

Bus Top Premium

Workshop Manual

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1 Introduction

1.1 Contents and purpose

This workshop manual is designed to assist trained personnel and contains important installation, maintenance, care and repair information relating to the ventilation and emergency exit hatches of the Bus Top Premium range.

The emergency exit and ventilation hatches are used as

- emergency exits
- static ventilators

in city buses and coaches.

1.2 Meaning of signal words

Throughout this manual, the signal words WARNING, CAUTION and NOTE have the following meanings:

WARNING

This heading is used to highlight operating instructions or procedures which, if not or not correctly followed, may result in personal injury or fatal accidents.

IMPORTANT

This heading is used to highlight operating instructions or procedures which, if not or not correctly followed, may result in damage to the equipment, its components or the vehicle.

NOTE

This heading is used to direct your attention to a special feature deemed essential to highlight.

1.3 Additional documentation to be used

This workshop manual contains all the information and instructions necessary for the installation, care, maintenance and repair of Bus Top Premium ventilation and emergency exit hatches.

Normally, there is no need to use additional documentation. If required, the operating instructions, the installation instructions and the spare parts list can be used as well.

1.4 Statutory regulations and safety instructions

In principle, the general accident prevention regulations and current works safety instructions are applicable. The position, number and size of emergency exits in buses and coaches is regulated in the relevant motor vehicle construction and use regulations.

The applicable European standard is ECE R 36. Other national standards may also be applicable.

1.5 Suggestions for improvements and changes

Complaints, improvement suggestions or corrections relating to this workshop manual should be addressed to:

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2 General Description

The Bus Top Premium ventilation and emergency exit hatch is used for ventilation and air extraction within buses and coaches as well as serving as an emergency exit for people in the event of danger.

In the Bus Top Premium emergency exit version, it is also available as an emergency exit hatch without a ventilation function.

The ventilation function is exclusively electrically operated. The following positions are defined for the hatch cover:

- Opened at the rear
- Opened at the front
- Opened at the front and rear
- Closed

In the event of danger, the cover assembly (2, Fig. 201) of the ventilation and emergency exit hatch can be manually unlocked and removed from the inside or the outside. The outside emergency actuation handle can be electrically lockable in order to protect against intrusion (optional). The Bus Top Premium is always covered by an interior trim on the side facing the passenger compartment. This workshop manual does not deal with the various designs and attachment variants.

Bus Top Premium ventilation and emergency exit hatches are available in the following basic versions:

- Bus Top Premium / electric with ventilation and emergency exit function
- Bus Top Premium / emergency exit without ventilation function

The following functions are available as an option:

- Rain sensor (for all electric variants)
- Locking of outside emergency actuation handle
- Provision of an electrical signal on emergency actuation

NOTE
View from below
without interior trim

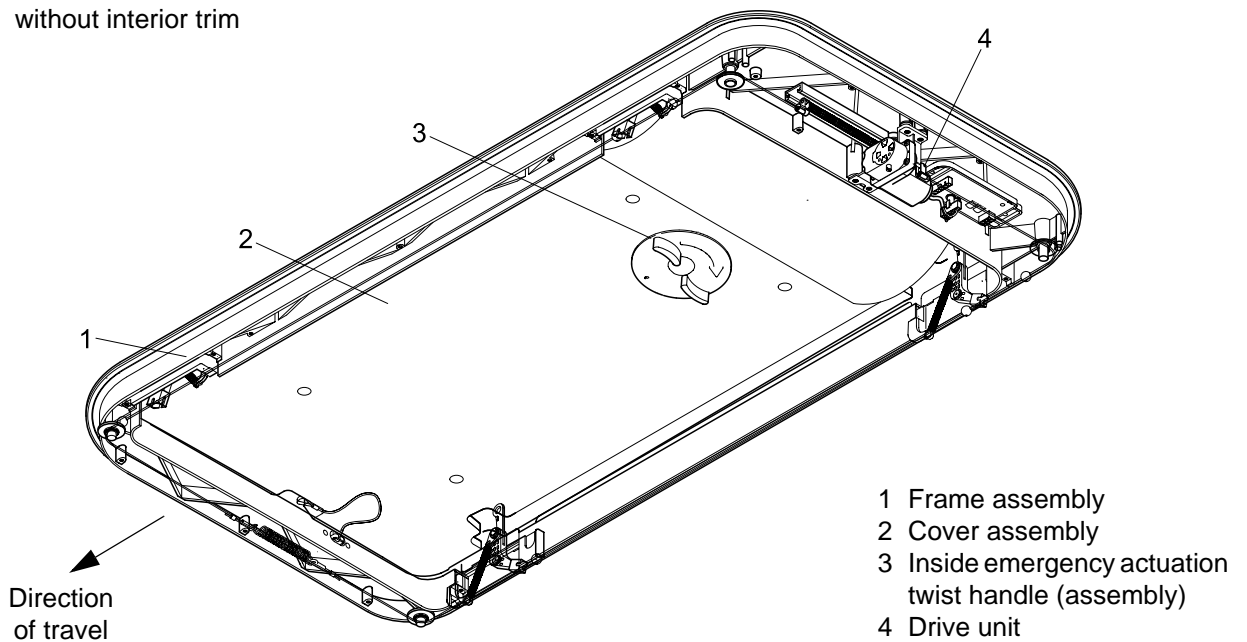


Fig. 201 Bus Top Premium – General view (page 1 of 2)

NOTE

- View rotated through 180°
- Insulating panel not shown

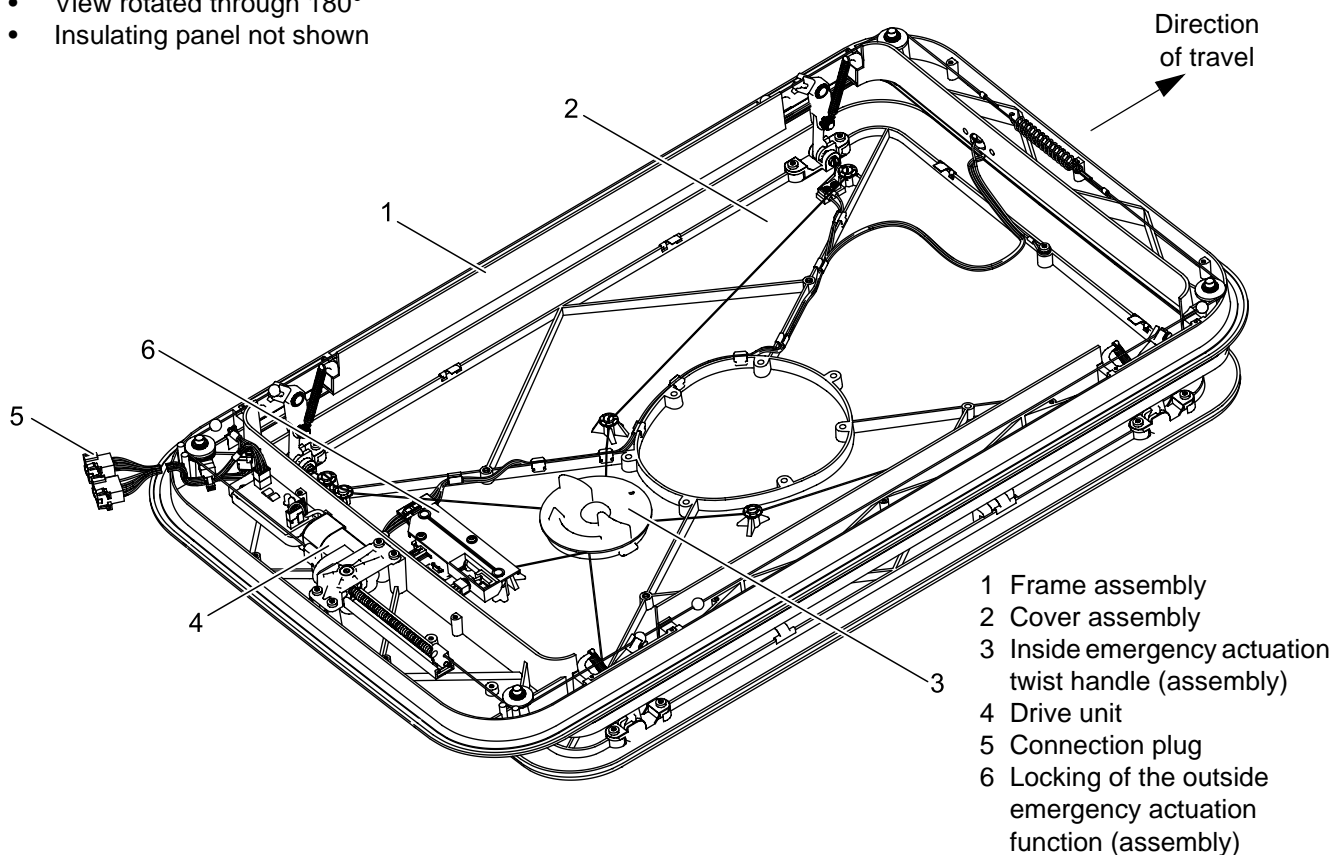


Fig. 201 Bus Top Premium – General view (page 2 of 2)

2.1 Cover assembly (Fig. 202)

The movable cover assembly closes the hatch aperture. It contains the following subassemblies:

- Cover
- Insulating panel
- Emergency unlocking mechanism
- Locking of the outside emergency actuation function (option)

2.1.1 Cover

The cover (5, Fig. 202) is made from fibreglass-reinforced, unsaturated polyester (UP GF 30) and is manufactured using the hot pressing process (SMC).

The cover supports the eye blocks (4) which function as the connecting points for the opening mechanism as well as the emergency unlocking mechanism.

The cover is sealed against the frame assembly when closed. The outside emergency actuation handle (6) is located on the outside. On the inside are located the inside emergency actuation twist handle (10) for the emergency unlocking mechanism, the optional assembly for locking the outside emergency actuation function as well as the wiring harness and the insulating panel (1).

