box field +G2 whether the motor protection switches Q42, Q41.1, Q41.2 and the FCPS F41 are switched on and that contactor K41 has energized.

If this is the case, check whether LED No. 0 on module -A1.7 and LED No. 1 on module -A2.7 are lit.

If not, there is a contact fault, e.g. cable break, loose terminal etc.

Signal 20) Check in switch box field +G2 whether the automatic cut-out F34, the motor protection switches Q43, Q34.1 and Q34.2 as well as the FCPS F34.1 are switched on.

Contactor K24 must have de-energized.

Contactor K34 must have energized.

LED No. 1 on module -A2.7 must be lit, as must also LED No. 1 on module -A1.7.

If these are not lit, this indicates a contact fault, e.g. cable break, loose terminal etc.

Signal 21) Check in switch box field +G2 whether the automatic cut-out F32, the motor protection switches Q32.1, Q32.2, Q32.3 and Q32.4 are switched on.

Check plugs +G2 - X1, +G2 - X3 and +G2 - X4 to ensure that they are correctly seated.

Contactor K32 must have energized.

LED No. 4 on module -A2.7 and LED No. 5 on module -A1.6 must be lit.

Signal 22) Check in switch box field +G4 whether contactor K25 has energized and whether the automatic cut-out F91 is switched on.

LED No. 4 on module -A1.6 and LED No. 0 on module -A2.7 must be lit.

Signal 23) Check whether the ammeter registers exciting current.

The rated value is 6 amperes.
Check in switch box field +G4 whether LED No. 3 on module -A1.7 is lit.

If the LED is not lit and no exciting current is present, refer back to the manufacturer.

Signal 24) Check in switch box field +G4 whether LED No. 7 on module -A2.7 and LED No. 4 on module -A1.8 are lit.

In the gondola position in which the brake is to hold the gondola, both LEDs must be lit, otherwise they must both be out.

If this is not the case, check for correct seating of plug +G4 - X3, check current relay F1 in switch box field +G4. Ascertain whether there is a contact fault e.g. cable break, loose terminal etc. and whether the voltage to the brake is operative.

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Signal 25) Check the motor temperature.
26)

In the case of fault signal 26, the signalling unit F20.3 in switch box field +G2 must be reset (press button R).

Signal 27) Check in switch box field +G2 whether the automatic cut-out F33 and the motor protection switch Q33.1 are switched on.

Check plug +G2 - X5 for correct seating.

Contactor K33.1 must have energised.

LED No. 5 on module -A2.7 and LED Nr. 6 on module -A1.6 must be lit.

Signal 30) Check whether the seat safety bars execute the movement demanded by the control command.

When the seat safety bars are closed, the lamp on the control desk must light up.

Check the proper functioning of the CLSs on the footboard by approaching them with a piece of steel.

In the gondola check whether the valve plugs are receiving voltage and whether the valves switch.

Check whether the pressure switches at front and rear in the gondola switch when the seat safety bars close.

Signal 32) Check the proper functioning of the CLSs by approach-
35) ing them with a piece of steel.

Check the feeder cable for a contact fault, e.g. cable break, loose terminal etc.

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Take special note of possible second faults, since these CLSs monitor each other.

Signal 36) In switch box field +G4, the LEDs Nos. 0, 1 and 2 on module -A1.9 must not be lit at the same time for more than 2 secs. If this overlapping time is longer, there is a malfunction in assembly -A1115 or assembly -A1123.

Signal 37) Check whether fault signal 24 is operative at the same time (press Second Faults button). If not, test whether this signal appears on the next attempt to start. If so, the control system of the brake must be checked.

CYCLO GEAR CONSTRUCTION, LORENZ BRAREN KG

8062 Markt Indersdorf near Münich

RECOMMENDED LUBRICANTS FOR CYCLO GEARING

Gearing Size/Type	Type of lubricant DIN 51502	Ambient/ Operating Temperature	ARAL	AVIA	BP	ESSO	Klüber	Mobil	Shell
Sizes 2-14	Fluid Gear Grease								
	G-P 0 h	from 0°C to +80°C	ARAL Grease FDP 0	AVILUB Grease N 6	BP ENER-GREASE HT 0	FIBRAX EP370	ST 15/ 400 EP	Sovarex Grease LO, Mobilplex 46	Shell Retinax G, Shell Special Gear Grease H

Lubricating Instructions

Cyclo standard gearing is filled with suitable grease at the works. On request, Cyclo gearing of sizes 4 to 14 can also be designed for oil lubrication.

In the case of extreme ambient and/or operating temperatures, e.g. radiation heat or heat from hot media supply lines, it is essential to refer back to Cyclo!

If the Cyclo gearing is at a standstill for any longer period of time, it is recommended that it be filled with motor corrosion protection oil HD SAE 30.

Lubricants of different manufacturers should not be mixed; this is particularly important in the case of greases.

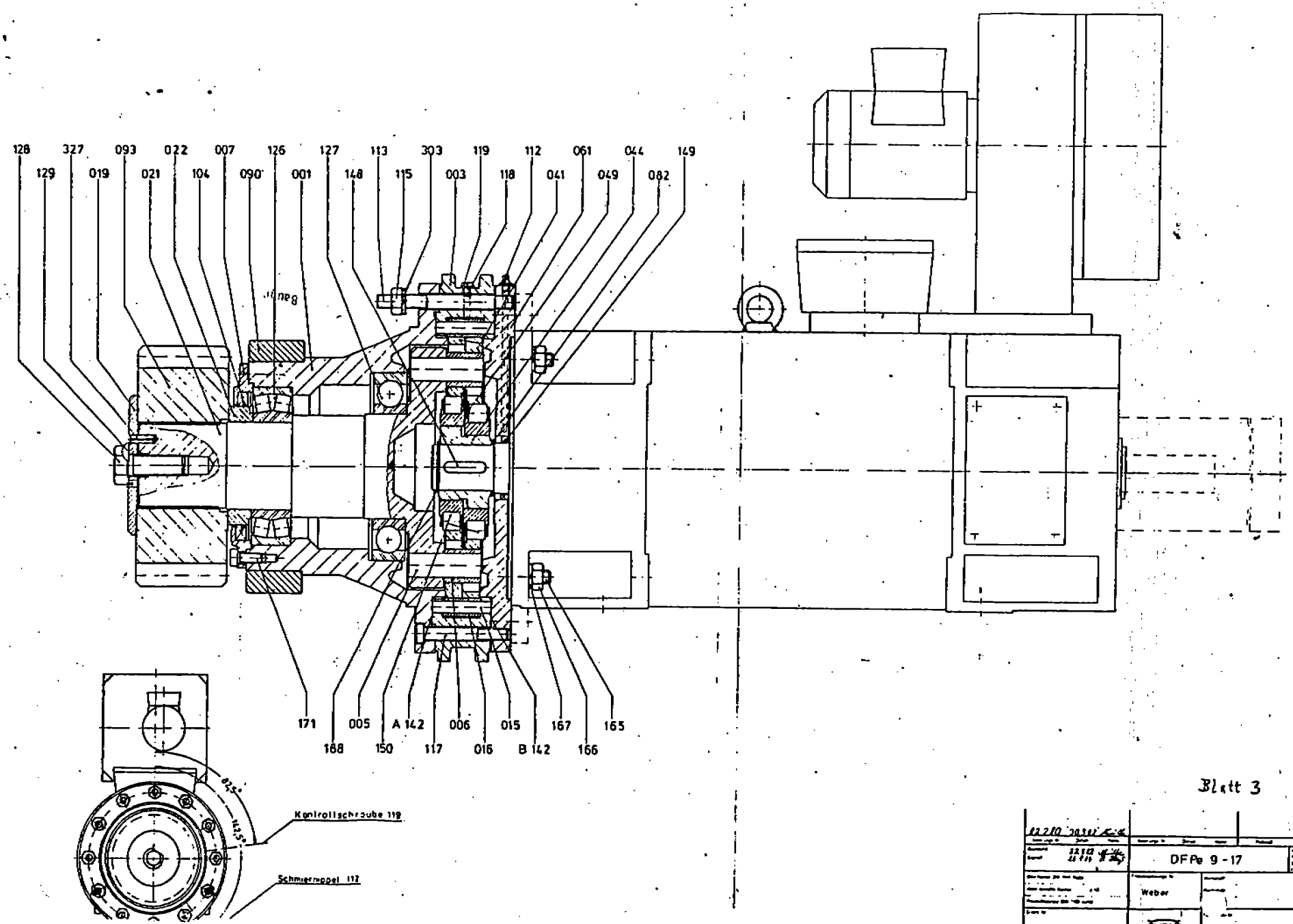
Always clean the gearing thoroughly prior to re-filling!

Lubricant Quantities for Cyclo Gearing

Size of Gearing	V7	V8	2	3	4	5	6	7
horizontal ccm	4	3	120	230	320	500	1000	1300
vertical ccm	4	3	140	280	400	600	1200	1600
Size of Gearing	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**-**
horizontal ccm	2000	2800	4500	6700	9300	12600	18500	
vertical ccm	2400	3400	5400	8000	11000	15200	22000	

In the case of multi-stage gearing, the required amount of lubricant must be determined for each stage!

*) = Available at filling stations



Blatt 3

DFPe 9-17

Weber

CYCLO

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IV. Maintenance Instructions

1. Important Maintenance and Cleaning Instructions

1.1 Bearings, electric motors, electric switchboards, magnetic valves, limit switches, distribution boxes and sockets must not be cleaned using steam jet blowers or aggressive cleansing agents or solvents.

1.2 After cleaning, bearings must be regreased in order to restore corrosion protection.

1.3 Electrical connections, distribution boxes etc. must be reclosed with great care after they have been opened.

Packing boxes/glands must be resealed with silicon rubber if necessary.

IMPORTANT:
During winter storage, the motors and the electrical switch box must be protected by connecting the anti-condensation heating. This is done by connecting cable +G2-X6 as well as the earthing contact type plug. If it is not possible to connect a power supply to operate the anti-condensation heating, the motors must be packed and protected against moisture with silica gel.

A number of bags containing silica gel must also be placed in the switch box.

For winter storage, it is recommended to place the electrical switch box in a closed room and to protect it from lengthy periods of exposure to temperatures of under approx. 20° C.

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1.5 Checking the Universal-Joint Shafts

The universal-joint shafts are dimensioned so that only one train of shafts would be necessary to transmit the forces.

The second shaft arrangement serves:

a) as an additional safety factor for the swing,

b) to eliminate play between the drive to maintain parallel alignment, so that is is always possible to guarantee smooth functioning of the parallel alignment maintenance system without any play.

c) In addition, the particularly smooth running of this machinery is due to 2 puncture-proof elastic couplings, the rubber elements of which are exchangeable (see Maintenance).

IMPORTANT: Note:

I. The swing must not be operated with only one operative shaft arrangement.

II. The perfect technical condition of the shafts must be checked at regular intervals as described below.

TEST: Raise and lower the gondola at the footboard end.
Permissible play:
approx. 3 - 4 cm.

1.6 Run test programs 1 - 7 every day prior to operating the swing with passengers.

1.7 Capture on switching off the drives, e.g. as a result of overspeed etc.:

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Actuate the desired ride control or stop button. If mains voltage is present, the swing will return to a controlled ride.

1.8 IMPORTANT!

Persons may not be present and no work may be carried out on the service platform at the back of the cloud unless

a) the main supply voltage and lighting voltage are switched off

b) the locking pin is inserted.

To compensate for settling movements, it is necessary to re-tighten screwed and bolted connections with the prescribed tightening torque.

At the time of tightening, the screw connections must be free of all tensile stresses and external forces.

The screwed and bolted connections should be checked for correct tightening force with a torque wrench every 500 hours of operation but in any case after every lengthy period of non-use (e.g. winter).

The following connections must be checked:

1. Mounting of the ball-and-socket joint
   Axle holder - Hub
   Tightening torque 400 Nm

2. Flange screw joint on the
   gearbox/electric motor combination
   Tightening torque 400 Nm

3. Mounting of the roller swivelling joint
   Gondola suspension - Intermediate flange
   Tightening torque 520 Nm

4. Mounting of the supports of the cardan shafts
   on the tilting arm - hub - gondola suspension
   Tightening torque 160 Nm

5. Flange mounting of the angular-gear
   on the hub and on the gondola suspension
   Tightening torque 80 Nm

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2. Lubricating Instructions

	Lubricating and Maintenance Period:
2.1 Large Top Drive Ring on the Hub	
Toothing, accessible through the flap in the protective box, lubricate at slow speed.	Daily, but at the latest when bare metal patches are seen on the sides of the teeth.

Procedure:

1. Run the gondola to TDC.

   ("Start" button + "Stop at Top" button)

2. Press the button "Looping Right" or "Looping Left", depending on which side of the drive ring is to be lubricated.

3. As soon as the gondola has started to move:

   Press the "Stop" button

   Then the gondola will run down towards the bottom in the correct direction with controlled braking.

Lubricant:	see Table
Drive Ring Ball Bearings:	2 x weekly (approx. every 30 - 40 hours of operation) approx. 3 cm^3 of grease per greasing nipple

Lubricant:	Universal rolling bearing grease or see Table of Lubricants

2.2 Parallel Drive

Toothing for the parallel position maintenance drive in the tower and on the gondola linkage:	Daily or after max. 10 hours of operation
This toothing is not visually accessible. For this reason, greasing is via greasing nipples.	
There are 2 nipples located next to each Wagner gearing set.	Daily press in approx. 4 - 6 cm^3 grease in each nipple and then run the swing through several revolutions right and left under no-load.

Drive Ring Ball Bearings

In the bearing on the gondola linkage	2 x weekly (approx. every 30 - 40 hours of operation) approx. 3 cm^3 grease per greasing nipple
Lubricant:	Universal rolling bearing grease or see Table of Lubricants

2.3 4 pcs. Cyclo Reduction Gearing

on the tower	annually
(flange-mounted onto the Siemens electric motors)	see separate maker's manual

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2.4	4 pcs. Wagner Gear	
	on the parallel position maintenance drive:	
	2 x on the hub 2 x on the gondola linkage	
	These gears are hermetically sealed to be pressure-tight and can thus be operated in any position	Oil level up to oil level sight glass Oil capacity per gear 2.5 l
	Lubricant:	see separate maker's manual
		Change the oil once a year
2.5	Universal-Joint Shafts	
	Slide Block	Maintenance-free
	Universal Joints	annually
	Lubricant	Universal grease
2.6	Other Plane Bearings	periodically
	Lubricant	Universal grease
2.7	Hydraulic Circuits	
	Cleanliness is the most important precondition for reliability and a long service life.	
	Seat Barriers	
	in the carpet (gondola)	Check oil level daily

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	Lubricant	Hydraulic oil, see Table of Lubricants
	Assembly Hydraulic Systems	
	On travelling models, in the centre section or in the transport pallet of the ship	Check oil level prior to each assembly
		Hydraulic oil, see Table of Lubricants
2.8	Electric Motors	periodically
	Depending on the climate or the location where the ride is operated, the motors must be blown through from time to time with dry air. Make sure that the ventilation apertures are kept clean	regularly
	Greasing the bearings of the main motor after approx. every 2000 hours	
	Lubricant	Multi-purpose rolling bearing grease
	Motors without greasing facilities are fitted with encapsulated bearings pre-greased for the service life of the bearing	
	Open Bearings such as articulated joints, hinges and pins on supports etc.	periodically
	Lubricants	Multi-purpose grease

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Slip Ring Assembly:

Rolling bearings are permanently greased.
Regrease after dismantling.

