



Maintenance Manual

Plug Sliding Door

Version 4 20150316

Reference: ISO 9001 (2008) §7.5.1 Control of production and service provision

Vehicle Type:	
Vehicle Number:	
Customer:	

Revision no.	Date:	Description of the change:	
4	16-03-2015		- Added note in paragraph 1.1: "Door leafs in closed position"
3	02-12-2014		<ul style="list-style-type: none"> - All checks reordered and re-categorized. - New figures for almost all checks, except the filter regulators. - Changed 102mm between door leafs to 104mm, because of different stiffness in side seals. - Added column "ADJ" to tables for marking if check needed adjustment before signing. - Removed check about vertical play, because check 13:3 also mentions vertical play besides tension on the door shaft. - Changed height and with tolerances from 1mm to 2mm.
2	02-09-2014		
		Name & function:	K. Slager Technical Documentation Specialist

SAFETY INSTRUCTIONS

The instructions in this maintenance manual are essential for a correct operation of the door system. Please take notice of all warnings and safety precautions on this page to prevent injury to yourself or others or damage to the Ventura door system. The safety and operation instructions should be retained for future reference.

The consequences that could result from failure to observe the precautions are listed in this section and indicated by the following symbol:



Read instructions; It is important to read the instructions before installing and adjusting the door system. Sufficient technical knowledge is needed to be able to follow the instructions.



Operation; The door system consists of movable parts. Lack of operation knowledge about the door system may causes high risk when not informed. When connecting the power supply, you have to be cautious about the operation of the door system.



Heavy components; the door system consists of relatively large and heavy components. For lifting and fitting these components use a lifting machine or ask a colleague to assist. Ventura Systems advice a maximum lifting weight of 22 Kg per person.



Calibrated tools; For installation and the adjustment of the door system are no special tools necessary. It is important to use tools of good quality and calibrated to prevent damage to the door system or injury to yourself.



Power sources; During the installation period the door leafs may only be moved by hand. During adjustment of the door system it is forbidden to connect the power supply, unless it is written.



Replacements parts; When replacement parts are required, be sure that the power supply is removed from the door system and that the door system can only be moved by hand. Safety features may not be active when replacing parts.

Notices

- While every effort has been made to ensure the information in this maintenance manual is correct and complete, in case of errors we would appreciate you will contact Ventura Systems.

INSTRUCTIONS

This guide is meant for the maintenance of Ventura plug sliding door systems. It is important to follow all instructions. **All instructions must be conducted without air/electric pressure** unless mentioned otherwise. When pressure is needed it will be mentioned. The instructions should be executed for the left and right door leaf when it's a double leaf door system. How often you need to do maintenance on the door system can be seen in the table below.

Use	Times per day open/close	Frequent Maintenance
Normal	0-230	1x per year
Mid-Heavy	230-350	2x per year
Heavy	350-...	3x per year

Maintenance of a door system should only be performed when the bus is positioned on a flat surface to prevent distortion/distorting of the bus body, which can lead to inaccurate measurements of the door aperture.

Signing

When maintenance is performed, all checks should be signed with a signature or name when the setting is correct. This should be done after adjustment when necessary. When adjustment is performed, sign the second last column with a checkmark.

	ADJ	Checked by:
of the he		

Adjusted



Lubricants/Grease

Certain parts need grease as a lubricant. Ventura Systems uses a multipurpose Lithium based grease "Q8 Rembrandt EP-2¹", which has extreme pressure properties. Additional information of Rembrandt EP-2 like products and details can be requested if necessary.



¹ Multi-purpose lithium soap based greases with the **addition of an extreme pressure (EP) additive** to give excellent anti-wear properties for plain and anti-friction bearings operating under heavy or shock loaded conditions, according NLGI 2. Q8 Rembrandt EP greases provide for long service life and offers rust protection even in the presence of water. (<http://www.q8oils.com/>)

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1 MAINTENANCE DOOR

Safety warning: Most checks don't require pneumatic or electric pressure. Remove pressure before maintenance. If pressure is needed, it is mentioned in the check. Remove pressure after the check and when the next step doesn't require pressure.