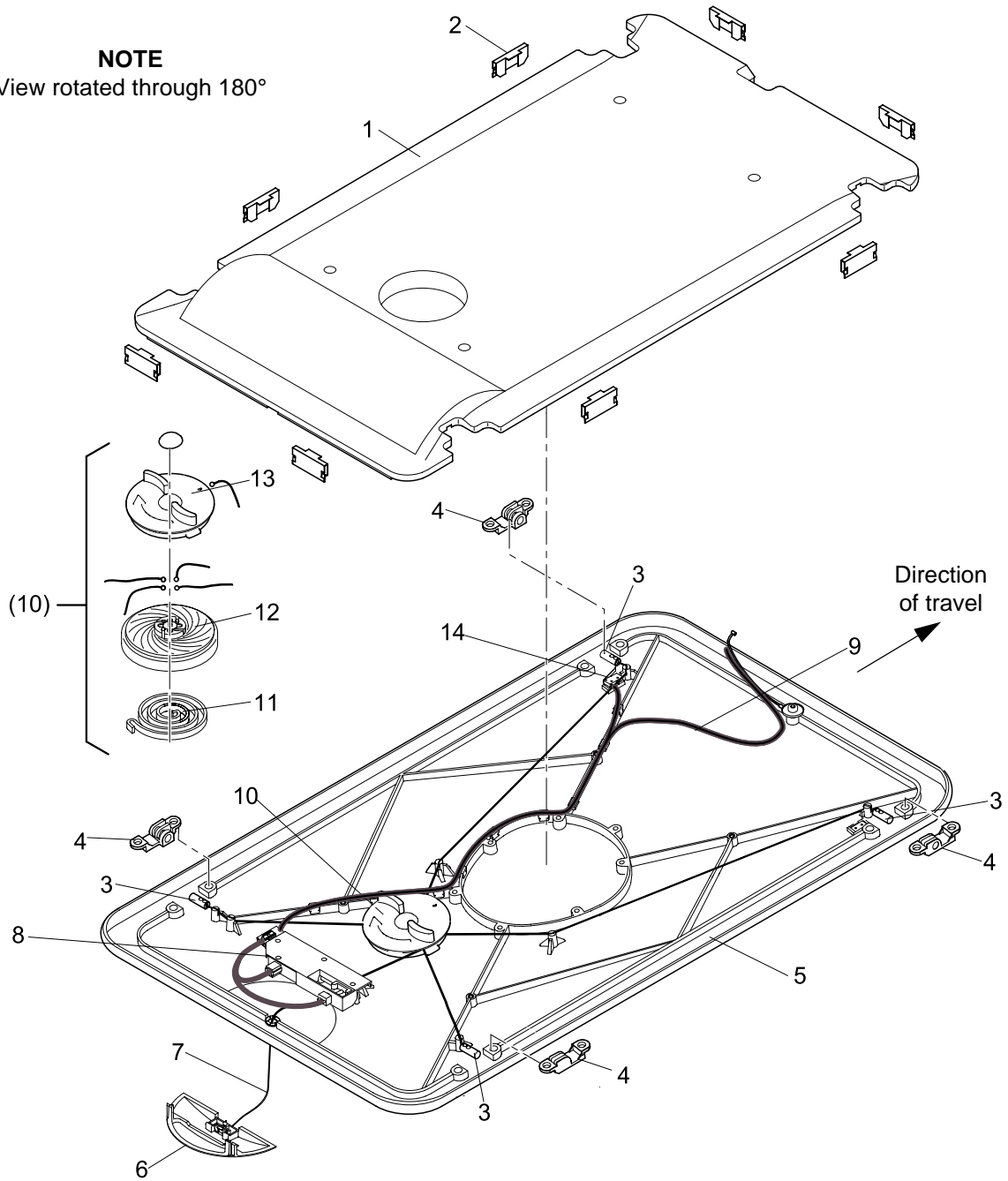
2.1.2 Insulating panel

The insulating panel (1, Fig. 202) is attached to the cover from underneath using 8 securing clips (2) as well as 4 screws with washers. It serves as a trim panel facing the passenger compartment and also provides thermal insulation.

2.1.3 Emergency unlocking mechanism

The emergency unlocking mechanism consists of the outside emergency actuation handle (6, Fig. 202) which is connected via a pull cable (7) to the inside emergency actuation twist handle (10). This consists of the locking disc (13) with the cable reel (12) and return spring (11) as well as four unlocking cables with ball-carrier pegs (3).

NOTE
View rotated through 180°



- | | |
|--------------------------------------|--|
| 1 Insulating panel | 8 Locking of the outside emergency actuation function (assembly, option) |
| 2 Securing clip (8) | 9 Wiring harness (option) |
| 3 Peg with unlocking cable (4) | 10 Inside emergency actuation twist handle (assembly) |
| 4 Eye block (4) | 11 Return spring |
| 5 Cover | 12 Cable reel |
| 6 Outside emergency actuation handle | 13 Locking disc |
| 7 Pull cable | 14 Microswitch (option) |

Fig. 202 Bus Top Premium cover assembly

2.2 Frame assembly (Fig. 203)

The frame assembly contains the following subassemblies:

- Frame
- Opening mechanism
- Drive
- Control unit
- Arrester cable
- Cover seal
- Rain sensor (option)

2.2.1 Frame

The frame (1, Fig. 203) is made from fibreglass-reinforced, unsaturated polyester (UP GF 30) and is manufactured using the hot pressing process (SMC). The lever mechanism, the seal (8) against the cover, the electronic control unit (2), the drive unit with spindle drive (4) and the optional rain sensor are installed in the frame.

2.2.2 Lever mechanism

The lever mechanism (3, Fig. 203) consists of four openers with ball levers, rocker arms and dead-centre springs.

The dead-centre springs stabilise the lever mechanism in its particular limit positions.

When the drive cables (5) move, the steel balls fixed onto them engage in the ball cups of the openers. As a result, the openers (and with them the hatch) are lifted or lowered.

2.2.3 Drive

The drive for the opening mechanism consists of the drive unit with spindle drive (4, Fig. 203) and drive cables (5) which are described in more detail below.

2.2.3.1 Drive unit with spindle drive

The forwards and backwards movements of the drive cables (5, Fig. 203) and the resulting kinematic sequence of lever movements are initiated by a drive unit with a spindle drive (4). A DC motor forms the basic unit of this drive unit. It drives a multi-stage helical gear unit which in turn rotates a nut with a trapezoidal thread. This nut is mounted in the motor and gear unit housing. The nut is held in place by axial thrust bearings, which means the rotation of the gear unit is converted into a translation of the spindle with a trapezoidal thread. A cable adapter is fitted as a guide element with a guide piece in order to prevent friction between the nut and spindle from causing the spindle to rotate as well, since this would lead to twisting of the drive cables which are attached to the cable adapters on both ends. It runs in a fixed profiled rail which prevents the spindle from rotating.

The drive unit is mounted in rubber bushes on the frame and in the motor carrier.

The spindle travel required for opening is 135 mm. During

a certain portion of the movement cycle, the motor acts against the dead-centre spring integrated in the lever mechanism, whereas the remaining travel is propelled by this spring to a certain extent. As a result, the spindle does not have a constant axial speed.

The cable adapter located on the opposite end of the guide rail contains a magnet which signals the spindle position to a sensor in the control unit housing.

2.2.3.2 Drive cables

The drive cables (5, Fig. 203) are the transmission elements in the kinematic sequence for opening and closing the roof. The cables have steel balls pressed onto them at defined points, and are attached to the spindle of the drive unit (4) on both sides. A compensating spring (7) connected in between compensates for the expansion of the cable due to temperature changes, thereby keeping the cable tension approximately constant. Furthermore, this makes the opening procedure more even. Both cables are connected together by a cable segment.

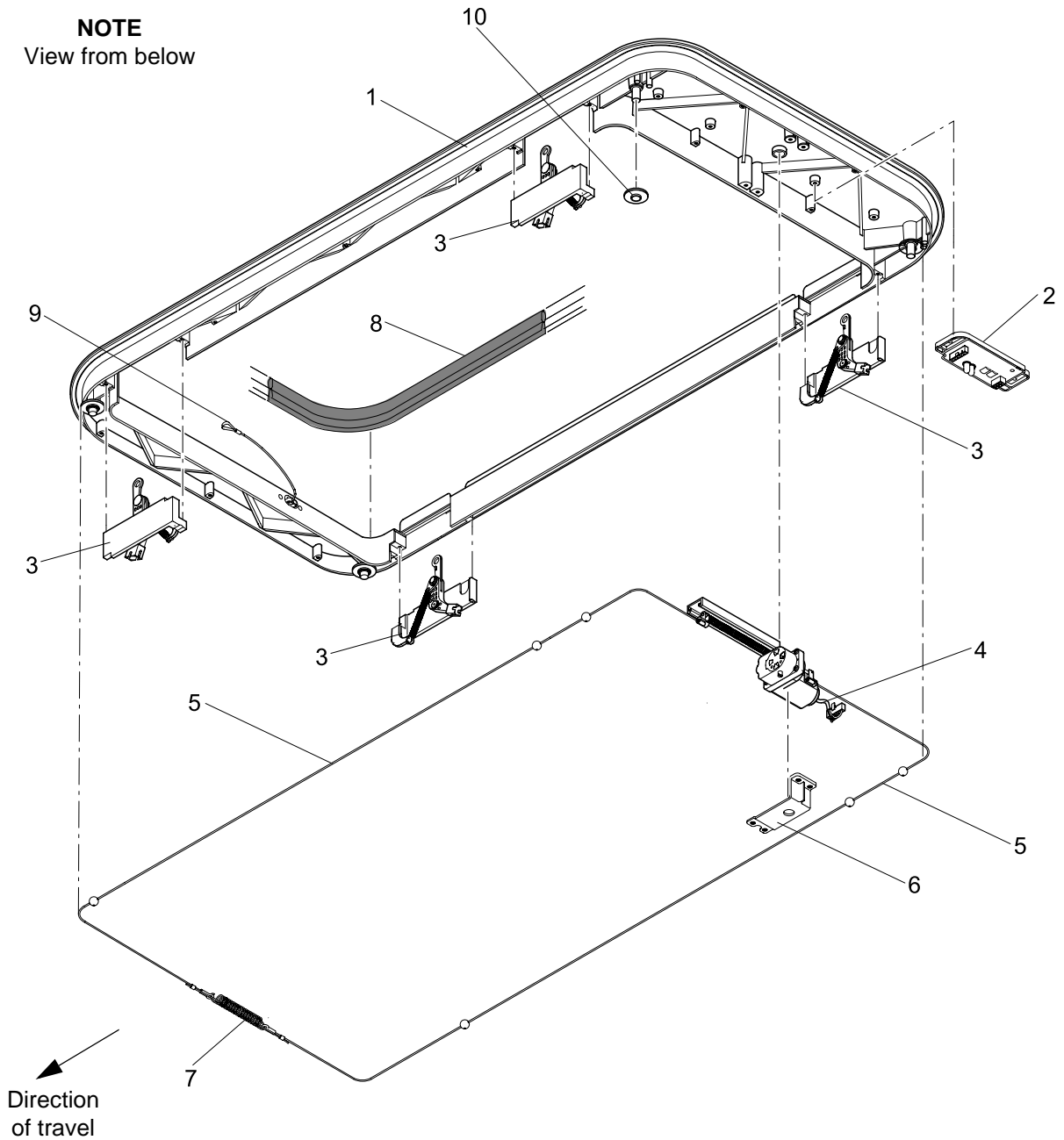
2.2.4 Control unit

The control unit (2, Fig. 203) consists of electronic components and has a program stored in it. The assembly is encapsulated to protect it against ambient conditions. The drive is connected to the 5-pin plug connector (X9) and the adapter wiring harness is connected to the 6-pin plug connector (X3).