Lubricant: Multi-purpose grease

Carbon Brushes

Check for wear of the brush itself, check that all links and joints run easily — periodically

IMPORTANT: Check only when de-energised.

Fixing Bolts

For tightening torques and instructions — see overview drawing

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Maintenance Regulations for Slip Ring Assembly

Maintenance covers

a) slip rings
b) brush holders
c) brushes

a) Slip Rings

The slip rings must always have a smooth and clean surface. It is essential to keep them free from dust and grease. If this cannot be done to the required degree, the slip rings and brushes must be cleaned at regular intervals. For the same reasons, do not use contact grease. Rough areas on the slip rings must be smoothed in good time using fine carborundum cloth; the grinding dust must then be removed.

b) Brush Holders

The brush holders must be firmly seated on the pin. When connecting the brush holder cables, make sure that the clamping screw, which also serves as the terminal screw, does not become loose.

It must be possible to move the brush holder arms at the joints without exerting force. A medium amount of play in the joint is less risky than too little play.

Defective brush holder springs must be exchanged immediately.

c) Brushes

The brushes must be checked at regular intervals; however this must be done without taking them out of the brush holders. This maintains the good contact between the slip ring surface and the brush.

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When setting a new brush on the surface of the slip ring, make sure that the brush immediately obtains an adequate grinding surface in order to avoid undue wear on the brushes and the slip rings.

To achieve this, wrap fine carborundum cloth around the slip ring under the brush and turn the slip ring. The grinding dust must then be removed. It is essential not to mix brushes of different makes, since the different properties of the brushes will make current distribution uneven and result in the brush with better conductive properties being exposed to greater wear.

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Recommended Grease for the Toothing of the Parallel Position Maintenance Drive

a) Toothed ring on the gondola linkage

b) Toothed ring, built into the inside of the tower

Makers	Type
Carl Bechem GmbH Weststraße 120 5800 Hagen-Vorhalle Tel. 02331 / 30 70 96	Berulit 443
ARAL	Aralub LFZ 1
SHELL	Shell Grease S 8327
BP	Long-service grease

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3. Table of Lubricants

3.1 CYCLO Rotation Gearing

Gear grease (fluid) G-Poh from 0° to +80° C

Aral	FDP O grease
Avia	AVILUP N 6 grease
BP	BP ENERGREASE HT O
ESSO	FIBRAX BP 370
KLÜBER	ST 15/400 EP
Mobil	Sovarex Grease LO, Mobilplex 46
Shell	Shell Retinax G,
	Shell Special gear grease H

Recommended Lubricants for the Track and Toothing for INA Rotating Gear

Make	Lubricant for Track	Lubricant for Toothing	Temperature Range °C permanent	Temperature Range °C short-term	Thawpoint °C	Worked Penetration
Aral	Grease HL 2	Sinit FZ 12 Grease LFZ	-35/+120	-35/130	190	265-295
BP	Energrease LS 2	Energol WRL	-35/+120	-35/130	190	265-295
Castrol	Spheerol AP 2 Spheerol APT 2	Grippa S	-20/+120 -20/+120	-20/130 -20/130	195 180	265-295 280
Esso	Beacon 2	Surret Fluid 30	-30/+120	-30/125	185	265-295
Gulf	Crown Grease No. 2	Lubcote No. 2	-30/+120	-30/130	195	277
Mobil	Mobilux 2	Mobil-tac E	-30/+130	-30/140	182	265-295
Shell	Alvania Grease	Cardium Fluid D Fluid 12	-20/+115	-20/130	185	265-295
Texaco	Multifak 2	Crater 2 X Fluid	-20/+120	-20/130	200	265-295
Valvoline	LB-2	FGC	-25/+110	+120	180	260-280

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3.3 Rolling Bearings and Plain Bearings, General

Multi-purpose Rolling Bearing Grease

3.4 Hydraulics

ISO Viscosity Class DIN 51 519	ISO VG 68
Agip	Agip OTE 68
ARAL	Aral Kosmol TL 68
AVIA	AVILUB Turbine Oil CS
BP	BP Energol THE 68
Castrol	PERFECTO T 68
Chevron	Chevron OC Turbine Oil 68
ECUBSOL	on enquiry
ELF	ELF MISOLA H 68
ESSO	TERESSO 68, TRO-MAR T 68
FINA	FINA BAKOLA 68
Fuchs	RENOLIN DTA 20
Gulf	Gulfcrest 68
Mobil	Mobil D.T.E. Oil Heavy Medium
Optimol	on enquiry
Shell	Turbo Oil T 68
SUNDCO	SUNDVIS 931 ISO 68
TEXACO	Regal Oil R & O 68
TOTAL	Total Preslia 68
VALVOLINE	VALVOLINE Turbine Oil 3 S
WISURA	WISURA DT 68

TABLE OF LUBRICANTS FOR WAGNER REDUCTION GEARS

The oil quality marked with • is suitable for gear unit type KP 285
Drive speed n_1 = 1400 rpm
oil ca. 3 Ltr.

important for operation!

This table is to be given to the operator before the gear unit is put into operation as the gear unit is supplied without oil. Do not fit couplings, spur gears or discs on to the shafts by hammering as the bearings may break. They should be fitted in to position by means of the tap holes in the shafts.

Mark with • acc.	Type of gear unit	Viscosity cSt at 40°C E at 50°C	Type of lubrication	Type of bearing	ESSO	MOBIL OIL	SHELL	ARAL	BP
	Turbo gear unit Spur gears	45–55cSt (4–5E)	Pressure lubrication. Oil from gear unit itself, otherwise oil from the circulating oil of the corresponding turbine. Filter cooler	Anti-friction bearings (roller bearings) Same oil as in gear unit. Pressure lubrication.	NUTO H46	MOBIL DTE OIL Medium	Tellus Oel 46	Degol BG 46	Energol GR-XP 46
	Light design. Spur gearing. Bevel and spur gearing	45–80cSt (4–7E)	Oil bath lubrication Pressure lubrication at v > 8m/sec	Roller bearings. Same oil as in gear unit	SPARTAN EP 68	MOBILGEAR 626 MOBIL DTE 26	Omala 68	Degol BG 68	Energol GR-XP 68
X	Medium design. Spur gearing. Bevel and spur gearing.	95–130cSt (8–10E)	Oil bath lubrication at v < 8m/sec. Pressure lubrication at v > 8m/sec	Roller bearings	SPARTAN EP 100	MOBILGEAR 627 MOBIL DTE 27	Omala 100	Degol BG 100	Energol GR-XP 100
	Heavy design. Spur gearing. Bevel and spur gearing. Worm spur gearing. (very slow speed)	130–190cSt (10–14E)	Pressure lubrication with pump and filter cooler	Roller bearings with pressure lubrication	SPARTAN EP 150	MOBILGEAR 629	Omala 150	Degol BG 150	Energol GR-XP 150
	Worm gearing	200–260cSt (15–20E)	Oil bath lubrication (Pressure lubrication)		SPARTAN EP 220	MOBILGEAR 630	Omala 220	Degol BG 220	Energol GR-XP 220
	Slow running worm gearing	320cSt (24E)	Oil bath lubrication		SPARTAN EP 320	MOBILGEAR 632	Omala 320	Degol BG 320	Energol GR-XP 320
	Grate drive - lower part	460cSt (33E)	Oil bath lubrication	Roller bearings	SPARTAN EP 460	MOBILGEAR 634	Omala 460	Degol BG 460	Energol GR-XP 460
	Grate drive - lower part	680cSt (47E)	Oil bath lubrication	Roller bearings	SPARTAN EP 680	MOBILGEAR 636	Omala 680	Degol BG 680	Energol GR-XP 680

Proper lubrication with selected lubricants and the application of suitable types of hydraulic oils are essential for good operation, efficiency and trouble free operation of the gear units. The above table shows lubricants suitable for the various gear units. In case other lubricants are used, these must correspond in quality to the above mentioned products. (Valid for normal room temperatures and completely oil-tight enclosed gear units with pressure or oil bath lubrication).

	Datum	Name			
gezeichnet	17.1.83	Schumacher	WAGNER	Ausgabe-Nr.	Pause-Nr.
geprüft	11.1.87				

Technical Product Information

Mounting Instructions for Slewing Rings

Cleaning of the Slewing Ring

Corrosion protection coatings must be washed off the slewing ring before mounting. Suitable media are acid and water free paraffin or conventional grease solvents which should be applied with a brush. Solvents must be prevented by all means from entering the raceway system of the slewing ring. Therefore excessive solvent must be wiped up with a lint free cloth.

Markings

The so-called hardness gap (unhardened section between beginning and end of raceway hardening) is marked by an INA symbol or the plug in the filling hole in the case of four point contact ball bearings (type V) and crossed roller bearings (type X).

The point at which the maximum run-out occurs on the pitch circle diameter of slewing rings with gear teeth is marked with green paint. The backlash must be adjusted at this point during mounting.

Checking of the Supporting Structure

The supporting surfaces for the bearing rings must be cleaned and any foreign matter, like paint, welding beads, etc. must be removed. The supporting surfaces must be flat. The existing flatness and angularity deviation must be determined and compared with the permissible value δ_B.
The maximum permissible flatness and angularity deviation is:

- for four point contact ball bearings $\delta_{B\,V} = \frac{D_L + 0{,}5}{10}$ [mm]
- for crossed roller bearings and double direction thrust-radial roller bearings $\delta_{B\,X,Y} = \frac{D_L + 1}{20}$ [mm]

The value D_L (= pitch diameter of the rolling elements) must be put into the equations in **metres**. The rolling element pitch diameter is coded in the second group of four digits in the slewing ring designation e.g.:
Designation:

VA 40 1213 N
- N: normalized gear teeth
- 1213: pitch diameter of rolling elements [mm]
- 40: diameter of rolling element
- VA: with external gear teeth
- four point contact ball bearing; type V

The permissible flatness and angularity deviation δ_B should occur only once through a sector of 180° steadily rising or falling similar to a sine curve.

The angular deviation based on a flange width of 100 mm should not exceed half the value of δ_B. For other flange widths the permissible angular deviation must be determined by extrapolation.

Selection of Fixing Screws

The slewing ring must be fastened with the screws specified in the catalogue, limiting load diagram, drawing or technical data sheet. The specifications regarding the required number, quality and size must be observed not only to ensure the durability of the screw connection but also to guarantee the proper function and service life of the slewing ring.

If screws of a quality ≧ 8.8 are used, special consideration must be given to the permissible surface pressure of the bearing rings and of the supporting structure. Because of the high screw tensioning forces there is a risk that the maximum permissible surface pressure will be exceeded. This is 500 N/mm² for standard bearing rings and 900 N/mm² for bearing rings of quenched and tempered steel. For supporting structures of St37 to DIN 17100 (or 40D to BS 4360) the permissible surface pressure is 300 N/mm² and for supporting structures of St52 to DIN 17100 (or 50D to BS 4360) it is 500 N/mm². Therefore washers of quenched and tempered quality must be used in cases where the maximum permissible surface pressure may be exceeded.

If screws of quality 10.9 or 12.9 are used, quenched and tempered washers must be used under the screw heads and nuts. Washers may be dispensed with on the slewing ring side only when quenched and tempered bearing rings are used.

Mounting of the Slewing Ring

Place the slewing ring on the supporting structure. The bearing ring which is subjected to point load must be positioned so that the marked hardness gap is offset by 90° to the most highly loaded zone of the slewing ring. At the same time care must be taken that the bearing rings are supported over their whole width by the flanged rings of the supporting structure.

Fixing of the Slewing Ring

When the slewing rings have a bearing ring with gear teeth, the plain ring should be fixed first. Insert all

screws together with washers if required, and tighten only slightly. Then turn the loose ring (in the case of slewing rings with gear teeth, the gear ring) several times and tighten the screws of the fixed ring in a cross-wise sequence and preload them to the specified value. Between each cross-wise tightening sequence the loose ring must be rotated through several screw spacings.

The screws should be tightened with a torque wrench which has an accurate indicator, e.g. with dial gauge. The screw threads should be slightly oiled in order to avoid differences in the coefficient of friction. Both these measures prevent unacceptably high variations in the screw tensioning forces which are usually due to inaccurate torque wrenches or differences in the coefficient of friction. Table 1 lists the specified torque values for screws ≦M30.

For screws >M30 it is recommended to tighten with a hydraulic tensioning device. The screw tensioning forces which must be observed (preload based on 90 % of the elongation limit) are indicated in table 2. If a torque wrench has to be used because a hydraulic tensioning device is not available, the torque values must first be determined by test (see INA publication TPI 19).

The correct preload provides sufficient security against loosening. Therefore INA Slewing Rings need no further security. **Under no circumstances should locking washers or spring washers be used.**

The other (gear) ring must then be screwed to the supporting structure, if possible in the same manner.

After tightening both bearing rings, the backlash of the slewing ring gear teeth must be checked at the point marked green and set to a value (0,03 to 0,04) · module.

Table 1 Tightening torque values for fixing screws ≦ M 30

Screw quality/ size	Tightening torque M_A [Nm] [1]		
	8.8	10.9	12.9
M 6	9,5	13,5	15,7
M 8	22,5	32,4	38,7
M 10	45,0	63,0	75,6
M 12	77,4	109	131
M 14	122	176	207
M 16	194	270	324
M 18	261	369	441
M 20	369	522	630
M 22	504	711	855
M 24	639	900	1080
M 27	945	1305	1575
M 30	1260	1800	2160

[1] M_{sp} according to guideline 2230 of the VDI (Association of German Engineers) for $\mu_K = 0{,}14$
= F_{sp} with $\mu_G = 0{,}125$; $M_A = 0{,}9 \cdot M_{sp}$

Table 2 Screw tensioning forces where hydraulic tensioning devices are used

Screw quality/ size	min. A_S [1]	min. A_3 [1]	$F_{sp} = 0{,}9 \cdot F_{02}$ [kN]		
	mm²	mm²	8.8	10.9	12.9
M 24	335,4	304,5	193,2	271,7	326,0
M 27	439,8	404,4	253,4	356,3	427,5
M 30	537,2	491,5	309,4	435,1	522,2
M 33	667,5	616,5	384,5	540,7	648,8
M 36	785,7	723,2	452,6	636,4	763,7
M 39	942,6	873,2	542,9	763,5	916,2
M 42	1083	999,2	623,7	877,1	1053
M 45	1265	1174	728,5	1025	1230
M 48	1426	1320	821,5	1155	1386
M 52	1707	1590	983,0	1382	1659
M 56	1971	1833	1135	1597	1916
M 64	2599	2426	1497	2105	2526

[1] A_S and A_3 to DIN 2510 sheet 2

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V. General Remarks

1. List of Weights of the Main Components

Centre section		
Assembled for transport approx.		31,000 kg
Gondola		4,800 kg
Transport pallet		3,500 kg
Transport pallet + gondola		9,000 kg
Swing arm		2,850 kg
Gondola linkage		2,000 kg
Counterweight arm		2,700 kg
Counterweights	2 x	2,700 kg
Electrical switch box	approx.	1,800 kg

2. Any snow or ice must be removed on each occasion that the swing is put into operation.

3. For the tightening torques of the screws, see the overview drawing.

4. All load-bearing components and drive components must be checked at regular intervals to ensure that they are in perfect condition.