1.1 Door leafs in closed position

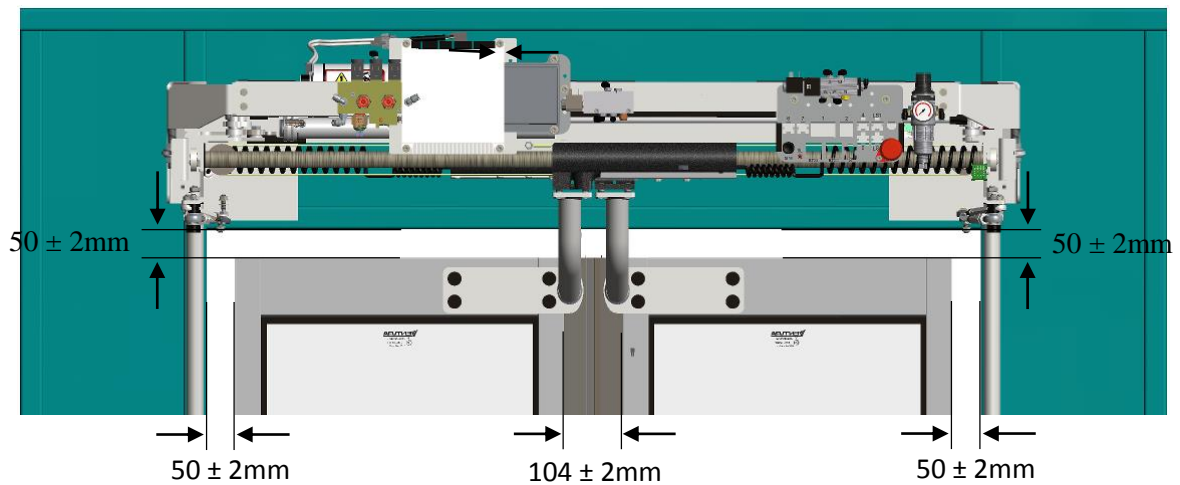


Figure 1.1: Plug sliding door and aperture

Nr.	Check	ADJ	Checked by:
1.	Check if the door leafs are in line with each other. Horizontal distance between door leaf and the aperture (excluding the rubber) should be $50\pm 2\text{mm}$ (Measured from inside the bus).		
2.	When closed there should be $104\pm 2\text{mm}$ distance between the door leafs measured from the aluminum profiles of the door leafs (with pressure). See figure 1.1. <i>Note: This setting is more important than check 1 because of the sensitive edges which are often in the rubber seals between the door leafs. Therefore this setting has priority over check 1, in case aperture dimensions deviate.</i>		
3.	Check if the vertical distances at the top and bottom of the door leafs are $50\pm 2\text{mm}$ (Measured between the door leaf profile and the aperture).		

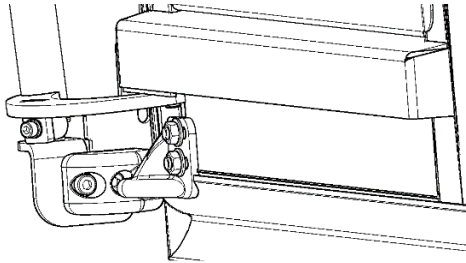


Figure 1.2: Old style rail

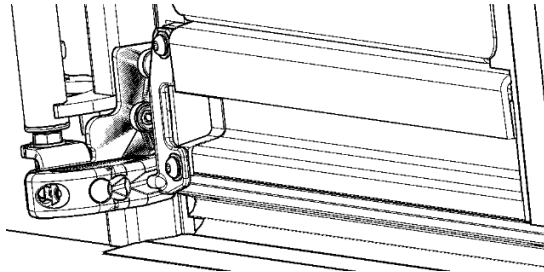


Figure 1.3: New style rail

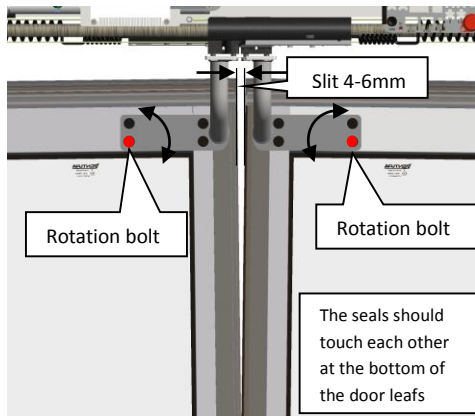


Figure 1.4: Gap between door leaves old style rail

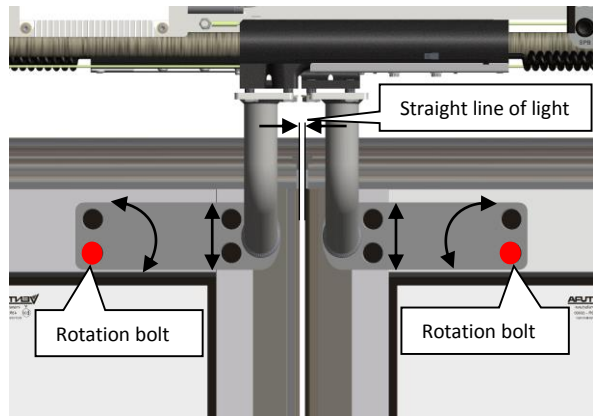


Figure 1.5: Gap between door leaves new style rail

Nr.	Check	ADJ	Checked by:
	<p><i>Note: Check if the door system has door leaves with an old style rail or new style rail (Figure 1.2 and 1.3). Only perform check 4 when door leaves have an old style rail and only perform check 5 when the door leaves have a new style rail.</i></p> <p><i>The old style is visually different because the rail is not integrated in the bottom part of the door leaf, but protrudes from the bottom part of the door leaf.</i></p>		
4.	Check if a gap of approximately 4-6mm at the top between the door leaves is visible (without pressure). The door leaves should touch each other at the bottom in closed position (See Figure 1.4).		
5.	Check if there is an equal gap between the door leaves (without pressure, see Figure 1.5).		

