

**SHANGHAI FAIVELEY RAILWAY TECHNOLOGY CO.**

**AMSTERDAM (Alstom)**

**5 MAINTENANCE                      AND                      OVERHAUL  
PROCEDURES**

# SHANGHAI FAIVELEY RAILWAY TECHNOLOGY CO.

## Release History

	Name	Department	Date	Signature
Prepared by:	Huang Yuanhua	EHD	03.03.2011	
Checked by:	Zhang Jun	EHD	03.03.2011	
Released by	Olaf.Giel	EH	03.03.2011	

## Revision Table

Revision	Date	Revised Sections, Description, Reason for changes
01	15.10.2010	First issue.
02	29.12.2010	Modify according to "Metro Amsterdam-HVAC_saloon-Faiveley-2010-11-24_maintainability_review".
03	03.03.2011	Modify the cab HVAC unit figures according to the modification of mechanical design; Modify according to file "2011_01_25_maintenance remarks".
04	31.05.2011	Updated according to conf call discussion in March 2011.
05	27.09.2011	Updated check thermostat and thermal breaker of aerotherm unit, Appendix 1 fastener reference table added.
06	18.10.2011	Electrical components in CP, hotgas bypass,bolt sheet updated
07	14.11.2011	Bolt updated for evaporator, condenser,fans.etc.
08	13.03.2011	Butterfly lock added for mixed air filter of saloon, ground cable added for open covers.
09	16.04.2012	Refrigerant filling amount updated. Adjustment of expansion valve of saloon added.
10	16.04.2014	Damper actuator no. updated.
11	22.04.2014	Figure 5.28,5.31,5.83,5.90 updated
12	24.06.2016	Clean filters pressure change to 7bar.

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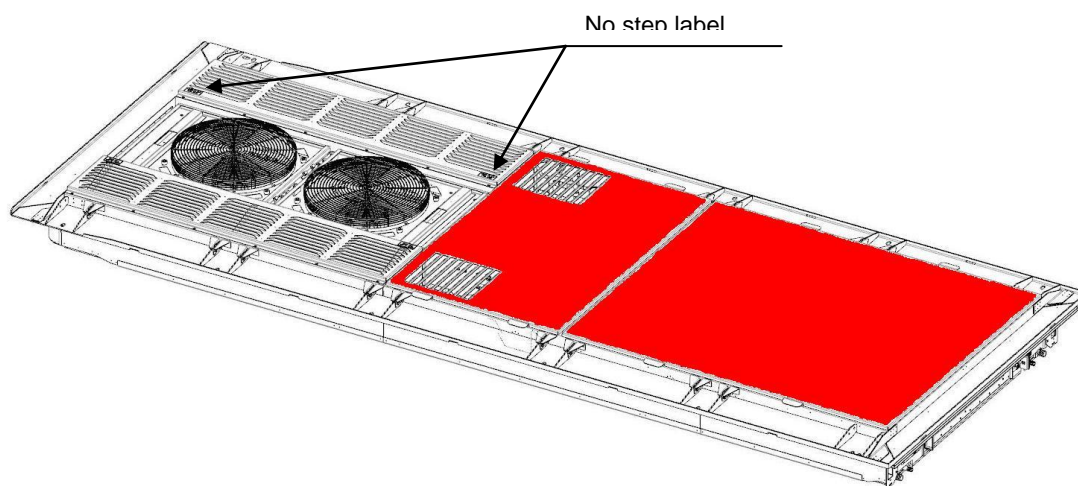
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## 5.1 Walkability of the HVAC unit

If any maintenance activity have to walk on the HVAC unit, please see the following figure to get the information of Walkability of the HVAC unit.



*Figure 5.1 Walkability of the HVAC unit*

In the above figure, red area is the walkable area, and there are also 4 “no step” label to be followed.

## **5.2 Maintenance condition**

The maintenance activities of HVAC unit contain maintenance activities in the vehicle depot and maintenance activities in the workshop.

For the maintenance activities in the vehicle depot, people have two accesses to reach the components of the unit: from the top of the unit (open the maintenance cover) and from the bottom of the unit (from the return air opening).

For the maintenance activities in the workshop, people also have two accesses to reach the components the same as above. For the access from the bottom of the unit, the workshop should prepare sap for maintenance activities.

The maintenance activities which should be done from the bottom of the unit are listed as below, others will be done from the top of the unit.

1. Clean/replace mixed air filter;
2. Clean/replace fresh air filter;
3. Replace return air damper actuator of saloon HVAC unit
4. Check/replace circuit breakers of control panel/manual motor starters for saloon HVAC unit.

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HVAC System

5 Maintenance and Overhaul Procedures

### 5.3 Maintenance Task List

Interval code	Kilometric performance	Interval (time)	Maintenance activity	Workshop staff		Section Reference
				No.	Qual.	
F1	25,000km	Every 3 month	– Clean mixed air filter for both cab HVAC unit and saloon HVAC unit	1	G	5.4.11, 5.4.9
			– Clean fresh air filter for both cab HVAC unit and saloon HVAC unit	1	G	5.4.10, 5.4.8
F2	100,000km	Every 1 year	– Clean condenser for both cab HVAC unit and saloon HVAC unit	1	G	5.4.25, 5.4.12 5.4.13
			– Check switch point of high pressure switch for both cab HVAC unit and saloon HVAC unit	1	M	5.4.21, 5.4.22
			– Check switch point of low pressure switch for both cab HVAC unit and saloon HVAC unit	1	M	5.4.23, 5.4.24
			– Clean evaporator for both cab HVAC unit and saloon HVAC unit	1	M	5.4.26, 5.4.14

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5 Maintenance and Overhaul Procedures

			<ul style="list-style-type: none"> <li>– Functional check of thermostat for cab HVAC unit ,saloon HVAC unit and cab arotherm Unit</li> </ul>	1	E	5.4.15, 5.4.16 5.4.17
			<ul style="list-style-type: none"> <li>– Functional check of thermal breaker for cab HVACunit ,saloon HVAC unit and cab arotherm Unit</li> </ul>	1	E	5.4.18, 5.4.19 5.4.20
			<ul style="list-style-type: none"> <li>– Inspect cab HVAC unit and saloon HVAC unit.</li> </ul>	1	G	5.4.7, 5.4.6
			<ul style="list-style-type: none"> <li>– Change mixed air filter material for both cab HVAC unit and saloon HVAC unit</li> </ul>	1	G	5.5.24, 5.5.22
F3	500,000km	Every 5 year	<ul style="list-style-type: none"> <li>– Replace supply air fan motor for saloon HVAC unit</li> </ul>	2	E	5.5.11
			<ul style="list-style-type: none"> <li>– Replace fresh air filter for both cab HVAC unit and saloon HVAC unit</li> </ul>	1	G	5.5.25, 5.5.23
			<ul style="list-style-type: none"> <li>– Change supply air fan for both cab HVAC unit and Cab Aerotherm unit</li> </ul>	1	E	5.5.10, 5.5.72

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5 Maintenance and Overhaul Procedures

F4	1,000,000km	Every 10 year	– Replace bumper for supply air fan for saloon HVAC unit	2	M	5.5.12
			– Replace motor bearing of condenser fan for saloon HVAC unit	2	E	5.5.17
			– Replace motor of condenser fan for cab HVAC unit	2	E	5.5.20
F5	1,500,000km	Every 15 year	– Replace compressor for both cab HVAC unit and saloon HVAC unit	2	M	5.5.26, 5.5.27
			– Replace compressor vibration damper for both cab HVAC unit and saloon HVAC unit	1	M	5.5.28, 5.5.29
			– Replace filter dryer for both cab HVAC unit and saloon HVAC unit	1	M	5.5.34, 5.5.35
			– Replace solenoid valve for both cab HVAC unit and saloon HVAC unit	1	M	5.5.56, 5.5.58
			– Replace coil for solenoid valve for both cab HVAC unit and saloon HVAC unit	1	M	5.5.60, 5.5.61

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5 Maintenance and Overhaul Procedures

			– Replace sight glass for both cab HVAC unit and Saloon HVAC unit	1	M	5.5.36, 5.5.37
			– Replace high pressure switch for both cab HVAC unit and saloon HVAC unit	1	M	5.5.45, 5.5.46
			– Replace low pressure switch for both cab HVAC unit and saloon HVAC unit	1	M	5.5.47, 5.5.48
			– Replace expansion valve for both cab HVAC unit and saloon HVAC unit	1	M	5.5.57, 5.5.59
			– Replace bumper for condenser fan for saloon HVAC unit	1	M	5.5.15
			– Replace condenser for both cab HVAC unit and saloon HVAC unit	2	M	5.5.30, 5.5.31
			– Replace evaporator for both cab HVAC unit and saloon HVAC unit	2	M	5.5.32, 5.5.33
			– Replace heating rods for both cab HVAC unit, cab aerotherm unit and saloon HVAC	1	E	5.5.43, 5.5.44

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5 Maintenance and Overhaul Procedures

			unit			5.5.73
			– Replace actuator for fresh air damper for saloon HVAC unit	1	E	5.5.65
			– Replace actuator for return air damper for saloon HVAC unit	1	E	5.5.66
			– Replace controller FPC for both cab HVAC unit and saloon HVAC unit	1	E	5.5.67, 5.5.69
			– Replace DI08 for saloon HVAC unit	1	E	5.5.70

## **5.4 Verification and cleaning of the equipment**

In the procedures, some tools must be prepared:

1. Hp-cleaner, vacuum cleaner, soft feather brush, gas-jetted gun and other removal tools.
2. spanners, screw drivers, pliers.
3. Wrench, torque wrench and hexagon wrench.
4. Pipe-cutters, hacksaw, deburring tool.
5. Brazing equipment.


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HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.1 Open the air handling chamber cover of saloon HVAC unit

<b>Title:</b> Air handling chamber cover – open	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> It is a procedure for other tasks.		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle/on the ground.		
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Saloon HVAC Unit. <b>Item No.:</b> 97.1733.0001		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97A100.000-00A.M2		
<b>SAFETY PRECAUTIONS:</b>  <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

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HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.08 hour

**Team Size:** 2 person

**Procedure:**

1. Loosen the 14 bolts which fix the air handling chamber cover to the HVAC unit frame, then loosen the bolt of ground cable to the HVAC unit frame.

See the following figure.

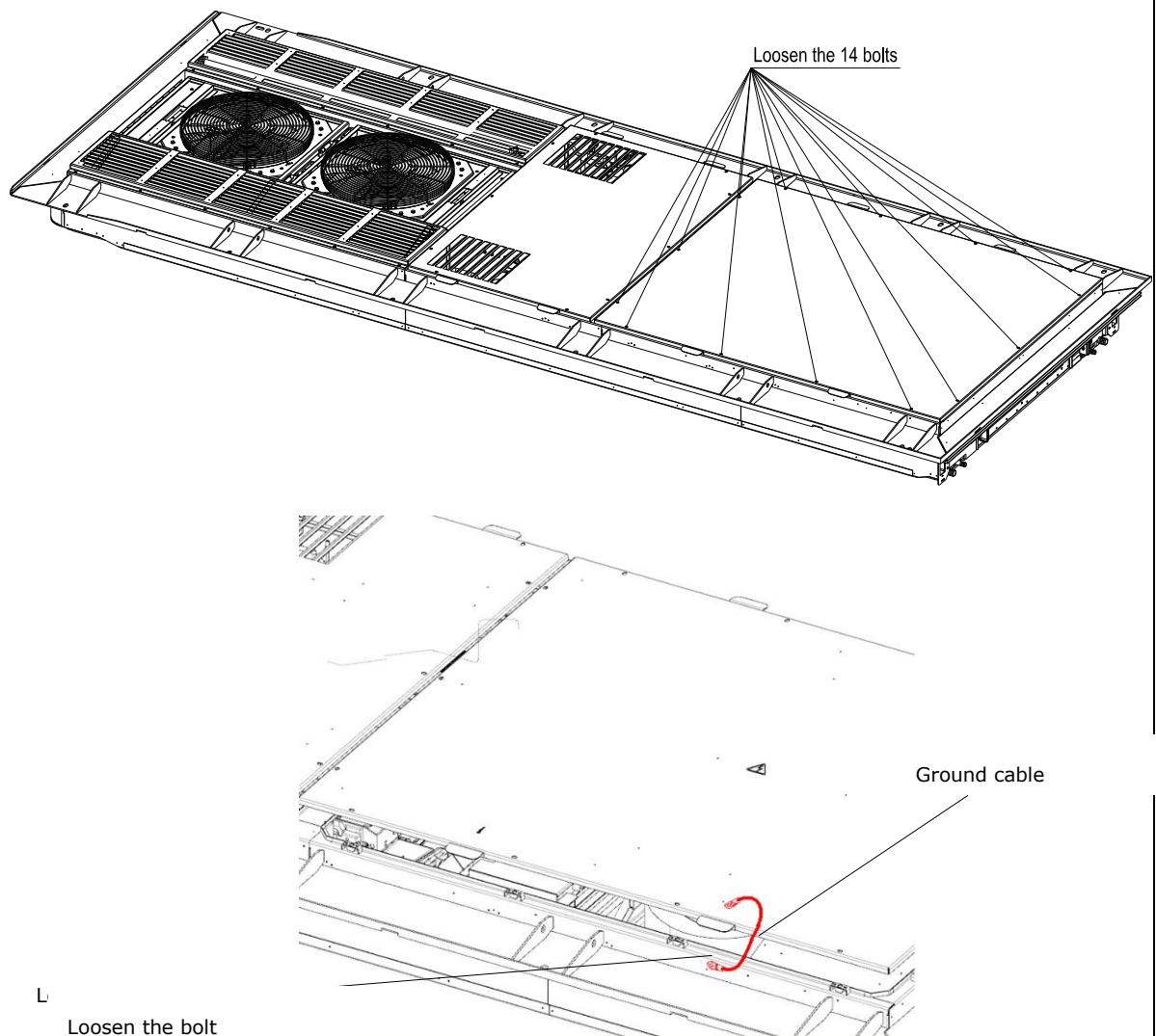
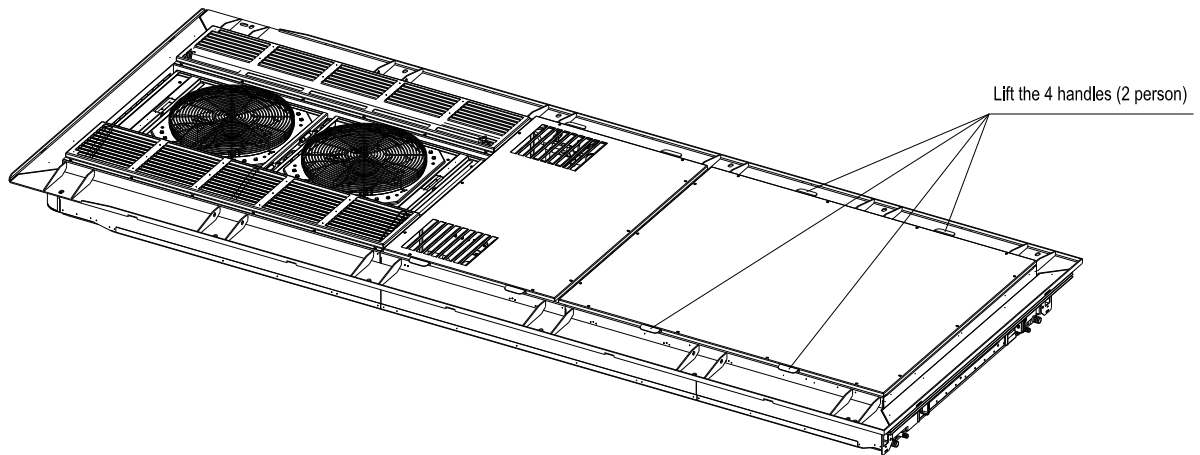


Figure 5.2 Loosen the bolts of the air handling chamber cover

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2. Lift the air handling chamber cover (2 persons) by lifting the handles and remove it, see following figure.



