IRIS Certification
ISO / TS 22163

OPERATION AND MAINTENANCE MANUAL
FOR
AUTOMATIC INTERNAL SLIDING DOOR FOR TRAIN SET

Airflow Equipment's (India) Pvt Ltd

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Sriperumpudur Taluk, Kancheepuram District.,
Chennai-607106, Tamil Nadu, India

Automatic Internal Sliding Door for Train Set

(Single Leaf)

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INSTALLATION & MAINTENANCE MANUAL

List of Modifications

Revision	Date	Modification Description	Pages
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Release History

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Approved By	Mr. Magarajan	AEIL Design	04-Jan-2023	

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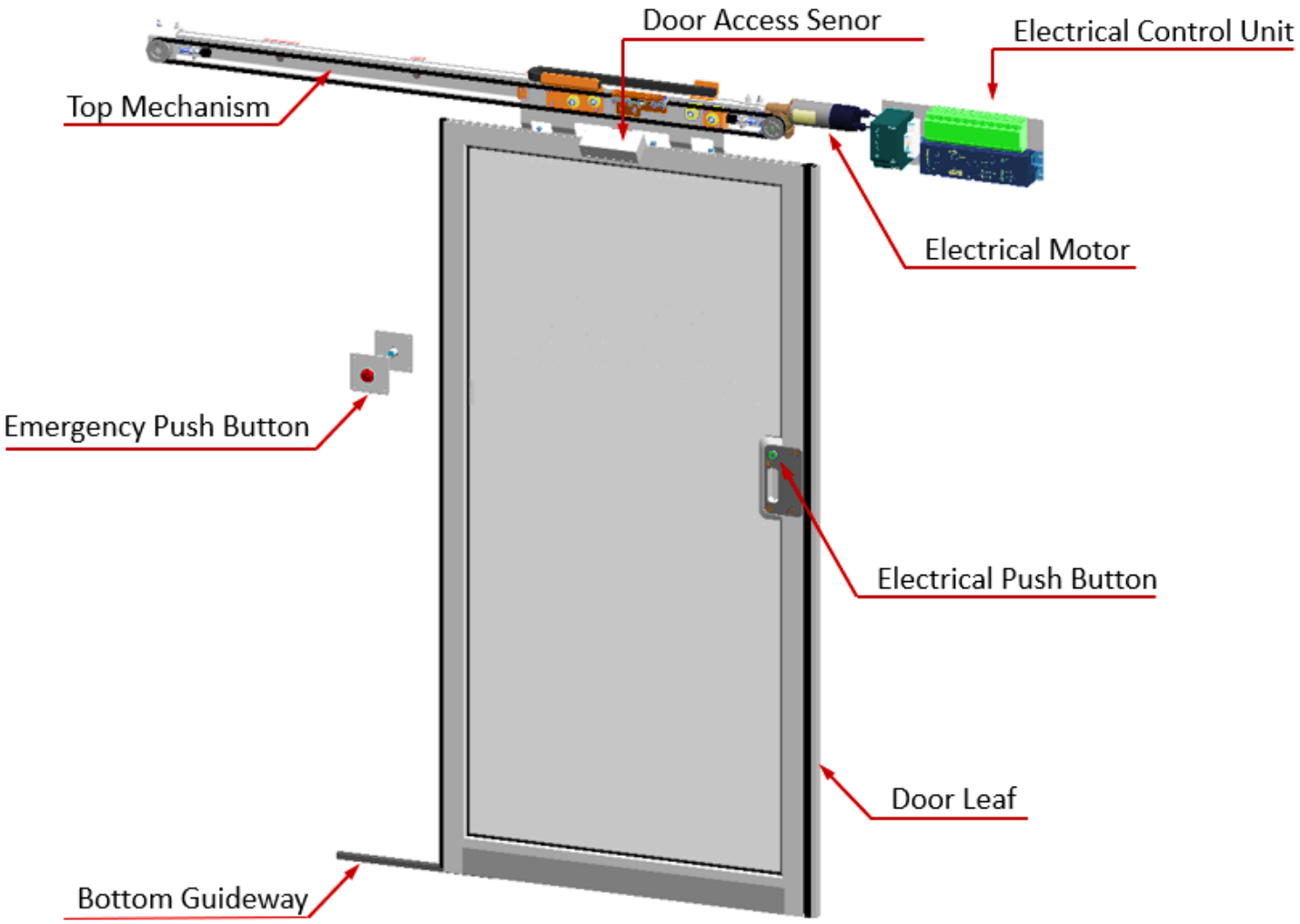
1. GENERAL SAFETY INSTRUCTIONS

- ✓ This manual is intended solely for qualified professionals. All installations, electrical connections and adjustments must follow the installation instructions.
- ✓ Please read these instructions carefully before installing the unit. Incorrect installation may result in severe personal injury and/or damage to property.
- ✓ Packaging materials (plastic and polystyrene, etc) should be discarded or recycled in accordance with waste disposal regulations.
- ✓ Make sure the voltage specified is correct for the device.

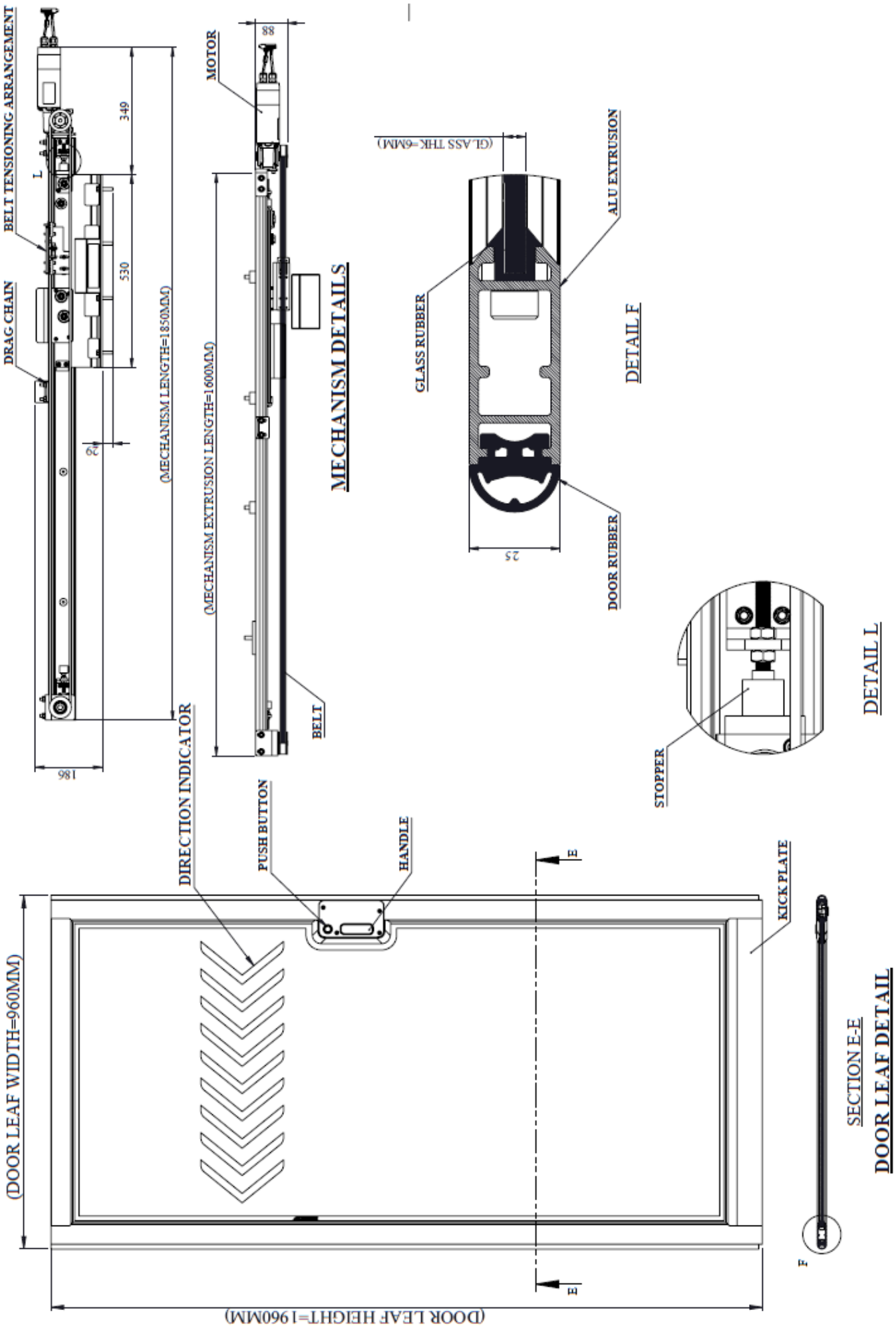
2. PRODUCT FEATURES

- ✓ Operating voltage – 24 V DC
- ✓ Two modes of operation – Auto and Manual (Emergency)
- ✓ Obstruction detection - If the door is obstructed during operation, the operator will stop the door and reverse movement
- ✓ Operates with infrared access sensors, finger protection system and push button
- ✓ Adjustment of hold up time, opening/ closing speed.
- ✓ When an opening signal is received by the control unit, the door is opened at the operator-adjusted opening speed until it reaches the back check position, where it decelerates to a slower speed.


Door Access Senor
Electrical Control Unit
Top Mechanism
Electrical Motor
Emergency Push Button
Electrical Push Button
Door Leaf
Bottom Guideway

3. SPECIFICATIONS

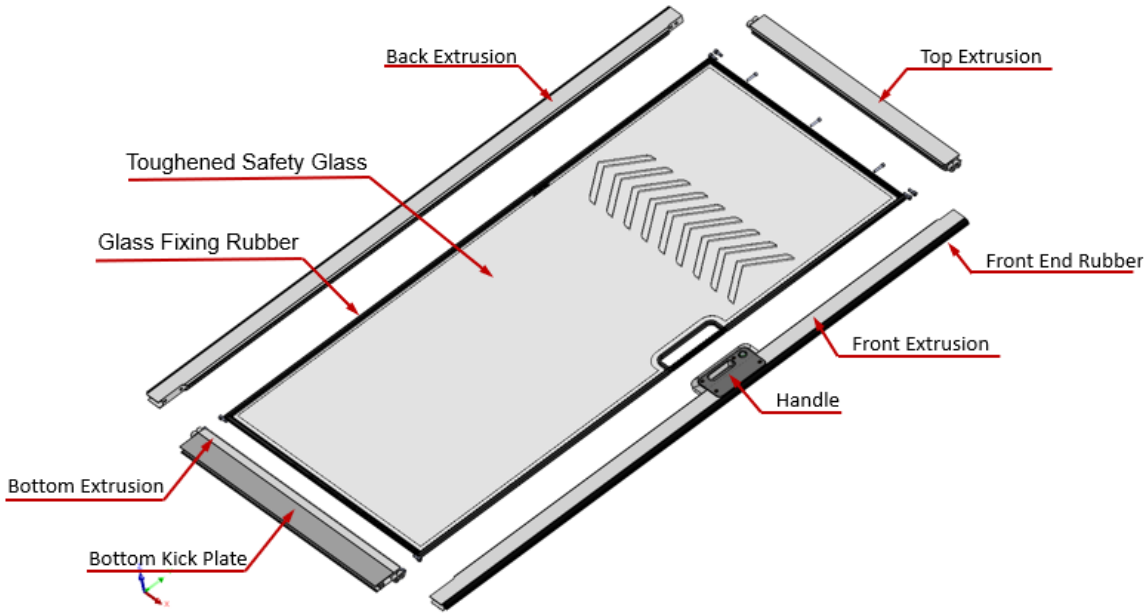
Operating voltage	24 V DC
Motor Specs	Geared motor, Pinion right, Max. door weight 180 kg
Maximum Torque Output	3 Nm
Opening Time	3 – 5 Seconds
Closing Time	3 – 4 Seconds
Hold Open Time	5 – 7 Seconds
Operating Temperature	-25 ^{o}C to 70 ^{o}C
Net weight of the door system	50 kg
Weight of the drive carrier	20 kg
Weight of the door leaf	30 kg
Dimensions of the drive carrier	Thickness – 104.5 ± 2 mm Width – 1850 ± 5 mm Height – 112 ± 2 mm
Dimensions of the door leaf	Thickness – 25 ± 2 mm Width – 960 ± 5 mm Height – 1960 ± 5 mm
Track assembly length	1600 ± 5 mm
Internal passing width	805 ± 5 mm
Internal passing height	1960 ± 5 mm