1.2 Adjustment of the catch wedge (Bottom)

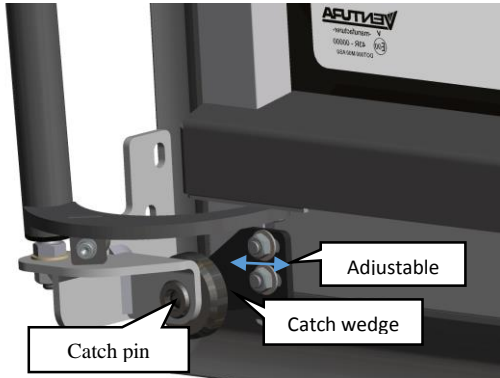


Figure 1.6: First generation catch wedge

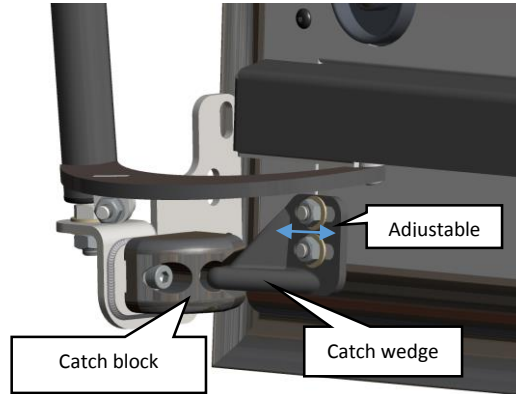


Figure 1.7: Second generation catch wedge

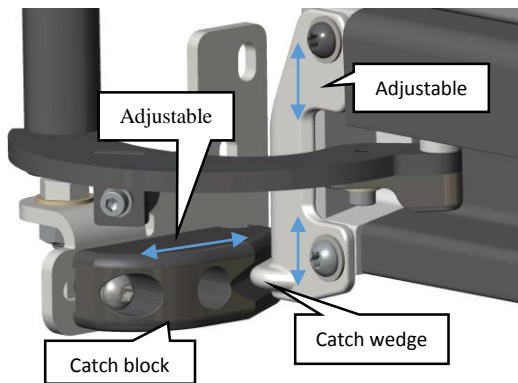


Figure 1.8: Third generation catch wedge

Nr.	Check	ADJ	Checked by:
1.	<p><u>First identify the type of catch block using figure 1.6 to 1.8.</u></p> <p>Check if the catch wedge is caught by the catch block when closing the door. If not then readjust the alignment of the catch wedge. If so, recheck paragraph 1.1 to see if the space between the door leaves is still $104\pm 2\text{mm}$.</p>		
2.	<p>Check if the lever of the door shaft does not touch the catch wedge when in closed position.</p>		

1.3 Door shafts

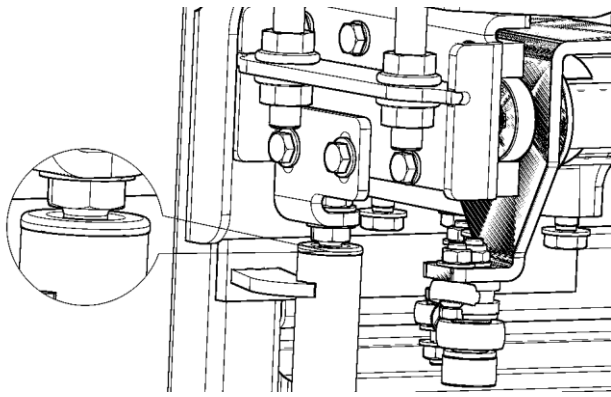


Figure 1.9: Top door shaft bush and pivot

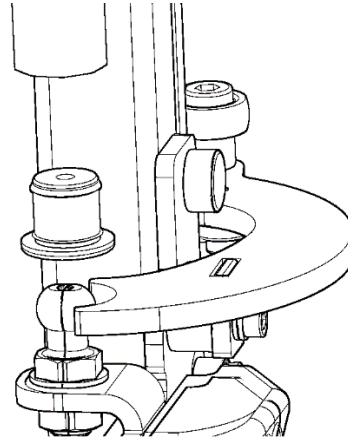


Figure 1.10: Bottom door shaft bush and pivot

Nr.	Check	ADJ	Checked by:
1.	Check if the top bearing bush and pivot aren't broken or worn out. If so replace part.		
2.	Check if the bottom bearing bush and pivot aren't broken or worn out. If so replace part.		
3.	Check if there is no tension on the door shaft. The pivots should hold door shaft in place without vertical play and without too much pressure. If so, adjust the bottom support and door shaft bracket (top).		