*Figure 5.3 Remove the air handling chamber cover*


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HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.2 Open the mixed air chamber cover of saloon HVAC unit

<b>Title: Mixed air chamber cover – open</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> It is a procedure for other tasks.		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle/on the ground.		
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Saloon HVAC Unit. <b>Item No.:</b> 97.1733.0001		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97A100.000-00A.M2		
<b>SAFETY PRECAUTIONS:</b>  <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

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HVAC System

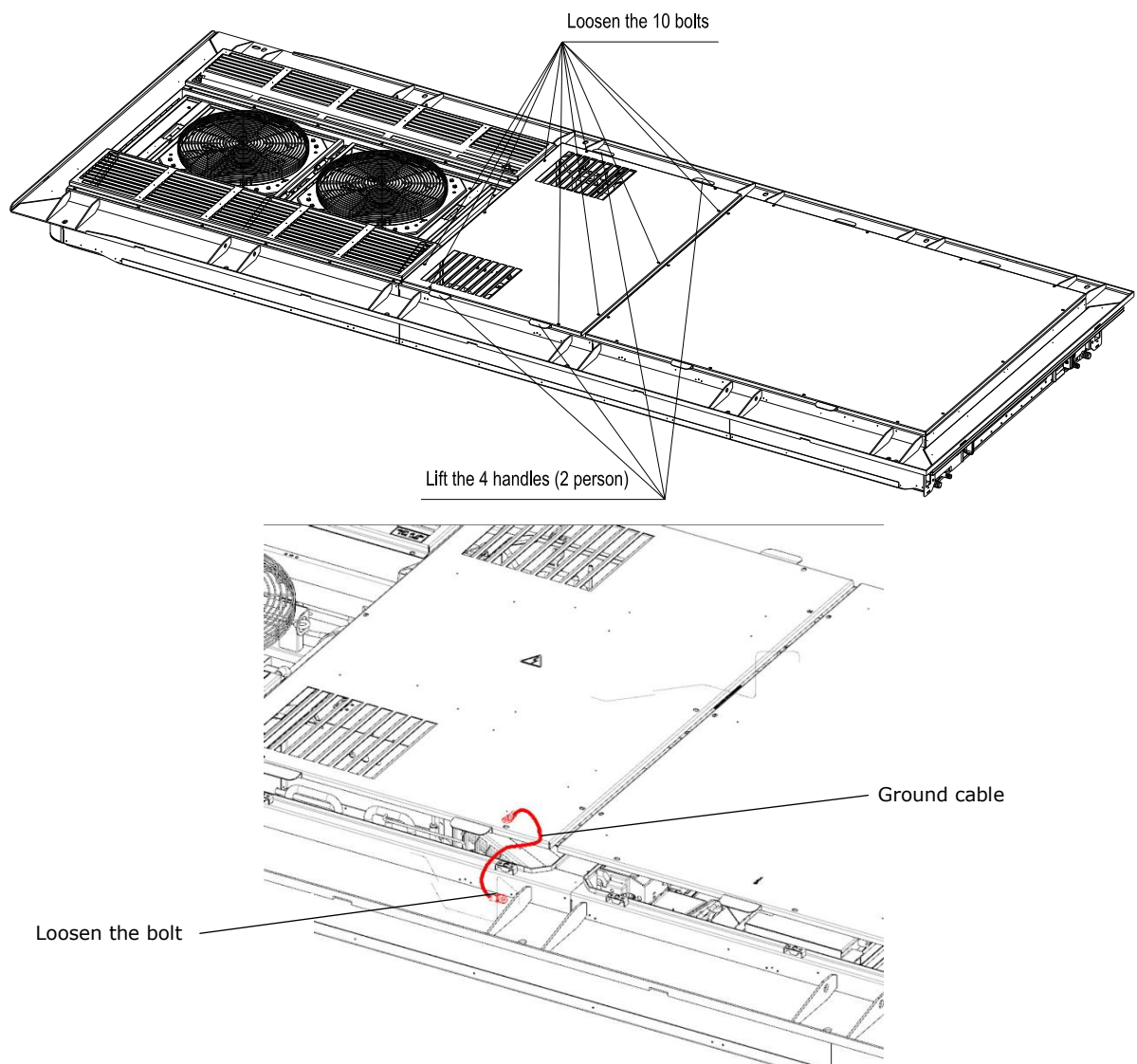
5 Maintenance and Overhaul Procedures

**Down Time:** 0.08 hour

**Team Size:** 2 person

**Procedure:**

1. Loosen the 10 bolts which fix the mixed air chamber cover to the HVAC unit frame, then loosen the bolt of ground cable to the HVAC unit frame. See the following figure.



*Figure 5.4 Open the mixed air chamber cover*

2. Lift the mixed air chamber cover (2 persons) by lifting the handles and remove it.


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## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.3 Open the condenser fan bracket of saloon HVAC unit

<b>Title:</b> Condenser fan bracket – open	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> It is a procedure for other tasks.		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle/on the ground.		
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Saloon HVAC Unit. <b>Item No.:</b> 97.1733.0001		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97A100.000-00A.M2		
<b>SAFETY PRECAUTIONS:</b>   <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES. WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

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HVAC System

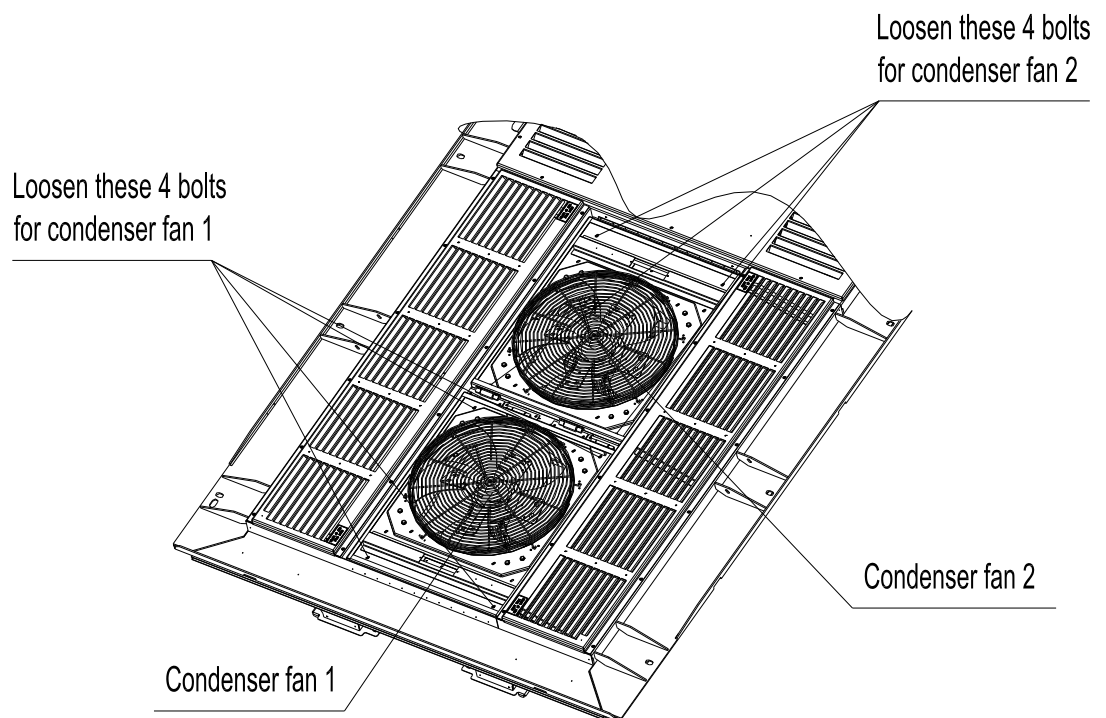
5 Maintenance and Overhaul Procedures

**Down Time:** 0.08 hour

**Team Size:** 2 person

**Procedure:**

1. Loosen the 4 bolts which fix the condenser fan bracket to the HVAC unit frame, see the following figure.



*Figure 5.5 Open the condenser fan bracket*

2. Open the condenser fan bracket by turn it around the axis of the Hinge.
3. Use the Supporting bar to support the condenser fan.


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## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.4 Open the maintenance cover of cab HVAC unit

<b>Title: Maintenance cover – open</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> It is a procedure for other tasks.		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle/on the ground.		
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Cab HVAC Unit. <b>Item No.:</b> 97.1733.0006		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97C000.000-97A.M2		
<b>SAFETY PRECAUTIONS:</b>   <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b>  <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

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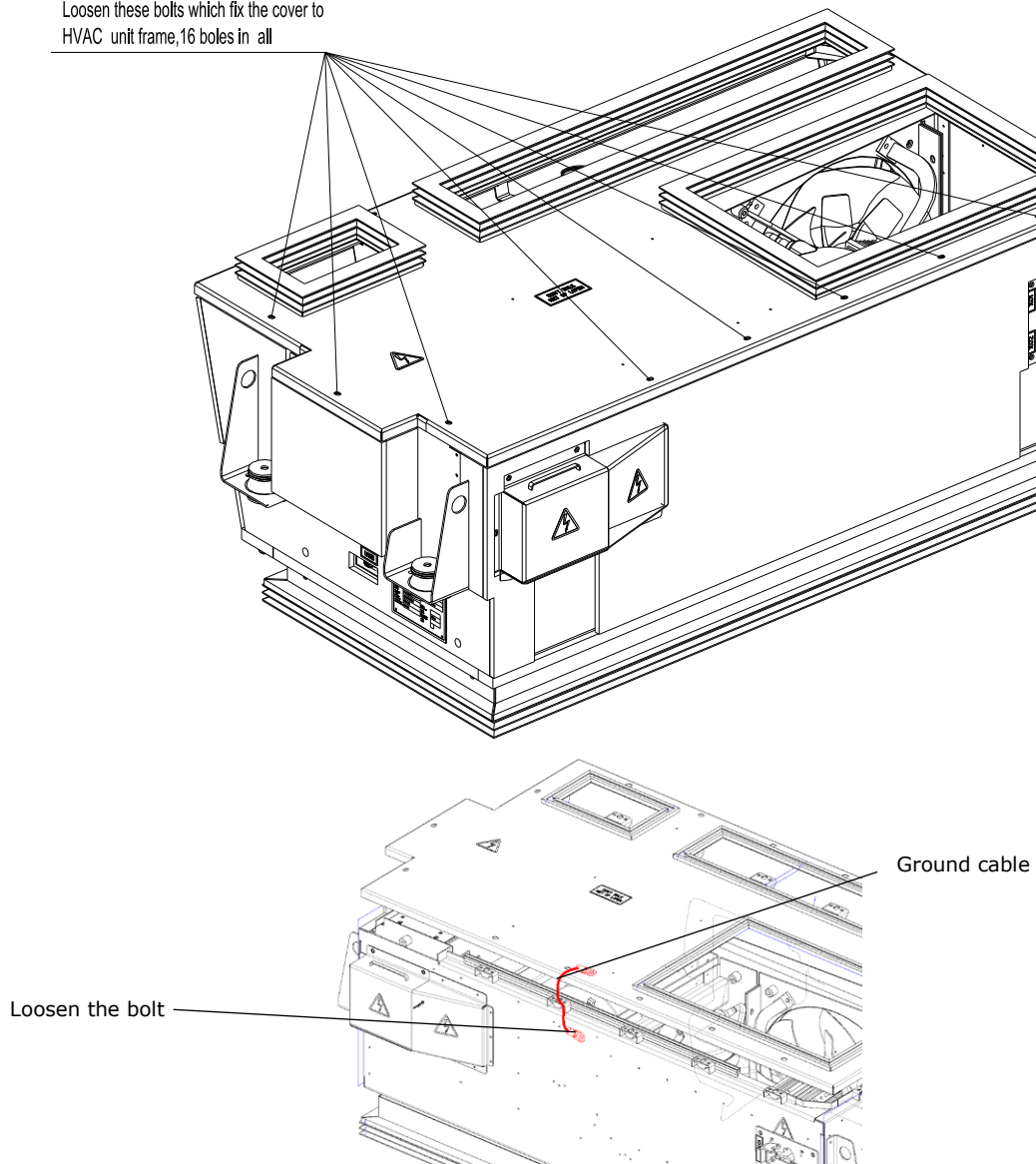
**Down Time:** 0.08 hour

**Team Size:** 2 person

**Procedure:**

1. Loosen the 16 bolts which fix the maintenance cover to the HVAC unit frame, then loosen the bolt of ground cable to the HVAC unit frame. see the following figure.

Loosen these bolts which fix the cover to HVAC unit frame, 16 bolts in all



*Figure 5.6 Open the maintenance cover of cab HVAC unit*

2. Remove the maintenance cover.


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HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.5 Remove the control panel of cab HVAC unit

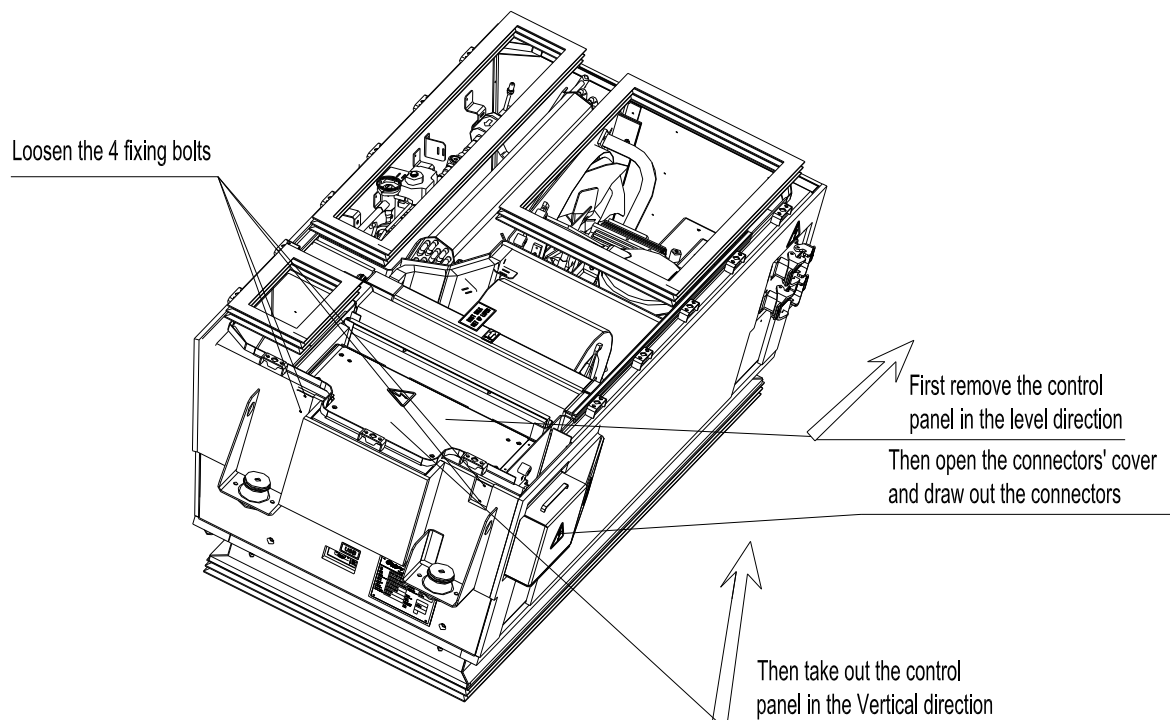
<b>Title:</b> Control panel – remove	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> It is a procedure for other tasks.		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle/on the ground.		
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Cab HVAC Unit. <b>Item No.:</b> -. KS97C100.910-00A.Z3		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> -.NA		
<b>SAFETY PRECAUTIONS:</b>  <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

**Down Time:** 0.3 hour

**Team Size:** 2 person

**Procedure:**

1. Open the maintenance cover of the HVAC unit, see 5.4.4.
2. Loosen the 4 bolts which fix the control panel to the HVAC unit frame, see the following figure.



*Figure 5.7 Remove the control panel of cab HVAC unit*

3. Remove the control panel in the level direction, see figure 5.7.
4. Open the connectors' cover and draw out the connectors in the side of the HVAC unit, see figure 5.7.
5. Remove the control panel from the HVAC unit.

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.6 Inspect saloon HVAC unit

<b>Title: Saloon HVAC unit – Check and clean</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> Check and clean the Saloon HVAC Unit.		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Saloon HVAC Unit. <b>Item No.:</b> 97.1733.0001.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97A100.000-00A.M2.		

**SAFETY PRECAUTIONS:**



**SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS**

**REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.**

**WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.**

**Down Time:** 0.4 hour

**Team Size:** 2 person

**Procedure:**

**5.4.6.1 Visual inspection and clean drainage holes and pan**

1. Interrupt power voltage.
2. Check the grilles of the condenser fan.
3. Open the covers of the HVAC Unit, see 5.4.1.
4. Visual inspection on damage, corrosion, loose connections
5. Visual check the attachment of parts and assemblies. Particularly consider the suspenders and screw connections (e.g. HVAC unit, compressor).

Any determined missing should be fixed.

6. Remove the heater, clean the drainage hole by tissue wrapped on pin, then clean the drainage pan.
7. Replace the heater.
8. Close the cover.
9. Recover power supply.