BELT TENSIONING ARRANGEMENT
DRAG CHAIN
L
349
530
29
186
(MECHANISM LENGTH=1850MM)
MOTOR
88
(MECHANISM EXTRUSION LENGTH=1600MM)
BELT
MECHANISM DETAILS
(GLASS THK=6MM)
ALU EXTRUSION
GLASS RUBBER
DOOR RUBBER
25
DETAIL F
STOPPER
DETAIL L
DIRECTION INDICATOR
PUSH BUTTON
HANDLE
KICK PLATE
E
E
(DOOR LEAF WIDTH=960MM)
(DOOR LEAF HEIGHT=1960MM)
SECTION E-E
DOOR LEAF DETAIL

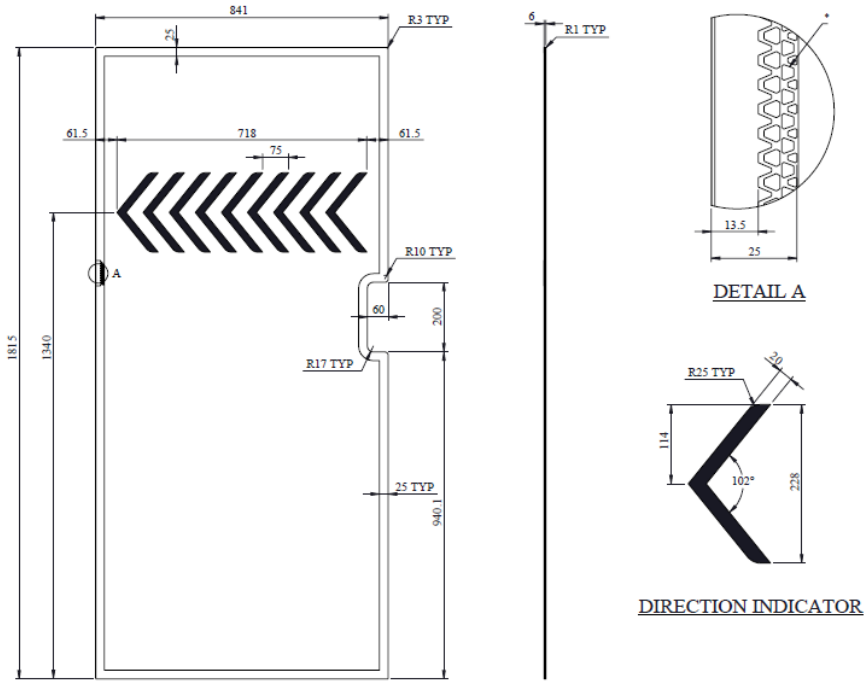
4. SUB ASSEMBLY DETAILS

4.1 DOOR LEAF AND ACCESSORIES

The frame of the glass door leaf is manufactured using 25 mm thick aluminium extruded sections that are powder coated. The 6 mm thick toughened safety glass with border raster and sand frosted indication arrows is sealed with the aluminium sections and fastened at the corners.



The leading edge of the door leaf is equipped with a rubber seal that houses the obstacle detecting contact strip. An integrated Aluminium sunk in cast handle is provided for manual movement of door using emergency. The handle also houses the pushbuttons for door access.



FRONT VIEW LEFT SIDE VIEW

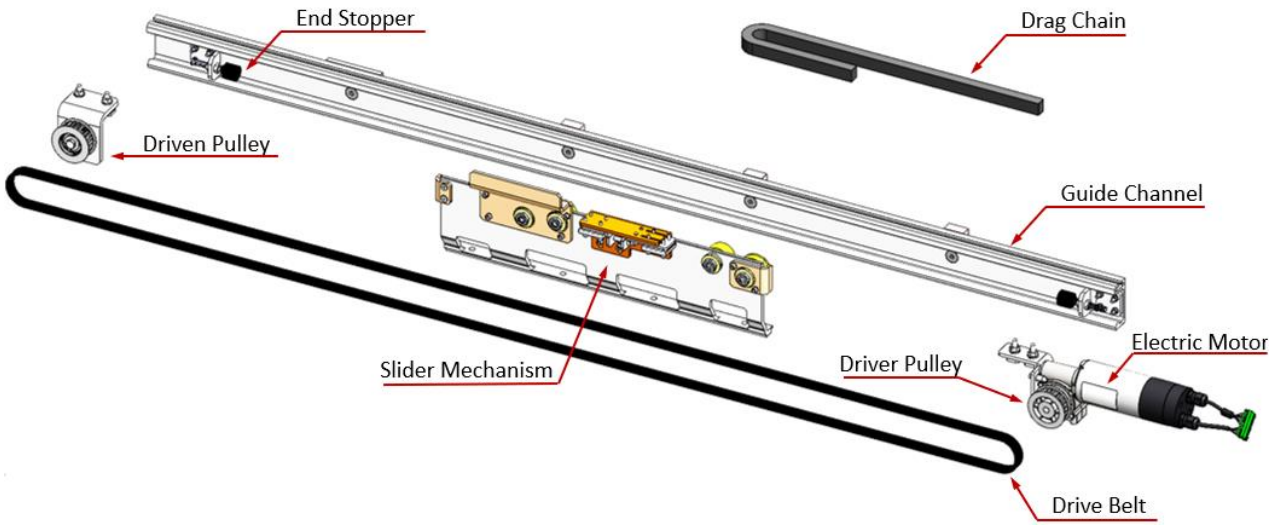
The bottom edge of the door leaf forms one part of the sliding pair partly responsible for smooth door guidance. The other part of the sliding pair mounted in the coach floor is a linear guide manufactured using Delrin.

The system also includes a stopper extrusion with a rubber profile mating with the rubber extrusion at the leading edge of the door.

4.2 DRIVE CARRIER MECHANISM

GUIDE RAIL:

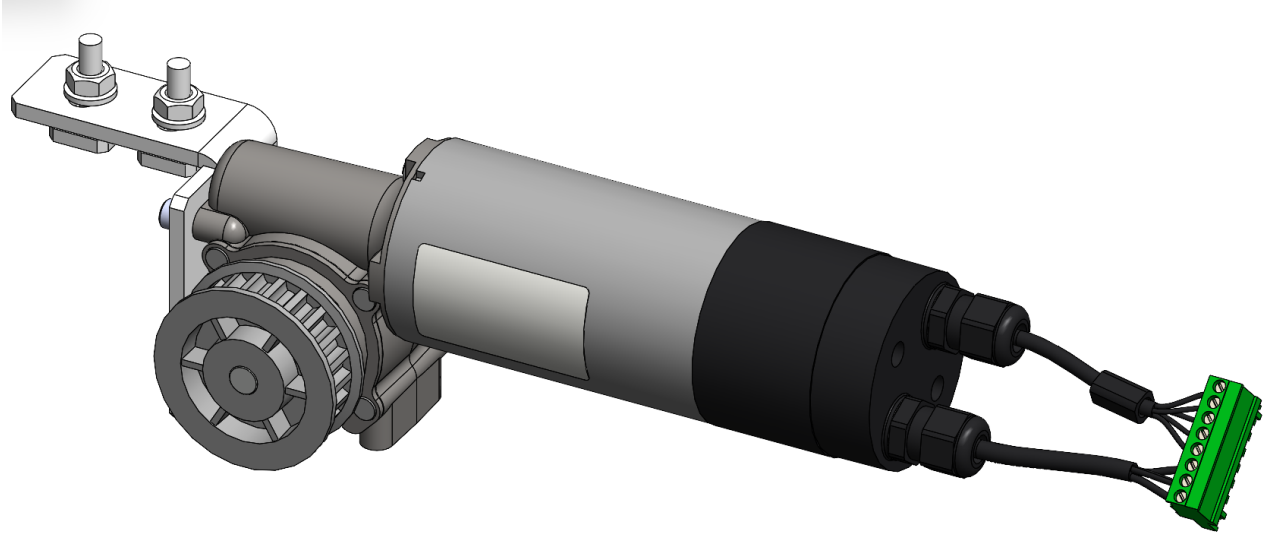
The door guiding system is made up of a strong and stable **C** shaped Aluminium profile. This profile is used to guide the movement of the door and also holds the motor and the guide pulley for deflection of the toothed belt. The door is supported by 4 plastic rollers mounted in the carriage section with eccentric shafts, with 2 of them being able to adjust to the upper surface and 2 of them being able to adjust to the upper surface of the guide rail.



The bottom part of the carriage section holds the door in place and allows for alignment and fastening. The movement of the door is limited by two stops on the track, which are set at the factory to the proper length. These stops also have rubber shock absorbers to prevent the door from stopping suddenly at the end of its movement. The carriage section is also equipped with the arrangement to lock the timing belt and adjust the tension for desired level of motion.

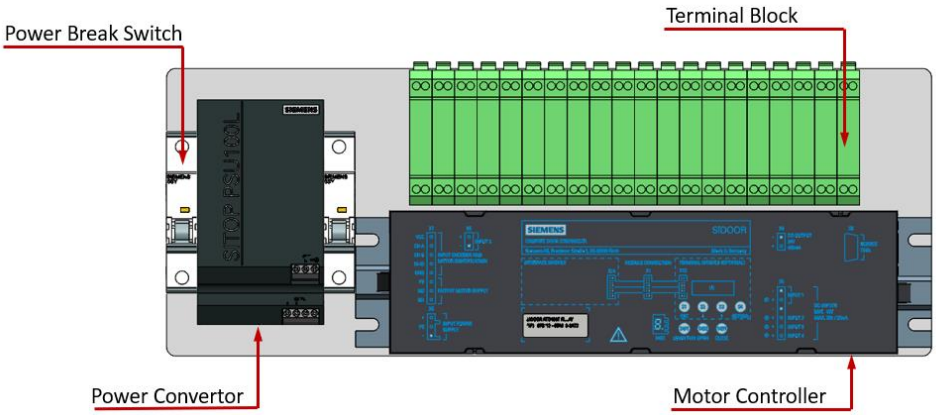
ACTUATION:

The Geared motor form the maintenance-free drive unit in the door drive. The geared motors feature DC motors with non-self-locking gearing and are speed-controlled. The set force and speed limits are not exceeded. The power is transmitted by a toothed belt that passes over the deflector pulley mounted in the guide rail.