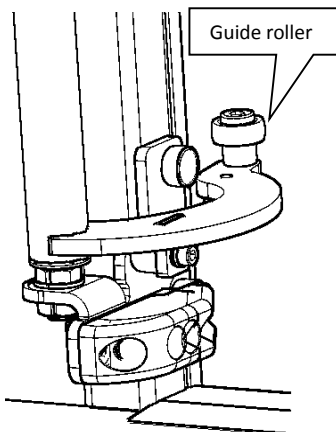


Figure 1.11: Guide roller on the door shaft bottom lever

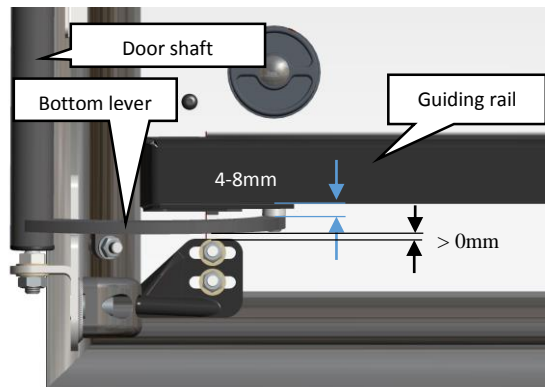
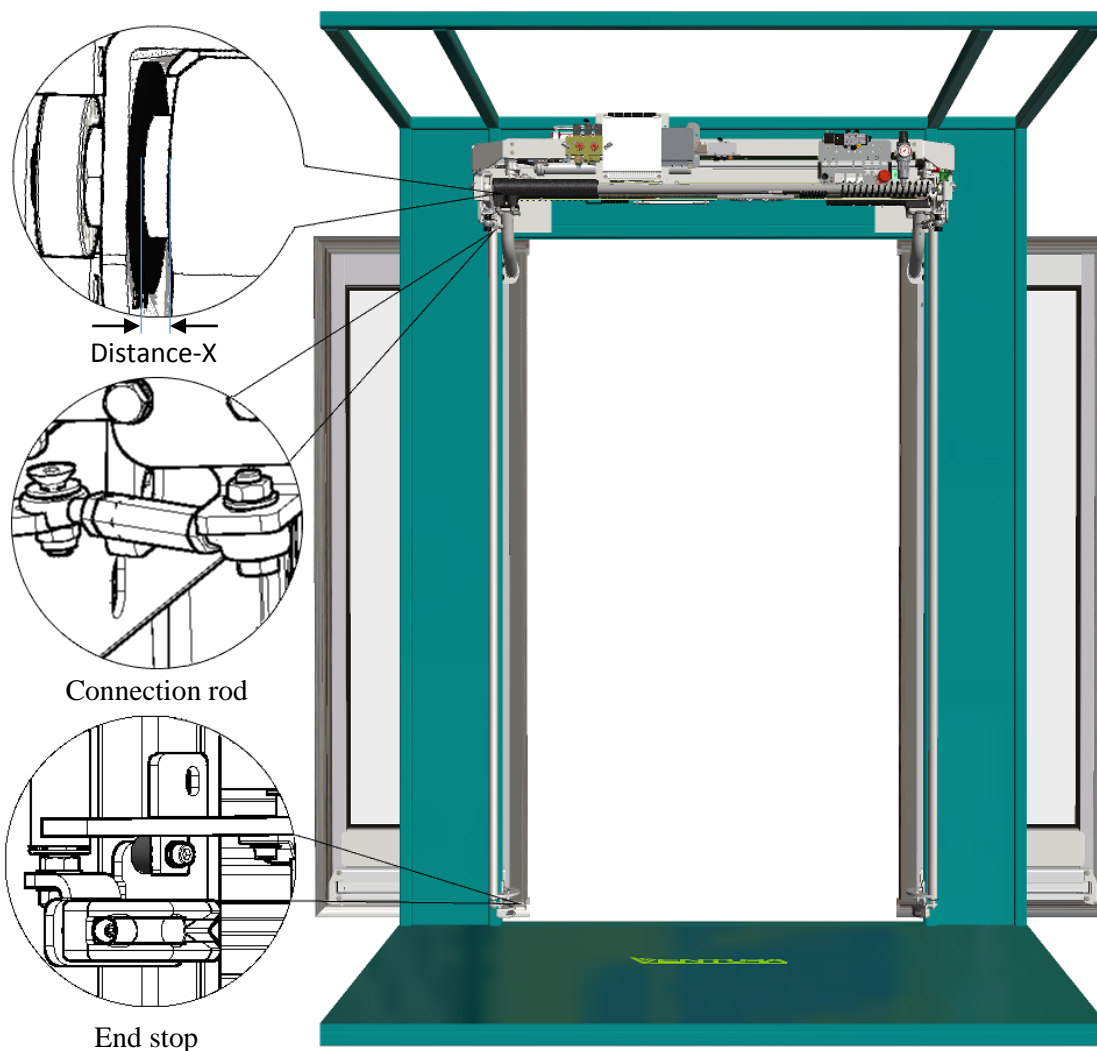


Figure 1.12: Space between the bottom lever and rails

Nr.	Check	ADJ	Checked by:
4.	Check if the guide roller is not broken or worn out. If so replace part.		
5.	Check if the distance between the bottom lever of the door shaft and the guiding rail is 4-8mm in closed position, otherwise re-adjust the door shaft height.		
6.	Check if the lever of the door shaft does not touch the catch plate when in closed position. If so, re-adjust the door shaft height.		