The control unit has inputs for the operating voltage and two switching inputs for position selection. The opening status of the roof is displayed by a lamp output (max. 5 W). The control unit (2) is only allowed to be attached in a defined position on the opposite side of the guide rail of the drive unit (4). It must be attached using two screws. This provides for the correct clearance from the corresponding cable adapter with its integrated magnet (defined by the fixing dome on the frame and two holes in the control unit). The distance between the control unit and the cable adapter must not exceed 1 mm when the cover is closed.

2.2.5 Arrester cable

An arrester cable (9) with a length of 260 mm is attached to the front of the frame (1, Fig. 203) as seen in the direction of travel. It is screwed onto the cover. The arrester cable prevents the cover assembly from getting lost and thereby safeguards vehicles travelling behind the bus or coach in the event that the emergency actuation function is triggered with the vehicle in motion (misuse).



- 1 Frame
- 2 Control unit
- 3 Lever mechanism (4)
- 4 Drive unit
- 5 Drive cable (2)
- 6 Motor carrier
- 7 Compensating spring
- 8 Cover seal
- 9 Arrester cable
- 10 Return roller (4)

Fig. 203 Bus Top Premium frame assembly

2.2.6 Cover seal

The cover seal (8, Fig. 203) guarantees secure protection against draughts and water ingress when the ventilation hatch is closed. A special elastomer section is used as the seal element. The base of this section is pushed onto the web running around the frame. The other side of the seal cross-section is an asymmetrical hollow tube.

IMPORTANT

The larger sealing lip of the section must be facing outwards.

When the hatch is closed, the hollow tube is deformed under pressure and is forced against the underside of the roof. This combination of non-positive and positive closure provides the required sealing effect.

2.2.7 Adapter wiring harness

The adapter wiring harness represents the electrical interface between the vehicle wiring harness and the ventilation hatch. It is made up of different cables, depending on the equipment fitted.

2.3 Optional assemblies

2.3.1 Rain sensor

The rain sensor automatically closes an open ventilation hatch in the parked vehicle in the event of precipitation and reopens the hatch when the precipitation stops (assuming this behaviour has been selected using the switches).

A rain sensor is attached to the outside of the frame of one ventilation hatch per vehicle. This controls several ventilation hatches, if present.

The rain sensor is maintenance-free, weatherproof and bus/coach wash-resistant. It is also impervious to the cleaning and care products normally used on buses and coaches.

NOTE

It is possible to retrofit existing ventilation hatches with a rain sensor. (Rain sensor retrofit kit order no. 660 23A)

2.3.2 Locking of the outside emergency actuation function

The outside emergency actuation function can be locked to protect against unauthorised opening.

NOTE

Locking must be triggered by a deliberate action on behalf of the driver, never by the "ignition off" or "voltage drop" signals. It may not be possible to operate the emergency unlocking function from the outside if locking is activated by these signals.

When the hatch is locked, the pull cable is locked by an electro-mechanical actuator with a cable lock. This prevents the emergency unlocking function from being triggered by the outside emergency actuation handle. The locking mechanism of the outside emergency actuation function consists of an electro-mechanical actuator with a limit switch (8, Fig. 202), the wiring harness and a cylinder pressed onto the pull cable. The wiring harness runs from the control unit (2, Fig. 203) along the cover seal to the arrester cable and from there back to the cover to the locking mechanism of the outside emergency actuation function.

2.3.3 Signalling the emergency actuation function

The emergency actuation function is signalled by a micro-switch (14, Fig. 202) attached to the cover close to the front right eye block. The signal is carried on the wiring harness (9).

If the peg is pulled out of the eye block, it actuates the switch lever of the microswitch.

This generates a signal which can be used for an acoustic buzzer or an optical check lamp.

3 Description of Function

3.1 Emergency exit function

IMPORTANT





Only use the emergency actuation function in an emergency!
 Only trained personnel are allowed to operate the emergency actuation function for other purposes (maintenance, repair, etc.).

The basic function of the cover is as an emergency exit. The emergency exit function can be triggered from the inside by turning the locking disc clockwise (direction of the arrow) or from the outside by pulling the emergency actuation handle. Both of these actuation procedures turn the locking disc and clamp the unlocking cables by means of the cable reel. Ball-carrier pegs are attached to the unlocking cables and are thereby pulled out of the eye blocks far enough for the cover to be released from the opening mechanism. After the emergency exit function has been actuated, the ball-carrier pegs are still located within the eyes of the eye blocks. They can be moved back to their initial position by hand or using an appropriate tool (screwdriver). The lever mechanisms should be set to the "opened at the front and rear" position to facilitate installation.

If an emergency actuation/locking indicator light (H2) is installed in the dashboard and connected up, it will light up when the ignition is switched on.

3.2 Ventilation function (not for emergency exit hatch)

The passenger compartment can be ventilated statically. The ventilation hatch is operated using on/off switches. The following positions are defined:

-  = closed
-  = opened at the front
-  = opened at the rear
-  = opened at the front and rear

Switch settings 0 (contact not made) and 1 (contact made) of on/off switches S1 (cover opened at the rear) and S2 (cover opened at the front) cause the roof to move into the positions shown in Fig. 301. The roof position indicator light (H1) lights up when the hatch is not closed (if connected).

Switch		Roof position			
S1 (rear)	S2 (front)	Closed	Opened at the rear	Opened at the front and rear	Opened at the front
0	0	X			
1	0		X		
0	1				X
1	1			X	

Fig. 301 Switch matrix (correlations between switch and hatch settings)

3.3 Control unit

3.3.1 Function of the control unit

NOTE

Due to the function and applications of the control unit, it has been fitted with an integrated overload protection in order to safeguard the system and to preclude potential dangers.

The spindle moves one cable adapter up to the stop against the gear unit housing in order to initialise the system after a battery voltage failure and after every 10th closing procedure. A limit switch signals when the adapter is approaching the stop and reduces the motor voltage shortly before the movement is blocked. If an obstruction is detected during initialisation, the mechanism is moved back by 20 mm at reduced motor voltage before a second attempt is made. Once the initialisation position has been reached, the drive moves the spindle to the roof position selected on the basis of the switch setting.

The control unit registers any change in the setting of the switches on the dashboard, registers the positions set on both switches within 2 seconds at most and moves the roof to the required position after comparing that position with the current roof position.

When the movement has finished, the switch setting is queried again and compared to the position which the roof has actually reached. The procedure has finished if the position matches the setting. If not, the movement process is repeated after a waiting time of max. 2 seconds. A temperature sensor in the control unit compensates for changes to the system resulting from temperature fluctuations.

The control unit registers a malfunction and switches off if the cover is frozen in position or if impermissible loads occur.

Reversing is initiated whenever stiffness is encountered, i.e. the hatch is moved back to its previous position.

3.3.2 Operating sequence

The control unit performs the following steps automatically when the ignition is switched on:

- The drive moves to its starting position if not already there.
- The drive moves to the position selected by the switch on the dashboard.

The drive starts moving as shown in Fig. 302 if the driver selects one of the possible switch settings (Fig. 301), namely "opened at the front", "opened at the rear", "opened at the front and rear" or "closed".

When the limit position has been reached ("selected opening position" = "attained opening position"), the control unit compares the position reached with the actual switch setting.

3.4 Mechanical movement sequence

The drive unit uses a nut with a trapezoidal thread to convert the rotation of the motor into the axial movement of a spindle with a trapezoidal thread which is screwed into the nut with a trapezoidal thread and is prevented from rotating. The drive cables with pressed-on steel balls are attached by adapters to both sides of the spindle with a trapezoidal thread. These steel balls engage in the ball cups of the opening levers when the drive cables move longitudinally. This drives the levers for opening and closing the cover.

The movement cycle of the ventilation hatch is defined by the position of the steel balls on the drive cable. This means the hatch is not moved directly from "closed" to "opened at the front" when the switch is moved to that setting.

The defined movement cycle is displayed in Fig. 302.

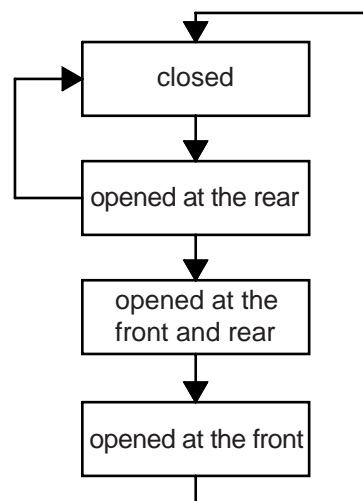


Fig. 302 Movement cycle of the ventilation hatch

3.5 Optional functions

3.5.1 Actuation by rain sensor

The rain sensor can be used for automatically closing all opened ventilation hatches in the parked vehicle if precipitation starts, and for re-opening them when precipitation stops.

All connected ventilation hatches are closed if rain water wets the surface of the sensor. Once the rain sensor has dried, the connected ventilation hatches are re-opened. The surface of the sensor is heated to differentiate between dew and raindrops.

3.5.2 Locking of outside emergency actuation handle

WARNING

Locking must be triggered by a deliberate action on behalf of the driver, never by the "ignition off" or "voltage failure" signals. It may not be possible to operate the emergency unlocking function from the outside in an emergency if locking is activated by these signals.

This function is provided if the bus wiring is performed in accordance with the circuit diagrams shown in section 7 (Figs. 702 and 703).

The outside emergency actuation handle can be locked as an option to safeguard against theft when the vehicle is parked. The locking function must be wired up by the customer. It is essential to make sure that the locking function is inactive during driving, e.g. by means of the "ignition on" signal.

If the outside handle is locked nevertheless when the ignition is switched on, the emergency actuation/locking indicator light (H2) on the dashboard lights up.