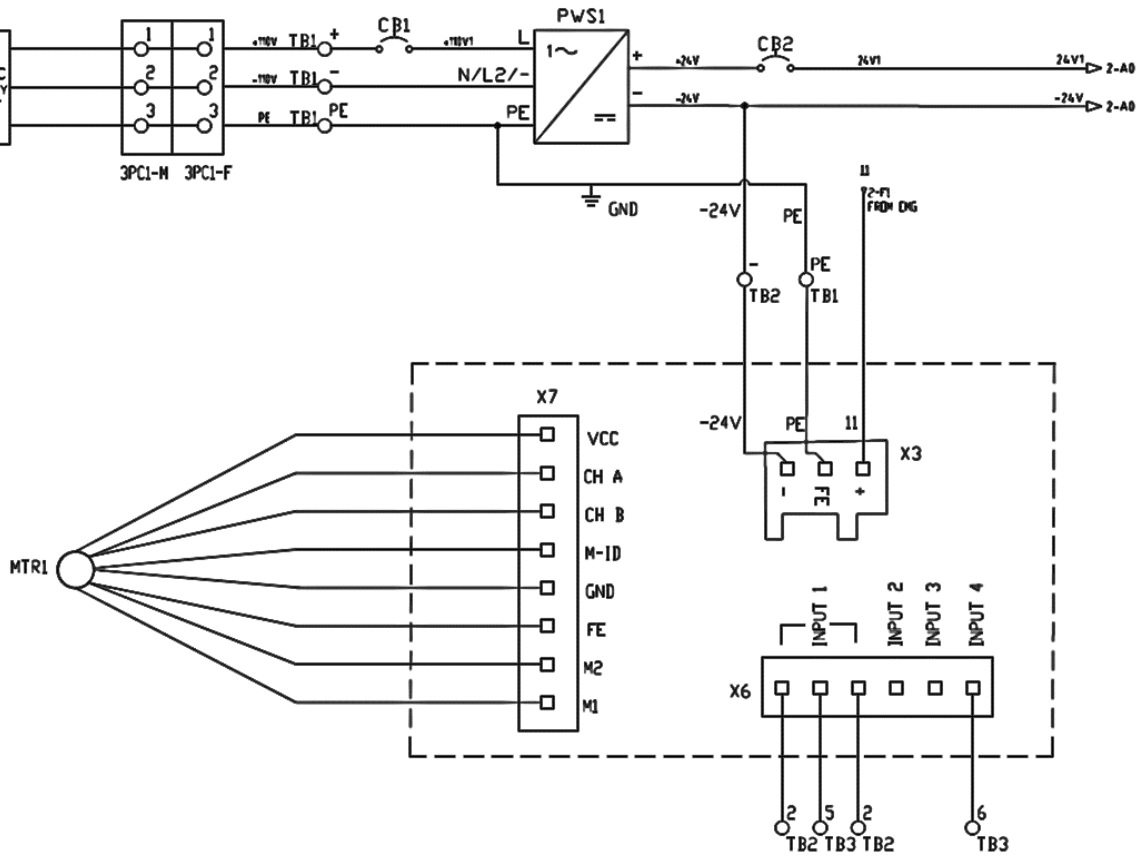
4.3 ELECTRICAL CONTROL UNIT

The electrical control unit consists of a power supply input, relay control unit and terminal block with switches. The system operates with 24 V DC supply and the available 110 V AC supply is converted to 24 V DC supply with the help of the power supply unit.



The system is equipped with 2 MCB, one for isolation of the door access sensor and the other for disconnecting the entire. The system is equipped with 2 emergency push buttons for disconnecting the system from power supply.

5. ELECTRICAL SCHEME



TB – Terminal Block

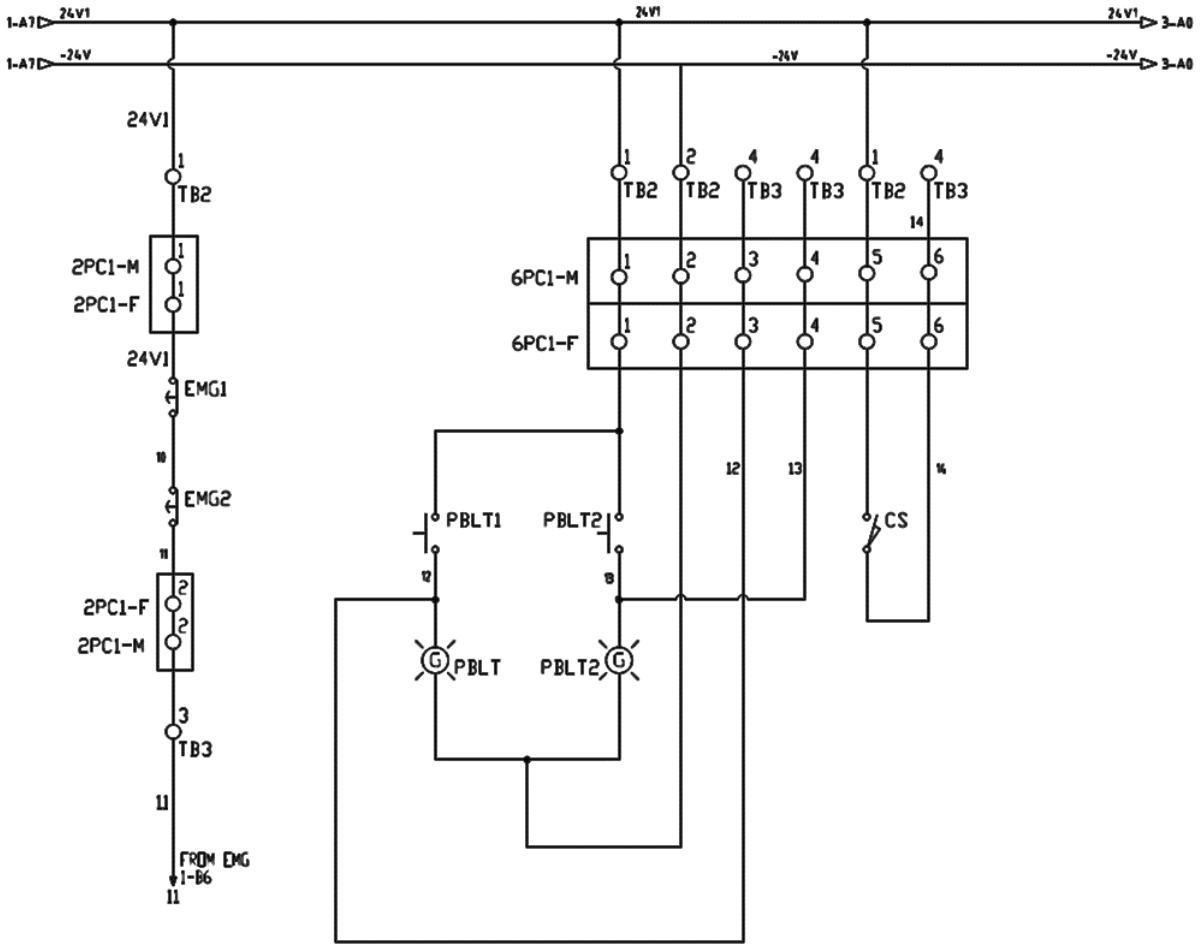
CB – Circuit Breaker

PWS1 – Power Supply (SMPS)

MTR1 – Motor

3PC1-M – 3 Pole Pluggable Connector – Male

3PC1-F – 3 Pole Pluggable Connector – Female



TB – Terminal Block

PBLT1 – Push Button 1

PBLT2 – Push Button 2

PBLT – Lamp 1

PBLT2 – Lamp 2

2PC1-M – 2 Pole Pluggable Connector – Male

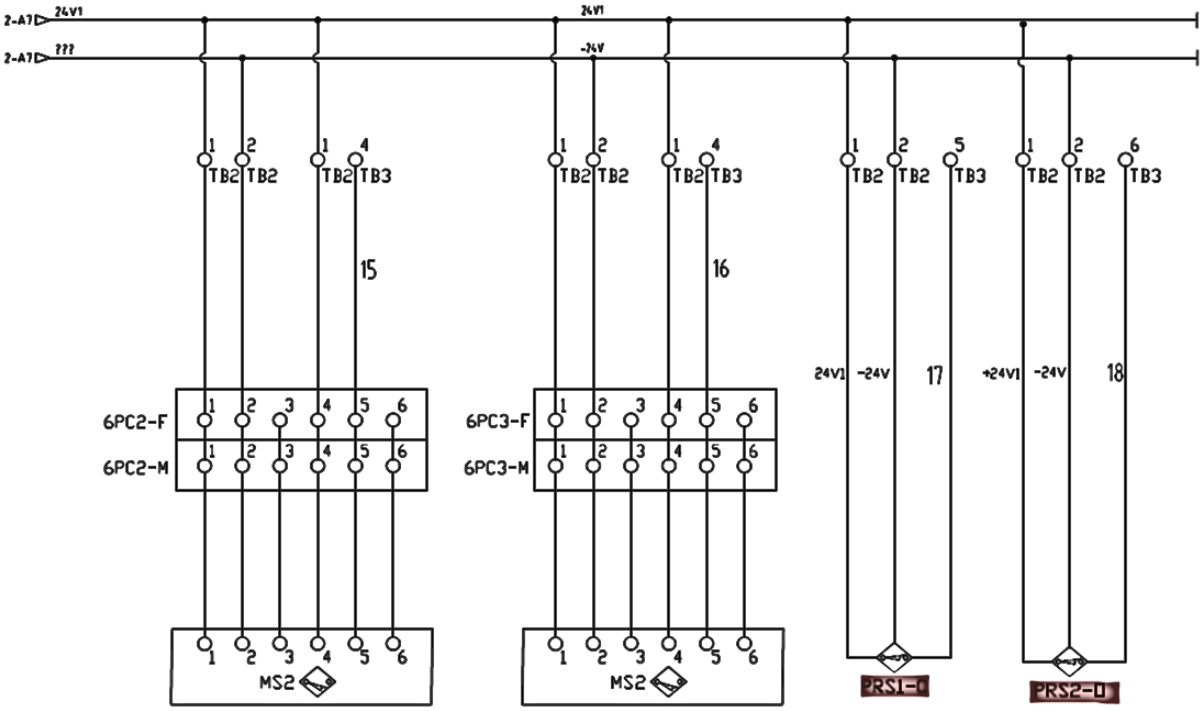
2PC1-F – 2 Pole Pluggable Connector – Female