5. Supports

The supports are to be inserted at the locations indicated in the support plan.
The support dimensions are valid for a permissible foundation pressure of max. 15 N/cm^2.
The supports must be kept as low as possible.
They must be solid, and must have a stable footing.
If necessary, they must be secured by ground anchors etc.
Protect against the soil being washed away from underneath by rain, running water, etc.
Sloping sites should be graded as far as possible prior to installing the swing.

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For anchoring of the rear wall see Drawing No.

6. Produce the earthing.

7. In the case of equipment whose dimensions, capacities etc. are regulated by the authorities, the official regulations must be observed.

8. Prior to operating the swing with passengers:

   a) The operating personnel must be thoroughly familiarised with the equipment and the operating instructions.
   b) A number of no-load ride programmes must be carried out every day prior to operation in order to check that the swing is ready for operation.

9. The swing and its equipment must be supervised at all times during operation. Any defects that arise must be remedied immediately; if necessary, operation must be terminated.

10. The gondola may be loaded with max. 40 people (calculated load per person = 75 kg). As far as possible, the load must be evenly spread (symmetrically on either side of the longitudinal axis and on either side of the transverse axis).

11. The supervising personnel must ensure that the passengers do not move onto the platform from which the gondola is entered until the gondola has come to a standstill and the passengers of the preceding ride have left the gondola.

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12. The operator may not start the ride until:

    a) all passengers are sitting on the seats,
    b) all seat safety bars have been hydraulically closed,
    c) the passenger entry and exit platforms have been cleared of all passengers.

13. If tumultuous crowds of people mean that there is a danger of people being pushed into the space normally occupied by the passenger gondola at BDC, operation must be stopped.

14. The seat safety bars must not be opened until the gondola has been run to the 0° position or within the stated tolerance.

15. Leaning out of the gondola, stretching out arms and legs, and taking animals, umbrellas, sticks and other bulky or sharply pointed objects into the gondola is prohibited.

16. Children under 8 years of age may not use the ride. Drunken persons are to be refused admittance to the ride.

17. The regulations as per 15 and 16 above must be prominently displayed on a notice.

    Furthermore, for operating the ride, the pertinent regulations, Points 5.1.1, 5.1.2, 5.1.6 and 5.1.8 of the "Guidelines for the Construction and Operation of Flying Structures" must be observed.

18. At wind speeds of force 8 or higher on the Beaufort scale (corresponding to a wind speed of approx. 70 km/h) operation of the ride must be discontinued.

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Foreword

The stationary model differs from the travelling model in that the auxiliary hardware for erection and dismantling is not built in or, at the request of the customer, only parts of it are built in.

However, since this auxiliary hardware can be retro-fitted at any time, this operating manual is valid for both versions.

This auxiliary hardware comprises:

1. Centre Section
   - 1.1 Telescopic cylinder for erecting the tower.
   - 1.2 Pump aggregate with oil reservoir, switch box and control system.
   - 1.3 Supporting cylinders in the rear stabilisers.
   - 1.4 Pull-out support cylinders at the front.
   - 1.5 Changeover cocks and piping.

2. Transport Pallet

   - 2.1 Support cylinder with pull-out devices.
   - 2.2 Changeover cocks and piping.

Erection and dismantling of the stationary model is analogous to that of the travelling model.

To lift the components from the transport vehicles and to move them into position, it is necessary to use a crane.

Centre Section: 1 x 31 tons
Pallet with gondola: 2 x 4.5 tons

For the lifting heights and component widths either side of the hook (required length of crane jib) see the sketches

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I. Erection and Dismantling of the Looping Swing

1. Preparation of the Ground - Stationary Model

Preparation of the ground as per Supports plan, Drawing No.
measure out the ground area exactly.
Prepare the points of support.
Determine the relevant heights:

The highest point of the ground within the area where the swing is to be erected determines the height of the supports. See also the instructions under Point I/5.

Although the surface pressure is adequate to set the swing down on normally solid ground, it is recommended to set the bottoms of the supports on a concrete base with frostproof foundations.

2. Preparation of the Centre Section - Stationary Model

2.1 Drive the centre section into position.

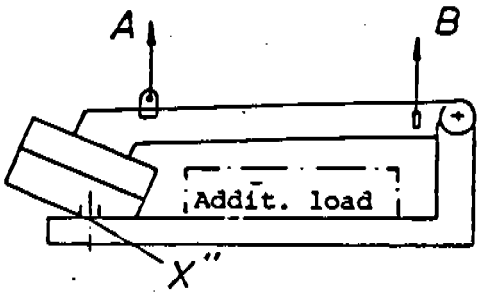
2.2 Use a crane to lift the centre section off the transport vehicle and to set it down on the foundations. It may be necessary to use intermediate supports in order to fold out the rear stabilisers and to lock these into position (see also 2.3.)

Overall Weight of Centre Section:

29.0 tons	Own weight
2.0 tons	Additional load (e.g. decorations)
31.0 tons	Gross weight

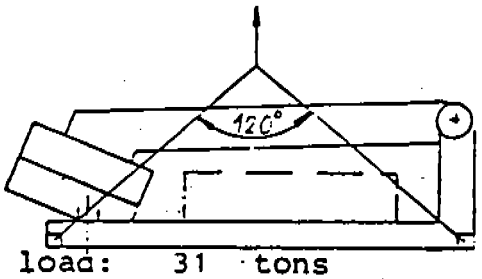
2.2.1 Possible Lifting Arrangements for the Centre Section

a) Lifting the centre section by the transport lugs on the tower

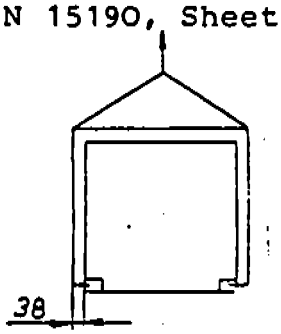


Lifting loads:
A = 2 x 9 tons
B = 2 x 6.3 tons
30.5 tons

b) Lifting the centre section by the standard container corner lifting fittings (DIN 15190, Sheet 3)



Lifting load: 31 tons



When lifting the centre section with a crane, the slings or ropes of the lifting tackle are to be arranged so that they form a spread angle of max. 120° (see sketch). The centre line of the load attachment rope must not be more than max. 38 mm away from the outer wall of the corner lifting fittings.

2.3 Swivel out the rear stabilisers and lock in position.

2.4 Undo the bolt connections between the bearing supports on the hub and the centre section (see Detail X in 2.2.1).

2.5 Attach the crane tackle to the eye lugs on the head of the tower. Required crane lifting force approx. 19000 kg (complete with booms, service platforms, decorations and cloud).

2.6 Lift the tower approx. 1.5 m. (approx. 5 feet). Turn the hub through 90°, so that the flanges for

attaching the arms point left and right.

2.7 For this purpose, use a ratchet to turn one of the electric motors by hand (the motor at bottom right seen from the back).

2.8 Then remove the ratchet and slide in the locking pin to secure the hub against turning while attaching the arms.

2.9 Attaching the Arms:
Using lifting gear, run the arms up to the flange on the hub, making sure that the identification numbers stamped into the metal on the flanges of the arms and of the hub are in agreement. This ensures that the correct arm is fitted on the correct side.

Gently engage the claw parts of the couplings in the corresponding pockets. There is no special alignment of the two coupling halves in a circular direction.

I M P O R T A N T:	Prior to joining the parts of the coupling together, check to make sure that all rubber elements are in position.

2.10 Tighten the fixing bolts between the arms and the hub using a torque spanner.

Tightening torque: Ma = 1650 Nm
IMPORTANT: The mating surfaces of the flanges on the arms and the hub must be free of all oil and grease.
Threads greased with MOS 4.

2.11 Attaching the Boom Decorations:

The boom decorations consist of:
panelling encasing the swing arm
panelling encasing the counterweight

the cloud including the supporting frame and onion-shaped decorations on the counterbalance arm.

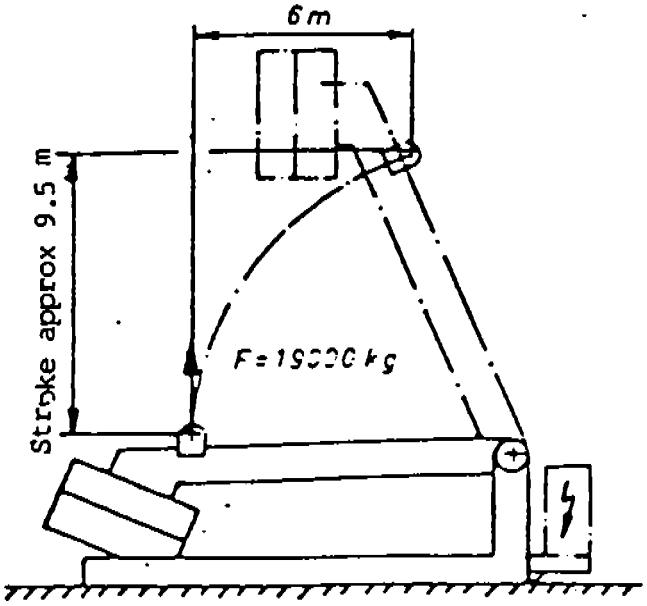
Assembly is carried out in the following sequence:

a) Lock the arms to secure them against turning further (see Point 2.7)
b) Attach the assembly platforms and railings
c) Attach the two top front panelling sections *)
d) Attach the two top side panelling sections *)
e) Attach the balcony
f) Attach the counterweight panelling sections
g) Attach the frame for the cloud
h) Attach the cloud

*) The bottom panelling sections are not attached until the "carpet" has been fitted.

2.12 Use the crane to lift the tower to a position where the outer flanges of the boom are at rightangles to the ground.

Forces and Heights for Erection:



2.13 Fitting the Pendulum Support:

The pendulum support comprises two parts. Insert the bottom part on its bearing and bolt in position. The top part is attached to the tower. Attach a quick-release locking device of the lifting rope near the bottom mounting fixture of the pendulum support.

Connect the other end of the lifting rope to the tower, release the pendulum support from its holder. Gently lower the pendulum support on the rope and bolt together with the bottom part.

Tightening torque of the fixing bolts: Ma = 800 Nm . Threads greased with MOS 4.

If the tower was not lifted high enough to be able to join together the top and bottom parts of the pendulum support, carefully raise the tower to the required height using the crane. When setting the top part of the pendulum support down on the bottom part, it is particularly important to make sure that the top and bottom parts of the pendulum support are in exact flush alignment as otherwise there is a risk of the support buckling when the load is applied.

2.14 Once the pendulum support has been completely assembled and attached, the erection crane can be removed.

2.15 Release the locking pins.

For further handling instructions, see "Travelling Model".

1. Preparation of the Ground - Travelling Model

Preparation of the ground in accordance with the support plan, Drawing No.
Measure out the ground area covered by the swing.
Prepare the points of support.
Determine the relevant heights:

The highest point in the ground within the area covered by the swing determines the height of the supports. See also instructions under Point I/5.

2. Preparation of the Centre Section - Travelling Model

2.1 Drive the centre section in position.

2.2 Connect up the power supply for the erection aggregate: 380 V 50/60 cps.

2.3 Swing out the rear stabilisers and lock in position.

2.4 Pull out the front lifting device, swing down the supporting cylinders with foot and lock in position.

2.5 On uneven ground and depending on the height of the chassis of the vehicle, it may be necessary to support the hydraulic cylinders of the rear stabilisers with one large and one small support block (base dimensions 1200 x 1200 and 700 x 700). Make sure that the support blocks are exactly positioned on top of each other and that the contact surfaces are clean. If necessary, the cylinders of the front lifting device are supported by a small support block (base dimensions 700 x 700).

2.6 On sloping ground, the support blocks supplied with the swing must in turn be supported, e.g. by suitable shims, so that they are absolutely horizontal.

2.7 On sloping ground make sure that the additional packing under the downslope support blocks is high enough to allow the centre section to be lowered in such a way that there is still a gap of 50 mm between the centre section and the ground.

2.8 The centre section is raised by extending the hydraulic cylinders. The front support cylinders are automatically synchronised by being connected in parallel whereas the rear stabilising cylinders are operated separately from each other. By operating the rear cylinders separately (raising and lowering), the centre section must always be kept roughly horizontal.

2.9 Lower the centre section by the following sequence (see sketch).

2.9.1 Raise the centre section and remove the transport vehicle.

2.9.2 Depending on the ground clearance of the vehicle and the nature of the terrain, it may be necessary to push two small support blocks under the centre section at the front and lower the centre section onto these (lower the centre section at the front and the back).
Telescope the cylinders on the lifting device and push the small support blocks from the cylinders of the lifting device backwards under the centre section.

2.9.3 Push the trough-shaped support under the cylinder of the lifting device. Lower the centre section onto the supports at front and rear. Place a small support block under the cylinder of the rear stabiliser and align the supports for operation (see Point 2.10).

2.9.4 Raise the centre section and remove the support blocks from under the centre section.

2.10 Prior to lowering the centre section onto the operating support blocks, the latter are to be aligned and properly levelled using a spirit level (see support plan).