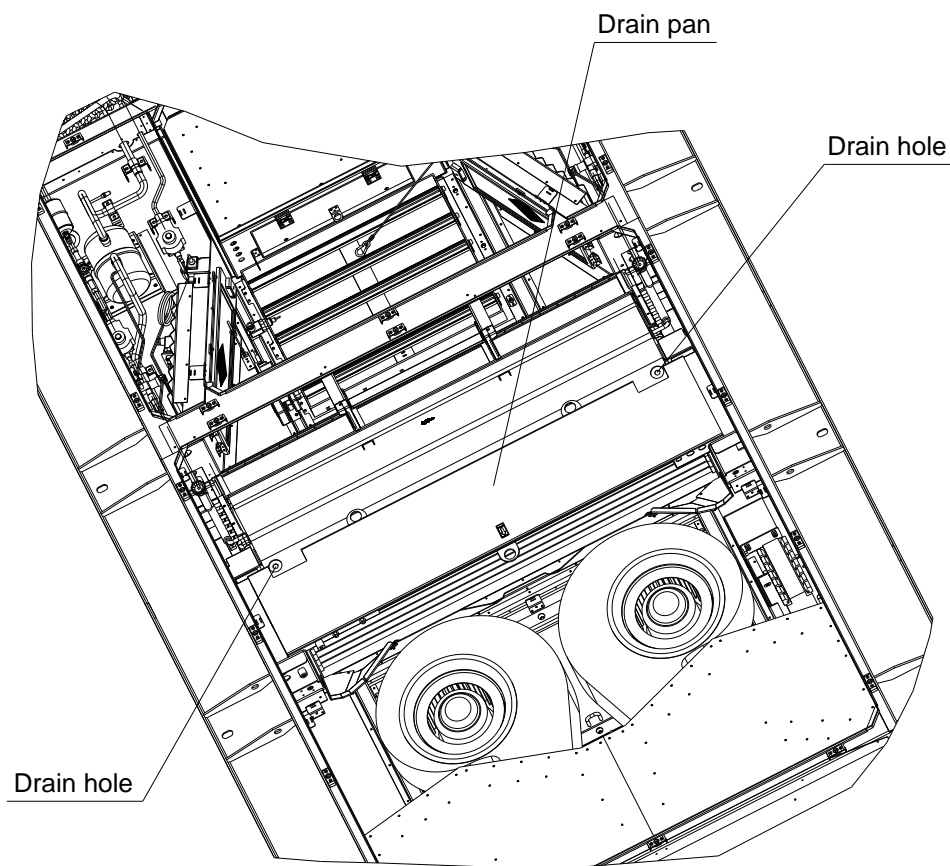


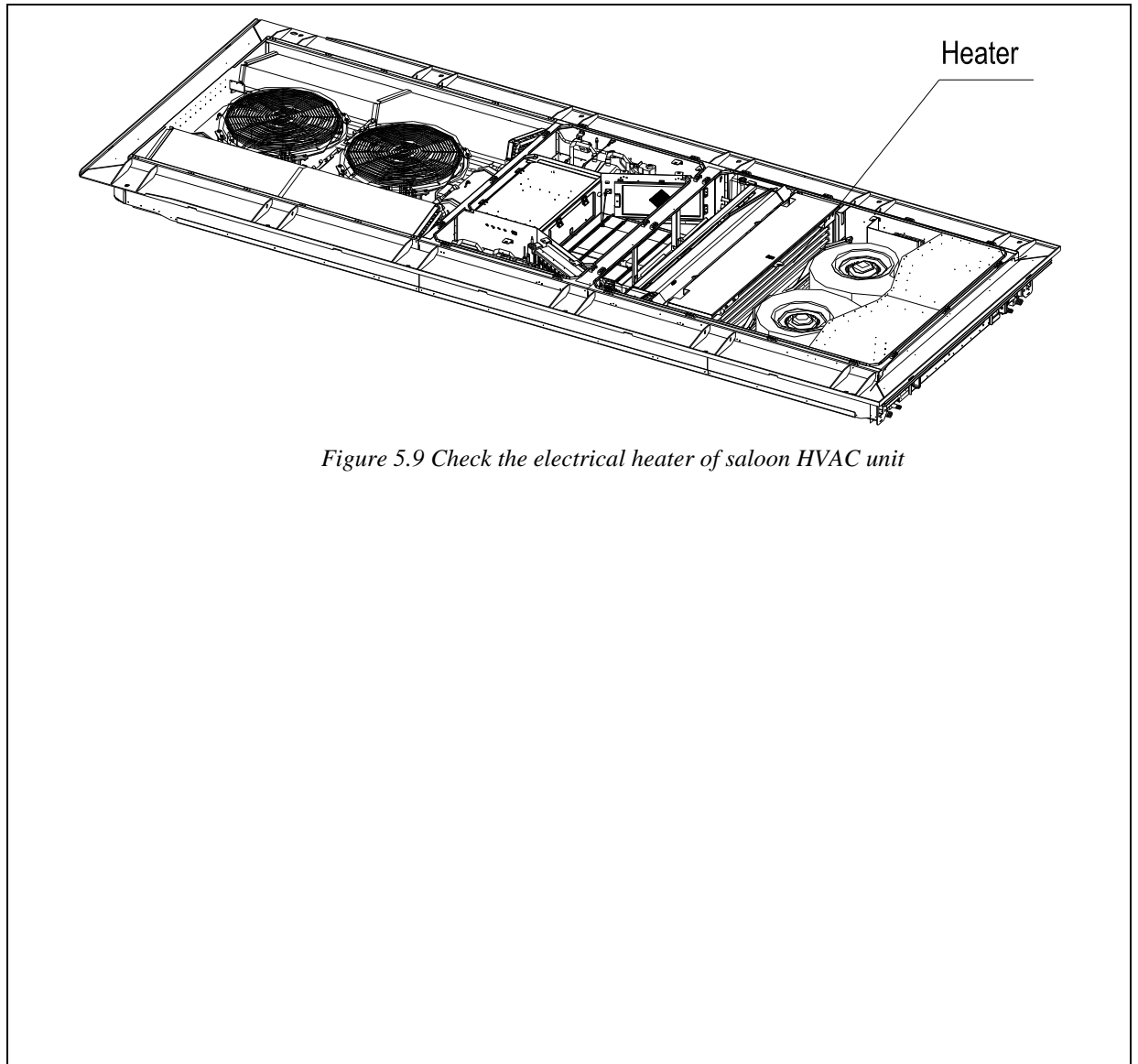
Figure 5.8 Clean drainage pan

#### 5.4.6.2 Visual check electrical heater:

1. Open the cover of the HVAC Unit, see 5.4.1.
2. Using a brush and vacuum cleaner, remove dust and debris from the heater, supply air fan and surrounding area.
3. Inspect the heater for damage and corrosion.
4. Check that the fixing M8 bolts are present and tight. Replace any missing and tighten to a torque of 135 kgf cm
5. Using a 500V insulation resistance tester, measure the resistance between ground and each heater element. A reading below 5 Megaohms indicates a suspect motor deterioration.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.9 Check the electrical heater of saloon HVAC unit*

# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

### 5 Maintenance and Overhaul Procedures

#### 5.4.6.3 Visual check sight glass

1. Open the maintenance cover of the HVAC unit, see 5.4.2 .
2. Switch on the HVAC system.
3. The sight glass can only be observed in the closed refrigerant circuit after the system has run for a while.
4. Visual check sight glass according to the following figure.
5. Single blisters are not a sign for lack of refrigerant in the circuit, while a chain of blister means so, leakage test is needed.
6. Observe the colour indicator of the sight glass.

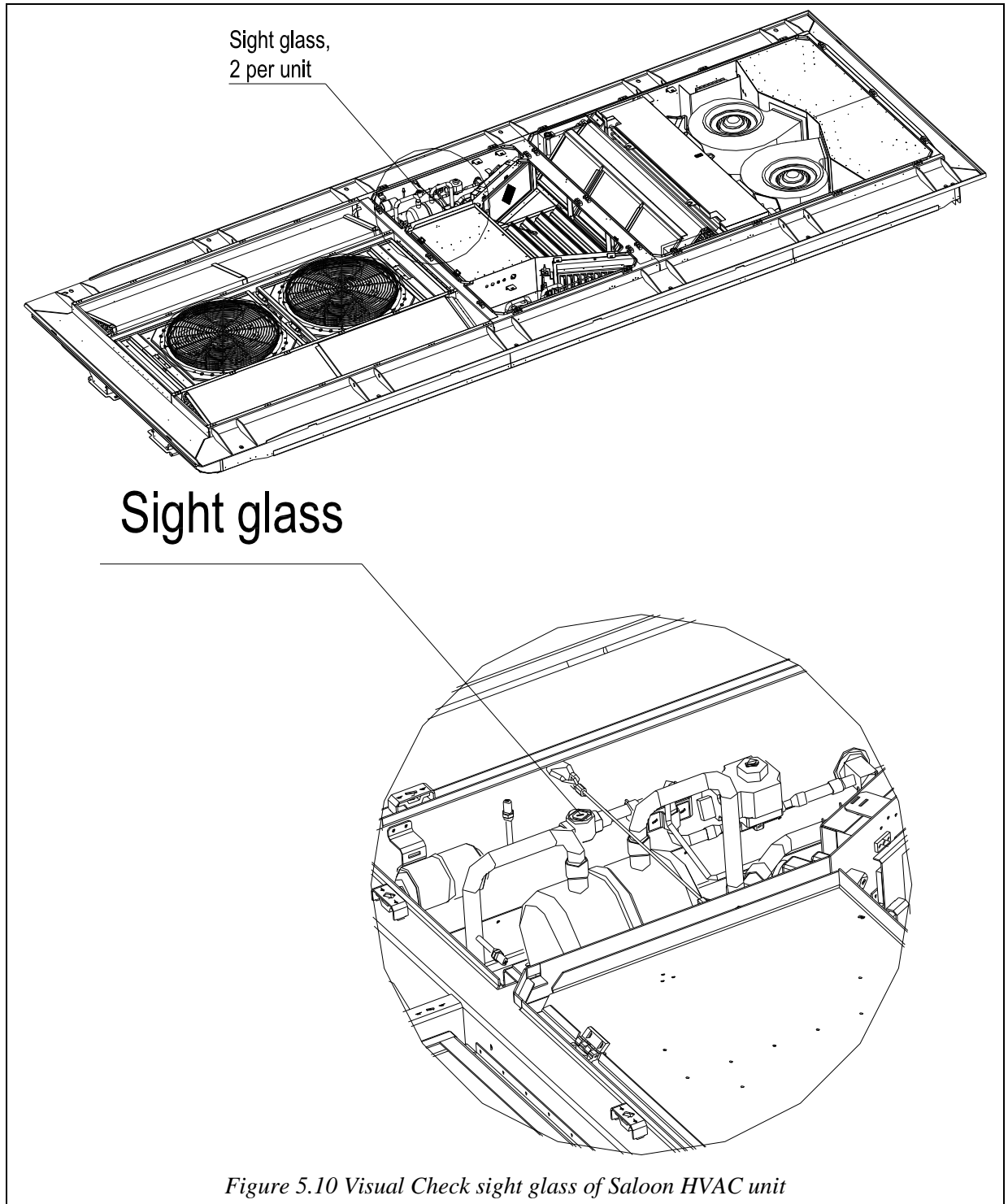


	Colour	Status
Wet	Red	Wet
Caution	Purple	Caution Wet
Dry	Violet	Caution Dry
	Blue	Dry

7. The indicator colourings show a humidity condition between “drying (dry)” and “damp (wet)”. A too high water content can be the sign of unsatisfactory dehumidifying in the refrigerant circuit. If the indicator in the sight glass shows red, the refrigerant must be changed. The filter dryer is to be changed if the indicator indicates the color to “Red” or “Purple”.
8. Turn off the HVAC system. Close the maintenance cover.

# AMSTERDAM (Alstom)

## Rolling Stock



#### SAFETY PRECAUTIONS:



#### WARNING

Live parts!

Maintenance work may be performed by authorized qualified personnel only!



**DANGER** – Risk of injury by rotating fan impeller

#### 5.4.6.4 Visual check condenser fan motor

1. Open the related condenser fan bracket, see 5.4.3.
2. Open the cover of terminal box on the condenser fan motor
3. Check whether all the wires are tight in the terminal box, If not, retighten.
4. Open the maintenance cover of air handling chamber, see 5.4.2.
5. Connect the laptop to the controller FPC24
6. Run the condenser fan via Mona software
7. Check whether the rotating direction is the same as indicated on the label. If not the same, interchange any two of three wires of the condenser fan.
8. Check screw and bolt connections, retighten with tightening torque  $16\pm 1$  Nm.

#### 5.4.6.5 Visual check supply air fan motor

1. Open the maintenance cover of air handling chamber, see 5.4.1.
2. Check the connector of supply air fan.
3. Open the maintenance cover of air handling chamber, see 5.4.2.
4. Connect the laptop to the controller FPC24.
5. Run the supply air fans via Mona software.
6. Check whether the rotation direction is the same as indicated on the housing of supply air fans.
7. If the rotation direction is not right, interchange any two of three wires of the supply air fans.
8. Check screw and bolt connections.

# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

### 5 Maintenance and Overhaul Procedures

#### 5.4.6.6 Check temperature sensor

1. Open the related maintenance cover, see 5.4.1, 5.4.2, find the location of the temperature sensors, please refer to chapter 5.5.50 to 5.5.52.
2. Check the wire connection between temperature sensor and controller.
3. Uninstall the temperature sensor, refer to 5.5.50 to 5.5.52.
4. Measure the resistance between temperature sensor terminals by using multimeter, measure the air temperature by using infrared thermometer, hold the thermometer, aim at the heater and push the switch and then read the reading.
5. Compare the values with the following table.
6. If the resistance is not in the range, replace the temperature sensor.

°C	0	1	2	3	4	5	6	7	8	9	10
-30	88 500	43 200	99 300	105 200	113 400	120 300	128 000	136 400	146 400	156 800	167 000
-20	48 535	51 450	54 550	57 850	61 400	65 200	69 520	73 600	78 200	83 150	88 500
-10	27 665	29 215	30 865	32 620	34 490	36 475	38 590	40 845	43 245	45 805	48 535
-0	16 325	17 185	18 095	19 055	20 080	21 165	22 310	23 530	24 825	26 200	27 665
0	16 325	15 515	14 750	14 025	13 345	12 695	12 085	11 505	10 960	10 440	9 950
10	9 950	9 485	9 045	8 625	8 230	7 855	7 500	7 160	6 840	6 535	6 245
20	6 245	5 970	5 710	5 460	5 225	5 000	4 786,5	4 583,5	4 388,5	4 203,5	4 028,5
30	4 028,5	3 861,5	3 701,5	3 548,5	3 403,5	3 265,0	3 133,5	3 008,5	2 888,5	2 773,5	2 663,3
40	2 663,3	2 558,5	2 458,5	2 363,5	2 271,5	2 185,0	2 100,5	2 020,0	1 945,0	1 871,5	1 801,5
50	1 801,5	1 733,5	1 670,0	1 608,0	1 549,5	1 493,0	1 439,0	1 387,0	1 337,5	1 289,5	1 244,0
60	1 244,0	1 200,0	1 158,0	1 117,5	1 078,5	1 041,5	1 005,5	971,0	938,0	906,5	876,0
70	876,0	846,5	818,0	791,0	765,0	739,5	715,5	692,0	670,0	648,5	627,5
80	627,50	607,50	588,50	570,00	552,00	535,00	518,00	502,00	486,85	472,00	457,65
90	457,65	443,85	430,50	417,65	405,15	393,35	381,65	370,50	359,65	349,35	339,15
100	339,15	329,50	320,15	311,00	302,15	293,65	285,50	277,50	269,85	262,50	255,15
110	255,15	248,35	241,50	235,00	228,65	222,50	216,65	210,85	205,35	200,00	194,65
120	194,65	189,65	184,85	180,00	175,30	170,85	166,55	162,35	158,25	154,30	150,47
Between 0 and 70 °C, the accurate is lower than 0,2°K											

#### 5.4.6.7 Visual check contactors

1. Open the mixed air cover of HVAC unit, see 5.4.2, find the location of the control panel.
2. Use a screw driver to loosen the fast locks on the top cover of control panel and remove them.
3. Turn up the top cover and fix it by the clamp inside the control panel.
4. Inspect all contactors for visible damage, corrosion, loose connections. Remove all defects found.
5. Release the clamp, turn down the top cover of control panel, tighten the bolts.
6. Close the mixed air cover of HVAC unit.