3.5.3 Signalling the emergency actuation function

As an option, triggering of the emergency actuation function can be picked up by a microswitch on the front right locking bolt and can be used to generate an electrical signal. Depending on the application, this signal may trigger an acoustic buzzer or an optical check lamp at the driver's seat.

4 Technical Data

Fig. 401 lists the most important technical data on the Bus Top Premium emergency exit and ventilation hatch.

Passage size	807 x 505 mm
Max. opening height	55 mm
Body height, opened	103 mm
Nominal voltage	24 V
Operating voltage range	18 – 32 V
Fusing: • Terminal 30 (load circuit) • Terminal 15 (operating circuit)	5 A 5 A
Current consumption under rated conditions (20 °C)	max. 1 A
Output data of the check lamps	max. 5 W
Weight	9.0 kg
Material	SMC
Sound power level	≤ 63 dB(A)
No-load current consumption (control unit)	≤ 1.2 mA
Temperature range	-40 °C to +85 °C
Times for movement sequences	See Fig. 601

Fig. 401 Technical data

5 Troubleshooting and Fault Rectification

The following potential sources of malfunctions are not taken into account and should always be checked so that they can then be excluded as the cause of the particular fault:

5.1 General

This section describes troubleshooting and fault rectification for Bus Top Premium ventilation and emergency exit hatches.

IMPORTANT

Troubleshooting and fault rectification demand precise knowledge of the structure and theory of operation of the ventilation hatch, and are only allowed to be performed by trained personnel.

If in doubt, refer to sections 2 and 3 for a description of how the functions interact.

IMPORTANT

Troubleshooting is generally restricted to localising the faulty components and provides information about defects in cable connections.

- Corroded plugs**
- Loose plug contacts**
- Poor crimp contacts on plugs**
- Corroded cables and fuses**
- Corroded battery terminals**
- Master switch switched off**
- Fuses blown**
- Inadequate electrical power supply**

The circuit diagram (Fig. 701) represents an important aid to troubleshooting.

Conduct a function test in the vehicle after rectifying each fault (see section 6).

5.2 General fault indications

The following table (Fig. 501) lists the possible general fault indications.

Fault indication	Cause	Rectification
Hatch does not move	No operating voltage	Switch on master switch of vehicle's electrical system Fit new fuse Check contacts and repair if necessary
	Cable not connected to drive unit	Connect cable between drive unit and control unit, repair if necessary
	Drive unit defective or too sluggish	Fit new drive unit
Drive runs up against block after reset, does not reach required position	Distance between magnet and Hall chip in control unit too great	Attach control unit Fit new drive unit
	Loss of magnet	Fit new drive unit
	Mechanical defect in drive unit	Fit new drive unit
	Control unit defective	Fit new control unit

Fig. 501 General fault indications (page 1 of 2)

Fault indication	Cause	Rectification
Movement breaks off, fails again after reset	Stiffness detected Plug connection to drive unit faulty Electrical cables damaged Intermittent voltage interruptions, operating voltage unstable Drive unit defective or too sluggish	Check mechanical elements for stiffness, fit new ones if necessary Check plug connection and contacts, repair if necessary Check electrical cables and repair if necessary Check operating voltage Check plug connection and contacts, repair if necessary Fit new drive unit
Ventilation hatches do not close when it is raining and ignition is switched off (only applies to rain sensor)	Rain sensor dirty Plug connections faulty Electrical cables damaged Rain sensor defective	Clean sensor surface Check plug connection and contacts, repair if necessary Check electrical cables and repair if necessary Fit new rain sensor
Moisture ingress when hatch closed	Cover seal defective, leaking or worn Outside emergency actuation handle leaking Lever mechanism damaged	Fit new cover seal (see 8.4) Fit new emergency handle detent and pull cable Fit new lever mechanism

Fig. 501 General fault indications (page 2 of 2)

6 Function Test

This section describes the checks on Bus Top Premium ventilation and emergency exit hatches and their components in order to establish their functional capability.

NOTE

The circuit diagram (Fig. 701) can also be used for the function test.

6.1 Visual inspection

The regular visual inspection involves:

- Checking the cover for damage, cracks, etc.
- Checking for foreign bodies, dirt and moisture ingress in the closing edge area
- Checking the cover seal is correctly seated and undamaged, in particular in the area of the joint
- Checking the arrester cable for damage and that it is properly attached to the frame
- Checking the wiring harness to the cover assembly for chafing points, in particular in the area of the drive cables
- Checking the drive cables for damage, correct tension and that the pressed-on steel balls are securely attached
- Checking the return rollers for damage and wear
- Checking the ball pressure of the ball-carrier pegs and for stiffness or wear in the eye block
- Checking the outside emergency actuation handle is securely attached

6.2 Ventilation functions

Actuation takes place with the ignition on as shown in the switch matrix (Fig. 301) using 2 on/off switches. If the roof position indicator light (H1) is connected, it lights up when the hatch is opened.

6.2.1 Test conditions

Installation position according to installation instructions
 Test temperature $23 \pm 5 \text{ }^\circ\text{C}$
 Voltage V 24 V DC

6.2.2 Testing the movement sequences

One after the other or at the same time, move the switches to the possible switch positions and compare the time that elapses before the selected limit position is reached to the rated times given in Fig. 601. The run times not listed in Fig. 601 can be derived by adding up the constituent values. Note the movement direction of the hatch (arrowed) when doing this.

NOTE

- The control unit detects increased friction losses, excessive roof loads and blockages, and switches off.
- If the control unit detects stiffness, it reacts differently depending on the temperature.
- Reversing takes place if stiffness is detected.
- The electrical power supply must be interrupted for at least 10 seconds for a manual reset after the unit has switched off.

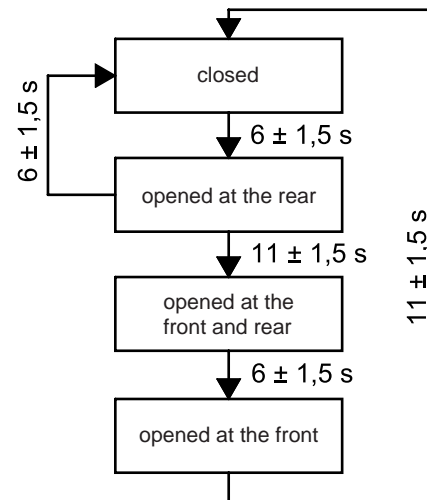


Fig. 601 Rated times for movement sequences (at 20 °C and 24 V vehicle electrical supply)

6.3 Emergency actuation function

IMPORTANT

Operating the emergency actuation function from the outside or inside causes the pegs to be withdrawn from the eye blocks and they remain in this position. The pegs must be returned to their initial position manually.

Turn the emergency actuation twist lever 90° clockwise. Pull the outside handle about 8 cm away from the cover. Measure the pulling force when doing this. It should not exceed 170 N. Then pull the pegs back far enough so the cover can be lifted off the opening levers.

NOTE

The outside handle can only be actuated if the optional lock on the outer actuation handle is unlocked.

If an emergency actuation/locking indicator light (H2) is installed in the dashboard and connected up, it will light up when the ignition is switched on.

6.4 Checking the lock after emergency actuation**IMPORTANT**

The position of the emergency actuation handle is no indication as to whether the pegs have engaged correctly.

You must look and check that the lock is correctly engaged.

By looking through the cutouts in the insulating panel around the opening lever, it is possible to check whether the pegs are correctly located in the eye blocks.

6.5 Locking the outside emergency actuation handle (option)**NOTE**

Locking must be triggered by a deliberate action on behalf of the driver, never by the "ignition off" or "voltage failure" signals. It is no longer possible to operate the emergency unlocking function from the outside if locking is activated by these signals.

NOTE

The indicator light does not go out until the "unlocked" limit position has been reached. Consequently, it is normal for the light to light up briefly after the ignition is switched on.

If an emergency actuation/locking indicator light (H3) is installed in the dashboard and connected up, it will light up if the outside handle is locked when the ignition is switched on.

6.6 Actuation by rain sensor (option)**NOTE**

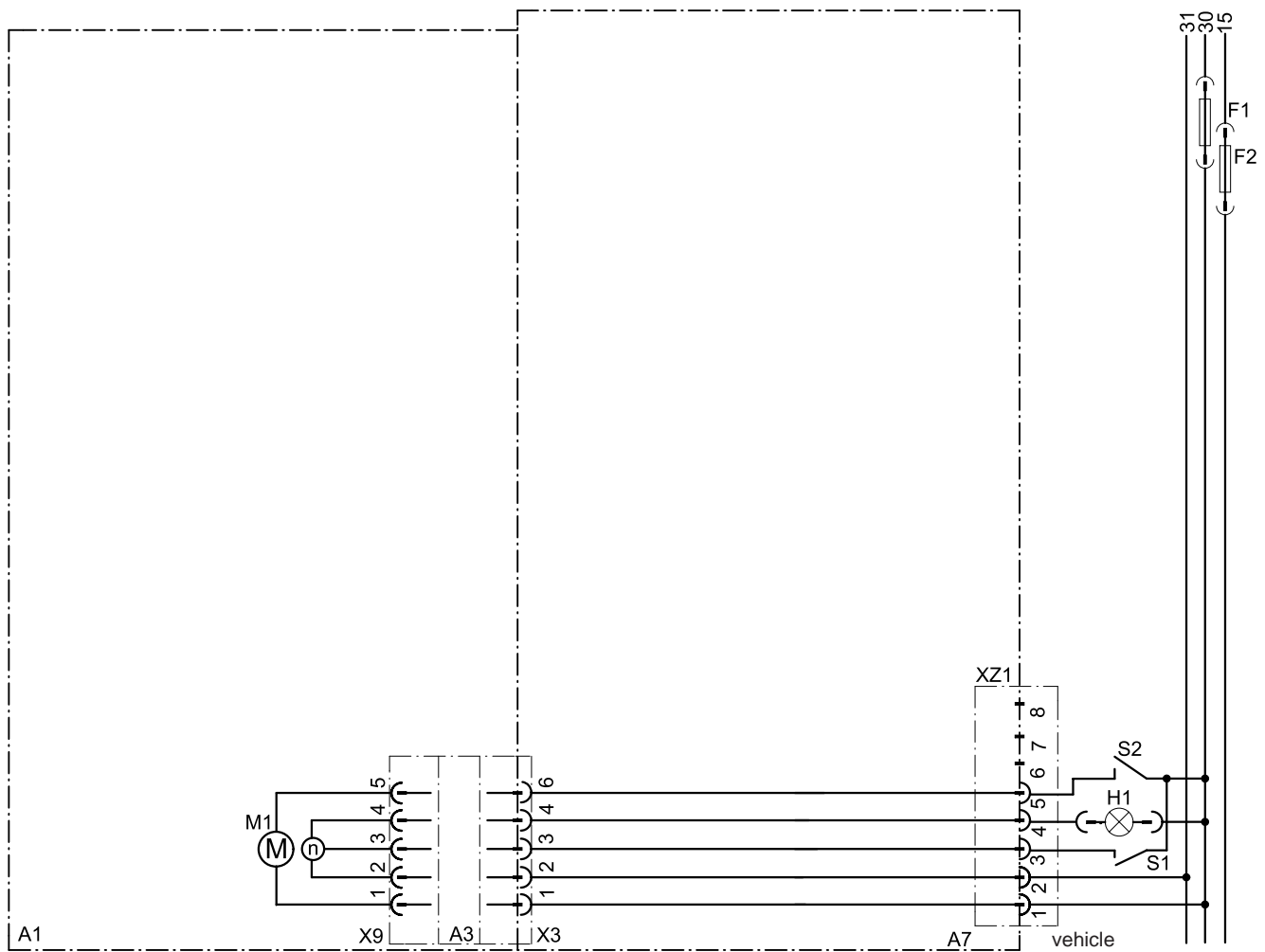
The function test is only possible with the ignition switched off, the "rain sensor on" switch switched on and the ventilation hatches opened.