2.11 Place wooden boards (50 mm thick) on the support blocks.

2.12 Lower the centre section onto the operating support blocks.

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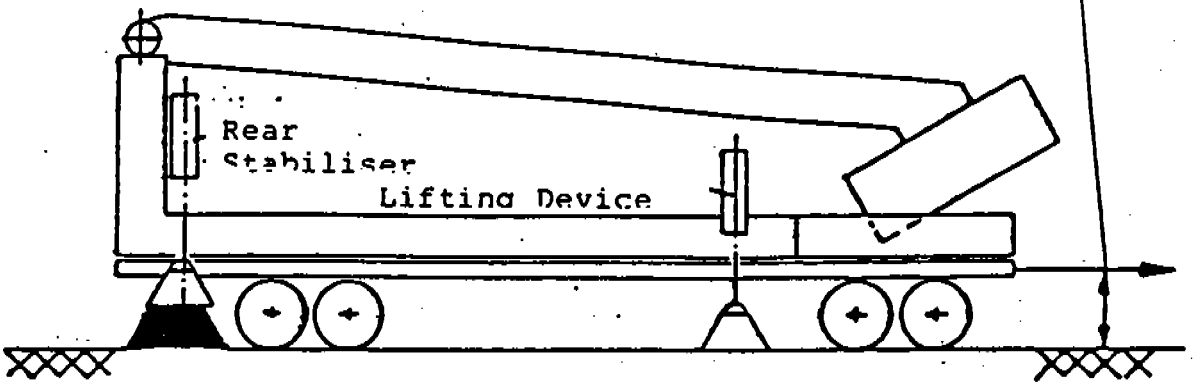
Without additional support 1100

With additional support 1600

2.9.1



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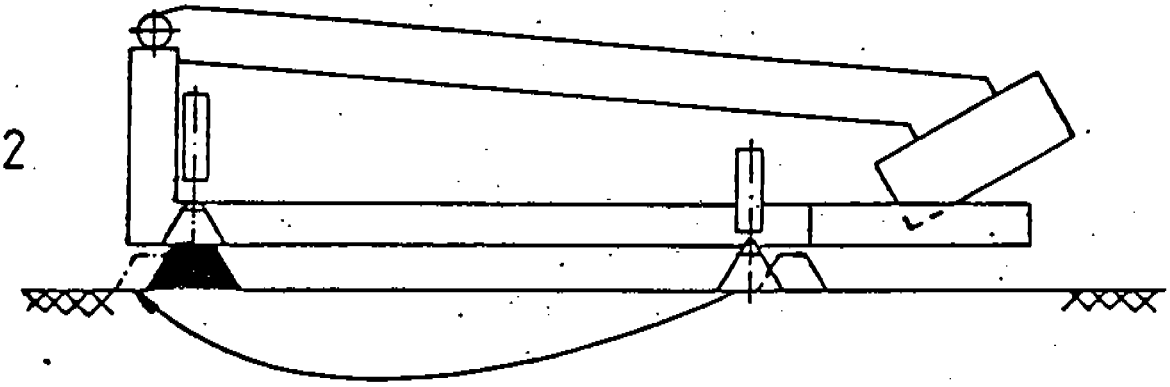

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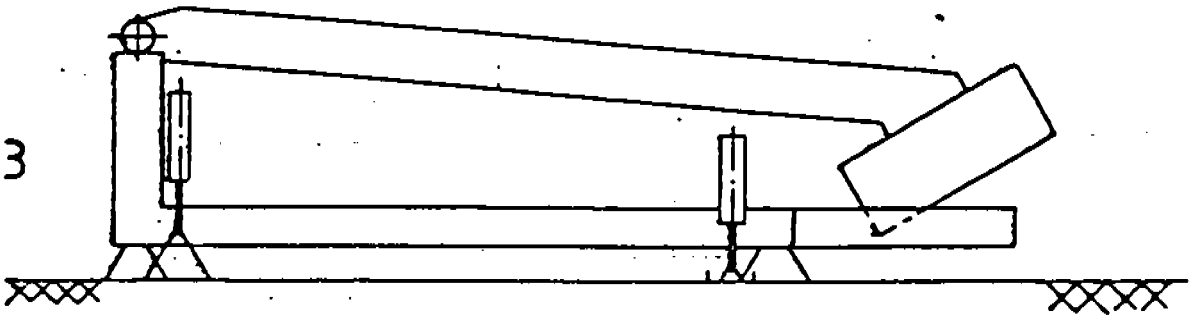

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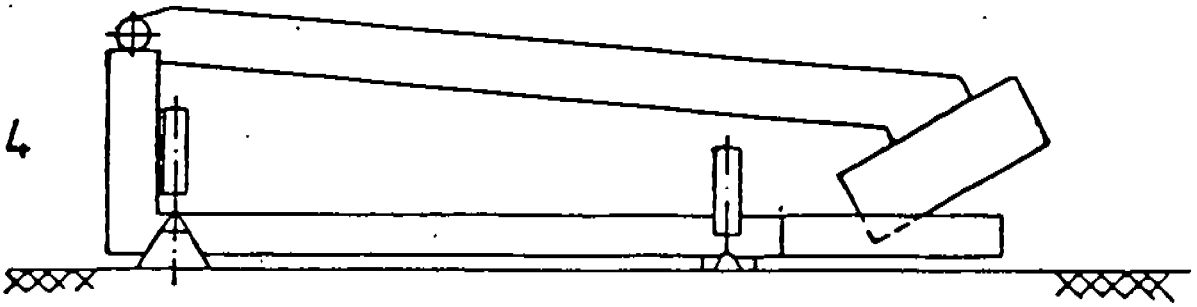

2.13 Retract the hydraulic cylinders of the rear stabiliser as well as the front lifting device. Release and swivel the outriggers of the front lifting device.

2.14 Undo the transport securing bolts between the tower and the centre section.

2.15 On the centre section near the location of the support, there are two ball cocks.
These ball cocks must be switched over. After switching over the ball cocks, the erection cylinder is connected to the erection hydraulic system.

2.16 Raise the tower approx. 1.5 m.

2.17 Turn the hub through 90° so that the flanges for attaching the arms point to right and left.

2.18 For this purpose, use a ratchet crank to turn one of the electric motors by hand (the motor at bottom right seen from the back).

2.19 Then remove the ratchet crank and slide in the locking pins to prevent the hub from turning while the arms are attached.

2.20 <u>Attaching the arms:</u>

Use lifting gear to position the arms on the flanges of the hub making sure that the identification numbers stamped into the metal between the flanges of the arms and those of the hub are in agreement. This ensures that the correct arm is attached on the correct side.

Gently engage the claw parts of the couplings in the corresponding pockets.
There is no special alignment of the two coupling halves in a circular direction.

IMPORTANT: Prior to joining the parts of the coupling together, check to make sure that all rubber elements are in position.

2.21 Tighten the fixing bolts between the arms and the hub using a torque spanner.

Tightening torque: Ma = 1650 Nm IMPORTANT: The mating surfaces of the flanges on the arms and the hub must be free of all oil and grease. Threads greased with MOS 4.

2.22 Attaching the Boom Decorations:

The boom decorations consist of:
panelling encasing the swing arm
panelling encasing the counterweight
the cloud including the supporting frame and onion-shaped decorations on the counterbalance arm.

Assembly of the decorations follows the following sequence:

a) Lock the arms to secure them against turning further (see Point I 2.19)
b) Attach the assembly platforms and railings
c) Attach the two top front panelling sections *)
d) Attach the two top side panelling sections *)
e) Attach the balcony
f) Attach the counterweight panelling section
g) Attach the frame for the cloud
h) Attach the cloud

*) The bottom panelling sections are not attached until the "carpet" has been fitted.

2.23 Erect the tower to an upright position. To do this, extend the telescopic erection cylinder up to the stop.

2.24 Fitting the pendulum support:
The pendulum support comprises two parts. Insert the bottom part on its bearing and bolt in position. The top part is attached to the tower. Attach a quick-release locking device of the lifting rope near the bottom mounting fixture of the pendulum support. Connect the other end of the lifting rope to the tower, release the pendulum support from its holder. Gently lower the pendulum support on the rope and bolt together with the bottom part.

Tightening torque of the fixing bolts: Ma = 800 Nm Thread greased with MOS 4.

For this purpose, to bridge the air gap, slowly lower the tower by means of the erection cylinder.

2.25 Switch off the erection aggregate.

2.26 Release the locking pins.

3. Installation of the Electrical Switch Box

3.1 Lay the two guide rails on the centre section and secure with pegs.

3.2 Place the switch box at the side of the tower on these rails. The opening for the feeder must be at the front on the cylinder side.

3.3 Roll the switch box into the middle position and secure.

Important! Do not crush cables.

3.4 Establish all cable plug connections.

> Important:
> All cables are numbered. The corresponding numbers are to be found on the lids of the sockets on the switch box as well as on the cables. The numbers correspond to their designations in the cabling plan. All plugs are additionally coded by pins.

Arrangement of the plugs on the switch box base:
Drawing No.: 02.C09.00/03 A1

The plugs are arranged on the switch box base in such a way that all connections that go off to the front are located on the left-hand side of the switch box and all connections to the steel structure of the centre section, to the tower etc. are located on the right-hand side of the switch box base. Three lighting sockets are located at the back of the switch box. The main feeder cable enters the switch box base at its "front" end, i.e. on the side facing the cylinder or the pendulum support.
The plugs and sockets have multiple protection against mistakes in connecting the switch box:

a) Their arrangement according to destination on a particular side of the switch box base.
b) Lettering on both the switch box base and on the cable.
c) All plugs are coded by pins in such a way that they cannot be inserted into the incorrect socket.
d) Identification colours as per drawing no.

e) The main feeder cables and the cable connections to the motors are firmly attached to the switch box by screw connections. The tightening torque for these connections must be adhered to by using

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3.5 Aligning the Centre Section:

This is best done after the arms have been attached and the electrical connections have been produced.

Carry out two measurements with the spirit level:

a) lateral inclination:

Lay the spirit level in the cutout of the centre section.

b) forward or backward tilt:

Hold the spirit level under the swing arm along the longitudinal axis.

(See diagram overleaf)

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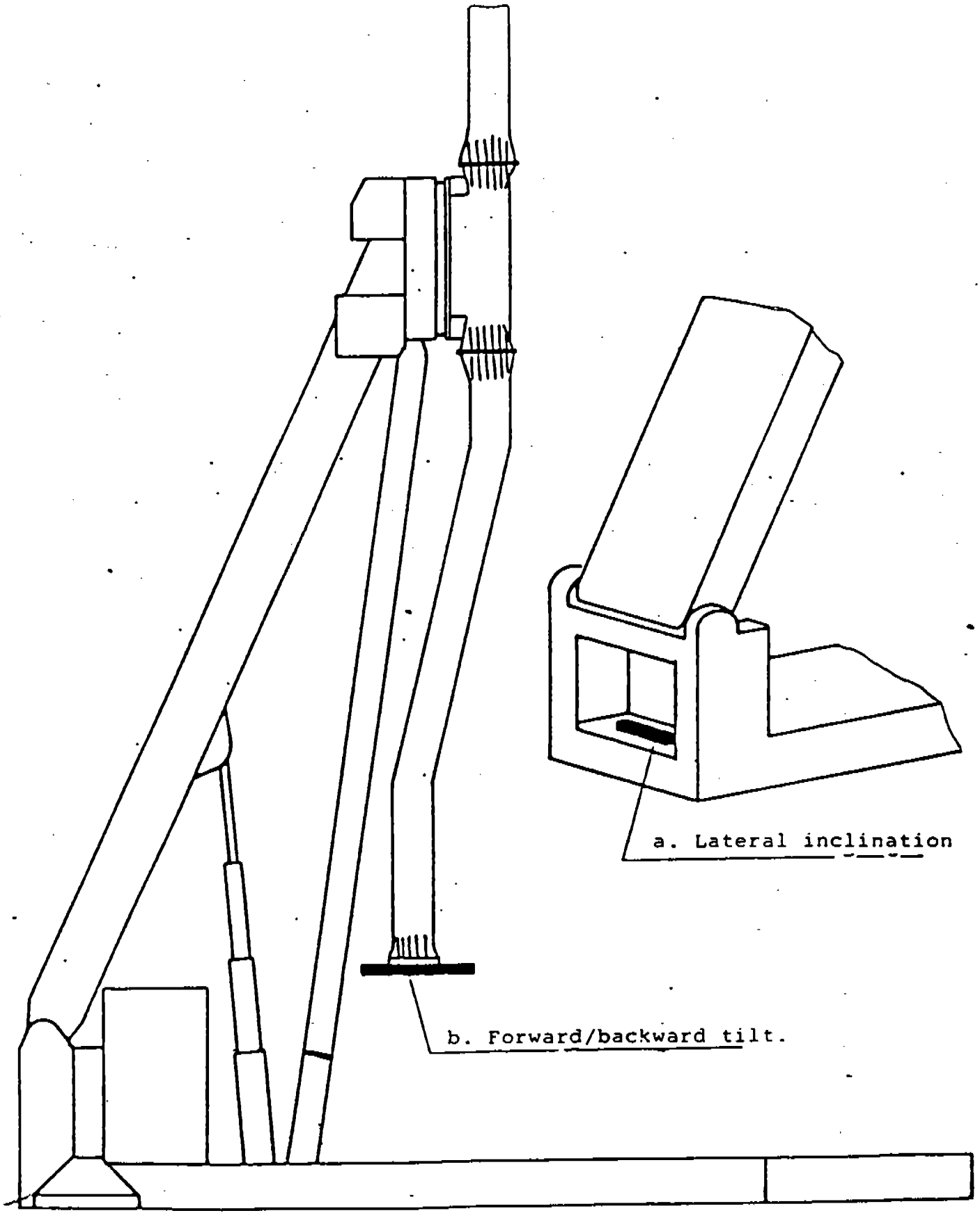

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3.6 Establish the cable screw connections:

a) For main feeder see Point I/4.
Connection via 2 parallel rubber cables:
OZOFLEX HO7 RN-F4G70

with protective multiple earthing : each of 4 x 70 mm^2
with PE conductor networks : each of 5 x 70 mm^2

b) Motor connections
Connection via 4 pcs. 1 x 95 mm^2

c) Connect the earthing cable coming from the tower to the main busbar (switch box + G1).

I M P O R T A N T!
It is essential to make sure that the cable lugs maintain good contact. This is why the screw connection is tightened with a torque spanner.

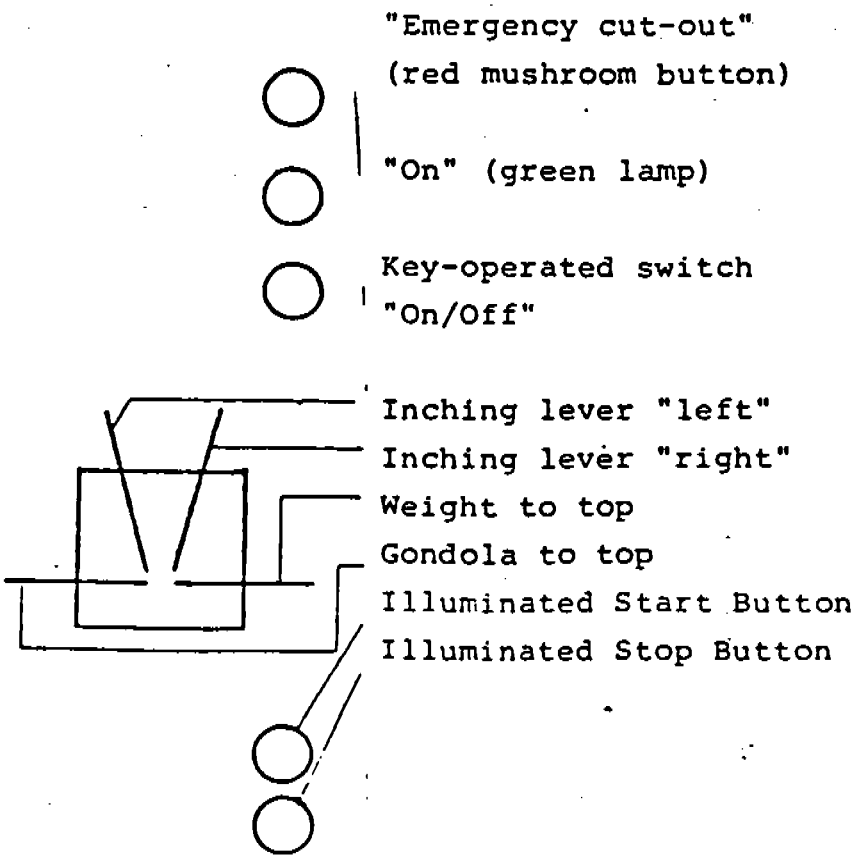
Torques:

Main feeder: M_D = 50 Nm (M12)
Motor connections: M_D = 50 Nm (M12)
80 Nm (M16)

3.7 Connecting the erection control panel:
The plug must be inserted into the bottom section for +G4-X6, which is also used for the main control desk.