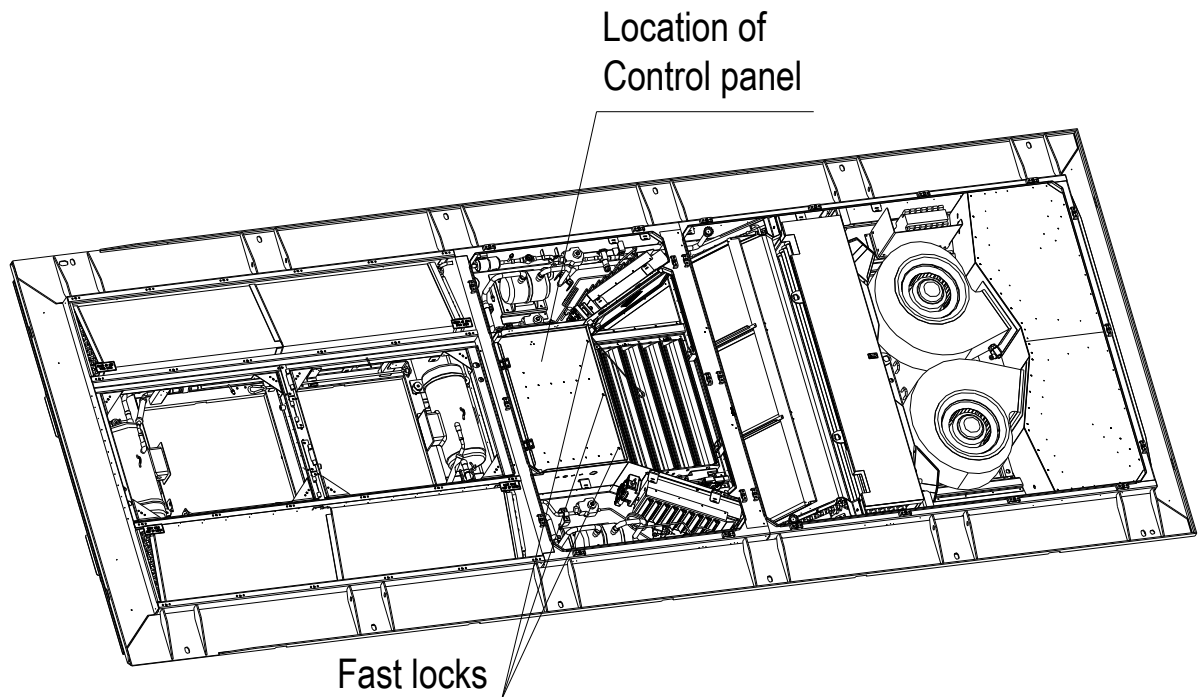
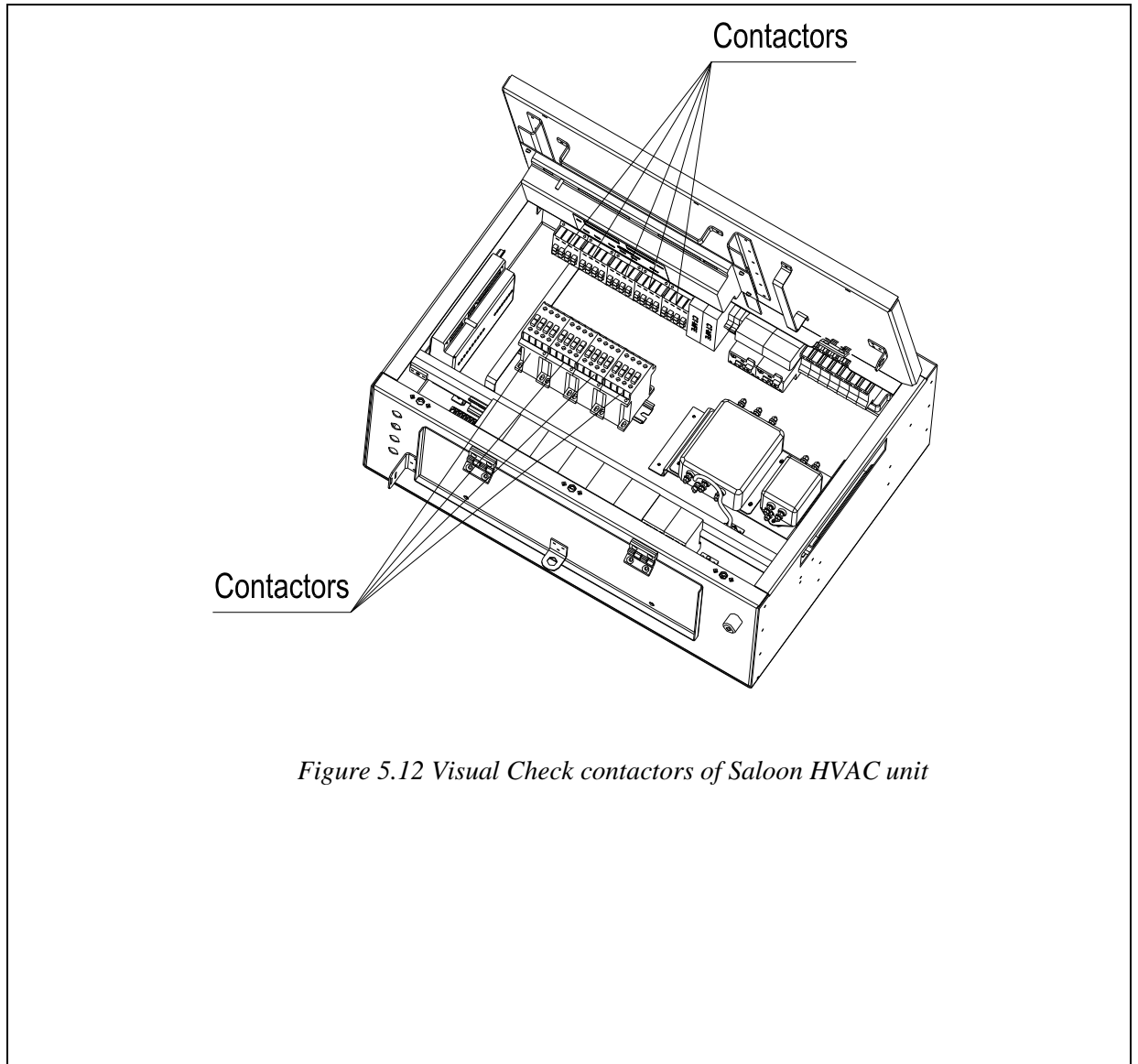


Figure 5.11 Location of control panel

# AMSTERDAM (Alstom)

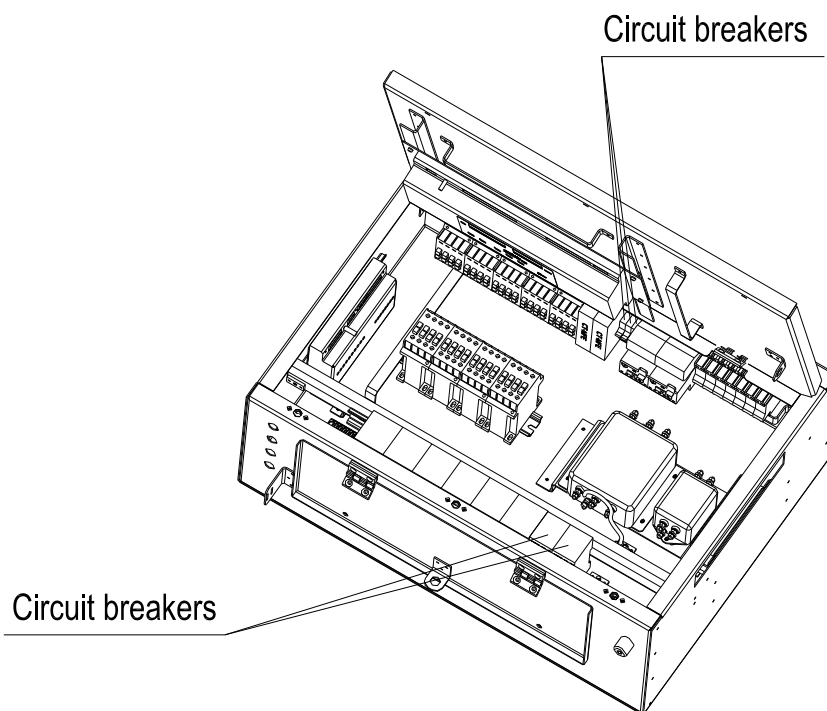
## Rolling Stock



*Figure 5.12 Visual Check contactors of Saloon HVAC unit*

#### 5.4.6.8 Visual check circuit breakers

1. Open the mixed air cover of HVAC unit, see 5.4.2, find the location of the control panel.
2. Loosen the bolt on the top cover of control panel.
3. Turn up the top cover and fix it by the clamp inside the control panel.
4. Inspect all circuit breakers for visible damage, corrosion, loose connections. Remove all defects found.
5. Release the clamp, turn down the top cover of control panel, tighten the bolts.
6. Close the mixed air cover of HVAC unit.



*Figure 5.13 Visual Check circuit breakers of saloon HVAC unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.7 Inspect cab HVAC unit

<b>Title: Cab HVAC unit – Check and clean</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> Check and clean the cab HVAC Unit.		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Cab HVAC Unit. <b>Item No.:</b> 97.1733.0006.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97C100.000-00A.Z2.		

**SAFETY PRECAUTIONS:**



**SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS**

**REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.**

**WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.**

**Down Time:** 0.2 hour

**Team Size:** 2 person

**Procedure:**

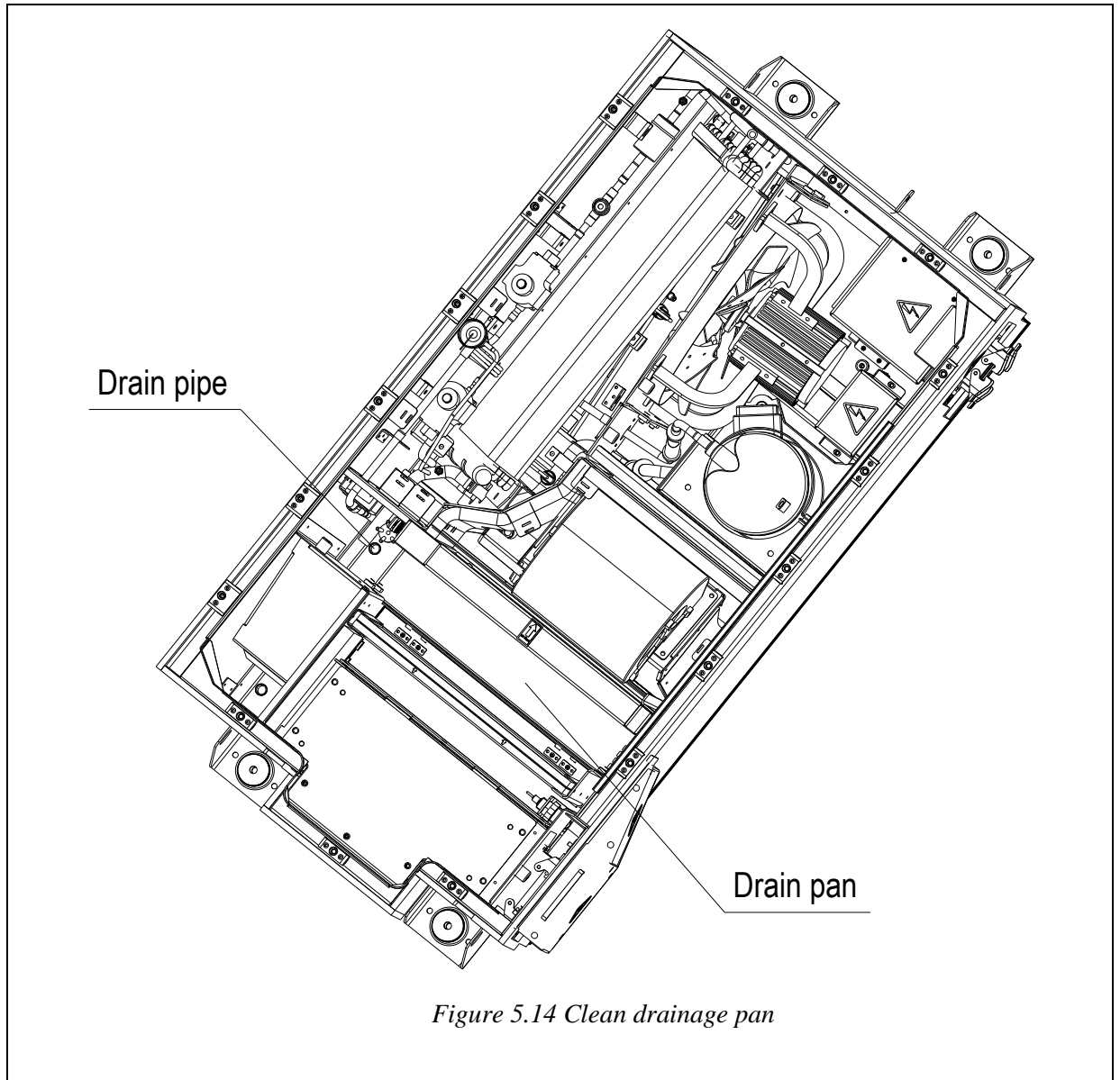
**5.4.7.1 Visual check and clean drainage holes and pan.**

The Cab HVAC Unit is positioned over the cab.

1. Interrupt power voltage.
2. Check the grilles of the condenser fan.
3. Open the cover of the HVAC Unit, see 5.4.4.
4. Visual inspection on damage, corrosion, loose connections
5. Visual check the attachment of parts and assemblies. Particularly consider the suspenders and screw connections (e.g. HVAC unit, compressor).  
Any determined missing should be fixed.
6. Remove the heater, clean the drainage pipe by tissue wrapped on pin, then clean the drainage pan.
7. Replace the heater.
8. Close the cover.
9. Recover power supply.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.14 Clean drainage pan*

## AMSTERDAM (Alstom)

### Rolling Stock

#### 5.4.7.2 Visual check electrical heater

1. Open the cover of the HVAC Unit, see 5.4.4.
2. Use a brush and vacuum cleaner, remove dust and debris from the heater, supply air fan and surrounding area.
3. Inspect the heater for damage and corrosion.
4. Check that the fixing M8 bolts are present and tight. Replace any missing and tighten to a torque of 135 kgf cm
5. Using a 500V insulation resistance tester, measure the resistance between ground and each heater element. A reading below 5 Megaohms indicates a suspect motor deterioration.

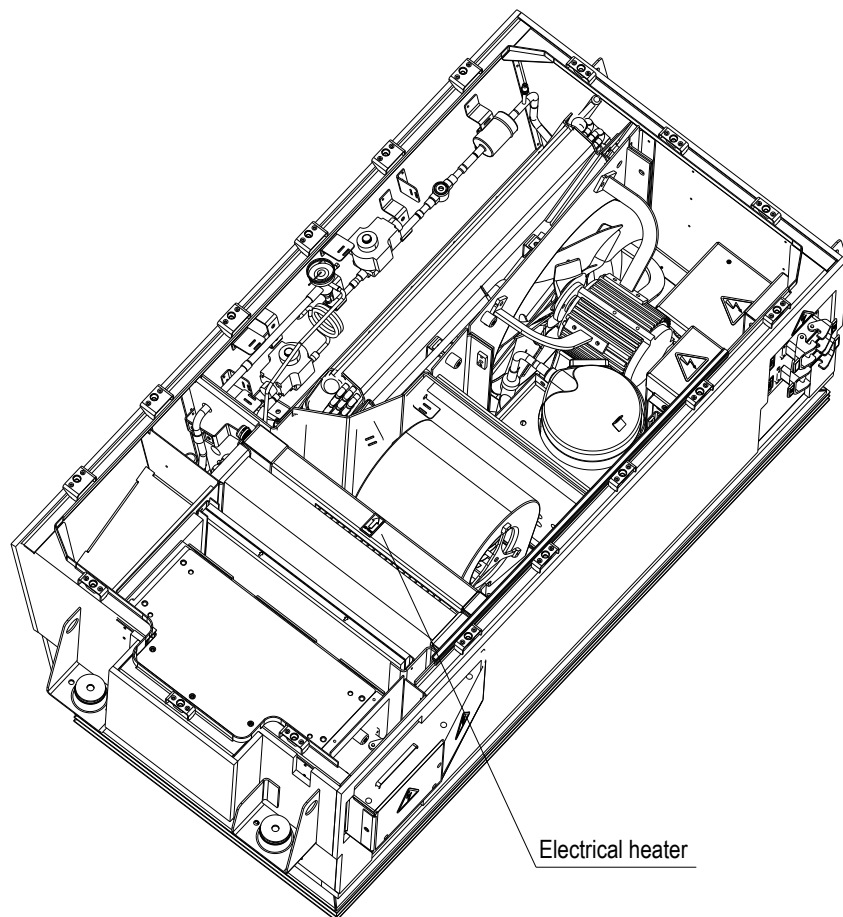


Figure 5.15 Check the electrical heater of cab HVAC unit

# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

### 5 Maintenance and Overhaul Procedures

#### 5.4.7.3 Visual check sight glass

1. Open the maintenance cover of the HVAC unit, see 5.4.4.
2. Switch on the HVAC system.
3. The sight glass can only be observed in the closed refrigerant circuit after the system has run for a while.
4. Visual check sight glass according to the following figure.
5. Single blisters are not a sign for lack of refrigerant in the circuit, while a chain of blister means so, leakage test is needed.
6. Observe the colour indicator of the sight glass.



	Colour	Status
Wet	Red	Wet
Caution	Purple	Caution Wet
Dry	Violet	Caution Dry
	Blue	Dry

7. The indicator coloring shows a humidity condition between “drying (dry)” and “damp (wet)”. A too high water content can be the sign of unsatisfactory dehumidifying in the refrigerant circuit. If the indicator in the sight glass shows red, the refrigerant must be changed. The filter dryer is to be changed if the indicator indicates the color to “Red” or “Purple”.
8. Turn off the HVAC system. Close the maintenance cover.