1.4 Door leaves in open position



Nr.	Check	ADJ	Checked by:
1.	Put the door in a 100% open position (with pressure). The bearing housing bushes should touch the cushioning rubber on the frame of the door mechanism.		
2.	Check if "Distance X" between the aperture and the door arm of both door leaves are equal.		
3.	Put the door leaves in open position and check if the roller of the door shaft support touches the end of the guiding rail. If not, the door leaf doesn't swing fully open at the bottom. This can be adjusted with the connection rods.		
4.	The end stop of the door shaft should touch the door shaft support when door is open.		

1.5 Adjust the door to be parallel to the aperture



Figure 1.13: Door leafs parallel to the aperture, seen from above



Figure 1.15: Door leaf seals parallel to the aperture

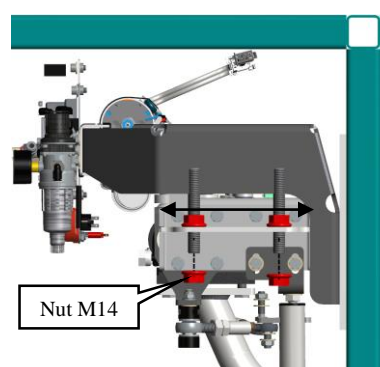


Figure 1.14: Adjust door mechanism position

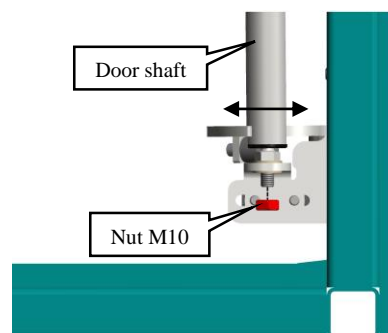


Figure 1.16: Adjust door shaft position

Nr.	Check	ADJ	Checked by:
1.	Check if the door leafs are parallel with the step edge when fully open and without pressure. When closed, the door leaf can be put straight by the catch wedge, but should be straight on its own. Adjust the door leaf when not straight at fully open position (See Figure 1.13).		
2.	Check if the side seals of the door leafs are fitting well to the side of the aperture. The outward side of the side seal should be relatively straight and not bend inwards or leaf a gap between the side seal and the aperture. If not, then adjust the inward/outward position of the door mechanism or door shaft at the bottom support, depending on the corner that doesn't align with the aperture.		

1.6 Soft stop door mechanism

Older end stops	Newer end stops (since 2011)
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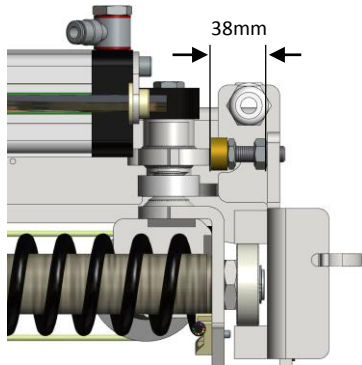