CS – Contact Strip

6PC1-M – 6 Pole Pluggable Connector – Male

6PC1-F – 6 Pole Pluggable Connector – Female

MS – Motor Sensor



TB – Terminal Block

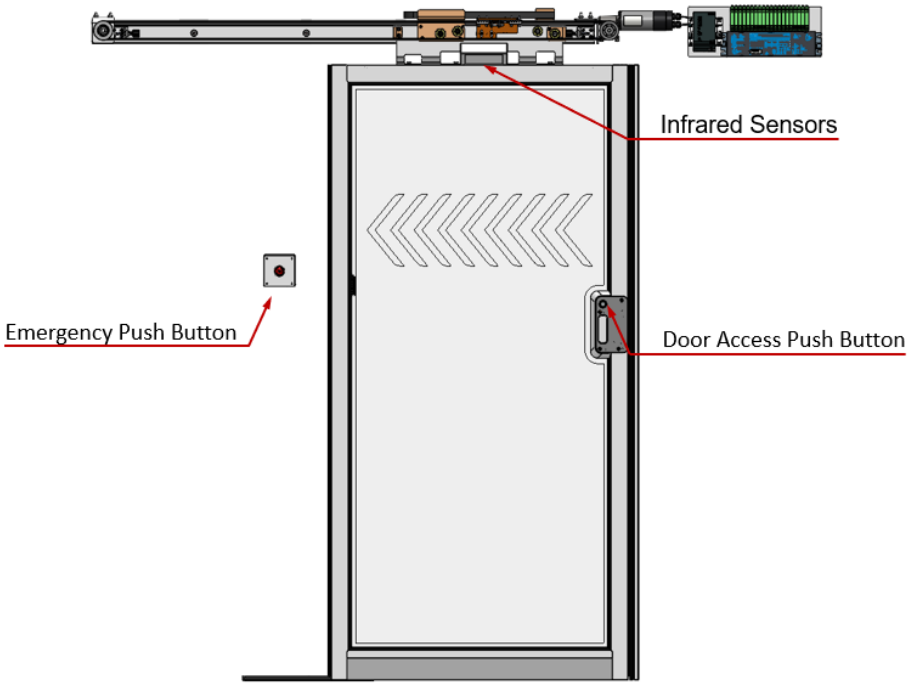
6PC1-M – 6 Pole Pluggable Connector – Male

6PC1-F – 6 Pole Pluggable Connector – Female

MS – Motor Sensor

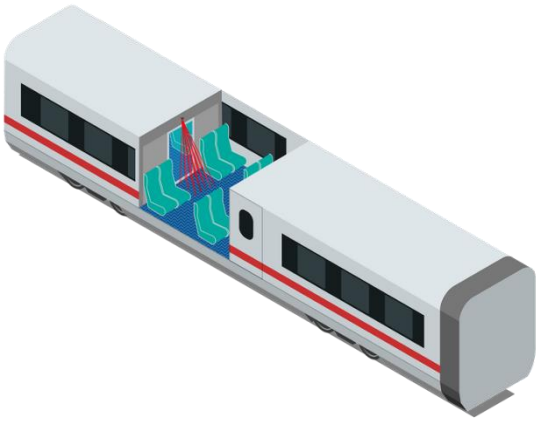
6. FUNCTIONING OF THE DOOR SYSTEM

The door is designed to open upon activation of one of two buttons, located on either side of the passageway. Activation can also be triggered by infrared sensors located at the top on both sides of the door. The door will close automatically after a pre-determined, adjustable duration. In case of an obstruction while the door is in motion, it will automatically reverse its movement.



THREE MODES OF OPERATION

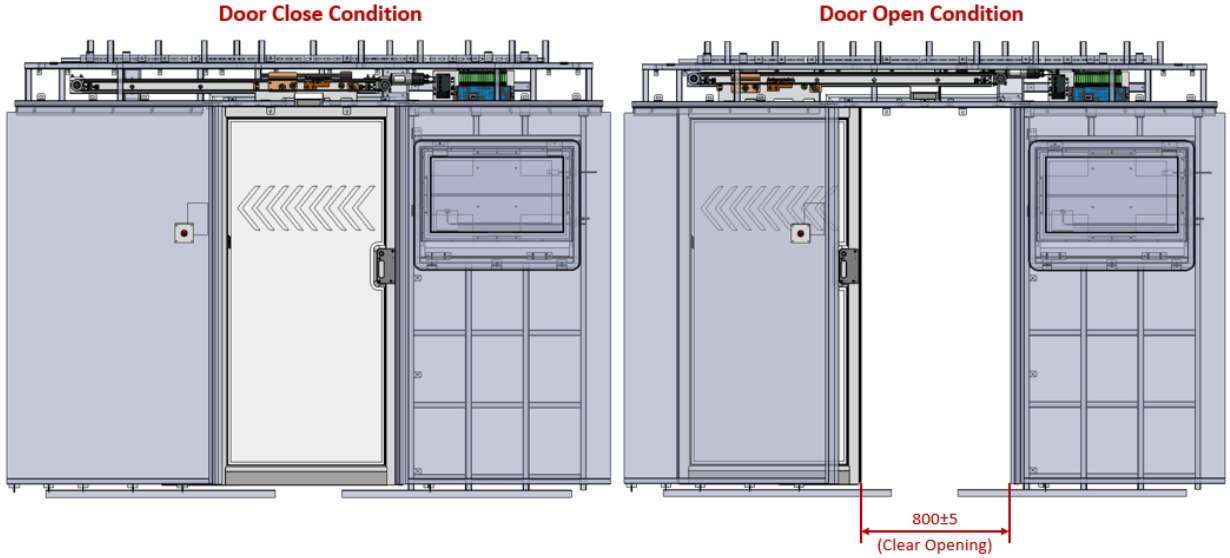
MODE 1: The door access sensor is programmed to sense the movement of passengers within the desired range. The door opens upon the appearance of the passenger and closes after the disappearance.



MODE 2 The door leaf is equipped with a push button on either side for opening of the door system. The push button can be accessed upon failure of either or both the sensors. The push buttons can also be used after isolating the sensors during malfunction.

MODE 3 The system is equipped with a red mushroom head emergency push button on either side. The door transfers to manual when either of the switches are pressed. The door will return to auto mode after turning the pushbuttons to its original state. This mode shall be used at the time of boarding at the stations, where numerous passengers enter the coach continuously.

OPENING/CLOSING ACTION



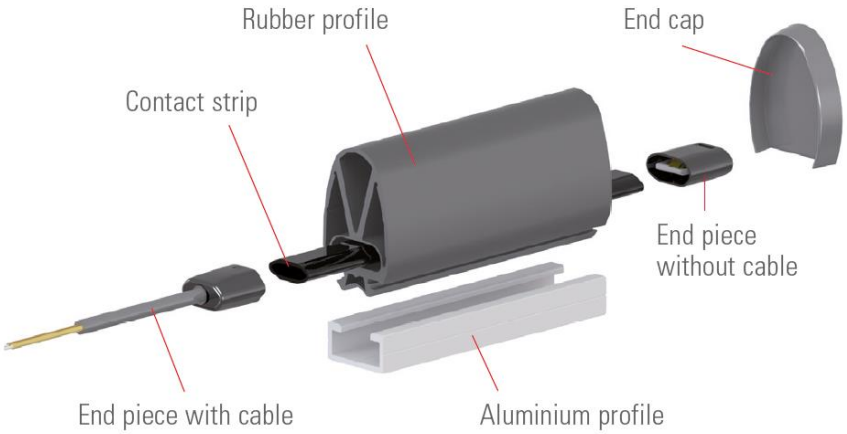
The door operates using either a push button or radar input. Upon activation, the door fully opens and remains open for a set interval of 5-7 seconds before fully closing. In the event of an obstruction in the passage during the closing process, the door immediately fully opens, pauses for 5-7 seconds, and then

resumes its normal closing operation. There is no limit on the number of attempts. The door responds identically whether triggered by the button or radar. If a person is detected by the radar while the door is open, it will remain open.

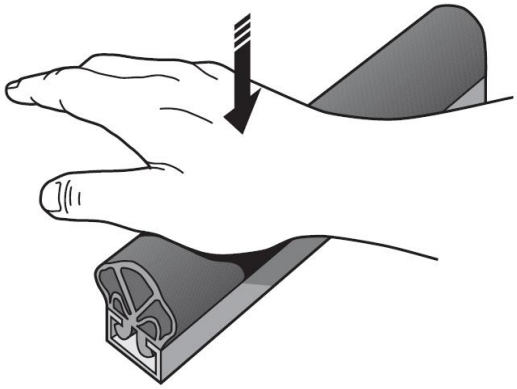
Once the closing process begins, it should be completed as normal. The door should remain in the closed position unless an opening action is initiated. Both the opening and closing of the door is automatic and takes between 3-5 seconds. The door should remain in the closed position during normal train operation and should not move due to the vibrations or accelerations.

OBSTACLE DETECTION

The door access sensor under normal operation eliminates that chance of any obstacle being touched by the door leaf. The obstacle detection system will be at play when the door is in operation on Mode 2 i.e., with the help of the push button.



The leading edge of the door leaf is installed with a rubber seal that houses the contact strip. The contact strip detects the obstacles and sends signal to the controller. The door leaf retreats immediately to the fully opened condition. The system also detects the obstacle using the reverse torque technique as a fail-safe option. The reverse torque technique also helps the controller to store the position of the obstacle with the help of



the encoder in the motor. This enables the door to slowdown just before the position of the obstacle and continue its travel. The door functions normally for the next cycle.

7. INSTALLATION PROCEDURE

7.1 CHECKS PRIOR TO INSTALLATION

Please consider the following before starting installation:

- ✓ Thoroughly review the manual, which contains crucial information on installation, usage, and safety of the actuator system.

- ✓ Only authorized personnel should operate the device and work in its vicinity.

- ✓ They must thoroughly read the manual and familiarize themselves with all the door system's functions.

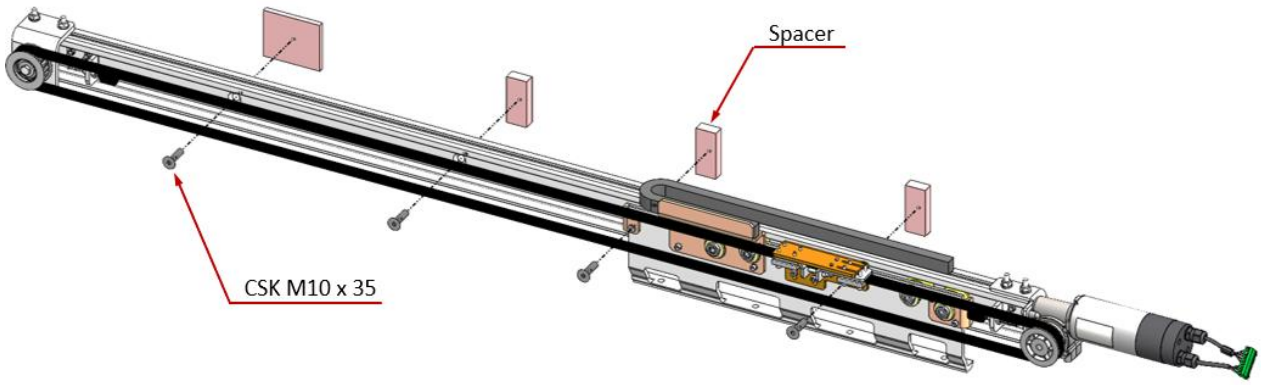
- ✓ Authorized personnel, as defined in this manual, are individuals who have the proper training, skills, and qualifications necessary for their work, including:
    a) Proper training and authorization to connect and disconnect electrical circuits and devices/systems according to safety standards.
    b) Adequate training on the use of appropriate safety equipment in accordance with safety standards.