# AMSTERDAM (Alstom)

## Rolling Stock

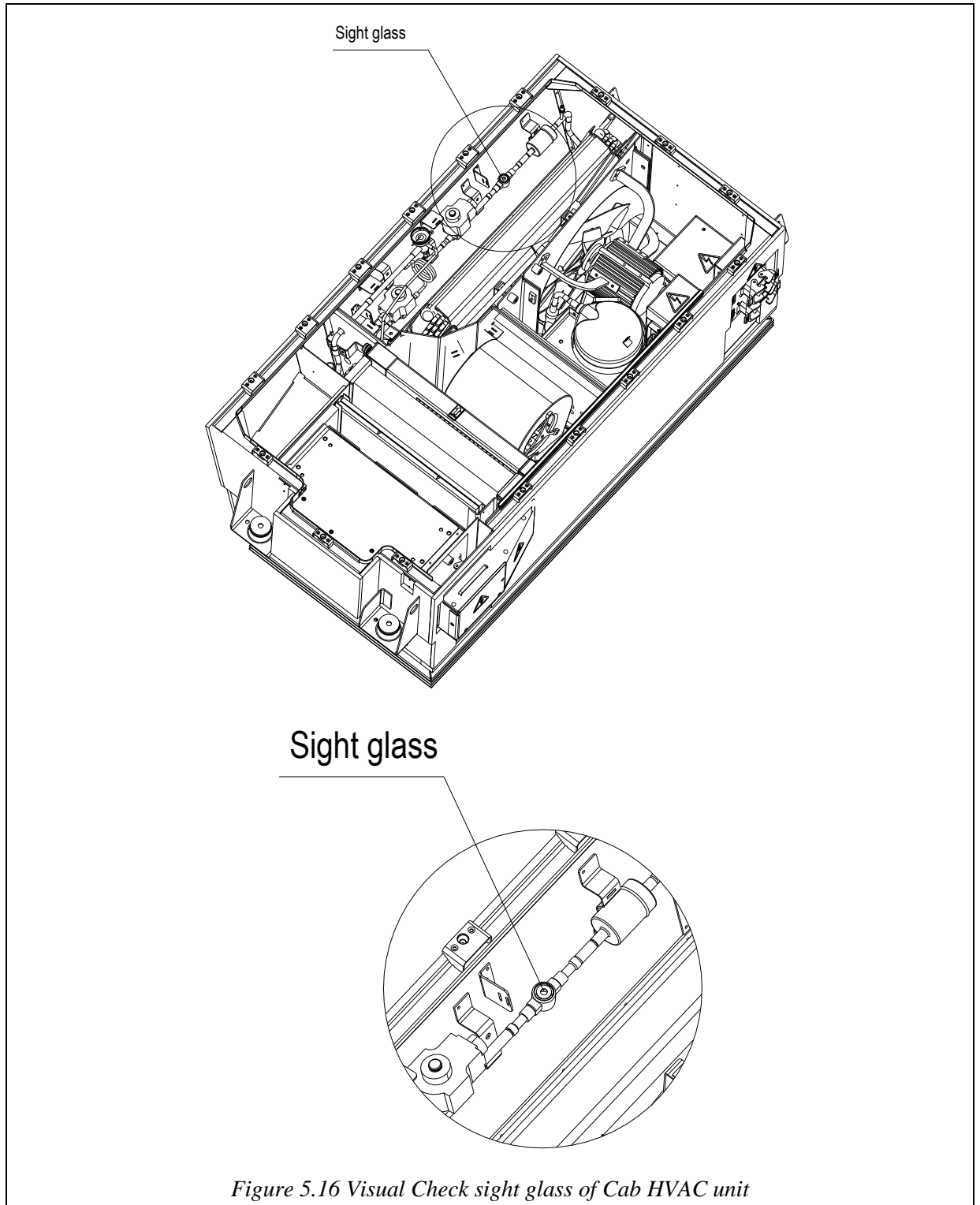


Figure 5.16 Visual Check sight glass of Cab HVAC unit

#### SAFETY PRECAUTIONS:



#### WARNING

Live parts!

Maintenance work may be performed by authorized qualified personnel only!



**DANGER** – Risk of injury by rotating fan impeller

#### 5.4.7.4 Visual check condenser fan motor

1. Open the maintenance cover of the HVAC unit, see 5.4.4.
2. Open the cover of terminal box on the condenser fan motor.
3. Check whether all the wires are tight in the terminal box, if not, retighten.
4. Open the maintenance cover of air handling chamber.
5. Connect the laptop to the controller FPC24.
6. Run the condenser fan via Mona software.
7. Check whether the rotating direction is the same as indicated on the label. If not the same, interchange any two of three wires of the condenser fan.
8. Check screw and bolt connections, retighten with tightening torque  $16\pm 1$  Nm.

#### 5.4.7.5 Visual check condenser fan motor

1. Open the maintenance cover of HVAC unit, see 5.4.4.
2. Check the connector of supply air fan.
3. Connect the laptop to the controller FPC24.
4. Run the supply air fans via Mona software.
5. Check whether the rotation direction is the same as indicated on the housing of supply air fans.
6. If the rotation direction is not right, interchange any two of three wires of the supply air fans.
7. Check screw and bolt connections.

# AMSTERDAM (Alstom)

## Rolling Stock

### 5.4.7.6 Check temperature sensor

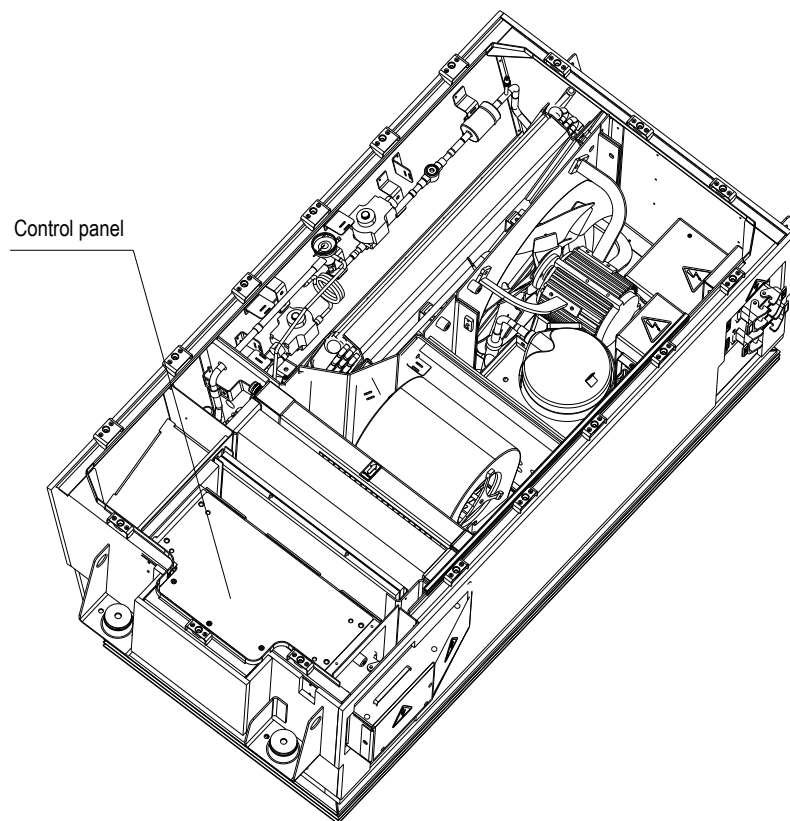
1. Open the related maintenance cover, see 5.4.4, find the location of the temperature sensors, please refer to chapter 5.5.48 to 5.5.49.
2. Check the wire connection between temperature sensor and controller.
3. Uninstall the temperature sensor, refer to 5.5.48 to 5.5.49.
4. Measure the resistance between temperature sensor terminals by using multimeter, measure the air temperature by using infrared thermometer, hold the thermometer, aim at the heater and push the switch and then read the reading.
5. Compare the values with the following table.
6. If the resistance is not in the range, replace the temperature sensor.

°C	0	1	2	3	4	5	6	7	8	9	10
-30	88 500	43 200	99 300	105 200	113 400	120 300	128 000	136 400	146 400	156 800	167 000
-20	48 535	51 450	54 550	57 850	61 400	65 200	69 520	73 600	78 200	83 150	88 500
-10	27 665	29 215	30 865	32 620	34 490	36 475	38 590	40 845	43 245	45 805	48 535
-0	16 325	17 185	18 095	19 055	20 080	21 165	22 310	23 530	24 825	26 200	27 665
0	16 325	15 515	14 750	14 025	13 345	12 695	12 085	11 505	10 960	10 440	9 950
10	9 950	9 485	9 045	8 625	8 230	7 855	7 500	7 160	6 840	6 535	6 245
20	6 245	5 970	5 710	5 460	5 225	<b>5 000</b>	4 786,5	4 583,5	4 388,5	4 203,5	4 028,5
30	4 028,5	3 861,5	3 701,5	3 548,5	3 403,5	3 265,0	3 133,5	3 008,5	2 888,5	2 773,5	2 663,3
40	2 663,3	2 558,5	2 458,5	2 363,5	2 271,5	2 185,0	2 100,5	2 020,0	1 945,0	1 871,5	1 801,5
50	1 801,5	1 733,5	1 670,0	1 608,0	1 549,5	1 493,0	1 439,0	1 387,0	1 337,5	1 289,5	1 244,0
60	1 244,0	1 200,0	1 158,0	1 117,5	1 078,5	1 041,5	1 005,5	971,0	938,0	906,5	876,0
70	876,0	846,5	818,0	791,0	765,0	739,5	715,5	692,0	670,0	648,5	627,5
80	627,50	607,50	588,50	570,00	552,00	535,00	518,00	502,00	486,85	472,00	457,65
90	457,65	443,85	430,50	417,65	405,15	393,35	381,65	370,50	359,65	349,35	339,15
100	339,15	329,50	320,15	311,00	302,15	293,65	285,50	277,50	269,85	262,50	255,15
110	255,15	248,35	241,50	235,00	228,65	222,50	216,65	210,85	205,35	200,00	194,65
120	194,65	189,65	184,85	180,00	175,30	170,85	166,55	162,35	158,25	154,30	150,47

Between 0 and 70 °C, the accurate is lower than 0,2°K

#### 5.4.7.7 Visual check contactors

1. Open the maintenance cover of HVAC unit, see 5.4.4, find the location of the control panel.
2. Take out the control panel from the HVAC unit, refer to 5.4.5.
3. Disconnect the connector on the back of the control panel.
4. Use a wrench to loosen the 9 bolts of cover 1, open the cover.
5. Inspect all contactors for visible damage, corrosion, loose connections. Remove all defects found.
6. Close the cover and tighten the bolts.
7. Locate the control panel in the right position and tighten the bolts.
8. Close the maintenance cover of the HVAC unit.

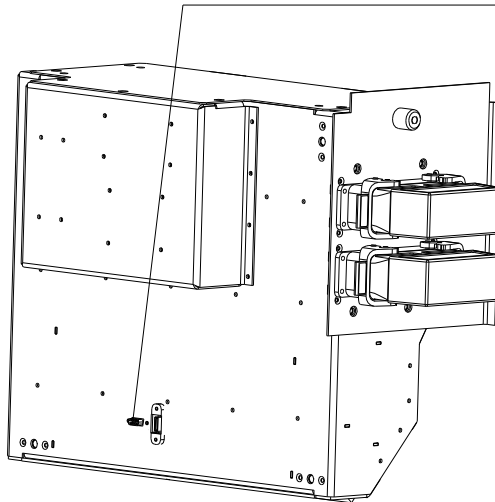


*Figure 5.17 Location of control panel*

# AMSTERDAM (Alstom)

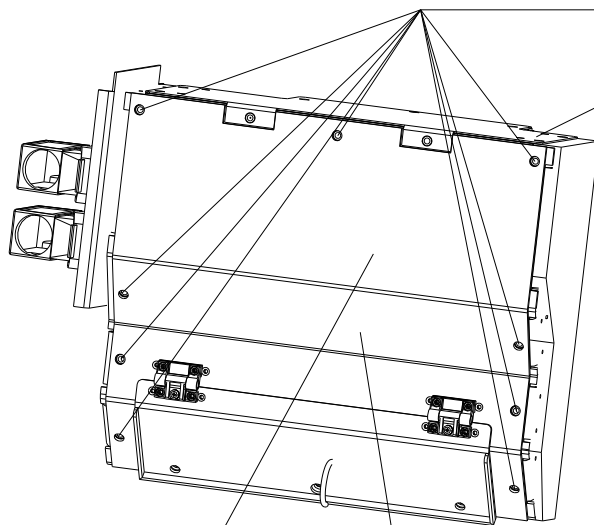
## Rolling Stock

Disconnect the connector



First loosen the 9 bolts

Cover 2

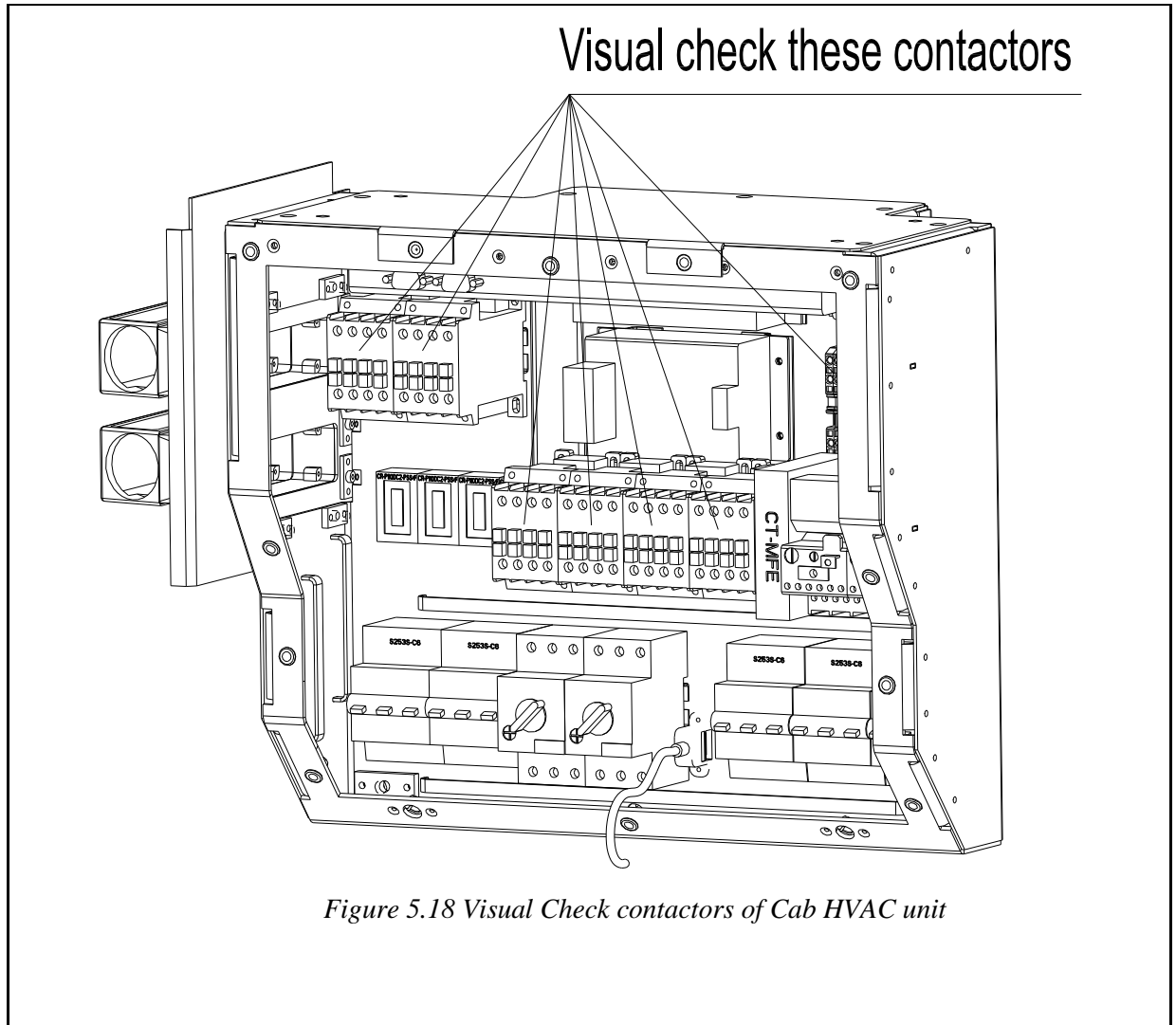


Cover 1

Then open the cover 1

# AMSTERDAM (Alstom)

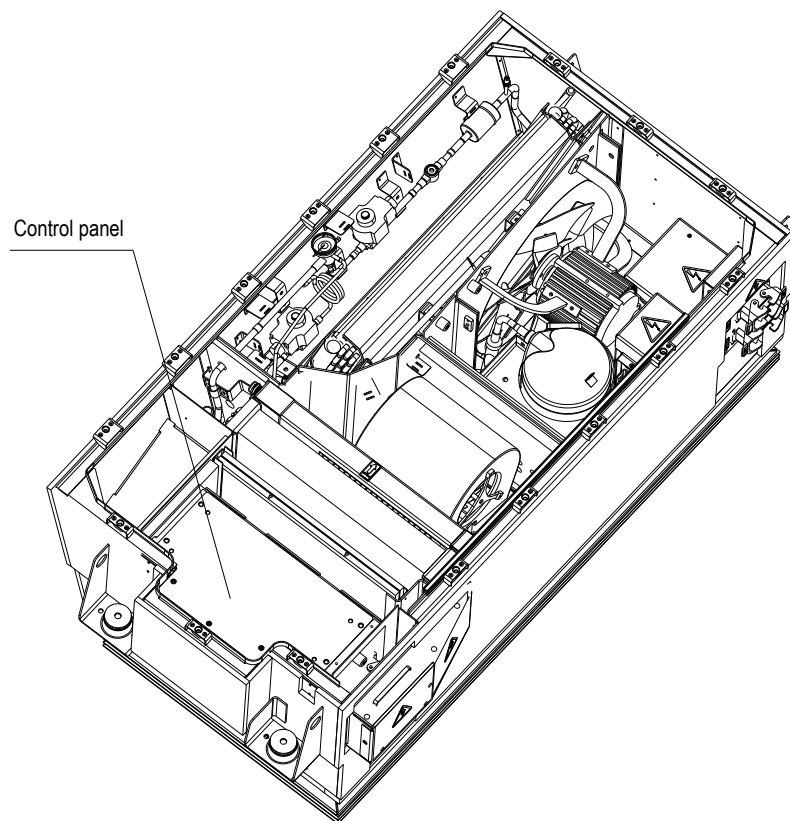
## Rolling Stock



*Figure 5.18 Visual Check contactors of Cab HVAC unit*

#### 5.4.7.8 Visual check circuit breakers

1. Open the maintenance cover of HVAC unit, see 5.4.4, find the location of the control panel.
2. Take out the control panel from the HVAC unit, refer to 5.4.5.
3. Disconnect the connector on the back of the control panel.
4. Use a wrench to loosen the 9 bolts of cover 1, open the cover.
5. Inspect all circuit breakers for visible damage, corrosion, loose connections. Remove all defects found.
6. Close the cover and tighten the bolts.
7. Locate the control panel in the right position and tighten the bolts.
8. Close the maintenance cover of the HVAC unit.



# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

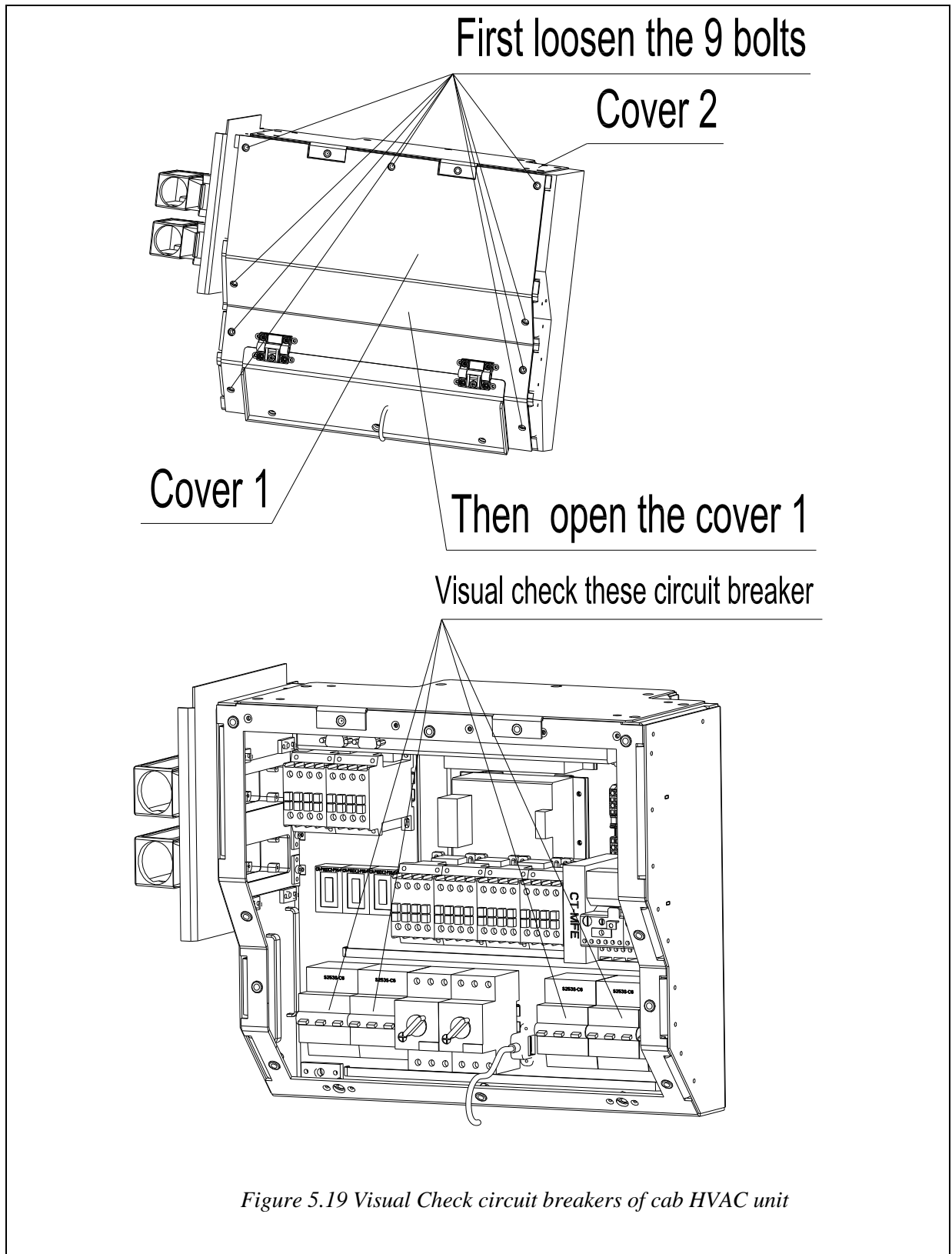


Figure 5.19 Visual Check circuit breakers of cab HVAC unit

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.8 Clean fresh air filter of saloon HVAC unit

The fresh air filter is mounted close to the fresh air damper after the fresh air intake.

<b>Title: Fresh Air Filter - Clean</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> To inspect and clean the Fresh Air Filter.		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Hp cleaner, stepladder. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Fresh Air Filter. <b>Parts number:</b> 12.1200.0156.		
<b>Illustrations:</b> Figure 1-19: Fresh air filter of chapter 7 Parts catalogue. <b>Reference Drawings:</b> KS97A100.000-09A.Z3.		
<b>SAFETY PRECAUTIONS:</b> N.A.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

**Team Size:** 1 person

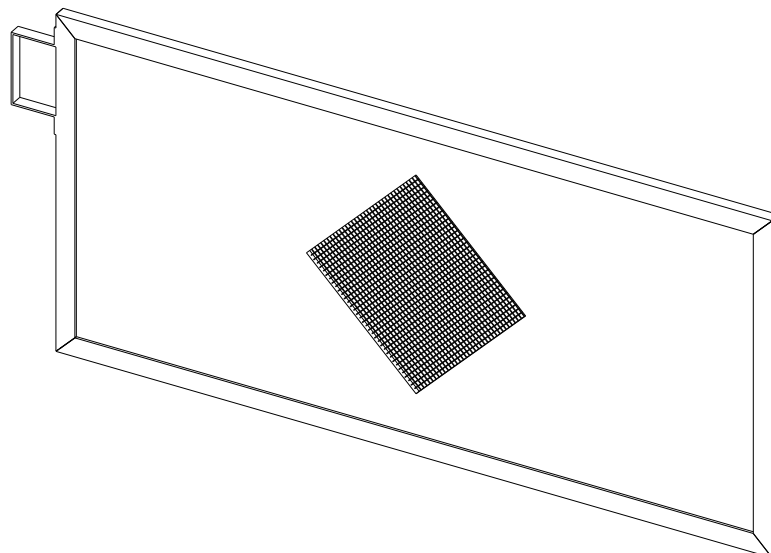
**Procedure:**

The fresh air filter is mounted close to the fresh air damper after the fresh air intake.

1. Use a stepladder for climbing small height, reach into the return air plenum.
2. Loosen the 3 fast locks which fix the return air damper to the frame and then turn it ,get to the return air chamber.
3. Remove the Fresh filter, which is positioned at the two sides of return air chamber.
  - ☞ Loosen the fixing bolt of the filter locker;
  - ☞ Take the locker away and turn the filter frame;
  - ☞ Draw the filter out of the filter frame.
4. Clean the filters with High pressure cleaner (the outlet pressure of the cleaner less than 7 bar).

Clean it with high pressure cleaner (water gun), place it steadily, use the water gun to clean both sides.

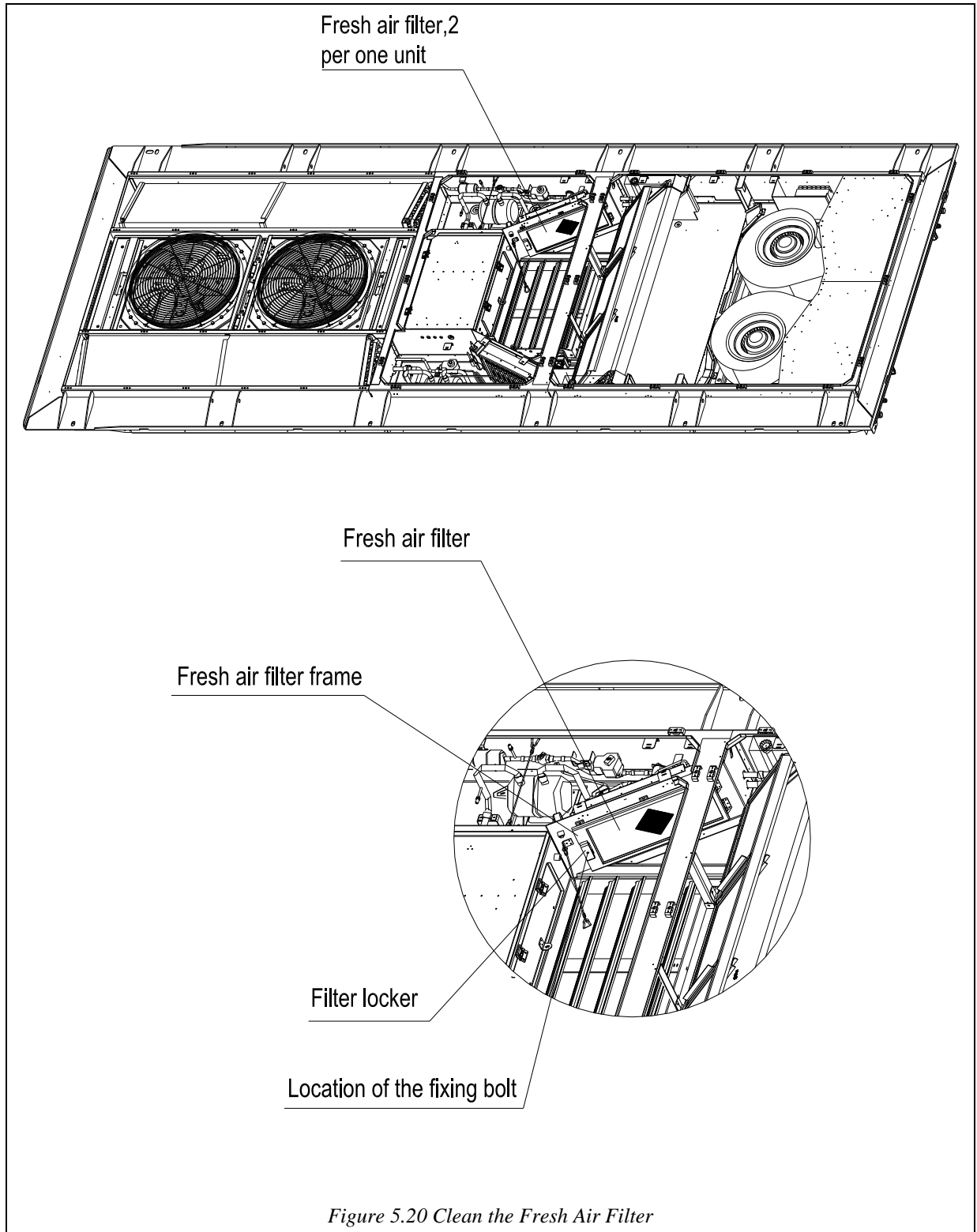
Then, dry the filter by air, don't dry it by sunlight.
5. Replace the filters by a reverse of the removal process.
6. Turn the return air damper to horizontal and then tighten the 3 fast locks to fix it to the frame.



*(not the picture of the real filter, only a model)*

# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.9 Clean mixed air filter of the saloon HVAC unit

The dust and other pollution contained in the mixed air filter will cause the pressure drop to increase over the filter, resulting in decreasing mixed air volume flow rate , and then can have drastic effects on the performance of the air conditioning system.

The maintenance intervals depend on the pollution of the ambient air and the running time of the system. In this system the return air filter shall be clean about every 30000 km. We suggest that user clean the filter according to the pollution extent of it, i.e.,the user can regulate the clean interval neatly.

<b>Title: Mixed Air Filter - Visual Inspection, Cleaning</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To inspect and clean the mixed Air filter.		
<b>System/Equipment Title:</b> Mixed air filter <b>Manufacturer :</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Hp cleaner, stepladder. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Mixed Air Filter. <b>Parts number:</b> 12.1200.0155.		

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

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**Illustrations:**

TBD.

**Reference Drawings:**

KS97A100.000-05A.Z3

**SAFETY PRECAUTIONS:**

N.A.

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

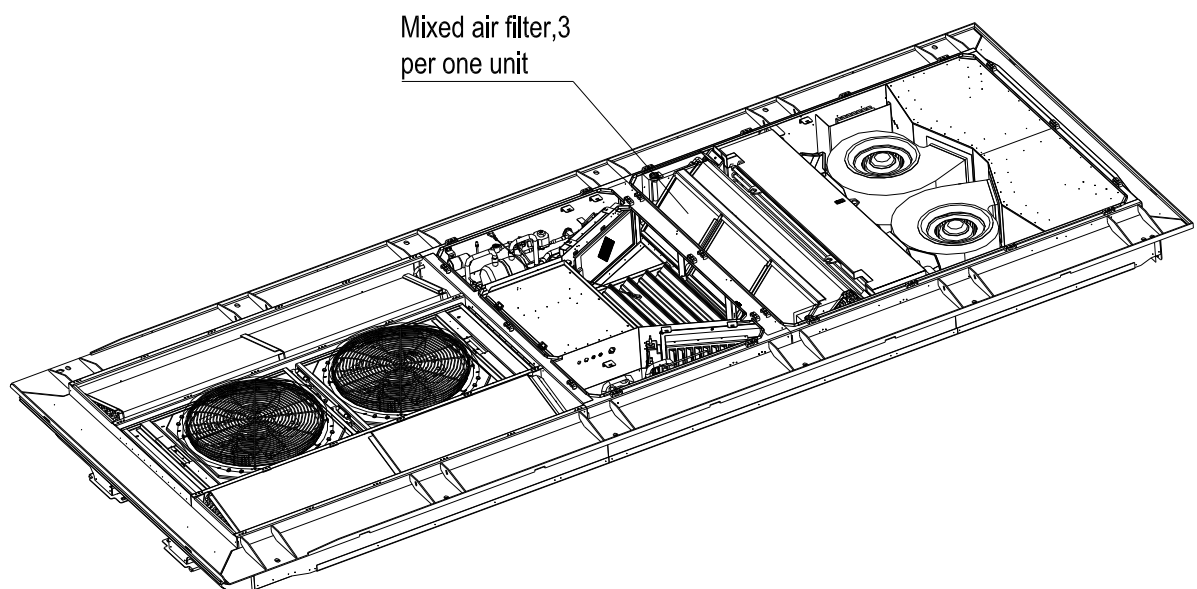
**Team Size:** 1 person

**Procedure:**

1. Use a stepladder for climbing small heights, reach the return air grille.
2. Loosen the 2 screws which fix the return air damper to the frame and then turn the return air damper to get to the return air chamber.
3. Remove the Mixed air filter.
  - ☞ Loose the butterfly lock of the fixing beam for mixed air filter;
  - ☞ Take the fixing beam away;
  - ☞ Draw the middle filter out of the filter frame.
  - ☞ Draw the two side filters out of the filter frame.
4. Clean the filters with High pressure cleaner (the outlet pressure of the cleaner less than 7 bar).