- Wet the rain sensor with water.
- All ventilation hatches close within 1 minute at most.
- The sensor surface is heated and will dry automatically.
- The ventilation hatches reopen after 15 minutes at most.

7 Circuit Diagrams

7.1 General

The circuit diagrams (Figs. 701 to 703) show the possible circuits of Bus Top Premium ventilation and emergency exit hatches.

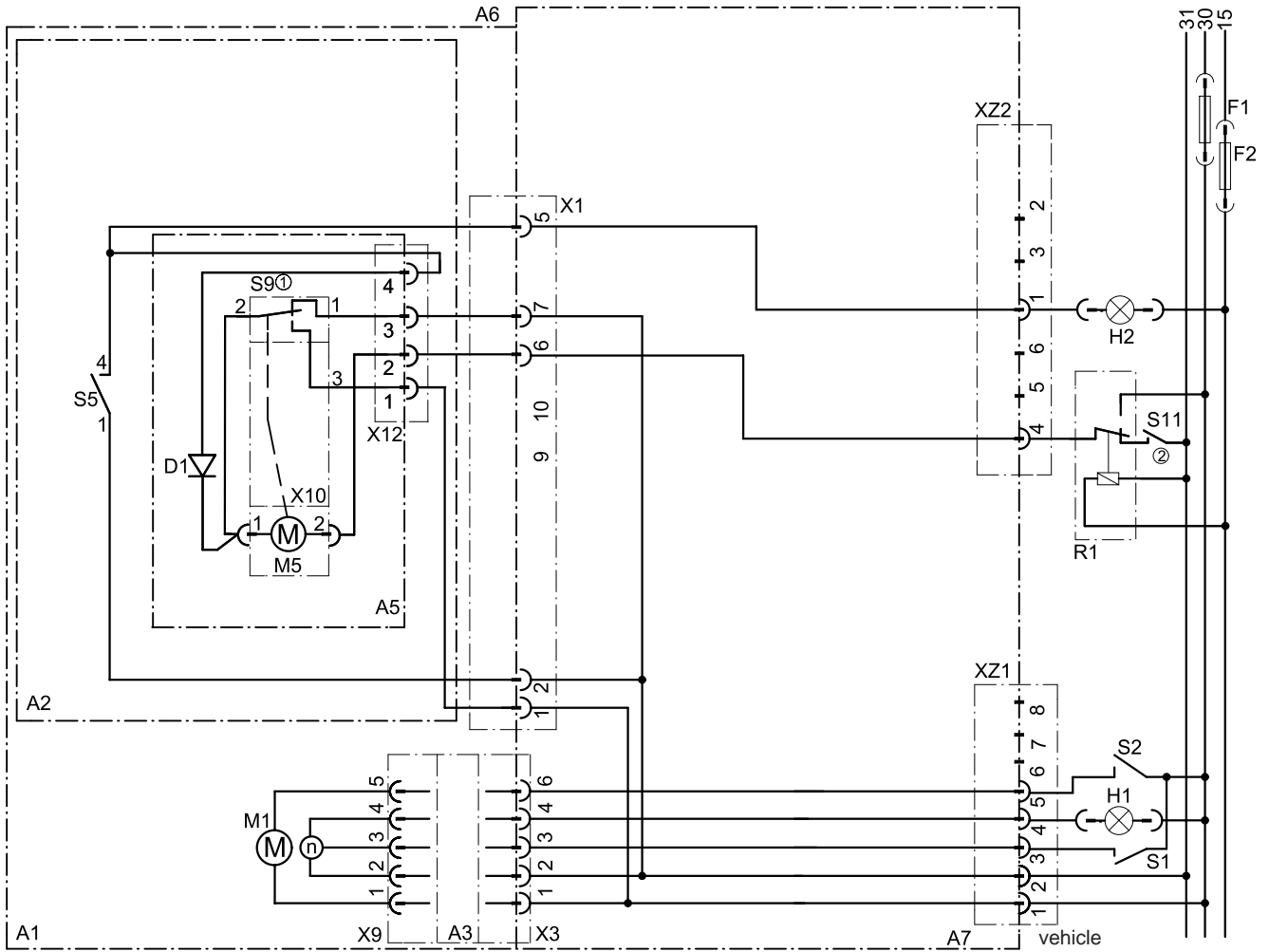


Bus Top Premium

Item	Designation
A1	Bus Top Premium
A3	Electrical control unit assembly
A7	Adapter wiring harness
F1	Flat fuse 5 A
F2	Flat fuse 5 A
H1	"Cover opened" check lamp

Item	Designation
M1	Drive
S1	"Cover OPEN" rear switch
S2	"Cover OPEN" front switch
X3	Plug connector, 6-pin, controller
X9	Plug connector, 5-pin, controller, spindle drive
XZ1	Plug connector, 8-pin (BT "K" adaptation)

Fig. 701 Bus Top Premium circuits (no options)



- ① Switch as motor changeover switch
- ② Min. contact duration 400 ms

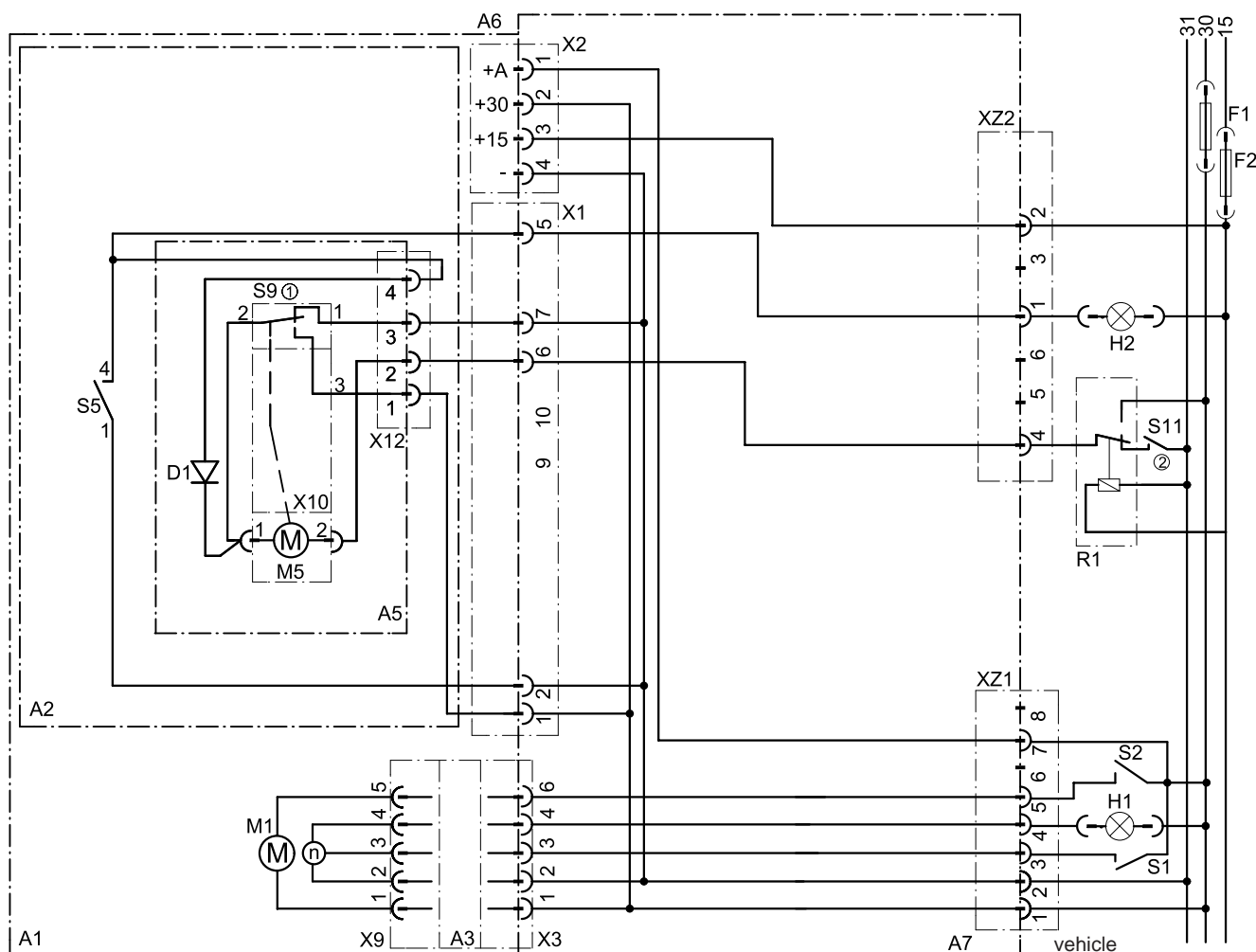
Bus Top Premium

Item	Designation
A1	Bus Top Premium
A2	Cover assembly
A3	Electrical control unit assembly
A5	Locking assembly (option)
A7	Adapter wiring harness
D1	Diode, reverse current block
F1	Flat fuse 5 A
F2	Flat fuse 5 A
H1	"Cover opened" check lamp
H2	"Emergency unlocking/locking activation" check lamp
M1	Drive
M5	Locking motor
R1	Relay for locking
S1	"Cover OPEN" rear switch
S2	"Cover OPEN" front switch