Figure 1.17: Without overcenter

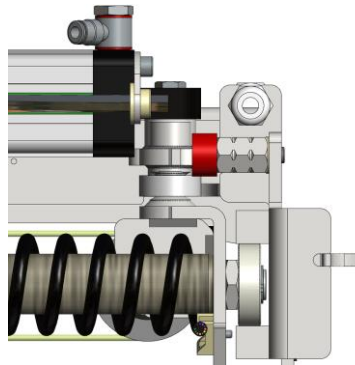


Figure 1.18: New end stop without overcenter

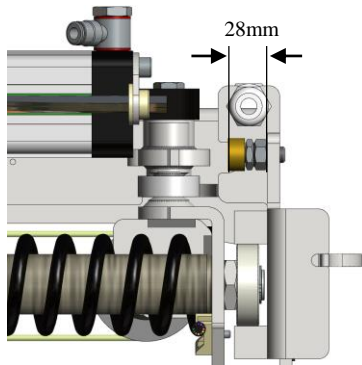


Figure 1.19: Overcenter Pneumatic with unlock cylinder

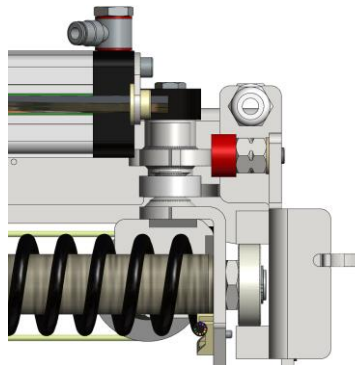


Figure 1.20: New end stop with unlock cylinder

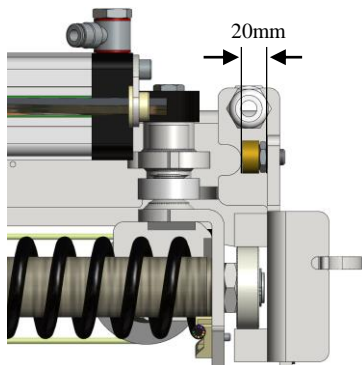


Figure 1.21: Overcenter electric with unlock cylinder

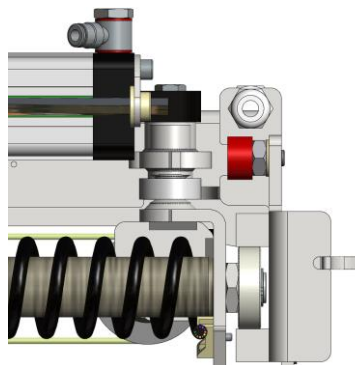


Figure 1.22: New end stop electric with unlock cylinder

Nr.	Check	ADJ	Checked by:
1.	Check if the end stop is the right distance from the frame according to Figure 1.17 - figure 1.22 depending on the situation.		

1.7 Tension steel cables

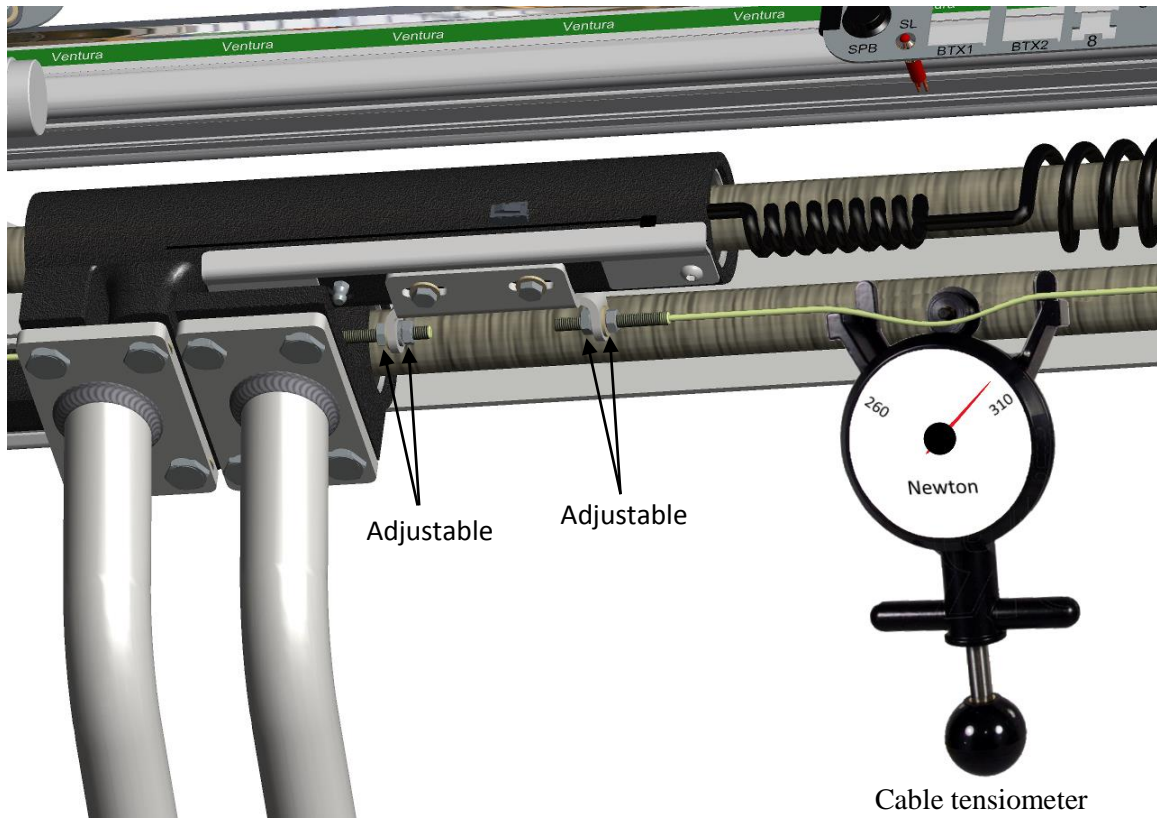


Figure 1.23: Measuring cable tension

Nr.	Check	ADJ	Checked by:
1.	Check the steel cables with a tension gauge. The tension should be within 260-310 Newton. (Doors in half open position and without pressure). If necessary adjust cable length on spanner.		