3.8 Main switch for drive "ON"

3.9 Manual Control Unit for Assembly and Erection



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Coding and Identification Colours of the Plugs on the Switch Box Bas

Plug Designation		Coding, Plug	Colour
+ G1 - X1	16 pole	8 + 16	maize yellow
+ G1 - X2	24 pole	1 + 24	brown
+ G1 - X3	10 pole	5 + 10	black
+ G1 - X4	10 pole	1 + 5	green
+ G1 - X5	6 pole	3 + 6	green
+ G1 - X6	6 pole	1 + 6	maize yellow
+ G1 - X7	10 pole	4 + 6	black
+ G1 - X8	6 pole	1 + 6	pearl white
+ G1 - X9	- pole	-	-
+ G1 - X10	6 pole	-	grey
+ G2 - X1	3 pole	1 + 10	black
+ G2 - X2	3 pole	5 + 6	orange
+ G2 - X3	3 pole	1 + 6	maize yellow
+ G2 - X4	3 pole	10 + 5	green
+ G2 - X5	3 pole	1 + 5	red
+ G2 - X6	6 pole	1 + 3 + 6	red
+ G2 - X7	16 pole	1 + 16	pearl white
+ G2 - X8	3 pole	10 + 6	brown
+ G3 - X1	6 pole	1 + 4 + 6	brown
+ G4 - X1	3 pole	4 + 6 + 6	orange
+ G4 - X2	16 pole	8 + 16	green
+ G4 - X3	10 pole	1 + 10	pearl white
+ G4 - X4	16 pole	8 + 9	black
+ G4 - X5	16 pole	1 + 9	orange
+ G4 - X6	24 pole	1 + 12	maize yellow
+ G4 - X7	24 pole	1 + 13	black
+ G4 - X8	24 pole	12 + 13	pearl white
+ G4 - X9	16 pole	1 + 8	red

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Further Cable Designations

Shunt Distributor + K3	Poles		Coding - Housing Bottom Section
+ K3 - x 30	6		1 + 4 + 6
+ K3 - x 31	6		5 + 6
+ K3 - x 32	3	500 V	1 + 10
+ K3 - x 300	6		1 + 4
+ K3 - x 301	6		3 + 6
+ K3 - x 302	10		1 + 10
+ K3 - x 303	6		4 + 6
+ K3 - x 304	10		1 + 5
+ K3 - x 305	6		1 + 3
+ K3 - x 306	10		5 + 10
+ K3 - x 307	6		1 + 3 + 6

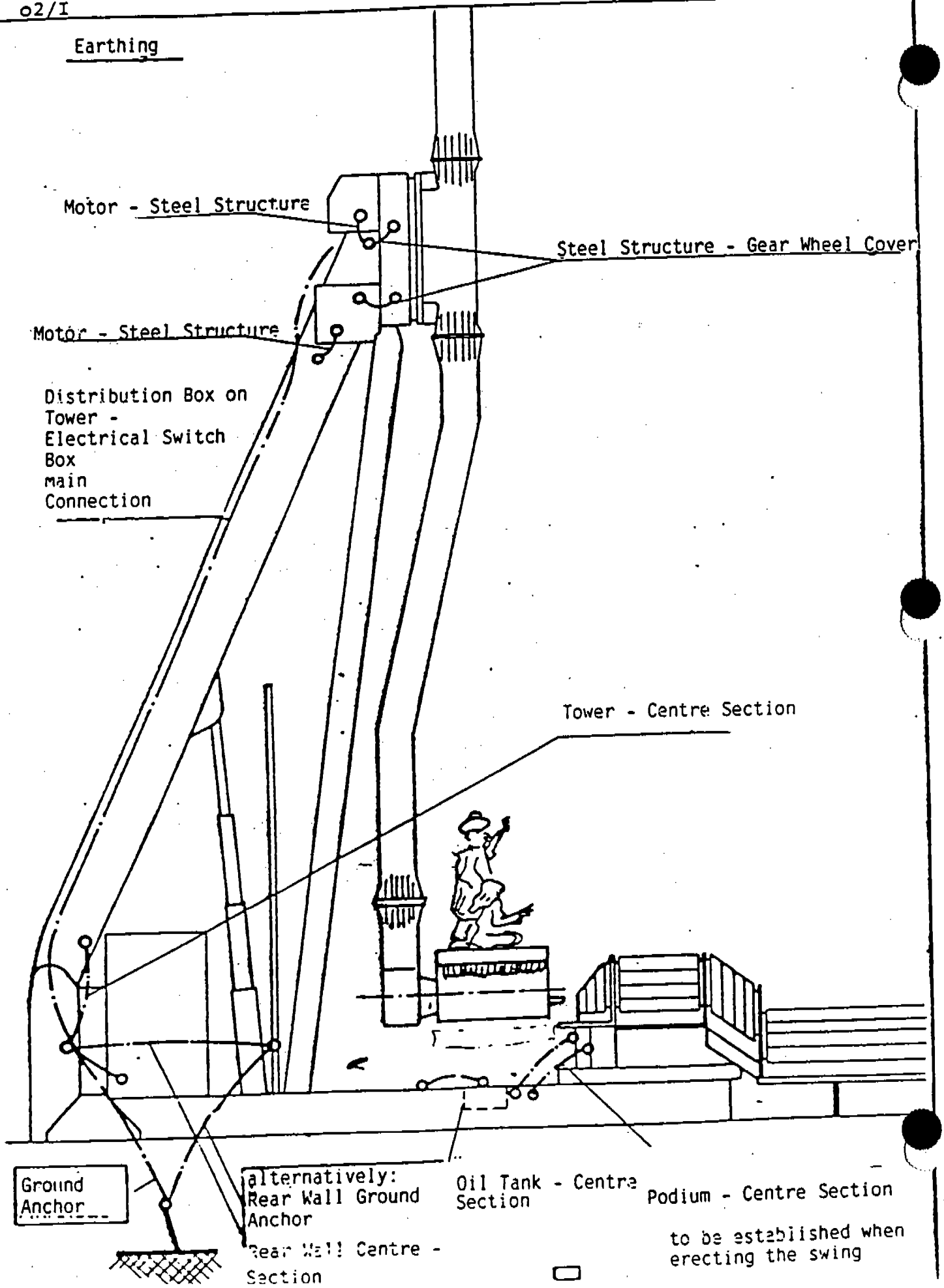
Shunt Distributor + K6	Poles		Coding - Housing Bottom Section
+ K6 - x 300	6		1 + 4
+ K6 - x 301	6		3 + 6
+ K6 - x 60	6		1 + 4 + 6
+ K6 - x 61	6		5 + 6
+ K6 - x 62	3	500 V	5 + 6

Shunt Distributor + K7	Poles		Coding - Housing Bottom Section
+ K7 - x 300	6		1 + 4
+ K7 - x 301	6		3 + 6
+ K7 - x 70	6		1 + 4 + 6
+ K7 - x 71	10		5 + 6
+ K7 - x 72	3	500 V	1 + 10

Control Panel + P1	Poles	Coding - Housing Bottom Section
+ P1 - x 6	24	1 + 12
+ P1 - x 7	24	1 + 13
+ P1 - x 8	24	12 + 13
+ P1 - x 9	24	1 + 8
+ P1 - x 1	16	8 + 16

02/I

Earthing



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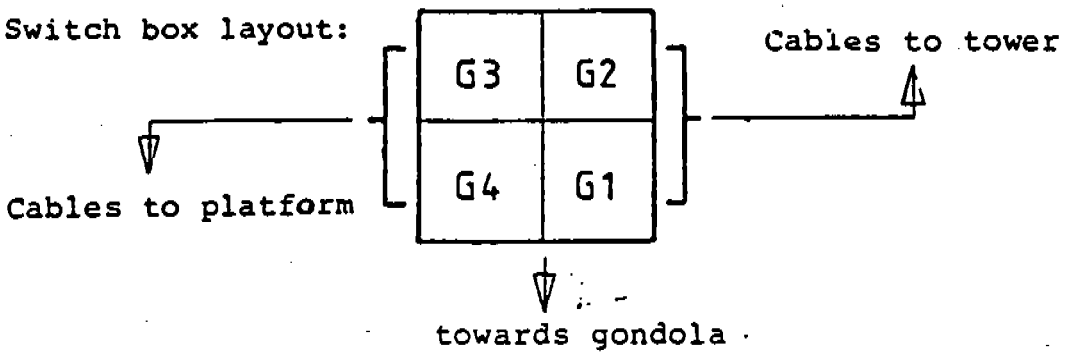
4. Connection of the Feeder Cables

Connect 2 cables of 4 x 70 mm^2 each in parallel to the busbar in the switch box.

Switch box layout:

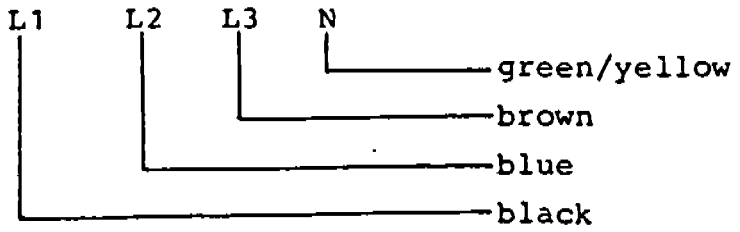


For the earthing connections in the box see the diagram earthing connections between the switch gear, centre section and tower.

A) Protective Multiple Earthing

1. Insert jumper (copper fishplate) between the N bar and the PE bar in Section G1.

2. Connection of the 4-core feeder in the right-hand rotary field.



The system is earthed via the neutral conductor of the Electricity Board.

B) Fault-Current Protective Circuit

The structure is earthed via its own ground rod.
Earth wire circuit resistance max. 130 ohms.

Earthing line in the structure:

1) Open jumper in cabinet G1 between the N bar and the PE bar.

2) Connection of the 4-core feeder line in the clockwise rotation field

   L1 - L2 - L3 - N

3) Connect earth spike to the structure.
   1 x 70

5. Attaching the First Counterweight

5.1 Adjust the arms so that the counterweight arm points vertically to the bottom:

a) Selector switch "gondola to top"
b) Briefly press the "Start" button until the "On" signal lamp lights up.
c) Press the "Start" button once more (arms rotate round to the preselected position).
d) The procedure can be interrupted at any point by pressing the "Stop" button.
e) The hold brake engages when the arms are in position.
f) Insert the locking pin.

5.2 Fit the first counterweight and bolt in position.

Tightening torque Ma = 1400 Nm.

5.3 Running the first counterweight round to the top:

a) Pull out the locking pin.
b) Selector switch "Counterweight to top".
c) Briefly press the "Start" button until the "On"

actuated in the meartime), otherwise:

d) Press the "Start" button.
e) The arm tries to move round to the top at crawling speed. If the motion comes to a standstill, the system automatically switches to swing start and the counterweight is automatically stopped at top dead centre (TDC).

5.4 The hold brake on one of the motors automatically holds the weight securely in this position.

5.5 Slide in the locking pin.

Important! Sliding in the locking pin switches off the drive and the brake.

5.6 If the locking pin is not lined up exactly enough with the perforated plate to be slid in, the position can be corrected by inching control.

5.7 Correcting the TDC position

a) Actuate the selector switch: "Inching control right" or "Inching control left".
b) Press the start button.
c) When these inching buttons for assembly work are actuated, the motors run at approx. 5 % of their maximum speed as long as the start button is pressed and develop only 35 % of their maximum torque.

5.8 Should for any reason the counterweight come to a standstill so far before or after the TDC that the hold brake cannot hold it, the brake opens again by having its power supply cut off as soon as the value of max. 2 % of max. speed is exceeded.

The drive units are also electrically disabled.
The weight runs back to the starting position.

5.9 The procedure for running the counterweight round to the top can be repeated.

5.10 After the system has been locked with the locking pin, it is possible to start attaching the gondola.

5.11 For safety's sake, switch off the system by operating the key-operated switch.

5.12 On the stationary model, the gondola linkage is now bolted onto the swing arm.

IMPORTANT:
The universal-joint shafts are fitted as follows:

1. Turn top universal-joint shafts outwards up to the stop:
   right-hand shaft to the right
   left-hand shaft to the left
2. Turn bottom universal-joint shafts to the inside up to the stop:
   right-hand shaft to the left
   left-hand shaft to the right
3. Turn bottom universal-joint shafts back by approx. one coupling pocket.
4. Join coupling halves together.
5. When the ship is properly mounted, it should be possible to move it up and down by some 1 - 3 cm at the gondola ends.
   This ensures that there is sufficient play in the teeth.
6. If the ship can be moved by more than approx. 5 - 6 cm, the couplings must be re-adjusted.

Bedienungsanleitung

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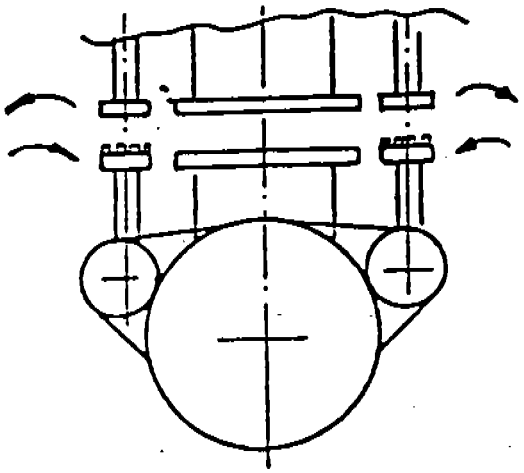


The two rotating parts of the gondola linkage are secured against each other by a locking frame.

The lugs on the locking frame lock into two holes on the flange connection between the swing arm and the gondola linkage.

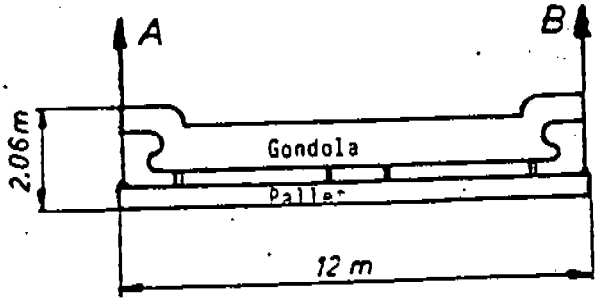
After the gondola linkage has been attached with the universal joint-shaft coupling inserted without any play, the frame must be removed and the bolted connection must be completed.