Item	Designation
S5	Switch for emergency unlocking indicator
S9	Locking motor changeover switch
S11	Switch contact for locking
X1	Plug connector, 7-pin for options
X3	Plug connector, 6-pin, controller
X9	Plug connector, 5-pin, controller, spindle drive
X10	Plug connection, 2-pin, locking motor
X12	Plug connection, 4-pin, locking assembly
XZ1	Plug connector, 8-pin (BT "K" adaptation)
XZ2	Plug connector, 6-pin (BT "K" adaptation)

Indicated position: De-energised, locked

Fig. 702 Bus Top Premium circuits (with locking servomotor option)



- ① Switch as motor changeover switch
 ② Min. contact duration 400 ms

Bus Top Premium

Item	Designation
A1	Bus Top Premium
A2	Cover assembly
A3	Electrical control unit assembly
A5	Locking assembly (option)
A6	Rain sensor (only with rain sensor option)
A7	Adapter wiring harness
D1	Diode, reverse current block
F1	Flat fuse 5 A
F2	Flat fuse 5 A
H1	"Cover opened" check lamp
H2	"Emergency unlocking/locking activation" check lamp
M1	Drive
M5	Locking motor
R1	Relay for locking
S1	"Cover OPEN" rear switch
S2	"Cover OPEN" front switch

Item	Designation
S5	Switch for emergency unlocking indicator
S9	Locking motor changeover switch
S11	Switch contact for locking
X1	Plug connector, 7-pin for options
X2	Plug connection, 4-pin for rain sensor
X3	Plug connector, 6-pin, controller
X9	Plug connector, 5-pin, controller, spindle drive
X10	Plug connection, 2-pin, locking motor
X12	Plug connection, 4-pin, locking assembly
XZ1	Plug connector, 8-pin (BT "K" adaptation)
XZ2	Plug connector, 6-pin (BT "K" adaptation)

Indicated position: De-energised, locked

Fig. 703 Bus Top Premium circuits (with locking servomotor and rain sensor options)

8 Service Work

8.1 General

This section describes the permitted service work on the Bus Top Premium and its subsequent installation.

8.2 Maintenance

- When frosty weather sets in, apply a rubber care product to the cover seal and the cable grommet of the pull cable leading to the outside emergency actuation handle.
- Check the emergency actuation function once a year (see 6.3). Inspect the emergency handle detent on the outside handle for damage and fit a new one if necessary.
- Lift the cover assembly out of all its mounting points once a year. To do this, operate the emergency actuation function from the inside or the outside. At the same time, inspect the pegs, eye blocks and the lever mechanism for traces of wear and replace them if necessary.
- Clean the surface of the rain sensor once a year, if fitted.

8.3 Inserting the cover assembly after emergency actuation

IMPORTANT

After the cover assembly has been removed using the emergency actuation function, it must be re-inserted by trained personnel.

1. Clip in the outside emergency actuation handle on the outside of the cover.
2. Move the lever mechanism to the opened position at the front and rear. Position the rocker arms vertically upwards when doing this.
3. Make sure that the pegs have been pulled all the way out of the eye blocks.
4. Check the arrester cable is correctly seated on the frame.
5. Check the screw connection of the arrester cable on the cover and tighten if necessary.
6. Place the cover on the lever mechanism so the rocker arms are positioned in the eye blocks.

IMPORTANT

Install the pegs without lubricant. Because of the exposed position, the use of lubricants can lead to premature wear and malfunctions.

7. Push the pegs fully into the eye blocks (use a screwdriver if necessary). Moving the lever joints slightly makes it easier to push them in.

IMPORTANT

On completing the job, check for correct locking as described in 6.4.

8.4 Fitting a new cover seal

NOTE

In most cases, it is possible to fit a new cover seal from the inside or outside with the Bus Top Premium opened, without having to fold over the cover assembly. In this case, you can skip steps 1 and 4.

1. Operate the emergency actuation function, fold the cover assembly over towards the front and lay it down with its back on the roof.
2. Remove the cover seal (17, Fig. 903) from the edge of the frame.
3. Push on the cover seal (17) until it makes full and even contact with the edge of the frame on the inside and outside.
4. Insert the cover assembly (see 8.3).

8.5 Subsequent installation

NOTE

The number of roof hatches and their possible installation positions are specified in the applicable regulations of the country in question.

8.5.1 Preparing to install

The Bus Top Premium has been designed for roof radii of 3750 to 22,000 mm transverse to the direction of travel. The roof surface must be level in the direction of travel. The roof must be at least 50 mm thick (distance between the outer skin of the roof and the inner surface of the trim), If the roof is more than 70 mm thick, then a seal must be provided between the frame of the Bus Top Premium and the trim, so as to prevent leaves getting in. The dimensions of the necessary roof cutout are shown in Fig. 801. Take account of existing roof bows. The company making the roof cutout and the cutout in the trim does so under its own responsibility. The electrical wiring must be prepared as shown in the circuit diagram (Fig. 701, 702 or 703) depending on which functions and options are incorporated in the Bus Top Premium.

8.5.2 Roof cutout size

When installing a ventilation/emergency exit hatch, make sure it is arranged centrally in the vehicle roof. If there are two hatches, they must be at least 2 m apart as measured along the central longitudinal axis of the vehicle.

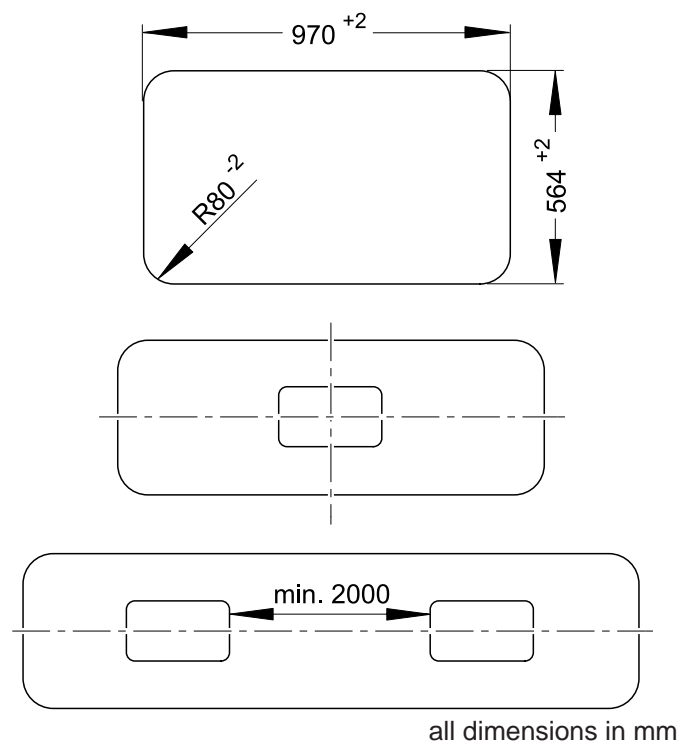


Fig. 801 Roof cutouts

8.5.3 Roof attachment

WARNING

The direction of travel must be taken into account when installing the Bus Top Premium. The arrester cable attachment must be located towards the front in the direction of travel, while the drive unit and the outside emergency actuation handle must be towards the rear. Otherwise, the function of the arrester cable cannot be guaranteed.

IMPORTANT

Installing the Bus Top with the cover closed can lead to distortion of the frame and consequently to malfunctions.

IMPORTANT

It is the responsibility of the company performing the installation to select a suitable adhesive for bonding to the roof material. Comply with the instructions supplied by the manufacturer of the adhesive.

NOTE

Fitting spacers between the frame and the vehicle roof will guarantee optimum adhesive bead formation.

The Bus Top is inserted using a mastic sealant, e.g. Sikaflex-221 or adhesives with comparable technical properties. The adhesive thickness must not exceed 5 mm.

We recommend using Sika products. These can be obtained from Spheros. The products in question are as follows:

- SikaActivator for cleaning the parts to be bonded
- SikaRemover-208 for removing non-cured impurities from the glue
- Sikaflex-221 as bonding or sealing compound

Method

1. Clean the parts to be bonded on the frame of the ventilation/emergency exit hatch using SikaActivator and a clean, lint-free cloth or nonwoven cleaning pad.

NOTE

Wait between 10 minutes and 2 hours before further processing (bonding the parts).

2. Clean the parts to be bonded in the roof cutout of the ventilation/emergency exit hatch using SikaActivator and a clean, lint-free cloth or nonwoven cleaning pad.

NOTE

Wait between 30 minutes and 24 hours before further processing (bonding the parts).

3. Use a nail to open a cartridge of Sikaflex-221, insert it into the compressed air or cordless electric applicator gun, screw on the union nut and screw on the cartridge tip with a triangular aperture.
4. Briskly apply the adhesive to the area of the joint.
5. Position the frame of the ventilation/emergency exit hatch accordingly in the bus roof within 20 minutes.

IMPORTANT

Immediately clean away impurities using SikaRemover 208. Never use other cleaning agents, since they may impair the curing process.

8.5.5 Electrical connection

WARNING

If the "locking of the emergency unlocking function" option is used, you must never wire it up so the function is triggered by the "ignition off" or "voltage drop" signals. It may not be possible to operate the emergency unlocking function from the outside in an emergency if locking is activated by these signals.

Make the electrical connection in accordance with section 7.

9 Repair

9.1 General

This section describes the repair work which is permitted on the Bus Top Premium.

Any further dismantling will invalidate the warranty.

IMPORTANT

De-energise the ventilation hatch before working on electrical/electronic components or assemblies.

Conduct a function test after each repair job.

9.1.1 Work on stripped down components

9.1.1.1 Cleaning

Clean all stripped down components.

9.1.1.2 Visual inspection

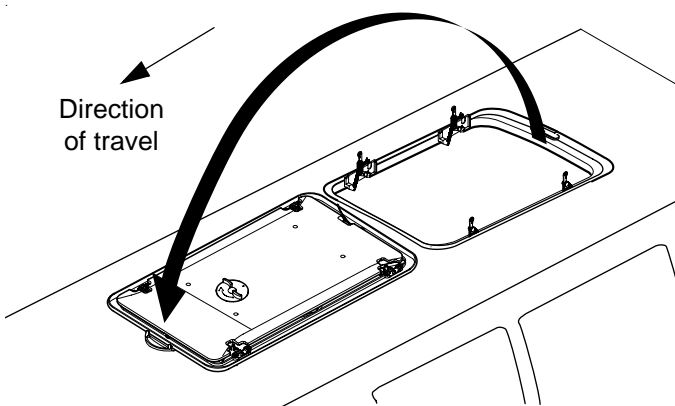
Check all components for damage (cracks, deformation, wear, etc.) and fit new ones if necessary. Inspect the plugs and cables for corrosion, loose contacts, crimping faults, etc. and repair them if necessary.