1.8 Greasing Bearing housing

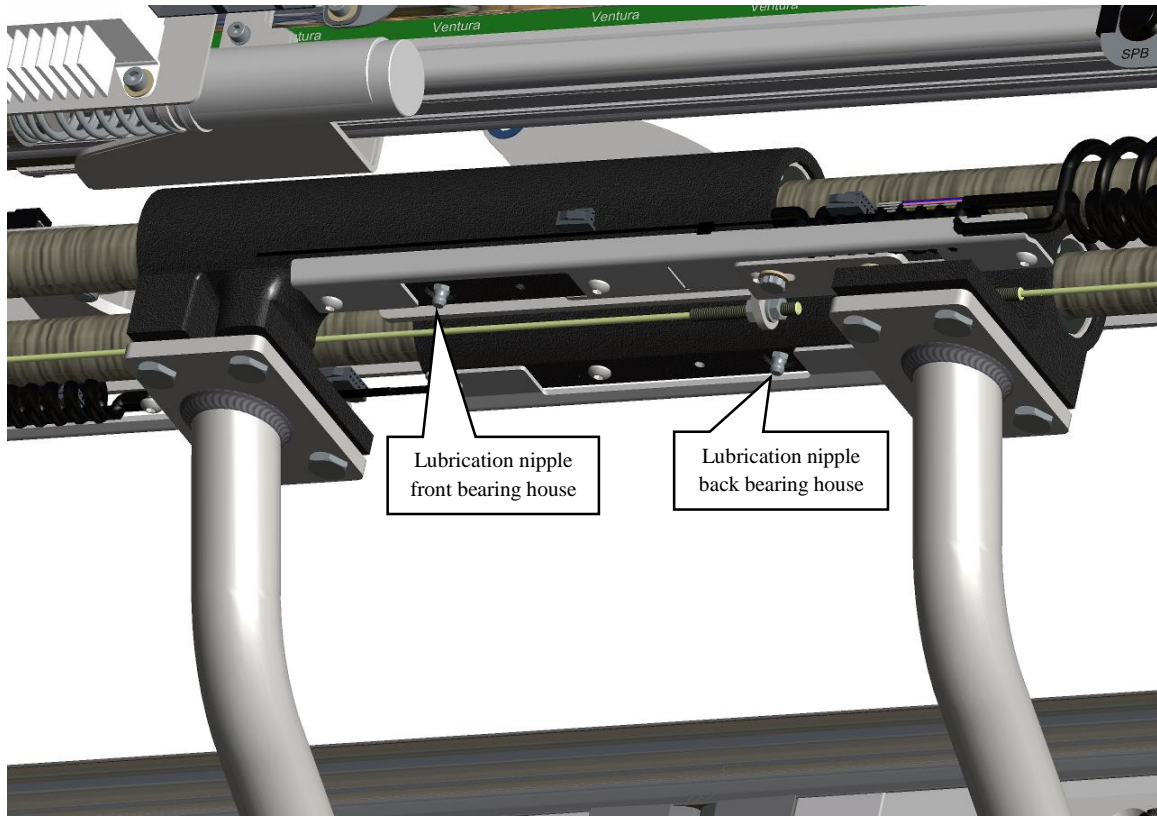


Figure 1.24: Apply multipurpose grease (Q8 Rembrandt EP2) to bearing housings

Nr.	Check	ADJ	Checked by:
1.	<ul style="list-style-type: none"> - Greasing of the bearing housing. The housing is greased before delivering. (Advice: <i>multipurpose grease, Q8 Rembrandt EP-2²</i>). - Both bearing housings have to be refilled every year (Normal use, 20 gr. Grease.) - First 10 gr. grease after moving the door wing a few times, again 10 gr. grease). 		

² NLGI 2

Multi-purpose lithium soap based greases with the **addition of an extreme pressure (EP) additive** to give excellent anti-wear properties for plain and anti-friction bearings operating under heavy or shock loaded conditions. Q8 Rembrandt EP greases provide for long service life and offers rust protection even in the presence of water. (<http://www.q8oils.com/>)

1.9 Electric actuator (if applicable)

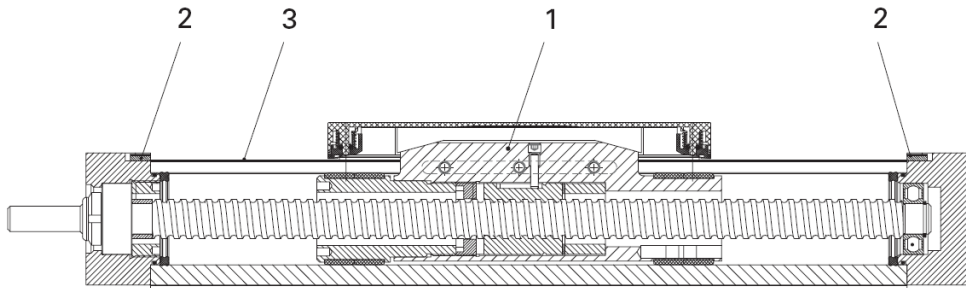


Figure 1.25: Electric actuator

Screw thread	Torque setting galvanized head screws
M3	0.5 ± 0.1 Nm
M4	2.2 ± 0.1 Nm

Nr.	Check	ADJ	Checked by:
1.	Check if the surface between the cover strip (3) and the aluminum profile of the actuator is clean from dirt and other impurities. (When cleaning do not use any aggressive cleaning materials and fluffy cloths.		
2.	Remove the cover strip and check if the spindle axis have a thin coating of grease. If not, then follow these steps: Move the carrier (1) to the middle of the actuator. Remove the clamps (2) at the end of the actuators and remove the cover strip. Grease the spindle axis and the inside of the actuator evenly over the full length of the actuator. Move the carrier a few times to each side. Put the cover strip back in place and screw the clamps. <i>Note: Use lubricant HOERBIGER-ORIGA-Fett 2 (HO-grease 2 identification no. #15071 tube 45 gr). The shaft bearings don't need greasing.</i>		