- ✓ Proper transportation, storage, setup, and assembly of the device, as well as attentive operation and maintenance, are crucial for ensuring its safe and proper functioning.

- ✓ Before turning on the system, confirm that all electrical connections are securely fastened.

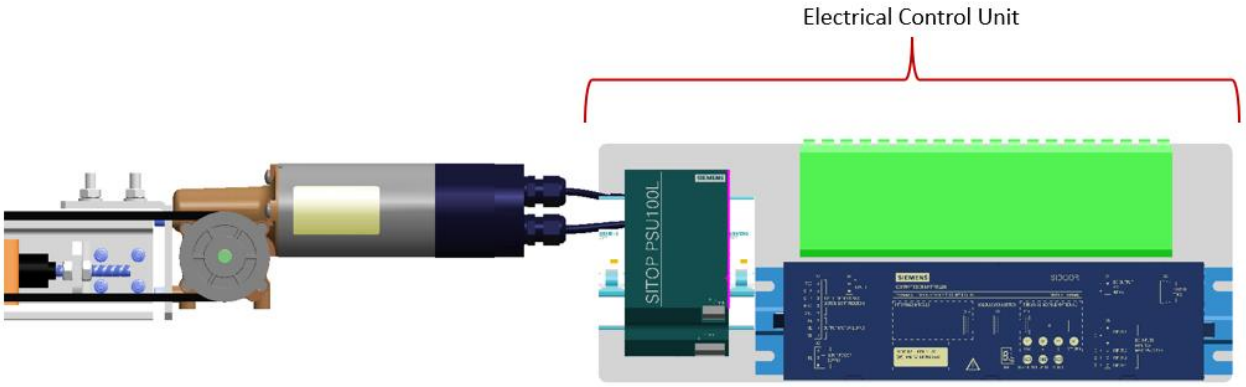
7.2 STEP 1 – INSTALLATION OF THE GUIDE RAIL MECHANISM

- ✓ Align the spacers in line with the mounting holes as per the below illustration.
- ✓ Place the M 10 x 35 mm hexagonal bolts (4 numbers) in the mounting holes through the guide rail and the spacer.
- ✓ Place the guide rail mechanism in the envelop provided in the coach shell.
- ✓ Fasten the bolts to the desired torque level after adjusting the horizontal alignment of the mechanism using spirit level.



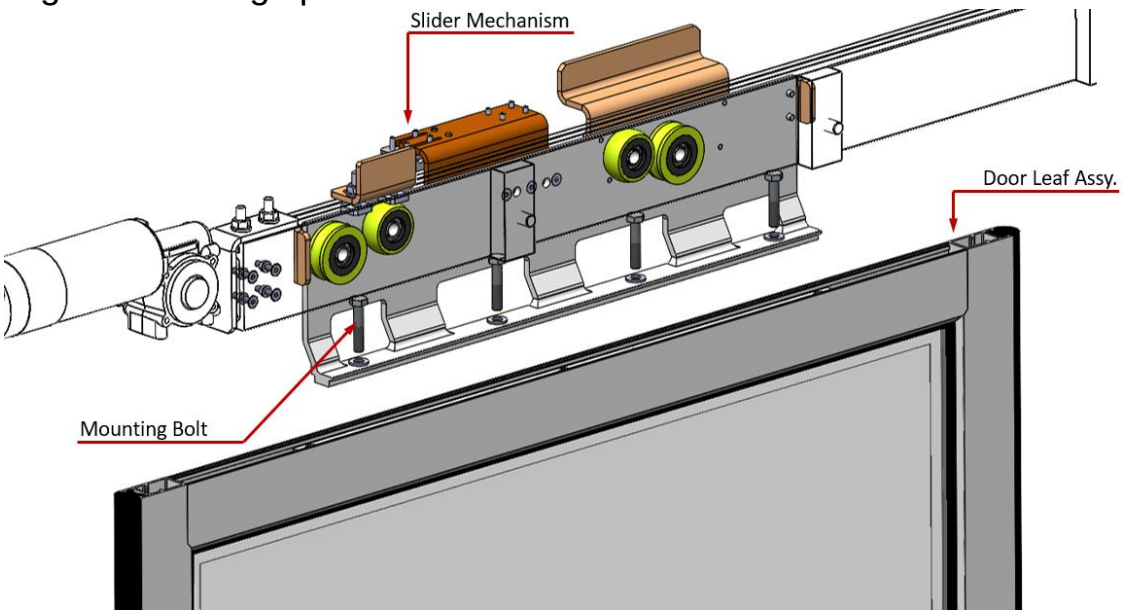
7.3 STEP 2 – INSTALLATION OF THE ELECTRICAL CONTROL UNIT

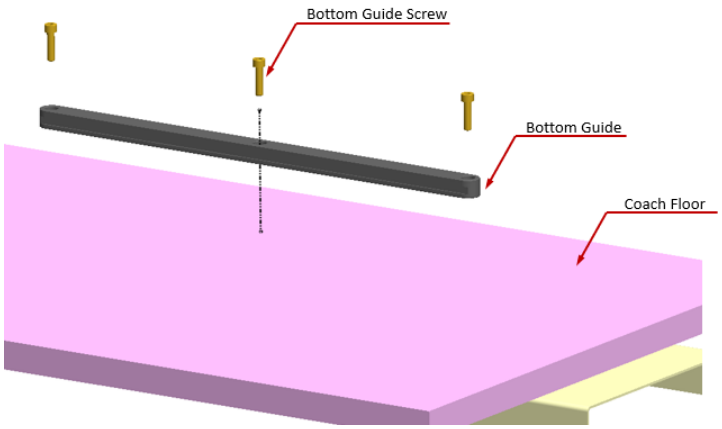
- ✓ Place the electrical control unit in the envelop adjoining the guide rail mechanism and torque the fasteners (4 numbers M5 x 25 mm Cap Allen bolts)



7.4 STEP 3 – INSTALLATION OF DOOR LEAF AND FLOOR GUIDING

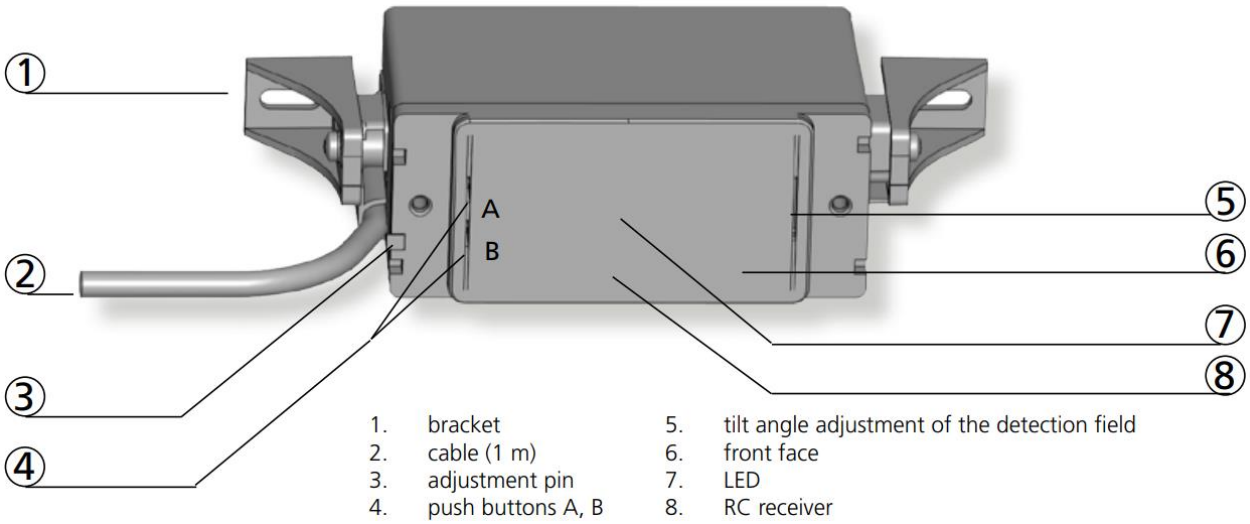
- ✓ Install the door leaf in the carriage section using 4 numbers M8 x 35 mm hexagonal head bolt and M8 spring washer. The straightness of the door leaf has to be ensured using spirit level.
- ✓ Fasten the bolts manually to hold the door in place.
- ✓ Insert the plastic floor guide in to the lower guide of the door leaf for a minimum length 100 mm.
- ✓ Mark the position of the floor guide and unscrew the bolts to remove the door leaf. Install the floor guide in the marked locations using 3 numbers M6 x 25 mm Cap Allen screw.
- ✓ Install the door leaf again and fully fasten the bolts after ensuring the straightness using spirit level.



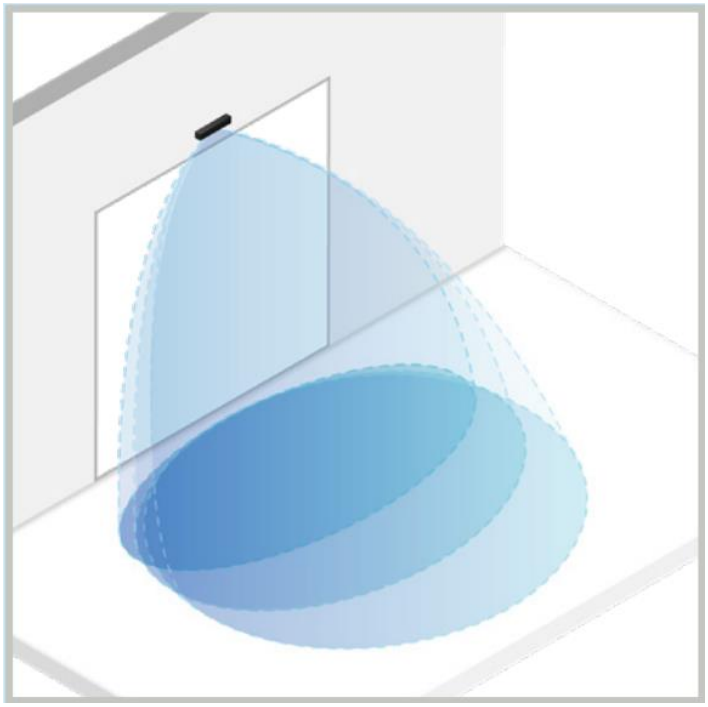


7.5 STEP 5 – INSTALLATION OF DOOR ACCESS SENSOR

- ✓ Fix the sensors in the provisions present in the interior panels (cabin and door way side) after loosening the screws on the either side.
- ✓ Adjust the position of the sensor to the desired angle of inclination and take out the sensor. Tighten the screws on either side to hold the adjustable brackets in position.
- ✓ Re-fix the sensors in the provisions and fasten them using the M3 x 10 mm screws and M3 washers provided in the packaging.