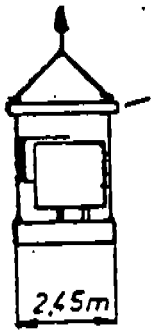
6. Attaching the Gondola-Stationary Model

6.1 Attaching the Figures

6.2 Using two cranes, lift the gondola complete with its transport pallet off the transport vehicle (without the gondola linkage).

Since the centre of gravity does not lie in the middle, the pallet must be lifted by means of a lifting crossbeam, whereby the lifting connection between the crossbeam and the crane hook must be long enough.





Crossbeam
Weights: *)
A = B = approx. 4500 kg
Gondola: approx. 4500 kg
Pallet: approx. 4000 kg
Total approx. 8500 kg

IMPORTANT: For aligning the gondola see "Travelling Model"

6.3 Bring the wheels on the transport pallet into position.

6.4 Set down the transport pallet on the rails of the centre section.

6.5 Push the transport pallet with the gondola under the swing arm.

*) When the gondola linkage is attached, the weights are increased by 2000 kg. A = B = approx. 5,500 kg with a non-central centre of gravity.

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6.6 By means of two cranes, lift the transport pallet and the gondola so that the flange of the gondola comes into contact with the flange of the boom (gondola linkage). This procedure must be carried out with the utmost caution so that no horizontal forces are applied to the boom.

> IMPORTANT: The flanges should touch only lightly and as far as possible without any force behind them. Any remaining air gap will be taken up by tightening the fixing bolts.
>
> Tightening torque for the fixing bolts:
> Ma = 800 Nm
> Threads greased with MOS 4.

6.7 After the flanges have been bolted together, the four fixing pins can be removed.

6.8 Then lower the transport pallet until it rests on the rails.

6.9 Bring the transport pallet into position for mounting the platform and peg in position with locking pins.

6. Attaching the Gondola (Travelling Model)

After locking the first counterweight into the TDC Position, the next step is to attach the gondola.

6.1 Bolt the gondola linkage onto the side of the gondola via the connection flange of the gondola; d o n o t r e m o v e the adjusting frame.

Tightening torque for the fixing bolt: Ma = 800 Nm
Threads greased with MOS 4

6.2 Attach the figures

6.3 Release the front stabiliser and swivel to one side.

6.4 Drive the transport pallet in front of the centre section at right angles to this.

6.5 Make the electrical connections to the pump aggregate of the transport pallet:
a) Connect cable 28/+G2-X8 to the switchbox.
b) Connect the plug from the hand control unit to the switchbox on the transport pallet.

6.6 Pull out the supporting cylinder of the transport pallet, set this upright and lock in position.

6.7 Align the trough-shaped supports to the horizontal and arrange them in such a way that the rollers of the cylinders of the transport pallet stand roughly in the middle of the trough-shaped supports and parallel to the transport pallet.

6.8 Raise the pallet and remove the vehicle. When raising the pallet, make sure that it is always horizontal.

6.9 Swing the front stabiliser under the pallet and lock in position.

6.10 Bring the wheels on the transport pallet into position.

6.11 Lower the transport pallet onto the rails of the centre section.

6.12 If on lowering the transport pallet it is found that the wheels are not aligned exactly enough over the rails of the centre section, the pallet must then be shifted to the correct position as follows:

At either end of the transport pallet there are lugs to which lifting ropes or push rods can be attached. If it is not possible to budge the pallet by hand, use the lorry. The running rollers on the cylinders must always be exactly aligned with the direction of pull!

Make sure that there is enough clear length of travel for the rollers in the trough-shaped support.

6.13 Set the pallet down on the rails in its final position and retract the supporting cylinders so far that they cannot touch the ground during the next movement of the transport pallet.

6.14 Push the transport pallet with the gondola and gondola linkage under the swing arm.

6.15 Move the trough-shaped supports to the new position and align correctly.

6.16 Extend the support cylinders once more and using these raise the gondola so far that the mounting flange of the gondola linkage comes to rest gently against the mounting flange of the swing arm.

IMPORTANT: Here, the universal-joint shafts are to be handled as described under 5.12 above.

6.17 Two drilled holes for bolts in the flange connection between the gondola linkage and the swing arm are blocked by the adjusting frame between the two rotating parts of the gondola linkage. Now remove the frame and insert the remaining bolts.

6.18 When the gondola is finally fixed in position, lower the transport pallet and set it down on the rails. First remove the pegs on the lugs of the gondola.

6.19 Aligning the Gondola When Attaching It to the Swing Arm

6.19.1 Aligning the centre section has been completed.

6.19.2 Aligning the Gondola

a) The locking device between the two parts of the gondola linkage which can rotate in relationship to each other ensures that the top flange surface of the gondola linkage is always parallel to the gondola.

b) The swing arm must be brought to the vertical position.

This can be checked by:

1. measuring the distances from the flanges to the centre section using a tape measure, or
2. by means of a spirit level laid against the flange.

If any correction is necessary, this may only be carried out within the range of play of the locking pin at the head of the tower.

Corrective Action:

On the bottom right-hand motor as seen from the back, there is a four-squared section on the shaft of the electric motor. Turn this squared section using a suitable tool.

6.19.3 Lift the ship by means of the hydraulic cylinders and attach it in as horzontal a position as possible.

6.19.4 After attaching the carpet, check that it is lined up parallel by measuring the distance to the centre section.

If the angle of tilt is too great, repeat the attaching procedure.

IMPORTANT: Observe Section 5.2 and make sure that the couplings are put together in such a way as to be free of play.

IMPORTANT:	Although it does not affect proper functioning if the gondola is attached at an angle, the footboard could strike against the platform.

6.20 Move the transport pallet into position for mounting the platform and peg it in position with locking pins.

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7. Attaching the Second Counterweight

7.1 Key-operated switch "On"

7.2 Release the locking pins.

7.3 If the pins are jammed: Move the ship backwards and forwards by hand to take the strain off the locking pins.

7.4 To run the gondola round to the top, follow the same procedure as for running the first counterweight round to the top.

7.5 The stop brake works in the same way as for running the first counterweight round to the top and again it is important to find the exact position to be able to slide in the locking pin.

7.6 Slide in the locking pin.

7.7 As was the case when attaching the first counterweight, an uncontrolled swing down of this weight or of the gondola does not endanger the overall structure in any way.

7.8 In that case repeat the manoeuvre.

7.9 After locking the swing arm with the locking pin, bolt on the second counterweight.

Tightening torque: Ma = 1400 Nm

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8. Remaining Decorations

Attach the bottom panelling sections.

9. Running the Gondola to the Passenger Access Position

a) Release the locking pin.
b) Selector switch "Counterweight to top"
c) The gondola will stop automatically in the passenger access position (bottom dead centre).

10. Final Installation Work

10.1 Make sure that the pallet is parallel to the gondola.

10.2 Check the distances between the pallets and the gondola.

a) The height between the footboard and the top edge of the pallet

min. 460 mm 2" PLAY EITHER DIRECTION

b) The horizontal distance is automatically set correctly by pegging the pallet onto the centre section.

10.3 Place support blocks under the transport pallet in such a way that there is an air gap of approx. 5 - 10 mm between its wheels and the rails on the centre section.

10.4 Set up the platform in accordance with the drawing.

10.5 Attach the railings and panels.

10.6 Put up the cash booth.

10.7 Lay out the cables.

10.8 Connect the main control desk.

10.9 Erect the rear wall and the facade.

10.10 Attach and connect the strip lighting.

10.11 Check the fuses of all plug-and-socket and screwed connections - insofar as these are provided.

10.12 The swing is ready for operation or ready for demonstration to the local building supervisory authorities.

11. Dismantling the Swing

Dismantling the swing is the same procedure in reverse:

11.1 Run the gondola to the top and detach the first counterweight.

11.2 Run the gondola to the bottom and detach the gondola.

11.3 Run the second counterweight to the bottom and detach.

11.4 Bring the boom to the horizontal and lock.

11.5 Detach the pendulum support.

11.6 Lower the tower.

11.7 Detach the decorations and boom.

Important:	Use locking pins for erection and dismantling work! If this is not done, the unbalanced weight of the counterweight or the gondola could cause these to swing down fast and endanger the fitters.

11.8 To lower the counterweight or to lower the gondola:

a) Actuate the selector switch.
b) Actuate the start button.
The swing starts with 10 % of the max. motor speed.
If the drive switches from driving to braking, the swing runs to bottom dead centre in the same way that it runs to top dead centre during erection.
Should the weight or the gondola not stop immediately at bottom dead centre due to momentum, it swings

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through and then swings back to stop at BDC.

Important: When the locking pin is slid in, this triggers malfunction alarm signal 16 (see malfunction alarm code).
After the locking pin has been returned to the operating position for the next step in installation work, the malfunction must be acknowledged in the switch box and the key-operated switch (On/Off) on the installation panel be actuated.

II. Description of Function

1. General

1.1 In the pauses between operation phases, the drive motors and also the switchboard must be protected against corrosion damage by anti-condensation heaters.

1.2 To operate the anti-condensation heating, the main light on the switchboard must remain switched on.

1.3 During long periods of storage, the switchboard must remain connected to the normal lighting mains. For this purpose, remove the earthed-contact type plug in cabinet G1 and establish a connection to the lighting mains.

1.4 Also connect the motor cable +G2/X 6 to the lighting mains via an intermediate coupling.

1.5 To start operation, the main switches must be switched on:

1. For installation: the right-hand main switch.
2. For lighting and the caravan: the left-hand main switch.

2. Erection and Dismantling Control Panel

2.1 Connect the control cable for the erection control panel for erection installation on the switch box.

2.2 The control panel for erection and dismantling has one cable and one plug.

2.3 A special changeover switch from "Assembly and Erection" to "Operation" does not exist.

2.4 To run the first counterweight up to the top and also to run the gondola up to the top while the second counterweight is attached, it is necessary to actuate corresponding buttons on the erection control panel. The weight or the gondola then swings until enough energy has been stored to be able to run to BDC in a programmed curve. If the stopping position is not reached exactlty. it can be corrected by using the inching control buttons on the control panel for erection and assembly.

3. Control Desk for Swing Operation

The control desk incorporates the following functions:

a) Current and voltage monitoring for both pairs of motors
b) Diagnostic fittings for monitoring and fault finding.
c) On/Off/Stop/Start
d) Ride control buttons for swinging and looping
e) Stop at top
f) Emergency cut-out button
g) Swing curve selector switch
h) Automatic control selector switch
i) Key-operated switch
j) Light switch
k) Diverse control and signal lamps

4. Seat Safety Bars

Drawing No.

4.1 After the passengers have taken their seats, the seat safety bars are closed from the control desk in the cash booth by pressing the "Start" button.

4.2 The hydraulic pump in the pump aggregate of the gondola starts up and the magnetic valve which is connected to the pump aggregate releases the flow of oil in the direction of "Close Seat Safety Bars", i.e. retraction of the piston rods on the actuating cylinders of the safety bars.

4.3 When all safety bars are closed, i.e. all safety bars lie snug against the passengers' bodies, the operating pressure builds up until the pressure relief valve is triggered. This pressure is then maintained so long as the hydaulic pump continues to work.

4.4 When sufficient pressure (approx. 15 bar) has been built up, this is signalled via a pressure switch.

4.5 This manometric switch has the effect of stopping the hydraulic pump after approx. 10 secs.

4.6 This signal simultaneously releases the swing for operation.

4.7 The built-up pressure will slowly decrease as a result of normal internal gap losses.

4.8 When the operating pressure has undershot a certain value, approx. 18 bar, the pump is restarted.

4.9 This restart can only occur when the gondola is in motion.

4.10 The pump then works for a preset time of approx. 10 seconds and then switches off automatically.

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4.11 Securing the safety bars against inadvertent opening.
The safety bars have multiple protection against inadvertent opening:

a) Pilot operated non-return valve common to all cylinders in the pump aggregate.
b) In locked condition, closed control slide valve cuts off the flow of oil.
c) Pilot operated non-return valves in every single cylinder.
d) Automatic restart of the pump whenever the pressure in the pipeline drops.

4.12 A hose break or any other leak in the system would be immediately noticeable by the pump not building up any pressure after the second start and the gondola not starting to move.

During operation, this results in a malfunction alarm.

4.13 Even then, the passengers are still out of danger because every single cylinder has its own non-return valve to isolate it from any leak.

5. Hydraulic System for Centre Section

The hydraulic system of the centre section receives its electricity supply separately and independently of the Siemens main electrical switch box.

Power supply: 380 V/50 or 60 cps.

The manual control unit controls five magnetic valves: one valve per cylinder plus a pressure build-up valve common to all cylinders.

The cylinders on the pull-out cylinder supports at the front are interconnected in such a way that the pressure

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is applied simultaneously and uniformly so that there is no danger of producing torsional stresses in the steel structure as a result of diagonal charging of the cylinders.

The cylinders are lowered (telescoped) via one-way restrictors. If the lowering speed is too great or the lowering procedure oscillates, this can be counteracted by reducing the flow rate of the one-way restrictors.

Each cylinder is fitted with a pipe break safety device so that, in the case of a hose break, the cylinder automatically stops at its current height.

Should a magnet not respond to electrical signals, every magnetic valve on every magnet has a rubber cap for emergency operation by hand. For the erection procedure, the shut-off cocks on the centre section must be switched over so that the hydraulic oil is fed to the telescopic erection cylinder.

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6. Ride Sequence and Procedures

6.1 Start:

When the start button is pressed, the seat safety bars close automatically. When the start button is pressed a second time, the gondola starts to move.

6.2 Stop:

Pressing the stop button triggers the brake. During looping, braking is triggered at top dead centre. The gondola comes to a standstill at approx. 130° on the far side of the circle and from there returns to the passenger access position, if necessary after a short return swing depending on the load. During swinging, braking starts immediately after the stop button is pressed. The gondola returns to the passenger access position after one or several swings depending on the load. As soon as the gondola has come to a standstill in the passenger access position and the stop brake has engaged, the seat safety bars open automatically.

6.3 Swinging:

There is a choice of several swinging curves with limit points at varying heights. These curves can be individually selected. The highest curve reaches the limit/reversal point at approx. 130°.

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6.4 Looping:

Looping always begins by swinging to the maximum reversal points. After these reversal points have been reached at approx. 130°, the control system releases the looping routine which is initiated by pressing the looping button.

If the swings do not reach these reversal points, the looping command is stored until they do.

Looping can be executed clockwise or counter-clockwise from the spectators' point of view.

Following looping, it is possible to select swinging or looping in the other direction by means of the button. The transition is preceded by a stop routine corresponding to the braking manoeuvre. This routine begins at TDC and ends at approx. 130°. From this point, the swing starts looping in the opposite direction or normal end-to-end swinging.