9.2 Removal and installation

9.2.1 Cover assembly

9.2.1.1 Removal

1. Move the cover assembly to the "opened at the front and rear" position.
2. Operate the emergency actuation function, fold the cover assembly 180° towards the front and lay it down with its back on the bus roof.



3. Remove the screw (12, Fig. 902) and washer (13) from the cover.

4. In roof hatches with locking function: Disconnect plug connector X1, remove the securing clips from the cable duct in the frame and pull the arrester cable (11) out of the mesh hose in the frame.

5. Remove the cover assembly from the bus roof.

9.2.1.2 Installation

1. Move the lever mechanism to the "opened at the front and rear" position.
2. Lay the cover assembly on its back on the bus roof at the forward side of the aperture.
3. In roof hatches with locking function: Pull the arrester cable (11) through the mesh hose, position the wiring harness in the cable duct of the frame and secure it with securing clips, plug in plug connector X1.
4. Use the screw (12) and washer (13) to secure the loop in the arrester cable (11) to the cover assembly.
5. Turn the inside emergency actuation twist handle 90° clockwise. Make sure the pegs are only still engaged in the inner eyes of the eye blocks.
6. Position the rocker arms of the lever mechanism vertically upwards.
7. Line up the eye blocks and rocker arms of the lever mechanism with one another.

NOTE

During the following step, make sure that the rocker arms are positioned accordingly and that all 4 pegs engage in the mounting holes.

7. Use a screwdriver to push the pegs up to the stop in the eye blocks.
8. Check the locking function operates correctly (see 6.4).

9.2.2 Frame assembly

The frame assembly cannot be replaced. Subsequent installation is described in subsection 8.5.

9.3 Dismantling and assembling

9.3.1 Insulating panel

9.3.1.1 Removal

1. Remove the cover assembly (see 9.2.1.1).
2. Remove the screws (3, Fig. 902) and washers (4).
3. Remove the securing clips (2).
3. Remove the insulating panel (1).

9.3.1.2 Installation

1. Place the insulating panel (1) in its installation position and attach it with the screws (3) and washers (4).
2. Tighten the screws to 2.5 ± 0.2 Nm.
3. Push on the securing clips (2).
4. Install the cover assembly (see 9.2.1.2).

9.3.2 Arrester cable

NOTE

The arrester cable always remains attached to the frame. No removal is intended.

Remove the screw (12) and washer (13) in order to release the arrester cable (11, Fig. 902) from the cover assembly.

9.3.3 Outside emergency actuation handle

9.3.3.1 Removal

1. Unfasten the claw (1, Fig. 901) from the handle shell of the outside emergency actuation handle (3) and remove the pull cable (2) from the handle shell.

9.3.3.2 Installation

1. Thread the pull cable and ball (2) through the hole in the handle shell of the outside emergency actuation handle (3) and upwards through the slot.

IMPORTANT

The lug on the top of the claw (1) must be pointing towards the handle aperture (4) of the outside emergency actuation handle, otherwise the pull cable may be damaged.

2. Secure the pull cable (2) with the claw (1).

- 1 Claw
- 2 Pull cable
- 3 Outside emergency actuation handle
- 4 Handle aperture

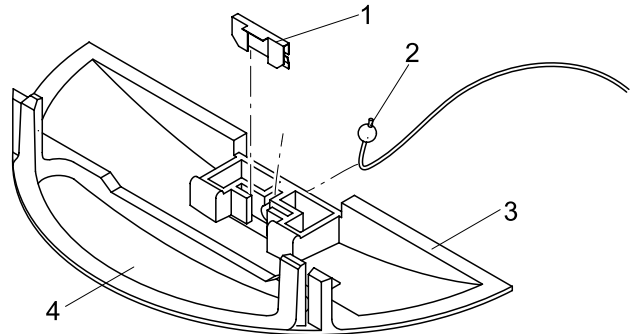


Fig. 901 Outside emergency actuation handle, dismantling and assembling

9.3.4 Inside emergency actuation twist handle**9.3.4.1 Removal**

1. Remove the cover assembly (see 9.2.1.1).
2. Remove the insulating panel (see 9.3.1.1).
3. Carefully lever the domed cap (25, Fig. 902) off the shaft on the cover (16) and dispose of it separately.
4. Lift off the twist handle (24) and remove the pull cable (20) from the mounting.
5. Lift off the cable reel (23) and remove the unlocking cables (10) from the mountings.
6. Remove the spiral spring (22).

9.3.4.2 Installation

1. Position the spiral spring (22) correctly and insert it into the slot cut in the shaft on the cover (16).
2. Place the cable reel (23) onto the shaft and, pressing down slightly, turn it clockwise until the detent lug on the underside engages in the spiral spring.
3. Use a screwdriver to press the balls on the unlocking cables (10) into the holes for them in the cable reel (23). When doing this, always select the opening which is facing in the direction of the cable.
4. Insert the pull cable (20) into the mounting in the twist handle (24) and thread the pull cable clockwise into the groove in the side of the twist handle (24).
5. With the pull cable taught, push the twist handle (24) onto the shaft, press it lightly against the cable reel (23) and hold it there.
6. Slowly turn the cable reel (23) clockwise until the twist handle (24) engages in the guide grooves of the cable reel.
7. Push a new domed cap (25) firmly onto the shaft.
8. Install the insulating panel (see 9.3.1.2).
9. Install the cover assembly (see 9.2.1.2).
10. Perform a function test (see 6.2).

9.3.5 Pull cable**9.3.5.1 Removal**

1. Remove the cover assembly (see 9.2.1.1).
2. Remove the insulating panel (see 9.3.1.1).
3. Remove the outside emergency actuation handle (see 9.3.3.1).
4. Use an angle cutter to cut open the segmented washers (14, Fig. 902) on the cable guide and dispose of them separately.
5. Disconnect the pull cable (20) from the twist handle (24).

6. Unthread the pull cable (20) through the washer (18) and the emergency handle detent (17) in the cover (16).

9.3.5.2 Installation

1. Thread the pull cable (20) through the washer (18) and the emergency handle detent (17).
2. Install the outside emergency actuation handle (see 9.3.3.2).
3. Hook the pull cable (20) into the twist handle (24).
4. Thread the pull cable (20) into the groove of the cable guide.
5. Push a new segmented washer (14) firmly onto the cable guide.
6. Install the insulating panel (see 9.3.1.2).
7. Install the cover assembly (see 9.2.1.2).
8. Perform a function test (see 6.2).

9.3.6 Unlocking cables with pegs**9.3.6.1 Removal**

1. Remove the cover assembly (see 9.2.1.1).
2. Remove the insulating panel (see 9.3.1.1).
3. Remove the inside emergency actuation twist handle (see 9.3.4.1).
4. Use an angle cutter to cut open the segmented washers (14, Fig. 902) of the cable guide and dispose of them separately.
5. Remove the eye blocks (see 9.3.7.1).
6. Remove the unlocking cables and pegs (10).

9.3.6.2 Installation

1. Place the unlocking cables and pegs (10) in the installation position, pushing the pegs into the eye blocks (15) and threading the cables into the grooves of the cable guides.
2. Install the eye blocks (see 9.3.7.2).
3. Push new segmented washers (14) firmly onto the cable guides.
4. Install the inside emergency actuation twist handle (see 9.3.4.2).
5. Install the insulating panel (see 9.3.1.2).
6. Install the cover assembly (see 9.2.1.2).
7. Perform a function test (see 6.2).

NOTE

View rotated through 180°

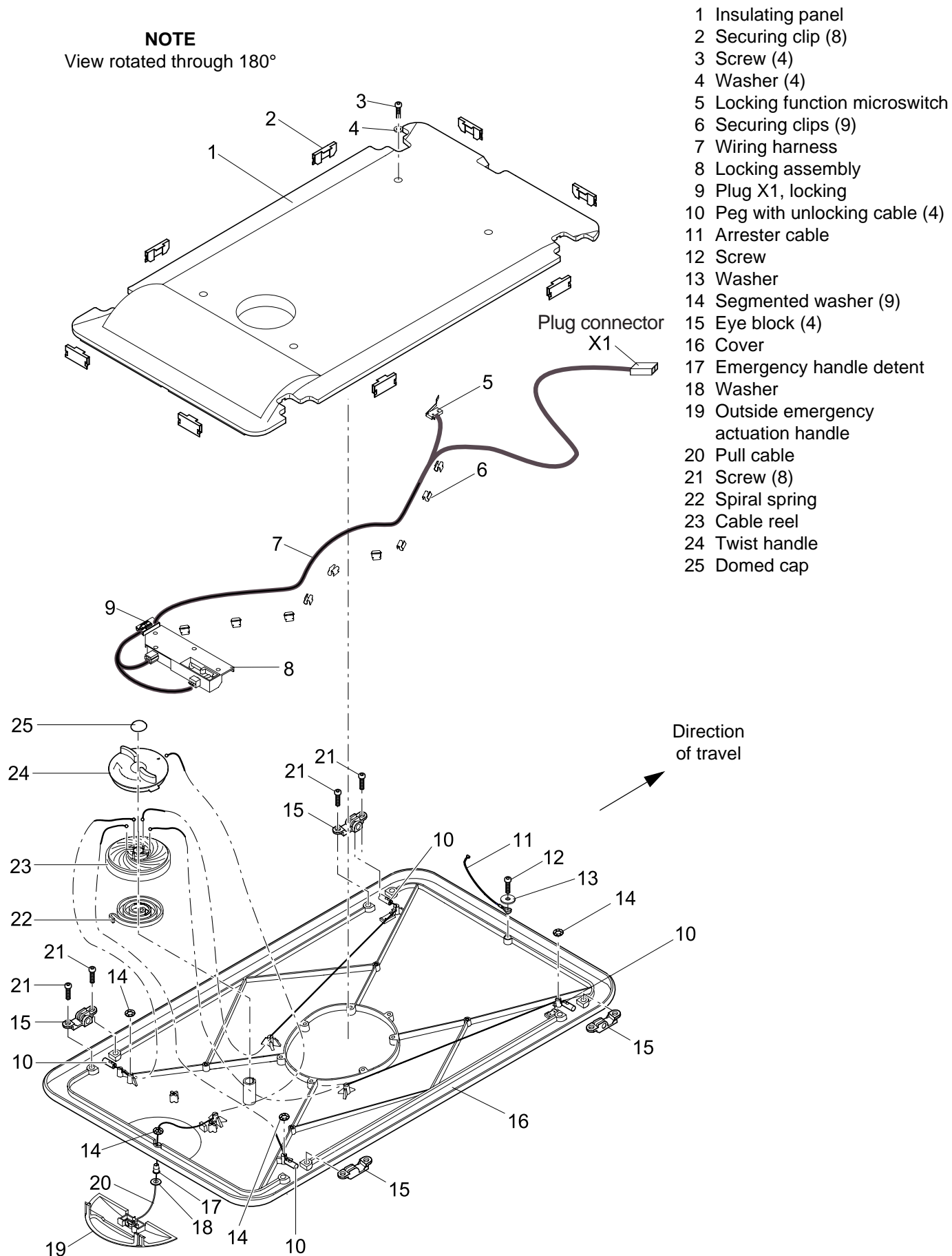


Fig. 902 Cover assembly, dismantling and assembling

9.3.7 Eye blocks

9.3.7.1 Removal

1. Remove the cover assembly (see 9.2.1.1).
2. Remove 2 screws (21, Fig. 902) and remove the eye blocks (15).
3. Pull the unlocking cables and pegs (10) out of the eye blocks (15).