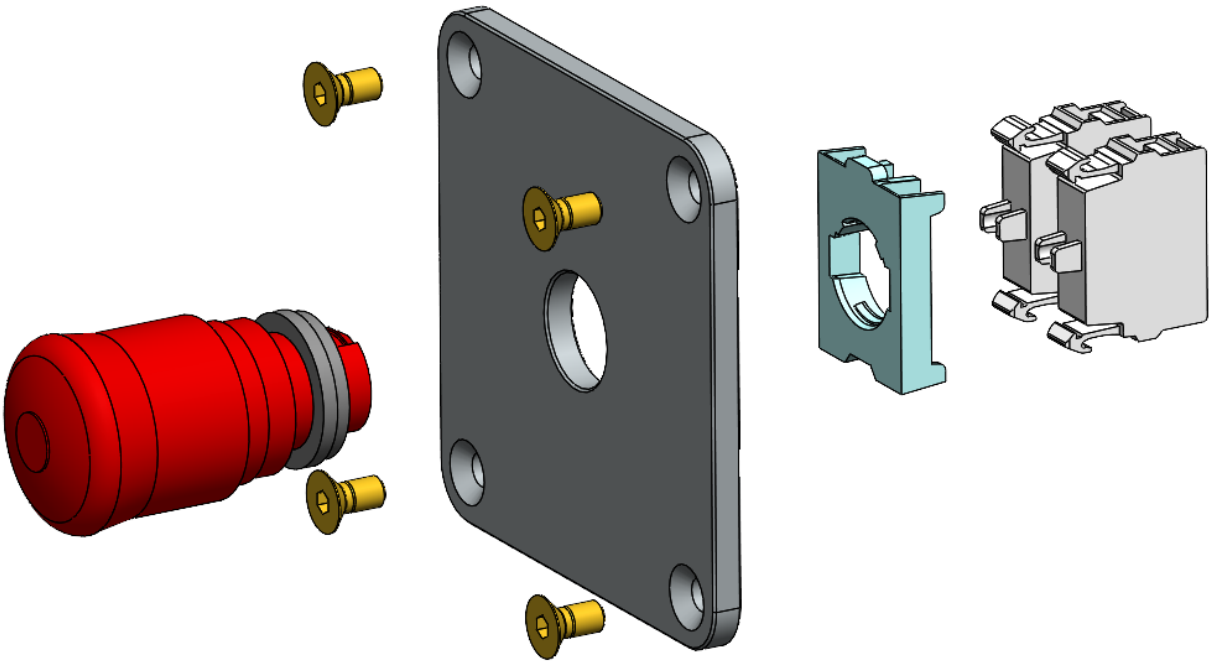


1. bracket
2. cable (1 m)
3. adjustment pin
4. push buttons A, B
5. tilt angle adjustment of the detection field
6. front face
7. LED
8. RC receiver



7.6 STEP 6 – INSTALLATION OF EMERGENCY PUSH BUTTON

- ✓ Install the emergency push buttons on both the compartment and door way side using M5 x 16 mm CSK Allen bolts along with the mounting shims.



7.7 STEP 7 – ELECTRICAL WIRING

- ✓ The cables from the door leaf (push button and contact strip) should be routed through the cable drag chain.

- ✓ Establish the connections as per the electrical scheme.

7.8 STEP 8 – START UP OF THE DOOR SYSTEM

- ✓ Disconnect the power supply from the coach using the circuit breaker and inspect the manual movement of the door leaf. Examine for smooth movement and complete sealing of the door leaf.

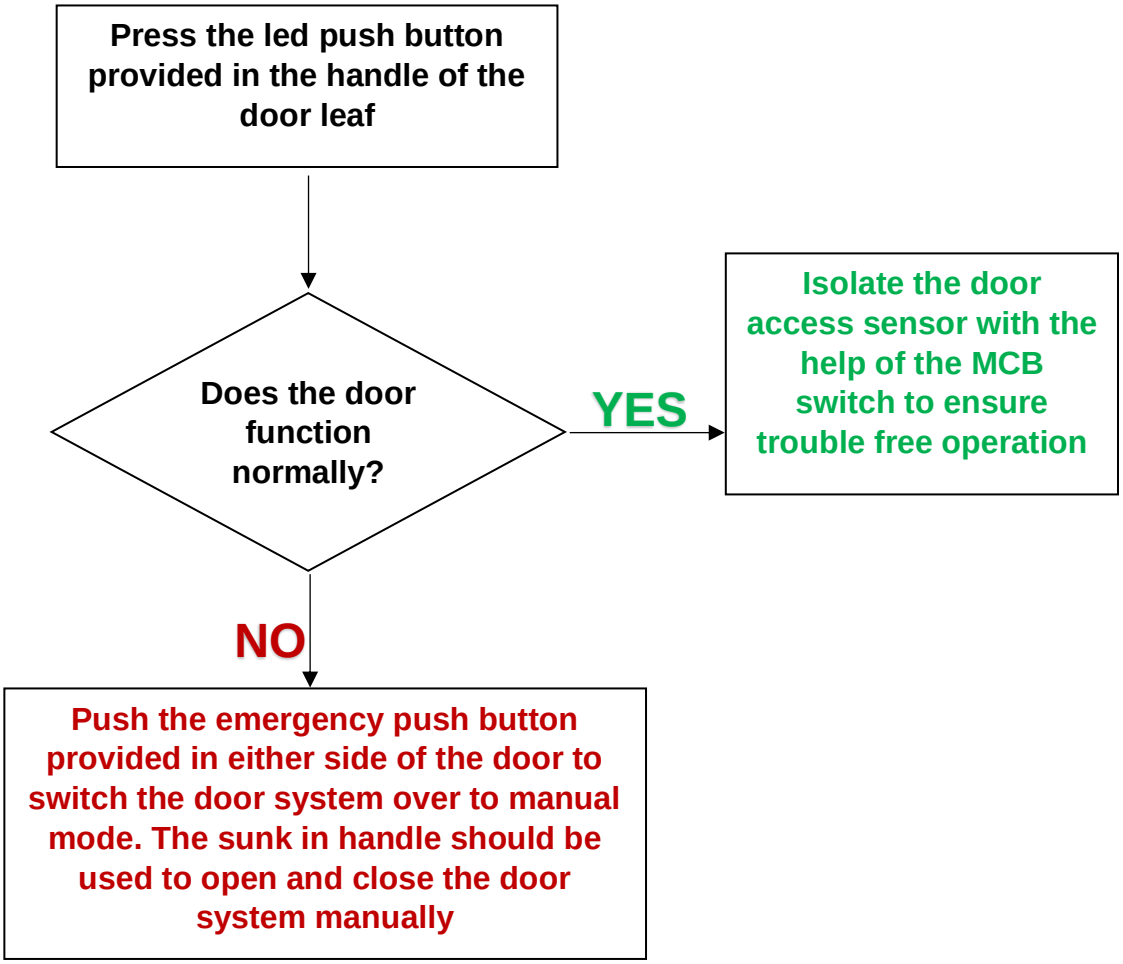
- ✓ Re-establish the connection by switching on the circuit breaker.

- ✓ Enter in to the sensing range of the radar – the door must open automatically.
- ✓ Stay in the sensing range of the radar – the door must remain opened.
- ✓ Move away from the sensing range of the radar – the door must close automatically.
- ✓ Isolate the door access sensor using the circuit breaker.
- ✓ Push the button provided in the door leaf – the door must open automatically and complete the full opening sequence in 3 to 5 seconds.
- ✓ The door should remain open for 5 to 7 seconds.
- ✓ The door must close automatically and complete the full closing sequence in 3 to 4 seconds.
- ✓ Reconnect the door access sensor by switching on the circuit breaker.
- ✓ Push the emergency switch and check the manual opening – closing of the door leaf.
- ✓ Release the emergency switch – the door must open and close automatically.
- ✓ Isolate the door access sensor and push the button in the door leaf.
- ✓ Stand in the pathway of the door leaf to check for obstacle detection.
- ✓ Reconnect the door access sensor by switching on the circuit breaker.

8. TROUBLE SHOOTING

PROBLEM – Failure to open automatically.

STEPS TO BE TAKEN



9. MAINTENANCE PLAN

9.1 INSTRUCTIONS FOR MAINTENANCE

9.1.1 ACTION 1 – INSPECTION OF DOOR RETRACTION

- ✓ Verify that the door retracts upon closing if it encounters an obstacle at any point.
- ✓ Confirm that the door reverses direction upon opening if it becomes hindered at any position.

9.1.2 ACTION 2 – CLEANING OF DRIVE CARRIER

- ✓ Scan for any dust particles in the guide track and remove the same with compressed air or a cleaning agent.

9.1.3 ACTION 3 – CLEANING OF FLOOR GUIDING

- ✓ Clean the floor guide using a soft cloth and a cleaning solution suitable for delicate surfaces

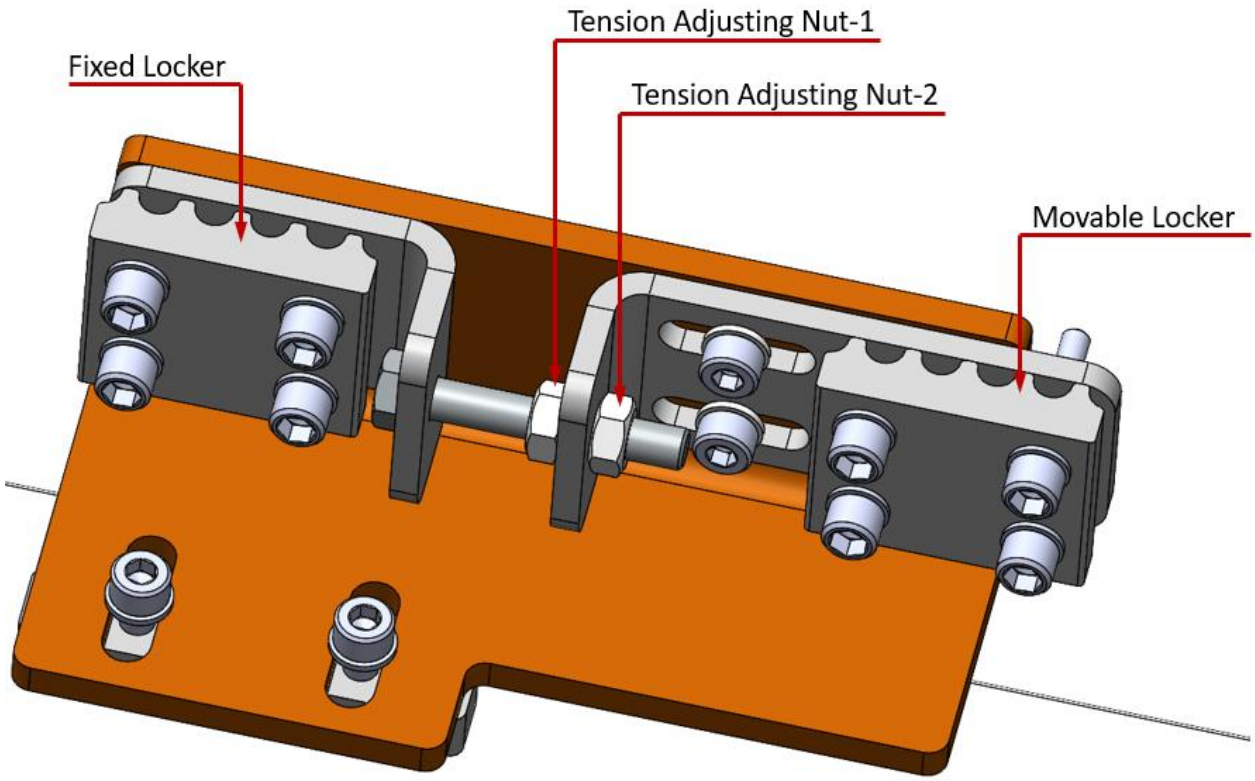
9.1.4 ACTION 4 – PARALLEL CONTACT INSPECTION

- ✓ Confirm that the door leaf and closing edge are in parallel contact.
- ✓ When the door is closed and the power is off, the rubber profile on the door's front edge should be parallel to the counter rail.
- ✓ Readjust the door leaf on the carriage if the front edge is not in parallel with the stopper extrusion.