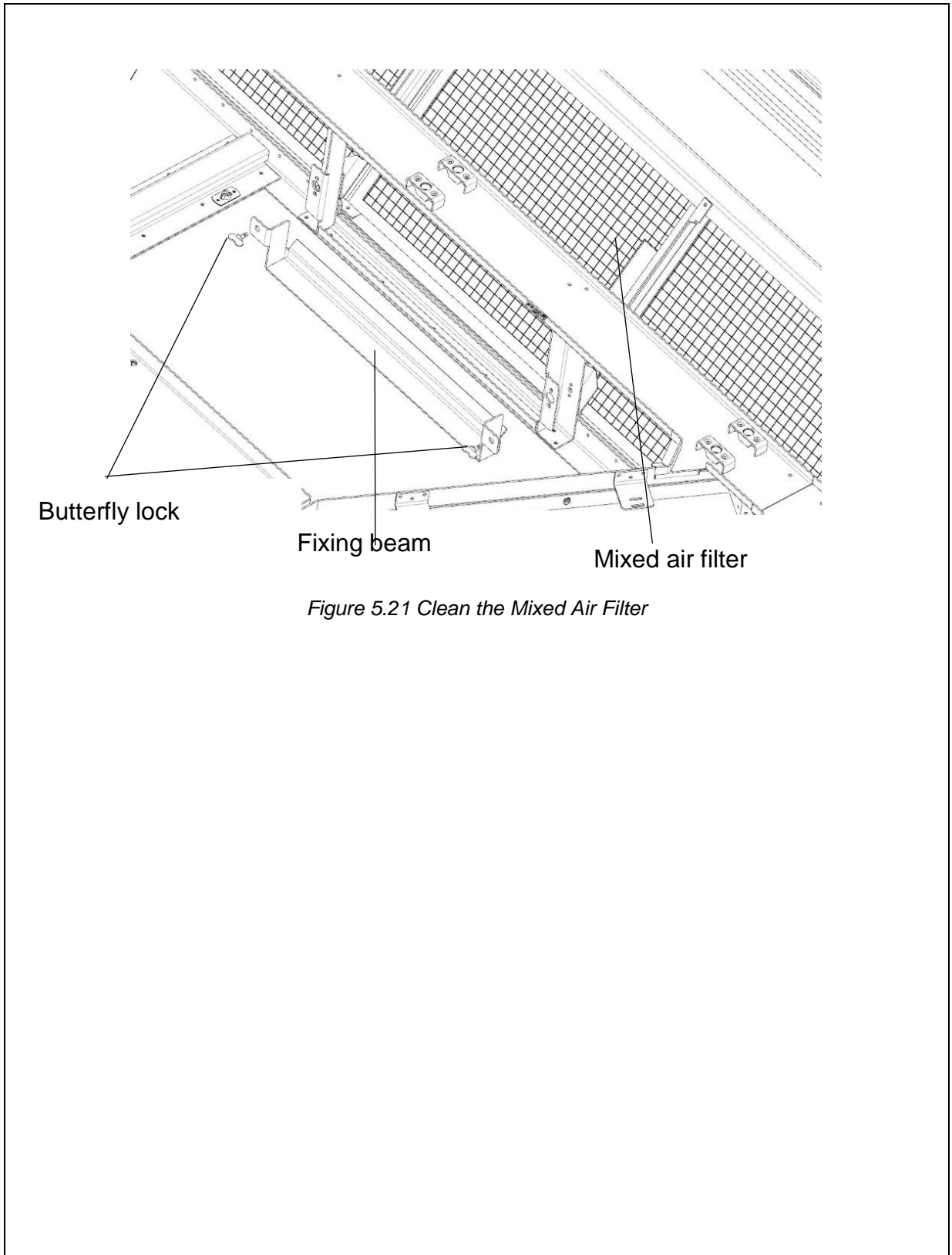
Clean it with high pressure cleaner (water gun), place it steadily, use the water gun to clean both sides.

Then, dry the filter by air, don't dry it by sunlight.
5. Replace the filters by a reverse of the removal process.
6. Turn the return air damper to horizontal and tighten the 2 screws to fix it to the frame.



# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.21 Clean the Mixed Air Filter*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.10 Clean fresh air filter of cab HVAC unit

One air grille is used in one HVAC system. It is located on front left side of HVAC unit. The fresh air filter is located downstream of the outside air grille, after the damper actuator.

<b>Title: Fresh Air Filter - Clean</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To inspect and clean the Fresh Air Filter.		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Hp cleaner, stepladder. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Fresh Air Filter. <b>Parts number:</b> 12.1200.0164.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97C100.000-06A.Z4		
<b>SAFETY PRECAUTIONS:</b> N.A.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

**Team Size:** 1 person

**Procedure:**

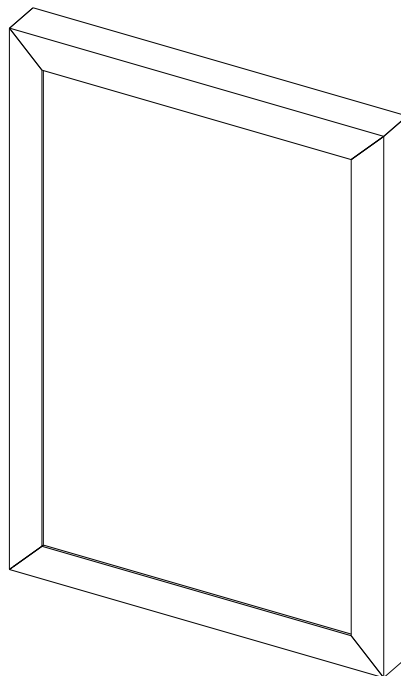
The fresh air filter is positioned besides the fresh air duct of the HVAC unit.

1. Use a stepladder for climbing small heights, reach to the service hatch.
2. Open the service hatch.
3. Unlock the fast lock of the filter support plate.
4. Turn the filter support plate around the axis of the fixing bolt, and then take out the fresh air filter.
5. Clean the filters with High pressure cleaner (the outlet pressure of the cleaner less than 7 bar).

Clean it with high pressure cleaner (water gun), place it steadily, use the water gun to clean both sides.

Then, dry the filter by air, don't dry it by sunlight.

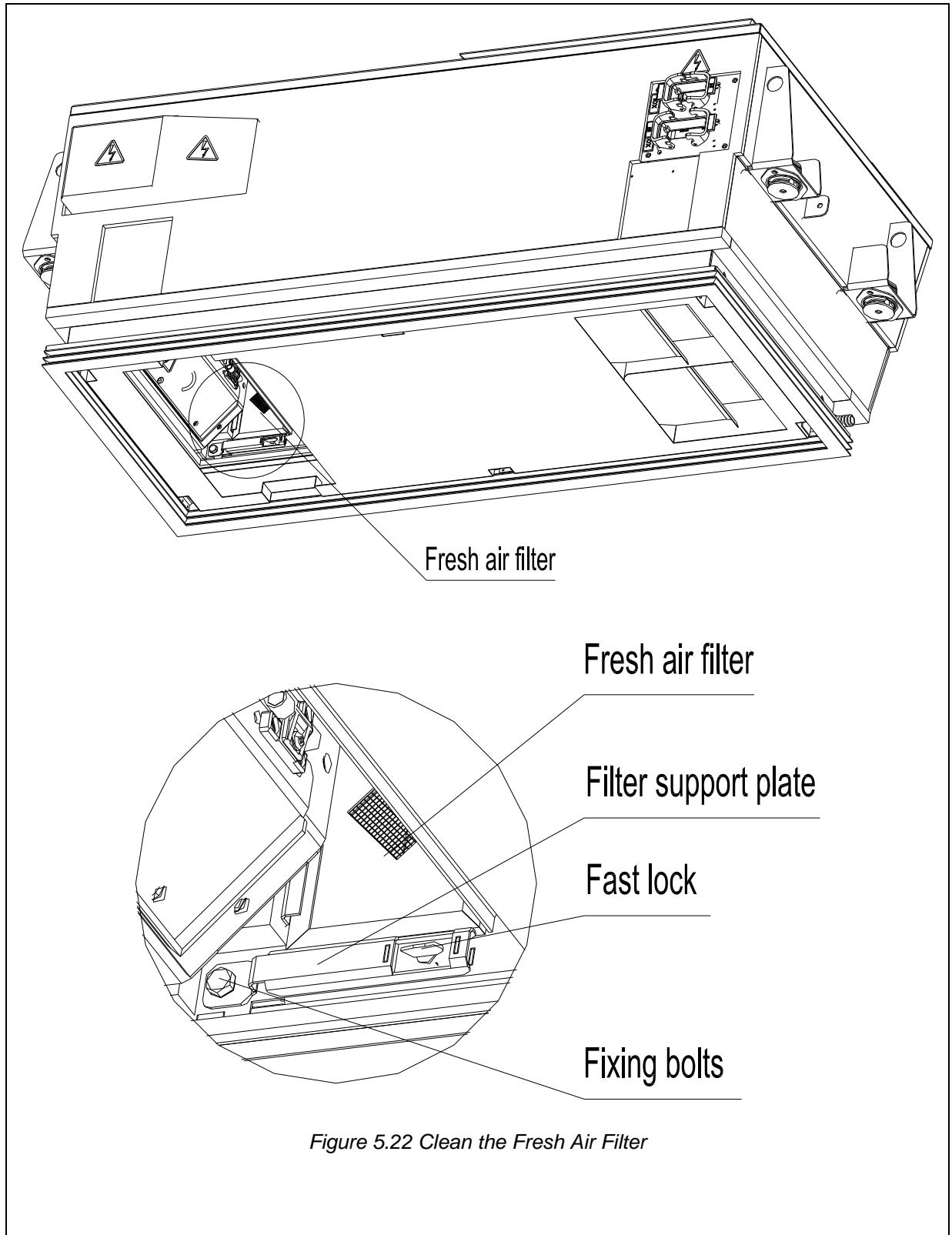
6. Replace the filters by a reverse of the removal process.
7. Close the return ceiling door.



*(not the picture of the real filter, only a model)*

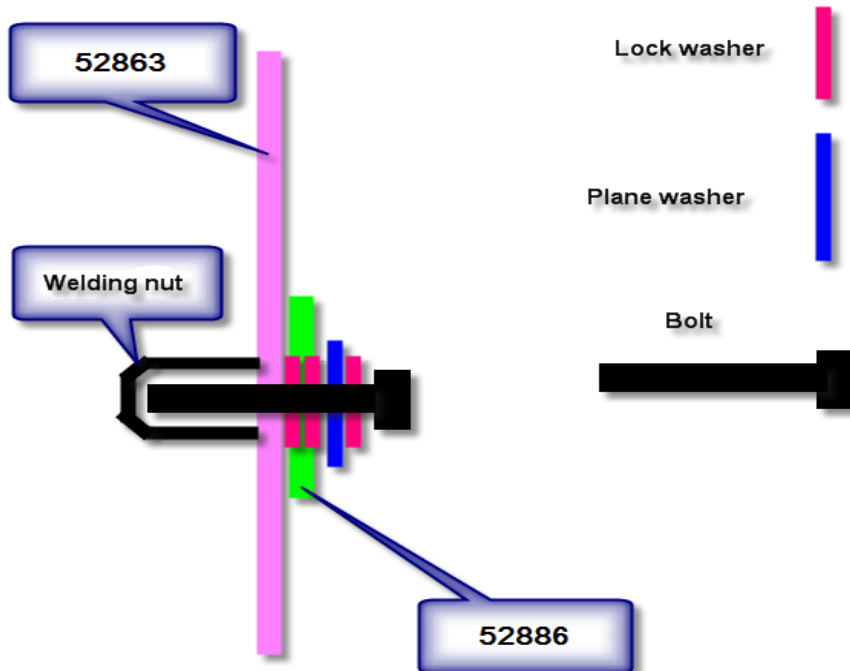
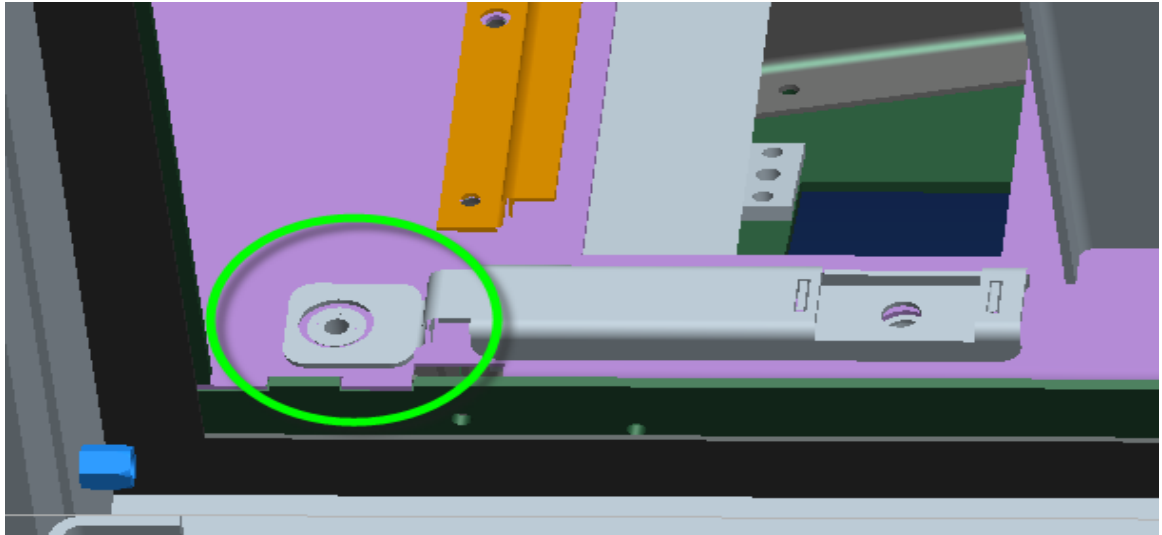
# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.11 Clean mixed air filter of cab HVAC unit

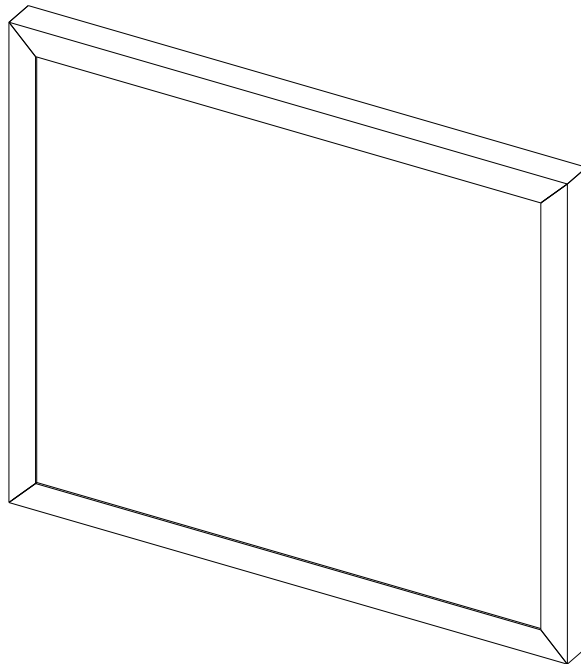
<b>Title: Mixed Air Filter - Clean</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To inspect and clean the Mixed Air Filter.		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Hp cleaner, stepladder. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Mixed Air Filter. <b>Parts number:</b> 12.1200.0163.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97C100.000-03A.Z3		
<b>SAFETY PRECAUTIONS:</b> N.A.		
<b>Down Time:</b> 0.15 hour <b>Team Size:</b> 2 person		

## AMSTERDAM (Alstom)

### Rolling Stock

**Procedure:**

1. Use a stepladder for climbing small heights, reach to the service hatch.
2. Open the service hatch.
3. Loosen the two fixing screws of the filter support plate.
4. Turn the filter support plate and take out the filter support plate.
5. Draw the mixed air filter out.
6. Clean the filters with High pressure cleaner (the outlet pressure of the cleaner less than 7 bar).  
Clean it with high pressure cleaner (water gun), place it steadily, use the water gun to clean both sides.  
Then, dry the filter by air, don't dry it by sunlight.
7. Replace the filters by a reverse of the removal process.
8. Close the return ceiling door.