9.3.7.2 Installation

1. Push the unlocking cables and pegs (10) into the eye blocks (15).
2. Place the eye blocks (15) in their installation position and attach with 2 screws (21).
3. Tighten the screws to 2.5 ± 0.2 Nm.
4. Install the cover assembly (see 9.2.1.2).
5. Perform a function test (see 6.2).

9.3.8 Control unit

9.3.8.1 Removal

1. Remove the headlining of the bus in the area of the Bus Top.
2. Disconnect plugs X3 and X9 (7, Fig. 903) from the sockets (2 and 4) on the control unit (3).
3. Remove 2 screws (5) and remove the control unit (3).

9.3.8.2 Installation

1. Place the control unit (3) in its installation position (on the right in the direction of travel) and attach with 2 screws (5).
2. Tighten the screws to 1.0 ± 0.2 Nm.
3. Connect plugs X3 and X9 (7) to the sockets (2 and 4) on the control unit (3).
4. Install the headlining of the bus.
5. Perform a function test (see 6.2).

9.3.9 Drive cables and compensating springs

NOTE

The drive cables (11, Fig. 903) and the compensating springs (14) cannot be removed without damaging them.

9.3.9.1 Removal

WARNING

The drive cables are under tension.

1. Disconnect the linking cable in the area of the compensating springs (14).
2. Remove the rear return rollers (8, to the left and right of the drive unit, see 9.3.11.1).
3. Unhook the drive cables (11) at the cable adapters.

9.3.9.2 Installation

1. Hook the drive cables (11) into the cable adapters.

IMPORTANT

The drive cables (11) on the left and right are not the same. The cable with the linking cable crimped onto it must be fitted on the right in the direction of travel.

2. Install the rear return rollers (8, to the left and right of the drive unit, see 9.3.11.2).
3. Hook the drive cables (11) into the compensating springs (14), pulling the linking cable through the compensating springs (14) as you do so.

IMPORTANT

Do not overstretch the compensating springs.

4. Pull the drive cables (11) over three return rollers (8), use pincers to tension the compensating springs (14) while slipping the drive cable (11) over the fourth return roller (8). Then release the pincers.
5. Pull the linking cable through the clamping sleeve, apply slight tension to the linking cable and crimp the clamping sleeve using the crimping tool K50.

NOTE

The crimping tool K50 with corresponding blocks 6 – 10 can be obtained from:

Gustav Klauke GmbH
Auf dem Knapp 46
D-42855 Remscheid
Federal Republic of Germany

Tel.: +49 (02191) 9070

9.3.10 Drive unit**NOTE**

The drive unit/return rollers can only be replaced in conjunction with replacement of the drive cables.

9.3.10.1 Removal

1. Remove the headlining of the bus in the area of the Bus Top.
2. Remove the drive cables (see 9.3.9.1).
3. Pull the plug X9 (7, Fig. 903) off the control unit (3).
4. Secure the drive unit (6) to prevent it from falling down.
5. Remove 4 screws (12) and remove the drive unit (6) with the motor carrier (13).

9.3.10.2 Installation

1. Place the drive unit (6) in the corresponding installation position on the frame and secure it to prevent it from falling down.
2. Put on the motor carrier (13) and secure with 4 screws (12).
3. Tighten the screws to 2.5 ± 0.2 Nm.
4. Connect the plug X9 (7) to the control unit (3).
5. Install the drive cables (see 9.3.9.2).
6. Install the headlining of the bus.
7. Perform a function test (see 6.2).

9.3.11 Return rollers**NOTE**

The drive unit/return rollers can only be replaced in conjunction with replacement of the drive cables.

9.3.11.1 Removal

1. Remove the headlining of the bus in the area of the Bus Top.
2. Remove the drive cables (see 9.3.9.1).

NOTE

The procedure is the same for all return rollers. This section only describes the removal of one return roller.

3. Cut through the lock washer (10, Fig. 903) and dispose of it separately, remove the washer (9) and return roller (8).

9.3.11.2 Installation

1. Push the return roller (8) and washer (9) onto the shaft and secure them with the lock washer (10).
2. Install the drive cables (see 9.3.9.2).
3. Install the headlining of the bus.

9.3.12 Lever mechanism**9.3.12.1 Removal**

1. Remove the headlining of the bus in the area of the Bus Top.
2. Remove the cover assembly (see 9.2.1.1).

NOTE

The procedure is the same for all lever mechanisms. This section only describes the removal of one lever mechanism.

3. Remove 2 screws (16, Fig. 903) and lever the lever mechanism (15) downwards out of its mountings in the frame (1). Push the drive cables (11) slightly to one side when doing this.

9.3.12.2 Installation

1. Push the drive cables (11) slightly to one side, insert the lever mechanism (15) into its mountings in the frame (1) and fasten it in place with 2 screws (16).
2. Tighten the screws to 2.5 ± 0.2 Nm.
3. Install the cover assembly (see 9.2.1.2).
4. Install the headlining of the bus.

NOTE
View from below

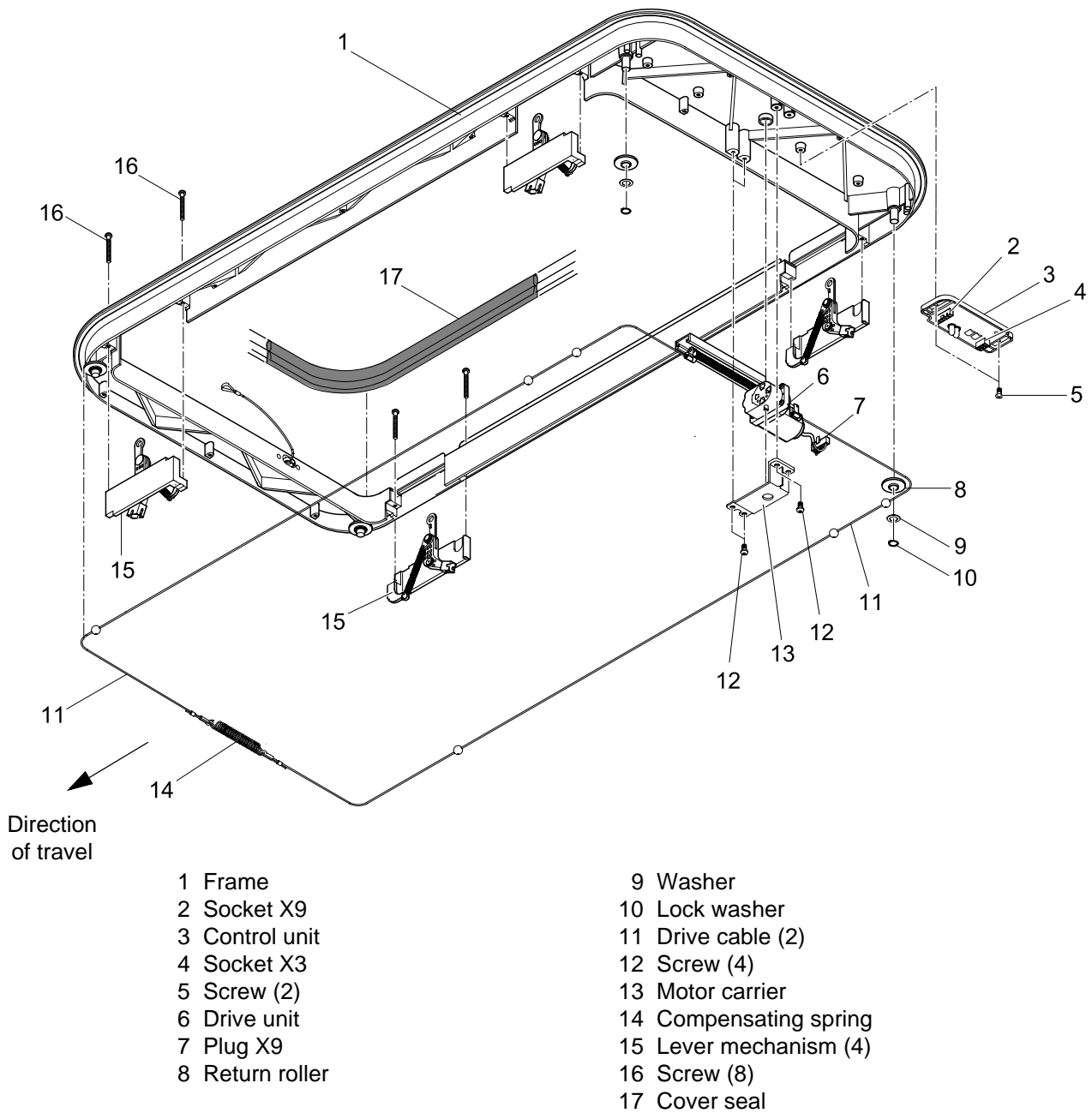


Fig. 903 Frame assembly, dismantling and assembling

10 Packaging / Storage / Shipping

10.1 General

If the ventilation hatch or its components are sent to Spheros GmbH for testing or repair, it must be cleaned and packaged in such a way that it is protected against damage during handling, transport and storage.



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