6.5 Automatic Ride Programme:

Set the automatic selector switch to programme 1, 2 or 3 and press the button. The seat safety bars close automatically.
When the start button is pressed again, one of the following routines then runs:

Program Step	Selector Switch on 1	2	3
Swinging	until 130° are reached on the right side		
Looping clockwise	1 x	2 x	3 x
Stop at top	10 secs.	10 secs.	10 secs.
Looping counterclockwise	1 x	2 x	3 x
Stop at top	-	-	10 secs.
End of program	at BDC, gondola returns to BDC		
Open seat safety bars	a u t o m a t i c		

6.6 Passenger Access Position:
The gondola automatically returns from swinging or looping to the passenger access position. In this position it is safely held by the stop brake so that the passengers can leave and enter the gondola. An inclination of approx. 2° is permissible.

6.7 Emergency stop from looping:
If the emergency cutout button on the control desk or on the switch box is operated, the gondola is returned to the passenger access position by the shortest possible route. Braking begins when the gondola passes through TDC.

6.8 Emergency stop from swinging:
When one of the emergency cutout buttons is operated, braking does not only start at the swing reversal points but also at any point on the swing curve immediately after the button is pressed in order to return the gondola to the passenger access position by the shortest

possible route.

6.9 Locations of emergency cutout buttons:
1 x main control desk
1 x erection control panel
2 x Siemens switch box

6.10 Power Failure:
The gondola continues to swing down and through under no load until it comes to a standstill. If the gondola is looping at maximum speed at the time of the power failure, it can be expected to continue to loop two or three more times without power until it then swings down and through without power until it comes to a standstill.

Should the emergency stop buttons fail, the key-operated switch must also be operated. The gondola will then swing down and through without power until it comes to a standstill.

6.11 The gondola stops at Top Dead Centre:
Even if there is a power failure, the seat safety bars remain closed. At the end of the counterweight arm, there is a rod between the counterweights. The prepared block and pulley tackle is attached to this and into an eye on the frame of the pallet and is then operated until the gondola starts to move.

Important: Once the gondola starts to move, all persons must leave the danger area immediately.

6.12 Emergency operation of the seat safety bars:
If the cushioned seat safety bars cannot be opened by normal operation, work the emergency pump on the safety bar aggregate by means of a detachable tubular lever.

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Important!
The operating personnel must not give the go-ahead for starting the gondola until all seat upholstery and the safety bars have snugged into position.

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III. Exceptional Operating Situations and Malfunctions

1. General

The swing may not be started until all unauthorised persons are within the boundaries set aside for them.

The maintenance personnel must leave the danger area beneath the gondola before the gondola starts to move.

Persons who are in non-cordoned off areas in order to carry out maintenance and adjustment work must make sure that they have constant direct visual contact with the operator of the swing.

A code of signals must be agreed between the operator and the maintenance personnel.

Work carried out on the equipment during operation must be kept to the absolute barest necessary minimum.

To stop the gondola during operation, press the stop button.

The shortest braking distance is produced by the emergency stop button. However this should not be used with passengers in the gondola.

2. Power Failure

In the case of a power failure, the gondola continues to swing until it comes to a standstill. The seat safety bars remain closed. For instructions on how to open the seat safety bars by hand in the case of a long power failure, see Point II 6.12.

The gondola stops in the 180° position as a result of a technical malfunction:
In this case the counterweight is at the bottom at a height of approx. 6 feet above the platform.
A group of several people must then pull or push until the gondola begins to move.

The force exerted by the people pushing or pulling is not enough:
Attach the block and pulley tackle supplied with the swing into the rod provided for this purpose between the counterweights and tauten the rope.

As soon as the counterweight starts to move, the area under the transport pallet must be evacuated immediately since otherwise there would be a danger of injury by the gondola as it swings down and through.

Important: Never stand on the centre section. Use a rope and pull from a safe distance. Keep escape routes clear.

Store the block and pulley tackle within reach (in the cash booth or under the gondola).

3. Safety Bars Fail to Open:
There is a hand pump on the safety bar aggregate of the gondola. Open the safety bars by means of this pump. In the cover of the central panel there is a slotted hole for attaching the lever of the hand pump.

The lever is detachable and should be kept in the cash booth.

Break in a Hydraulic Hose or Leak in the Actuating Cylinder of a Seat Safety Bar:
Cylinder does not leave the locked position:
Open the venting screw on the cylinder by reaching through the floor plate.

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4. Undefinable Situations

Should operating or danger situations arise in which operators consider it necessary to stop the swing immediately, this can be done by
the normal braking command
or by actuating the emergency cutout switch on the control desk.

5. Faults

5.1 Fault Signals Programme

The faultless functioning of the electrical and some of the mechanical systems is monitored by the fault signals programme.

Despite the very high quality of the components used, it is never possible to completely exclude faults arising in the course of time.

Existing and developing faults are indicated by lamps and numbers lighting up on the control panel and in the switch box.

> If the fault signals cannot be extinguished by acknowledgement or if the fault is repeatedly indicated, then it is a genuine fault.

These faults are divided into two categories:

1) Faults which interrupt the ride:

   a) By braking the swing via the stop function.
   Fault Nos. 1, 2, 15

   b) By braking the ride via the stop function after a delay of 1 minute.
   Fault Nos. 19, 21, 25

   c) By switching off the drive and thus allowing the ship to swing to a standstill.
   Fault Nos. 3 to 7, 9 to 12, 14, 17, 18, 20, 22, 23, 24, 26, 36, 37

Tests 5 and 6

Set the counter wheel. The test lamp starts to flash.

Press the start button.

Press the button "Looping right" or "Looping left".

After the first full revolution, press the test button.

The speed should increase.

As soon as the speed is too great, the drive should cut out.

The display should show the same fault number as the number on the counter wheel. The "Fault/Acknowledge" lamp should also flash.

IMPORTANT!
On no account must there be anybody in the gondola during these tests!

Test 7

Set the wheel to test No. 7.

Press the test button and hold it down.

Press the start button while the test button is depressed.

Keep holding the test button down until the fault No. 7 appears

On this test, the gondola will start to move only slowly after the start.

5.3.4 After completing these tests, reset the counter wheel to 0.

5.3.5 Malfunction Alarm Code

Alarm Signal	Nature of Malfunction
1	Angle encoder twisted
2	Rated value for speed
3	Deviation in actual value for speed
4	Control monitoring
5	Overspeed (pulses)
6	Overspeed (tachometer voltage)
7	Start monitoring
8	not yet assigned
9	Overspeed in top monitoring range
10	Control voltage
11	Power supply "regulation"
12	Fault current protective switch DC drives
13	Fault current protective switch three-phase current drives
14	Phase sequence monitoring
15	Emergency cutout switch operated
16	Locking pin
17	Plug monitoring
18	Power circuit fuse, DC drive
19	Contactor, switch box ventilator
20	Contactor, Simoreg panel
21	Contactor, motor fan
22	Power contactors, DC drives
23	Exciting current monitoring
24	Hold brake monitoring
25	Motor full protective system - warning
26	Motor full protective system - switching off
27	Contactors, seat safety bar hydraulics
30	Operating time, seat safety bars

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32	Contactless limit switch, bottom summit (BDC)
33	Contactless limit switch, top left
34	Contactless limit switch, top summit (TDC)
35	Contactless limit switch, top right
36	Limit indicator
37	Speed with triggered hold brake

5.4 Fault Finding Guide

5.4.1 Abbreviations used

LED = Light-Emitting Diode

CLS = Contactless Limit Switch

BDC = Bottom Dead Centre

FCPS = Fault Current Protection Switch

5.4.2 Proceed as follows for the relevant fault signals:

Signal 01) Check the CLS at BDC for proper functioning.

As long as the gondola stands at the bottom, the red LED on the CLS and the green lamp No. 0 on plugin module -A1.5 in switch box field +G4 must be illuminated. These signals must go out when the gondola leaves BDC; if not, there is a cable break or a loose terminal or the CLS is defective.

If this is in order, check whether there are any signals from the angle encoder. For this, when the gondola is at BDC, the top 8 green LEDs in switch box field +G4, plugin location -A1059 must be out.

If one or more LEDs are on, the angle encoder is defective or twisted or there is a break in a cable.

Check the angle encoder to ensure that it is rigidly mounted. It should not be possible to turn it by hand. Check the coupling to the slipring body.

Signal 02) Check whether the left-hand red LED B1 on PCB -A1131 in switch box field +G4 lights up briefly.

Check whether the two rows of red LEDs on PCBs -A1059 and -A1071 run parallel. If not, both PCBs must be exchanged. If this does does remedy the error, the fault may also lie in the PCBs -A1083 and -A1091, possibly also in PCB -A1131.

Signal 03) Measure whether there is any speed-sensitive output voltage (tachometer voltage). If this voltage exists, there is a fault in PCB -A1099, which must then be exchanged.

Signal 04) This faults necessitates exchanging PCB -A1107. If this does not remedy the fault, it is essential to refer back to the manufacturer.

Signal 05) If this fault occurs while the gondola is swinging
06) without any excess speed being apparent, the fault may possibly be cleared by exchanging PCB -A1107 (Fault No. 6) or PCB -A1099 (Fault No. 5).

If the speed really is too great, refer back to the manufacturer.

Signal 07) Check whether the isolators Q21/22 have been inserted in switch box field +G2.

During assembly/erection operations, make sure that the stop lamp has gone out before initiating the starting procedure.

Signal 08) Not assigned to a fault.

Signal 09) Occurs through incorrect operation by personnel when the selected curve for swinging does not correspond with the current load in the gondola.

Signal 10) Check in switch box field +G4 whether the automatic cut-outs F93 and F94 have been inserted. If the cut-outs trigger, check for a short-circuit.

Signal 11) Check in switch box field +G4 whether the motor protection switch Q44 and the automatic cut-out F91 have been switched on.

Check the microfuse in assembly -A1011. If the LED B1 on PC Board -A1131 is lit, a supply voltage is missing. These voltages can be measured in the four jacks (red, black and blue).

Signal 12) Eliminate the earth fault and press in the fault
13) current protection switch.

Signal 14) Check whether the mains voltage is present at the correct strength on all phases.

The mains voltage can be read off in switch box field +G1. The voltmeter can be switched over to the different phases by means of a toggle switch.

Signal 15) Release the emergency cutout switch in the control desk or in switch box field +G1 or +G4.

Signal 16) Check whether the locking pin in the tower head has snugged fully home and whether the corresponding CLS is functioning. The red LED on the CLS must be lit.

Check in switch box field +G4 whether LED 4 on module-A1.5 is lit. If not, there may be a cable break or a loose connection.

Signal 17) Check plugs +G4 - X1, +G4 - X2 and +G4 - X3 to ensure that they are correctly seated.

Signal 18) Check that all phases from the mains supply are available.
Check the fuses in isolators Q21 and Q22 and exchange if necessary.

IMPORTANT: Use only original SITOR fuses.
The main switch for the drive must be switched off while the isolator is inserted.

Press the motor protection switch back in, check fuses F21.1 and F22.1 and exchange if necessary. Check the fuses in isolator Q23 and the automatic cut-out F31.

Signal 19) Check in switch box field +G2 whether the motor protection switches Q42, Q41.1, Q41.2 and the FCPS F41 are switched on and that contactor K41 has energized.

If this is the case, check whether LED No. 0 on module -A1.7 and LED No. 1 on module -A2.7 are lit.

If not, there is a contact fault, e.g. cable break, loose terminal etc.

Signal 20) Check in switch box field +G2 whether the automatic cut-out F34, the motor protection switches Q43, Q34.1 and Q34.2 as well as the FCPS F34.1 are switched on.

Contactor K24 must have de-energized.

Contactor K34 must have energized.

LED No. 1 on module -A2.7 must be lit, as must also LED No. 1 on module -A1.7.

If these are not lit, this indicates a contact fault, e.g. cable break, loose terminal etc.

Signal 21) Check in switch box field +G2 whether the automatic cut-out F32, the motor protection switches Q32.1, Q32.2, Q32.3 and Q32.4 are switched on.

Check plugs +G2 - X1, +G2 - X3 and +G2 - X4 to ensure that they are correctly seated.

Contactor K32 must have energized.

LED No. 4 on module -A2.7 and LED No. 5 on module -A1.6 must be lit.

Signal 22) Check in switch box field +G4 whether contactor K25 has energized and whether the automatic cut-out F91 is switched on.

LED No. 4 on module -A1.6 and LED No. 0 on module -A2.7 must be lit.

Signal 23) Check whether the ammeter registers exciting current.

The rated value is 6 amperes.
Check in switch box field +G4 whether LED No. 3 on module -A1.7 is lit.

If the LED is not lit and no exciting current is present, refer back to the manufacturer.

Signal 24) Check in switch box field +G4 whether LED No. 7 on module -A2.7 and LED No. 4 on module -A1.8 are lit.

In the gondola position in which the brake is to hold the gondola, both LEDs must be lit, otherwise they must both be out.

If this is not the case, check for correct seating of plug +G4 - X3, check current relay F1 in switch box field +G4. Ascertain whether there is a contact fault e.g. cable break, loose terminal etc. and whether the voltage to the brake is operative.

Signal 25) Check the motor temperature.
26)

In the case of fault signal 26, the signalling unit F20.3 in switch box field +G2 must be reset (press button R).

Signal 27) Check in switch box field +G2 whether the automatic cut-out F33 and the motor protection switch Q33.1 are switched on.

Check plug +G2 - X5 for correct seating.

Contactor K33.1 must have energised.

LED No. 5 on module -A2.7 and LED Nr. 6 on module -A1.6 must be lit.

Signal 30) Check whether the seat safety bars execute the movement demanded by the control command.

When the seat safety bars are closed, the lamp on the control desk must light up.

~~Check the proper functioning of the CLSs on the footboard by approaching them with a piece of steel~~.

In the gondola check whether the valve plugs are receiving voltage and whether the valves switch.

Check whether the pressure switches at front and rear in the gondola switch when the seat safety bars close.

Signal 31) Check the proper functioning of the CLSs by approach-
32) ing them with a piece of steel.

Check the feeder cable for a contact fault, e.g. cable break, loose terminal etc.

IV. Maintenance Instructions

1. Important Maintenance and Cleaning Instructions

1.1 Bearings, electric motors, electric switchboards, magnetic valves, limit switches, distribution boxes and sockets must not be cleaned using steam jet blowers or aggressive cleansing agents or solvents.

1.2 After cleaning, bearings must be regreased in order to restore corrosion protection.

1.3 Electrical connections, distribution boxes etc. must be reclosed with great care after they have been opened.

Packing boxes/glands must be resealed with silicon rubber if necessary.

IMPORTANT:
During winter storage, the motors and the electrical switch box must be protected by connecting the anti-condensation heating. This is done by connecting cable +G2-X6 as well as the earthing contact type plug. If it is not possible to connect a power supply to operate the anti-condensation heating, the motors must be packed and protected against moisture with silica gel.

A number of bags containing silica gel must also be placed in the switch box.