9.1.5 ACTION 5 – BELT TENSION ADJUSTMENT

- ✓ The length of the timing belt increases by 3 to 6 % during the service life. The carriage is equipped with a tensioning arrangement to adjust the tension from time to time.
- ✓ Loosen the M5 x 12 mm Cap Allen screws present in bracket 2 of the tensioning arrangement.

- ✓ Rotate the tension adjusting nut 1 (M8) in clockwise direction followed by the tension adjusting nut 2 (M8) to move the bracket 2.
- ✓ Move the bracket 2 until the desired tension is achieved and lock the tension adjusting nuts.
- ✓ Torque the screws in the bracket 2 to maintain the tension level.



9.2 MAINTENANCE INTERVALS

MAINTENANCE ACTION	*EVERY 3 MONTHS*	*EVERY 6 MONTHS*	*EVERY 12 MONTHS*
ACTION 1	✓	✓	✓
ACTION 2	✓	✓	✓
ACTION 3	✓	✓	✓
ACTION 4		✓	✓
ACTION 5			✓

9.3 CORRECTIVE MAINTENANCE

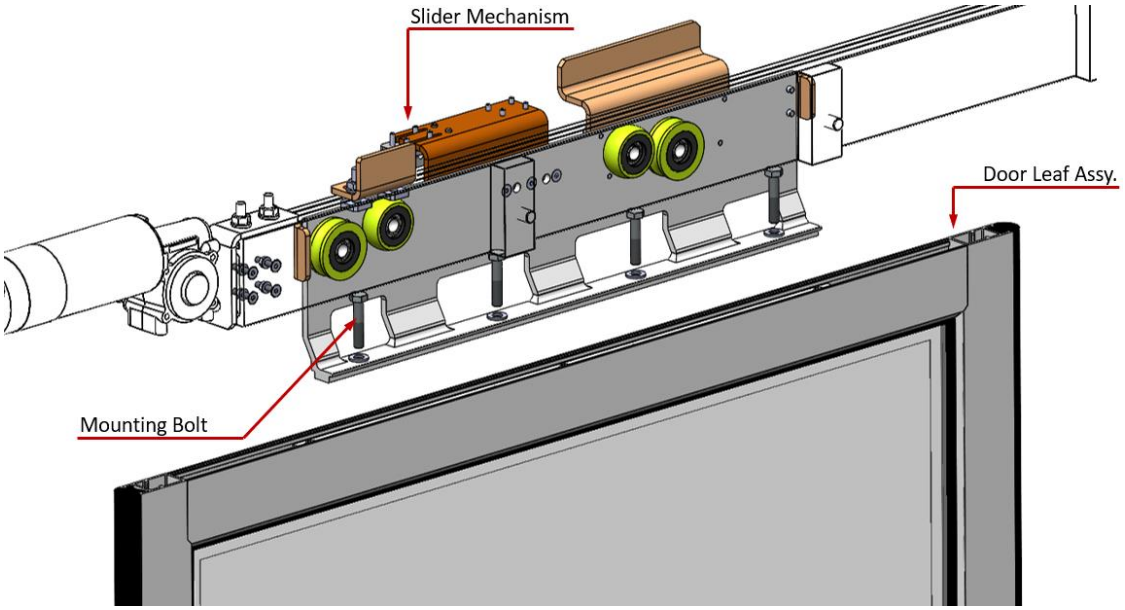
- ✓ The subassemblies can be substituted without the need of removing the door system.

- ✓ In certain situations, various components must be disassembled prior to replacing the faulty subassembly. It is expected that assemblers undertake this task independently by consulting the appropriate section of the maintenance manual.

10. REMOVAL AND REPLACEMENT

Disengage the complete system by switching the circuit breaker before removing any of the component.

10.1 DOOR LEAF



REMOVAL

- ✓ Disconnect the cables of the push button and contact strip from the control unit.

- ✓ Bring the door leaf near the fully closed position.

- ✓ Unscrew the 4 numbers M8 x 35 mm hexagonal bolts and remove the bolts along with the washers. The door leaf should be well supported during the removal operation.

- ✓ Remove the door leaf carefully.

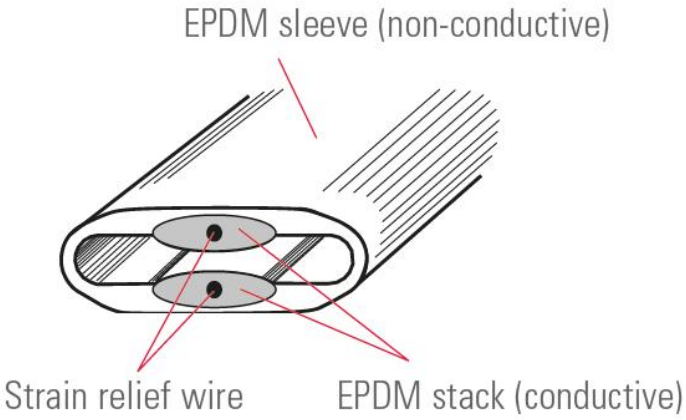
REPLACEMENT

- ✓ Install the door leaf in the carriage section using 4 numbers M8 x 35 mm hexagonal head bolt and M8 spring washer. The straightness of the door leaf has to be ensured using spirit level.

- ✓ Torque the fasteners to the desired level of tightness.

- ✓ Route the cables of the push button and contact strip trough the drag chain and re-establish the connection.

10.2 CONTACT STRIP



REMOVAL

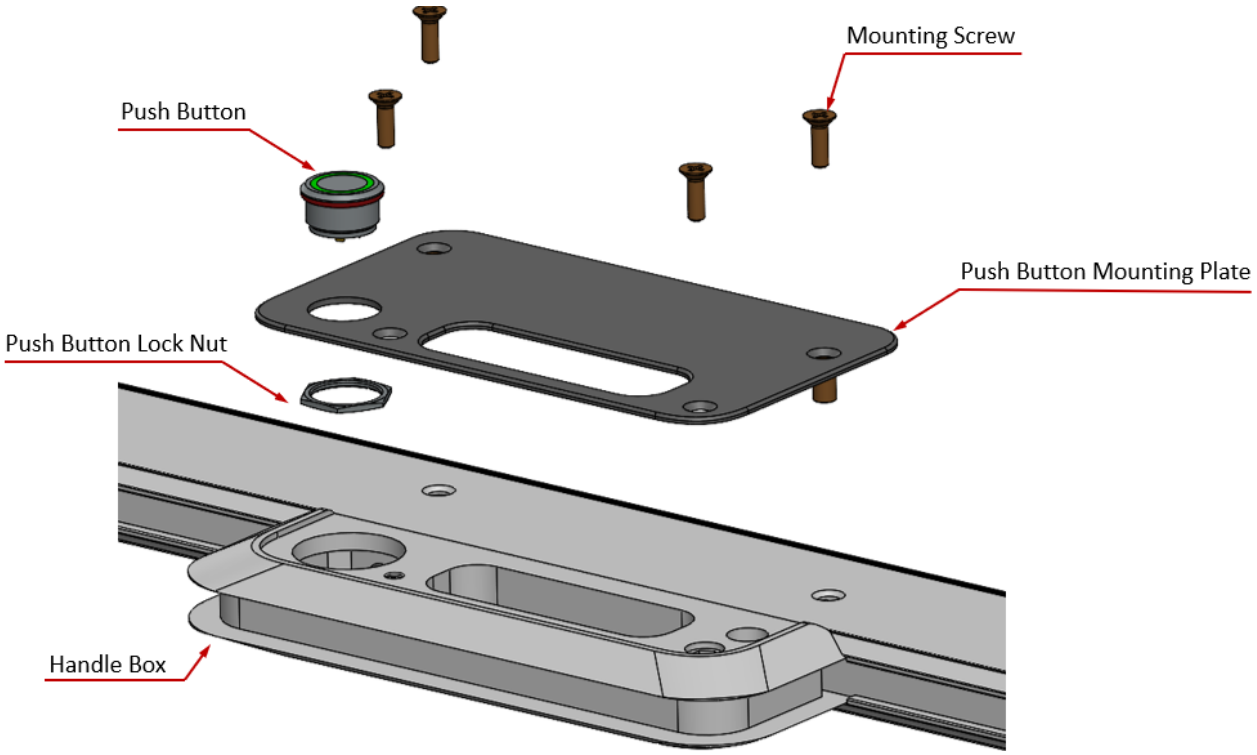
- ✓ Remove the door leaf from the system.

- ✓ Gently pull out the contact strip from the rubber extrusion at the leading edge of the door leaf.

REPLACEMENT

- ✓ Hold the door vertically and insert the contact strip into the rubber extrusion at the leading edge of the door leaf.

10.3 PUSH BUTTON



REMOVAL

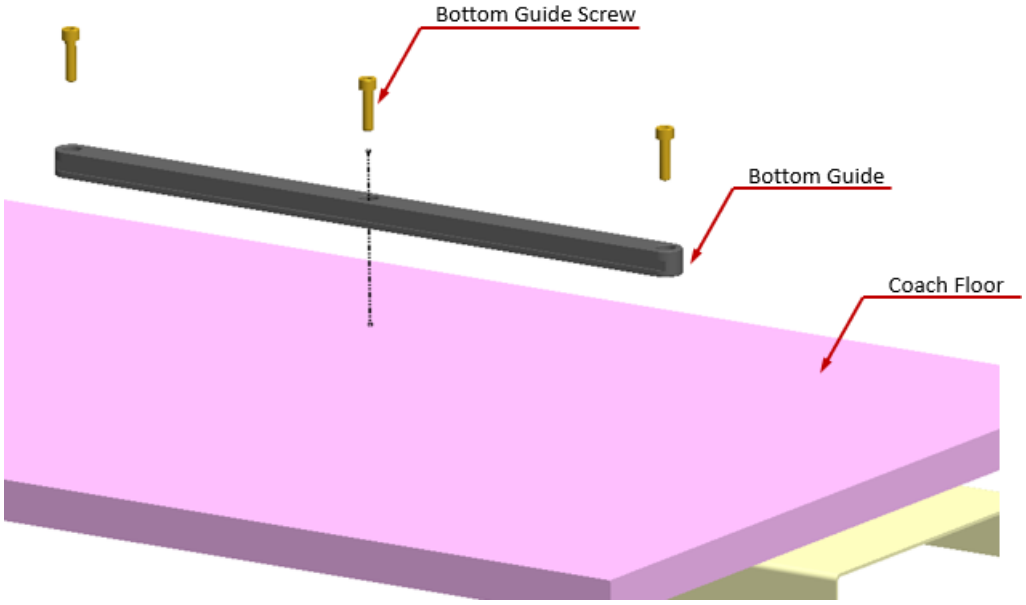
- ✓ Disconnect the cables of the push button from the control unit.
- ✓ Unscrew the 4 numbers M5 x 16 mm CSK Allen bolt from the push button mounting sheet.
- ✓ Remove the push button mounted in the sheet along with the wiring.