1.10 Filter regulator

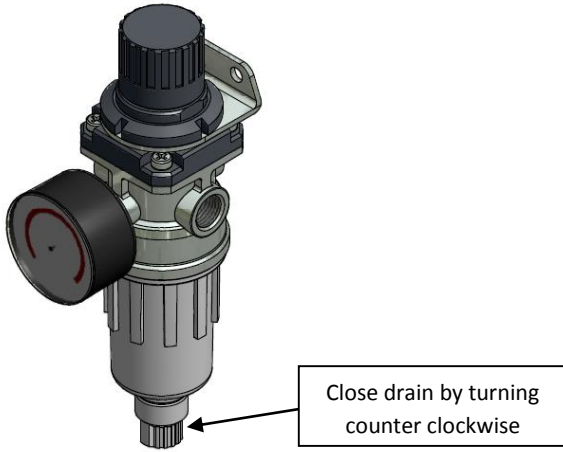


Figure 1.26: Camozzi filter regulator



Figure 1.27: Parker filter regulator

Nr.	Check	ADJ	Checked by:
	Locate the filter regulator if present and check if the clear bowl of the filter regulator is not full. When full press the bottom release drain nipple upwards until the clear bowl is empty.		
	<u>In case the filter regulator is a Camozzi instead of an older Parker.</u> The Camozzi filter regulator is semi-automatic meaning the filter will drain itself when the pneumatic pressure drops below 0.3 bar (4.3 PSI) and the drain is also turned open. It is advised to always keep the drain closed so the drain will not spill dirt over vital parts of the bus, depending on the filter regulator location.		
	Check if the pressure of the pneumatic system is between 8 ± 1 bar.		

1.11 Sensitive edge

Nr.	Check	ADJ	Checked by:
	Check if the sensitive edges are functioning.		

2 OPERATIONAL

2.1 Operation and controls

Nr.	Check	ADJ	Checked by:
	Open cycle, speed and cushioning (nominal 3.5 – 4 sec).		
	Closing cycle, speed and cushioning (nominal 3.5 – 4 sec).		
	Check the pneumatic system for leaking during opening and closing.		
	Check the electric system by looking for short circuits or damages.		
	Check if all bolts and nuts are properly tightened (See chapter 3).		
	Check if the pressure of the pneumatic system is 8 ± 1 bar.		

Table 2.1: Checking of operational and control functions

2.2 Safety

Nr.	Check	ADJ	Checked by:
	Check emergency buttons.		
	Check pneumatic obstruction detection (if applicable).		

Table 2.2: Checking of safety measurements

Signed on behalf of:

Date:

3 TORQUE SETTINGS

Guidelines for mounting and securing joints with steel bolts. In the tables below are the Torque M_a values given for bolts with nominal dimensions over full thread (no special bolts) with metric thread of hexagon bolts type DIN931, DIN933, DIN912. The Torque of bolts depends of friction coefficients of materials, surface treatments, surface conditions, fabrications methods etc. The values in tables below are values which correspond most with the practice, Torque dry.

	Class 8.8
Size	Torque dry range (Nm)
M5 pitch 0.8	6
M6 pitch 1.00	10
M8 pitch range (1.25 – 1.00)	25-27
M10 pitch range (1.50 – 1.00)	51 – 57
M12 pitch range (1.76 – 1.25)	87 – 96
M14 pitch range (2.00 – 1.50)	140 – 150
M16 pitch 2.00	215

Table 3.1: Torque chart for hex bolts. Zinc plated in Nm. ^{3 4}

Note: Torque of the bolts depends of pitch size, the lowest value in the table refers to the biggest pitch of the bolt.

Size	Metric⁵	Torque dry range (Nm)
T25	M5	16 - 19
T30	M6	31 - 37
T40	M8	54 - 65
T50	M12	132 - 158
T55	M12	218 - 256
T60	M14	379 - 445
T70	M17	630 - 700

Table 3.2: Torque chart for torx bolts in Nm⁶

Note: Metric size correspond to Torx “Flat head” and Torx “Pan head”

³ Imperial. Fastener Torque Chart. In Imperial Supplies. Retrieved May 7, 2014, from http://www.imperialsupplies.com/pdf/A_FastenerTorqueCharts.pdf.

⁴ Torque values according Fabory, values correspond with friction coefficient $\mu_k=0.14$, most common, Faborycentres issue 04, 15092002, page 15-37-1, 15-37-2

⁵ 15092002, page 15-371,15-37-2

⁶ Wiha. Typical Dimensional & Torque Specifications. In Wiha Tools Marketing. Retrieved May 7, 2014, from <http://www.wihatools.com/Marketing/torxspecc.htm>.

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4 REMARKS