For winter storage, it is recommended to place the electrical switch box in a closed room and to protect it from lengthy periods of exposure to temperatures of under approx. 20° C.

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Actuate the desired ride control or stop button. If mains voltage is present, the swing will return to a controlled ride.

1.8 IMPORTANT!

Persons may not be present and no work may be carried out on the service platform at the back of the cloud unless

a) the main supply voltage and lighting voltage are switched off

b) the locking pin is inserted.

2. Lubricating Instructions

	Lubricating and Maintenance Period:
2.1 Large Top Drive Ring on the Hub	
Toothing, accessible through the flap in the protective box, lubricate at slow speed.	Daily, but at the latest when bare metal patches are seen on the sides of the teeth.

Procedure:

1. Run the gondola to TDC.

   ("Start" button + "Stop at Top" button)

2. Press the button "Looping Right" or "Looping Left", depending on which side of the drive ring is to be lubricated.

3. As soon as the gondola has started to move:

   Press the "Stop" button

   Then the gondola will run down towards the bottom in the correct direction with controlled braking.

Lubricant:	see Table
Drive Ring Ball Bearings:	2 x weekly (approx. every 30 - 40 hours of operation) approx. 3 cm^3 of grease per greasing nipple

Lubricant:	Universal rolling bearing grease or see Table of Lubricants

2.2 Parallel Drive

Toothing for the parallel position maintenance drive in the tower and on the gondola linkage:	Daily or after max. 10 hours of operation
This toothing is not visually accessible. For this reason, greasing is via greasing nipples.	
There are 2 nipples located next to each Wagner gearing set.	Daily press in approx. 4 - 6 cm^3 grease in each nipple and then run the swing through several revolutions right and left under no-load.

Drive Ring Ball Bearings

In the bearing on the gondola linkage	2 x weekly (approx. every 30 - 40 hours of operation) approx. 3 cm^3 grease per greasing nipple
Lubricant:	Universal rolling bearing grease or see Table of Lubricants

2.3 4 pcs. Cyclo Reduction Gearing

on the tower	annually
(flange-mounted onto the Siemens electric motors)	see separate maker's manual

2.4 4 pcs. Wagner Gear

on the parallel position maintenance drive:

2 x on the hub
2 x on the gondola linkage

These gears are hermetically sealed to be pressure-tight and can thus be operated in any position

Oil level up to oil level sight glass

Oil capacity per gear 2.5 l

Lubricant: see separate maker's manual

Change the oil once a year

2.5 Universal-Joint Shafts

Slide Block — Maintenance-free

Universal Joints — annually

Lubricant — Universal grease

2.6 Other Plane Bearings — periodically

Lubricant — Universal grease

2.7 Hydraulic Circuits

Cleanliness is the most important precondition for reliability and a long service life.

Seat Barriers

in the carpet (gondola) — Check oil level daily

	Lubricant	Hydraulic oil, see Table of Lubricants
	Assembly Hydraulic Systems	
	On travelling models, in the centre section or in the transport pallet of the ship	Check oil level prior to each assembly
		Hydraulic oil, see Table of Lubricants
2.8	Electric Motors	periodically
	Depending on the climate or the location where the ride is operated, the motors must be blown through from time to time with dry air. Make sure that the ventilation apertures are kept clean	regularly
	Greasing the bearings of the main motor after approx. every 2000 hours	
	Lubricant	Multi-purpose rolling bearing grease
	Motors without greasing facilities are fitted with encapsulated bearings pre-greased for the service life of the bearing	
	Open Bearings such as articulated joints, hinges and pins on supports etc.	periodically
	Lubricants	Multi-purpose grease

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Slip Ring Assembly:

Rolling bearings are permanently greased.
Regrease after dismantling.

Lubricant: Multi-purpose grease

Carbon Brushes

Check for wear of the brush itself, check that all links and joints run easily — periodically

IMPORTANT: Check only when de-energised.

Fixing Bolts

For tightening torques and instructions — see overview drawing

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Maintenance Regulations for Slip Ring Assembly

Maintenance covers

a) slip rings
b) brush holders
c) brushes

a) Slip Rings

The slip rings must always have a smooth and clean surface. It is essential to keep them free from dust and grease. If this cannot be done to the required degree, the slip rings and brushes must be cleaned at regular intervals. For the same reasons, do not use contact grease. Rough areas on the slip rings must be smoothed in good time using fine carborundum cloth; the grinding dust must then be removed.

b) Brush Holders

The brush holders must be firmly seated on the pin. When connecting the brush holder cables, make sure that the clamping screw, which also serves as the terminal screw, does not become loose.

It must be possible to move the brush holder arms at the joints without exerting force. A medium amount of play in the joint is less risky than too little play.

Defective brush holder springs must be exchanged immediately.

c) Brushes

The brushes must be checked at regular intervals; however this must be done without taking them out of the brush holders. This maintains the good contact between the slip ring surface and the brush.

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When setting a new brush on the surface of the slip ring, make sure that the brush immediately obtains an adequate grinding surface in order to avoid undue wear on the brushes and the slip rings.

To achieve this, wrap fine carborundum cloth around the slip ring under the brush and turn the slip ring. The grinding dust must then be removed. It is essential not to mix brushes of different makes, since the different properties of the brushes will make current distribution uneven and result in the brush with better conductive properties being exposed to greater wear.

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Recommended Grease for the Toothing of the Parallel Position Maintenance Drive

a) Toothed ring on the gondola linkage

b) Toothed ring, built into the inside of the tower

Makers	Type
Carl Bechem GmbH Weststraße 120 5800 Hagen-Vorhalle Tel. 02331 / 30 70 96	Berulit 443
ARAL	Aralub LFZ 1
SHELL	Shell Grease S 8327
BP	Long-service grease

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Recommended Lubricants for the Track and Toothing for INA Rotating Gear

Make	Lubricant for Track	Toothing	Temperature Range °C permanent	short-term	Thawpoint °C	Worked Penetration
Aral	Grease HL 2	Sinit FZ 12 Grease LFZ	-35/+120	-35/130	190	265-295
BP	Energrease LS 2	Energol WRL	-35/+120	-35/130	190	265-295
Castrol	Spheerol AP 2 Spheerol APT 2	Grippa S	-20/+120 -20/+120	-20/130 -20/130	195 180	265-295 280
Esso	Beacon 2	Surret Fluid 30	-30/+120	-30/125	185	265-295
Gulf	Crown Grease No. 2	Lubcote No. 2	-30/+120	-30/130	195	277
Mobil	Mobilux 2	Mobil-tac E	-30/+130	-30/140	182	265-295
Shell	Alvania Grease	Cardium Fluid D Fluid 12	-20/+115	-20/130	185	265-295
Texaco	Multifak 2	Crater 2 X Fluid	-20/+120	-20/130	200	265-295
Valvoline	LB-2	FGC	-25/+110	+120	180	260-280

LUBRIPLATE 630-2 GEARSHIELD FLUID = AEROSOL CARTRIDGE

CYCLO GEAR CONSTRUCTION; LORENZ BRAREN KG

8062 Markt Indersdorf near Munich

RECOMMENDED LUBRICANTS FOR CYCLO GEARING

Type of lubricant Specification DIN 51 502	Ambient/ Operating Temperature	ARAL	AVIA	BP	ESSO	Klüber	Mobil	Shell
Fluid Gear Oil G-P 0 h	from 0° C to + 80° C	Aral Grease FDP0	AVILUB Grease N6	BP ENER-GREASE HT 0	FIBRAX EP 370	ST15/400 EP	Savarex Grease L0, Mobilpex 46	Shell Ret Shell Spe Gear Grea

Lubricating Instructions

clo standard gears are filled with suitable grease at the works. On request, clo gears of sizes 4 to 14 can also be designed for oil lubrication.

the case of extreme ambient and/or operating temperatures, e.g. radiation at or heat from hot media supply lines, it is essential to refer back to clo!

the Cyclo gear is at a standstill for any relatively long period of time, it recommended that it be filled with motor corrosion protection oil HD SAE 30.

bricants of different manufacturers should not be mixed; this is particularly portant in the case of greases.

ways clean the gearing thoroughly prior to refilling!

Lubricant quantities for Cyclo gears (Regrea

500 cm³

Table of Lubricants for Wagner Gears.

The oil grade with an adjacent tick is suitable for gear type .
Drive speed n_1 = rpm.

Important for Operation!

This table must be passed onto the operator prior to first-time operation of the gear since the latter is delivered without an oil filling.
To avoid damaging or destroying the bearings, never fit couplings, wheels or pulleys etc. on the shaft by means of hammer blows but draw them on gently making use of the threaded holes in the shafts.

Mark relevant item with *)	Type of Gear	Viscosity cSt at 40°C E at 50°C	Type of Lubrication	Bearing	ESSO	MOBIL OIL	SHELL	ARAL	BP
	Medium-heavy duty type Spur gear Mitre spur gear	95-130 cSt (8-10 E)	Splash Lubrication at 8m/sec Forced Lubrication at 8m/sec	Rolling Bearing	SPARTAN EP 100	MOBILGEAR 627 MOBIL DTE 27	Omala 100	Degol BG 100	Energol GR-XP 100

The correct use of the best-suited, properly selected lubricants makes it possible to achieve maximum performance and to prevent malfunctions and their consequences. The above table lists the lubricants that are suitable for lubricating the various gears. If other lubricants are used, the quality of these must correspond to that of the products listed above.
(Valid for all normal room temperatures and completely oil-tight encapsulated gears with forced lubrication or splash lubrication.)

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3.3 Rolling Bearings and Plain Bearings, General

Multi-purpose Rolling Bearing Grease

3.4 Hydraulics

ISO Viscosity Class DIN 51 519	ISO VG 68
Agip	Agip OTE 68
ARAL	Aral Kosmol TL 68
AVIA	AVILUB Turbine Oil CS
BP	BP Energol THE 68
Castrol	PERFECTO T 68
Chevron	Chevron OC Turbine Oil 68
ECUBSOL	on enquiry
ELF	ELF MISOLA H 68
ESSO	TERESSO 68, TRO-MAR T 68
FINA	FINA BAKOLA 68
Fuchs	RENOLIN DTA 20
Gulf	Gulfcrest 68
Mobil	Mobil D.T.E. Oil Heavy Medium
Optimol	on enquiry
Shell	Turbo Oil T 68
SUNDCO	SUNDVIS 931 ISO 68
TEXACO	Regal Oil R & O 68
TOTAL	Total Preslia 68
VALVOLINE	VALVOLINE Turbine Oil 3 S
WISURA	WISURA DT 68

V. General Remarks

1. List of Weights of the Main Components

Centre section		
Assembled for transport approx.		31,000 kg
Gondola		4,800 kg
Transport pallet		3,500 kg
Transport pallet + gondola		9,000 kg
Swing arm		2,850 kg
Gondola linkage		2,000 kg
Counterweight arm		2,700 kg
Counterweights	2 x	2,700 kg
Electrical switch box	approx.	1,800 kg

2. Any snow or ice must be removed on each occasion that the swing is put into operation.

3. For the tightening torques of the screws, see the overview drawing.

4. All load-bearing components and drive components must be checked at regular intervals to ensure that they are in perfect condition.

5. Supports

The supports are to be inserted at the locations indicated in the support plan.
The support dimensions are valid for a permissible foundation pressure of max. 15 N/cm^2.
The supports must be kept as low as possible.
They must be solid, and must have a stable footing.
If necessary, they must be secured by ground anchors etc.
Protect against the soil being washed away from underneath by rain, running water, etc.
Sloping sites should be graded as far as possible prior to installing the swing.

For anchoring of the rear wall see Drawing No.

6. Produce the earthing.

7. In the case of equipment whose dimensions, capacities etc. are regulated by the authorities, the official regulations must be observed.

8. Prior to operating the swing with passengers:

   a) The operating personnel must be thoroughly familiarised with the equipment and the operating instructions.
   b) A number of no-load ride programmes must be carried out every day prior to operation in order to check that the swing is ready for operation.

9. The swing and its equipment must be supervised at all times during operation. Any defects that arise must be remedied immediately; if necessary, operation must be terminated.

10. The gondola may be loaded with max. 40 people (calculated load per person = 75 kg). As far as possible, the load must be evenly spread (symmetrically on either side of the longitudinal axis and on either side of the transverse axis).

11. The supervising personnel must ensure that the passengers do not move onto the platform from which the gondola is entered until the gondola has come to a standstill and the passengers of the preceding ride have left the gondola.

12. The operator may not start the ride until:

    a) all passengers are sitting on the seats,
    b) all seat safety bars have been hydraulically closed,
    c) the passenger entry and exit platforms have been cleared of all passengers.

13. If tumultuous crowds of people mean that there is a danger of people being pushed into the space normally occupied by the passenger gondola at BDC, operation must be stopped.

14. The seat safety bars must not be opened until the gondola has been run to the 0° position or within the stated tolerance.

15. Leaning out of the gondola, stretching out arms and legs, and taking animals, umbrellas, sticks and other bulky or sharply pointed objects into the gondola is prohibited.

16. Children under 8 years of age may not use the ride. Drunken persons are to be refused admittance to the ride.

17. The regulations as per 15 and 16 above must be prominently displayed on a notice.

    Furthermore, for operating the ride, the pertinent regulations, Points 5.1.1, 5.1.2, 5.1.6 and 5.1.8 of the "Guidelines for the Construction and Operation of Flying Structures" must be observed.

18. At wind speeds of force 8 or higher on the Beaufort scale (corresponding to a wind speed of approx. 70 km/h) operation of the ride must be discontinued.

VI. Notes on Electrical Connections for Different Power Networks

1. The basic version of the swing is suitable for connection to the following power networks (this applies both for the power drive units and for the lighting elements).

380 V/ 50 cps
440 V/ 60 cps ± 15%

The swing is adjusted at the works for 380 V/ 50 cps.

Prior to connecting the swing to other networks, an electrician must carry out suitable conversions according to instructions.

Connection data related to a 380 V/ 50 cps power network

Rated current (drive and lighting)		380 amps
Short-time maximum current		450 amps
Fuse		315 amps
	alternatively	355 amps
	alternatively	400 amps
Transformer operation		250 kVA

Connection cables	2 cables each parallel
a) with protective multiple earthing	2 pcs. each 4 x 70 mm^2
b) with protective conductor networks	2 pcs. each 5 x 70 mm^2

When operating the ride with a power network of 440 V/ 60 cps
a lighting transformer for 440 V, 70 kVA on the primary side and 380 V on the secondary side must be used.

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2. Special Voltage

220 V/ 60 cps three-phase current network

This voltage must be avoided!

The following currents can be expected:

mean current: 500 A
max. current: 700 A

Should this network be used, for both the power drive units and the lighting elements of the swing it is necessary to use a transformer designed for 380/220 V on the secondary side (with neutral conductor).

When using this network or any other network other than those described under 1. above, it is essential to refer back to the manufacturer.

It is not recommended to operate the ride with a diesel generator. In any case, it is then essential to refer back to us or to the manufacturer of the electrical equipment, namely the Siemens company in Bremen.