REPLACEMENT

- ✓ Replace the push button in the mounting plate and drag the wiring through the hollow section using conduit spring.

- ✓ Fix the mounting plate in the handle and fasten the bolts.
- ✓ Reconnect the wires to the control unit.

10.4 FLOOR GUIDING



REMOVAL

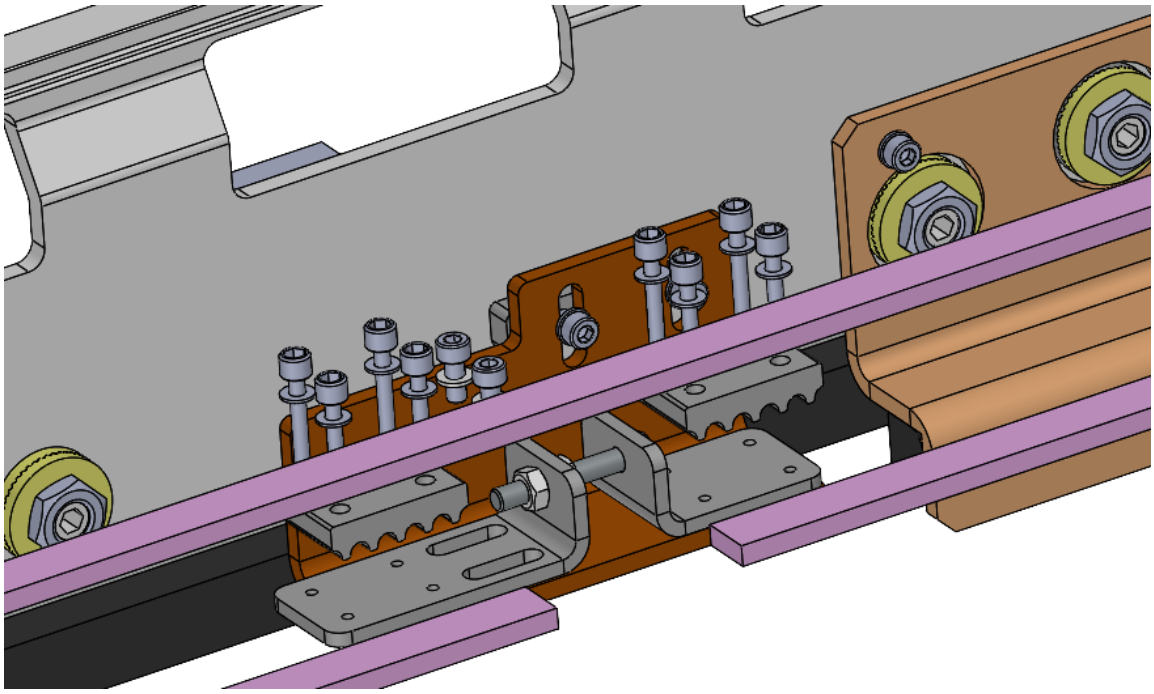
- ✓ Remove the door leaf.
- ✓ Unscrew the 3 numbers M6 x 25 mm Cap Allen screws and remove the floor guide.

REPLACEMENT

- ✓ Follow installation procedure 7.4

10.5 TOOTHED BELT

REMOVAL



- ✓ Rotate the tension adjusting nut to loosen the belt completely
- ✓ Unscrew the 8 numbers M4 x 20 Cap Allen bolts to remove the belt lockers.
- ✓ Remove the toothed belt.

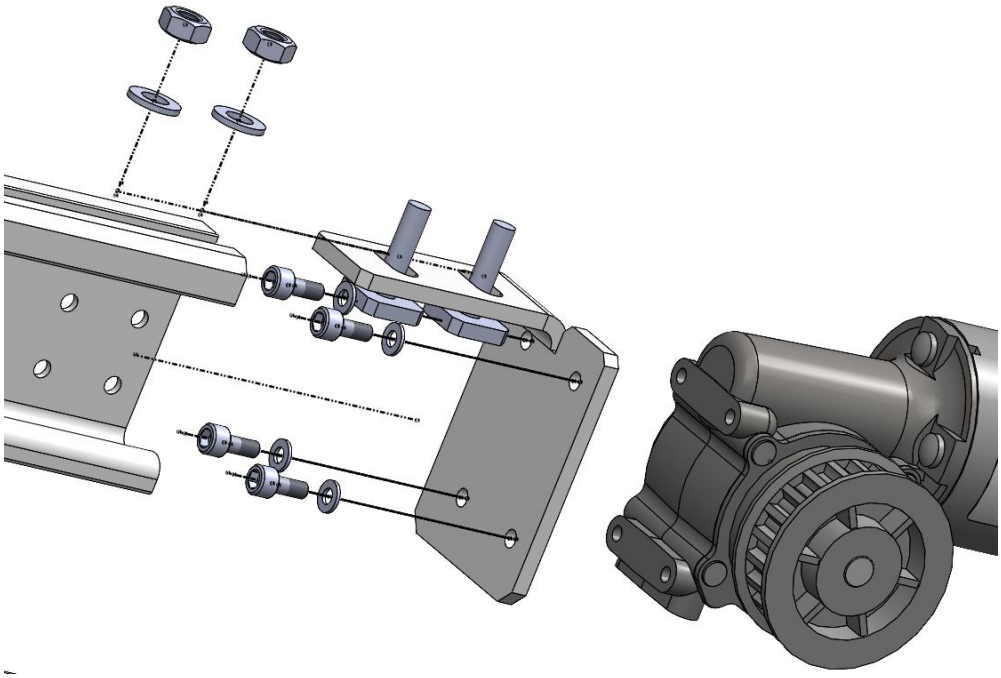
REPLACEMENT

- ✓ Lock any one end of the toothed belt using the locker and fasten the bolts.
- ✓ Guide the belt over the deflector pulley and the motor pulley.
- ✓ Lock the other end of the belt and fasten the bolts.
- ✓ Pretension the belt using the tensioning arrangement.

10.6 MOTOR

REMOVAL

- ✓ Disconnect the motor from the control unit.
- ✓ Unlock the toothed belt on the motor side by removing the 4 numbers M4 x 20 mm Cap Allen bolts.
- ✓ Remove the motor along with the mounting plate by removing the M8 nut and washers from the T bolt.
- ✓ Unscrew the 4 numbers M5 x 12 mm Cap Allen bolts from the mounting plate to remove the motor.



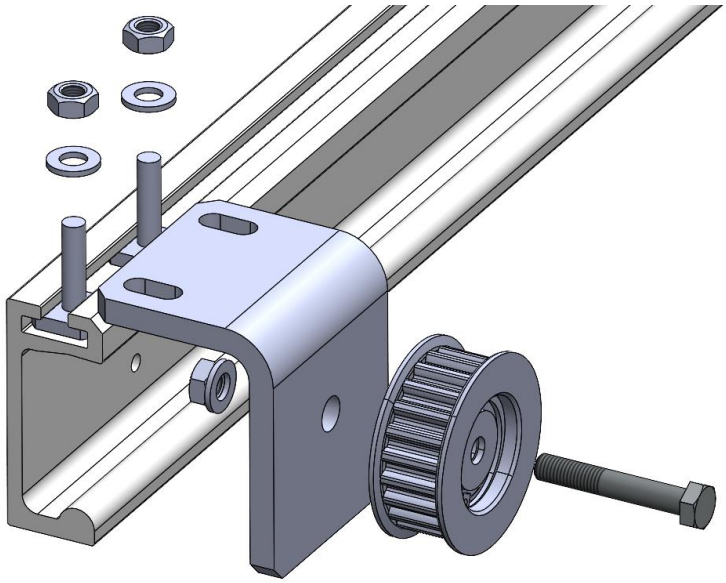
REPLACEMENT

- ✓ Fasten the motor onto the mounting plate using the M5 x 12 mm Cap Allen bolts.
- ✓ Place the T bolts in their original position and fasten the mounting plate using the M8 nut and washers.
- ✓ Connect the motor to the control unit and lock the toothed belt.

10.7 DEFLECTOR PULLEY

REMOVAL

- ✓ Unlock the toothed belt on the deflector pulley side by removing the 4 numbers M4 x 20 mm Cap Allen bolts.
- ✓ Remove the pulley along with the mounting plate by removing the M8 nut and washers from the T bolt.
- ✓ Unscrew the M8 nut and remove the nut along with the washer.
- ✓ Pull out the M8 x 50 mm hexagonal head bolt to remove the pulley.



✓

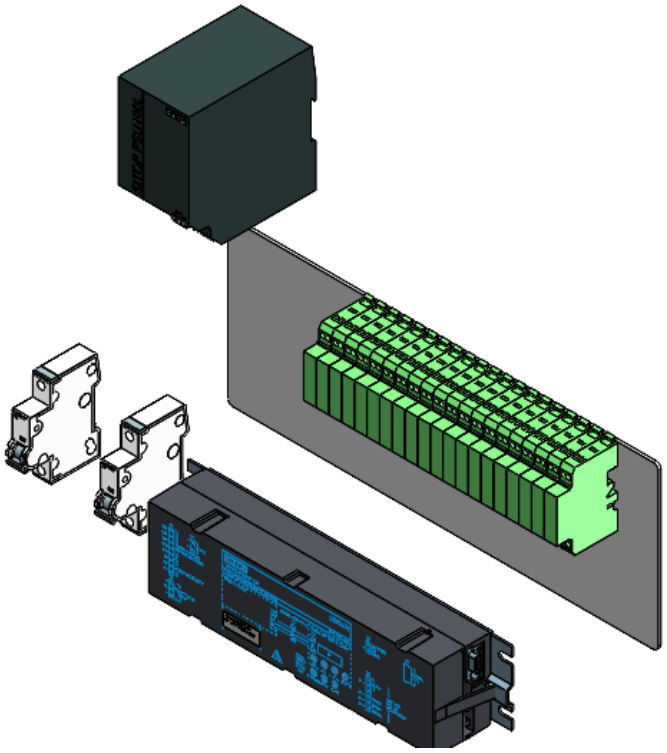
REPLACEMENT

- ✓ Insert the M8 x 50 mm hexagonal head bolt into the pulley and fasten the pulley onto the mounting plate using the M8 nut and washer.
- ✓ Place the T bolts in their original position and fasten the mounting plate using the M8 nut and washers.

10.8 CONTROL RELAY

REMOVAL

- ✓ Remove the cover from the control relay.
- ✓ Remove the plastic cover and disconnect all connections from and to the control relay.
- ✓ Unscrew the control unit from the mounting.



✓

REPLACEMENT

- ✓ Reassemble in the reverse order.

11. SPARE PARTS

DOOR CONTROL RELAY

MOTOR

POWER SUPPLY

DOOR ACCESS SENSOR

EMERGENCY PUSH BUTTON

PUSH BUTTON

CONTACT STRIP

DEFLECTOR PULLEY

TOOTHED BELT

CARRIAGE