*(not the picture of the real filter, only a model)*

# AMSTERDAM (Alstom)

## Rolling Stock

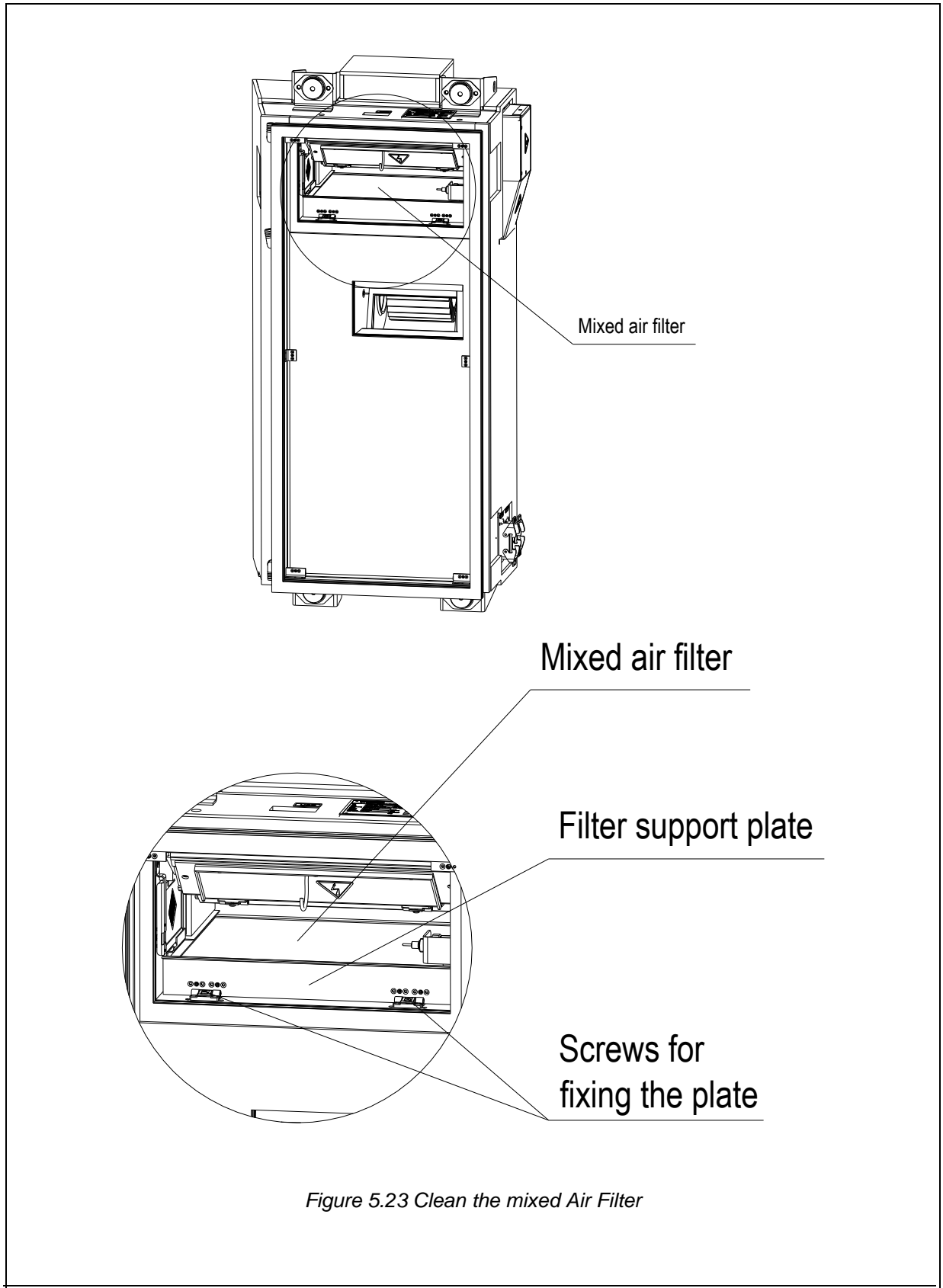


Figure 5.23 Clean the mixed Air Filter

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

#### 5.4.12 Clean left condenser of saloon HVAC Unit

In the HVAC system which is installed in train, the main part condenser is very easy to be polluted. If much dust and soot are stuck on the surface of the condenser, they will increase the thermal resistance and decrease the air flow, and then it will influence the heat exchange very much. This can lead that the high pressure in the system will be over the limitation of the pressure switch and then the HVAC system can not work in the worst condition. The condenser can be clean with compressed air. Absorb the dust from the side which a lot of dust is adhered to (along straight the fins). If the condenser is particularly dirt, we can brush softly with soft feather brush which has been dipped into dish cleanser.

<b>Title: Left condenser - Clean</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> Clean and inspect left condenser coil.		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Special Tools and Facilities:**

Industrial cleaner (vacuum cleaner), comb, soft brush.

**Materials and Consumables:**

Dish cleanser.

**Essential Parts:**

Left condenser.

**Parts number:**

12.1700.0308.

**Illustrations:**

TBD.

**Reference Drawings:**

KS97A100.210-00A.Z2

**SAFETY PRECAUTIONS:**

**SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS**

**REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.**

**WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.**

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

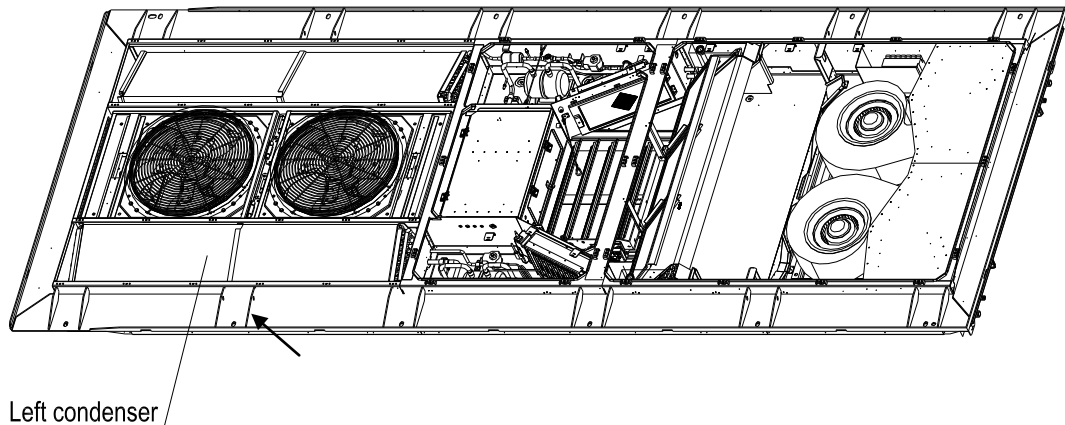
5 Maintenance and Overhaul Procedures

**Down Time:** 0.30 hours

**Team Size:** 2 person

**Procedure:**

1. Disconnect electrical connectors.
2. Open the left condenser cover.
3. Clean the condenser assemblies of dirt and dust by using a industrial cleaner, absorb the dust from the side which a lot of dust is adhered to(See the direction in the figure). If the condenser is particularly dirt, we can brush softly with soft feather brush which has been dipped into dish cleanser. Remove greasy accumulations by combing.
4. Visually inspect both coil assemblies and surrounding area for damage and corrosion, paying particular attention to the sharp edge on the cooling fins.
5. Close the condenser cover.
6. Connect electrical connectors.



*Figure 5.24 Clean the left condenser of HVAC unit*

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

#### 5.4.13 Clean right condenser of saloon HVAC Unit

In the HVAC system which is installed in train, the main part condenser is very easy to be polluted. If much dust and soot are stuck on the surface of the condenser, they will increase the thermal resistance and decrease the air flow, and then it will influence the heat exchange very much. This can lead that the high pressure in the system will be over the limitation of the pressure switch and then the HVAC system can not work in the worst condition. The condenser can be clean with compression air. Absorb the dust from the side which a lot of dust is adhered to(along straight the fins). If the condenser is particularly dirt, we can brush softly with soft feather brush which has been dipped into dish cleanser.

<b>Title: Condenser right - Clean</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> Clean and inspect right condenser coil.		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Special Tools and Facilities:**

Industrial cleaner (vacuum cleaner), comb, soft brush..

**Materials and Consumables:**

Dish cleanser.

**Essential Parts:**

Right condenser.

**Parts number:**

12.1700.0309.

**Illustrations:**

TBD.

**Reference Drawings:**

KS97A100.220-00A.OZ

**SAFETY PRECAUTIONS:**

**SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS**

**REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.**

**WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.**

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

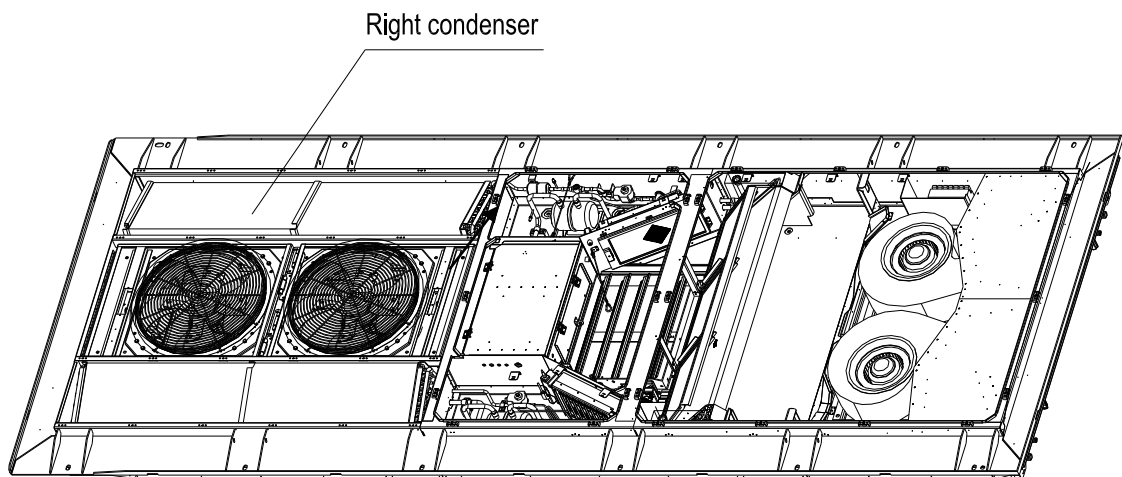
5 Maintenance and Overhaul Procedures

**Down Time:** 0.30 hours

**Team Size:** 2 person

**Procedure:**

1. Disconnect electrical connectors.
2. Open the right condenser cover.
3. Clean the condenser assemblies of dirt and dust by using a industrial cleaner, absorb the dust from the side which a lot of dust is adhered to(See the direction in the figure). If the condenser is particularly dirt, we can brush softly with soft feather brush which has been dipped into dish cleanser. Remove greasy accumulations by combing.
4. Visually inspect both coil assemblies and surrounding area for damage and corrosion, paying particular attention to the sharp edge on the cooling fins.
5. Close the right condenser cover.
6. Connect electrical connectors.



*Figure 5.25 Clean the right condenser of HVAC unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.14 Clean evaporator of saloon HVAC unit

The evaporator is located inside the HVAC unit when the evaporator is polluted, the thermal resistance and the pressure loss of the air flow which the air flow shall overcome when it passes through the unit shall be increased drastically. In this case the heat exchange, the performance and the evaporation temperature shall be dropped crazily, and the system shall work in the atrocious condition. The method of cleaning the evaporator please see the following form:

<b>Title: Evaporator - Clean</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC Unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> Clean and inspect evaporator coil.		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Brush, industrial cleaner (vacuum cleaner),comb. <b>Materials and Consumables:</b> Dish cleanser. <b>Essential Parts:</b> Evaporator. <b>Parts number:</b> 12.1700.0310.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Illustrations:**

TBD.

**Reference Drawings:**

KS97A100.230-00A.Z3

**SAFETY PRECAUTIONS:**



**SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS**

**REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.**

**WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.**

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

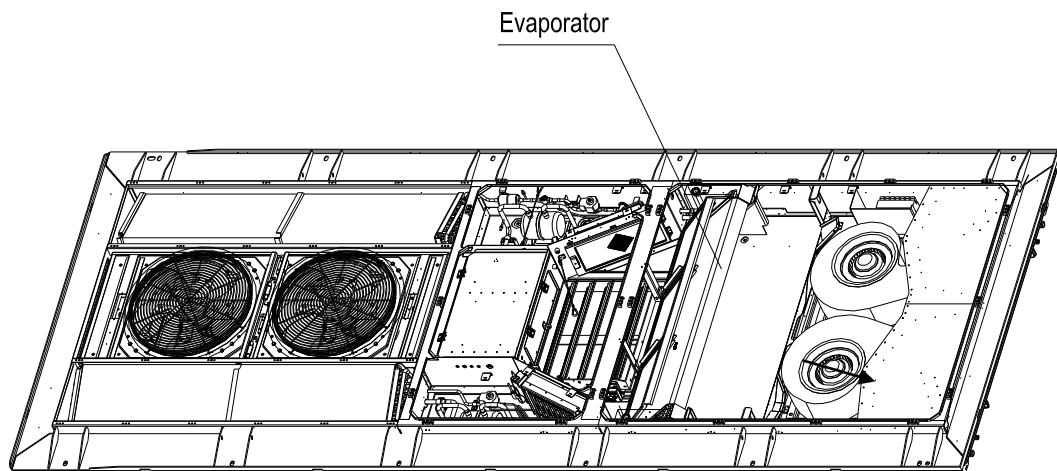
5 Maintenance and Overhaul Procedures

**Down Time:** 0.30 hours

**Team Size:** 2 person

**Procedure:**

1. Disconnect electrical connectors.
2. Open the air handling chamber maintenance cover, see 5.4.1.
3. Remove the mixed air filters, please refer to 5.5.22.
4. Clean the evaporator assemblies of dirt and dust by using a industrial cleaner, absorb the dust from the side which a lot of dust is adhered to (See the direction in the figure). If the evaporator is particularly dirt, we can brush softly with soft feather brush which has been dipped into dish cleanser. Remove greasy accumulations by combing.
5. Visually inspect both coil assemblies and surrounding area for damage and corrosion, paying particular attention to the sharp edge on the cooling fins.
6. Close the air handling chamber maintenance cover.
7. Connect electrical connectors.



*Figure 5.26 Clean the evaporator of HVAC unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.15 Check thermostat of cab HVAC unit

The thermostat is located on the electrical heater. The thermostat is controlled through the controller FPC. It is necessary to check switch point 50/70°C.

<b>Title: Thermostat - Check</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC Unit</b>	<b>Saloon HVAC unit</b>	
	<b>X</b>		
<b>Reason for Task:</b> check the thermostat			
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> Handhold heat blower, multimeter ,infrared thermometer.			
<b>Materials and Consumables:</b> N.A.			
<b>Essential Parts:</b> Thermostat.			
<b>Parts number:</b> 12.0601.0018			
<b>Illustrations:</b> TBD.			
<b>Reference Drawings:</b> Emerson 36TMH21.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1" data-bbox="352 1733 564 1787"><tr><td> <b>CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>Wear Required Safety Equipment, All Safety Rules and Regulations Must Be Observed.</b>			 <b>CAUTION</b>
 <b>CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

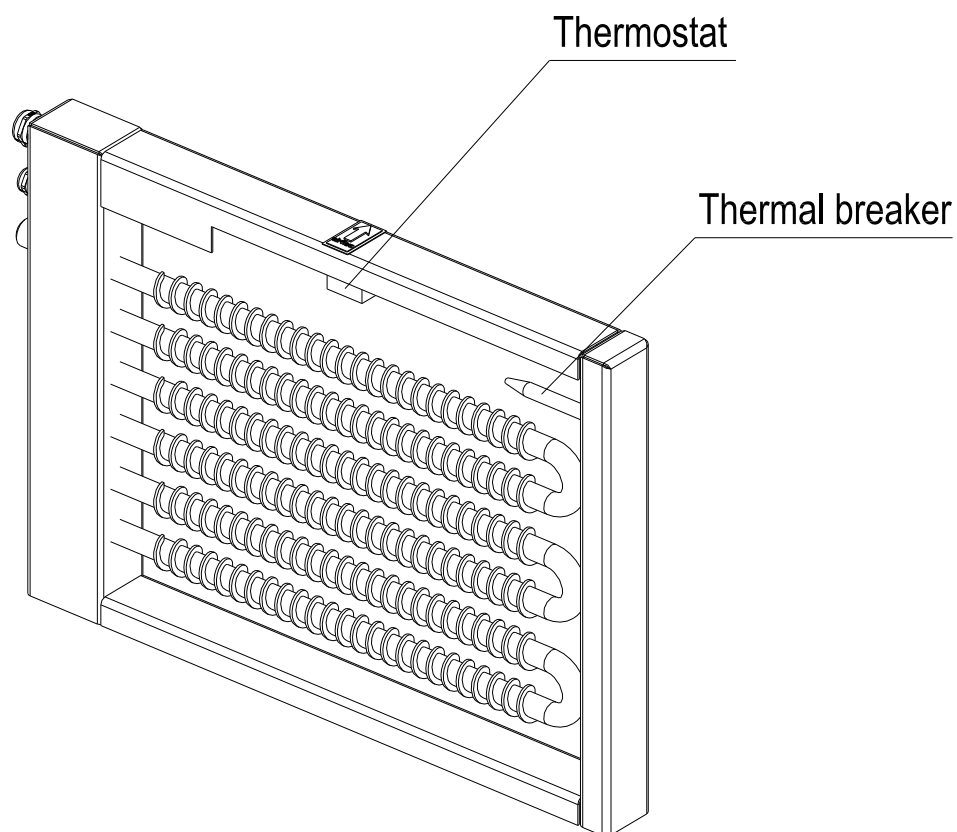
5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

**Team Size:** 2 person

**Procedure:**

1. Open the cover of the HVAC Unit, see 5.4.1.
2. Inspect thermostat for firm seating.
3. Inspect for dirt.
4. Use a handheld heat blower to heat the thermostat without starting the HVAC unit. Use a multimeter to measure the contacts of the thermostat to detect its state (open or close). In the meantime use an infrared thermometer to measure the temperature of thermostat, hold the thermometer, aim at the heater and push the switch and then read the reading.
5. When the temperature of the sensor of thermostat is higher than the setting value ( $70^{\circ}\text{C}$ ), the multimeter will detect an open signal. Then stop heat the thermostat.
6. Then the temperature will be reduced. When the temperature is lower than the setting value ( $50^{\circ}\text{C}$ ), the multimeter will detect a close signal.



*Figure 5.27 Check thermostat of unit heater of cab*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.16 Check thermostat of saloon HVAC unit

The thermostat is located on the electrical heater. The thermostat is controlled through the controller FPC. It is necessary to check switch point 50/70°C.

<b>Title: Thermostat - Check</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC Unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> check the thermostat		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Handhold heat blower, infrared thermometer. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Thermostat. <b>Parts number:</b> 12.0601.0018		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> Emerson 36TMH21		

#### SAFETY PRECAUTIONS:



**SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS**

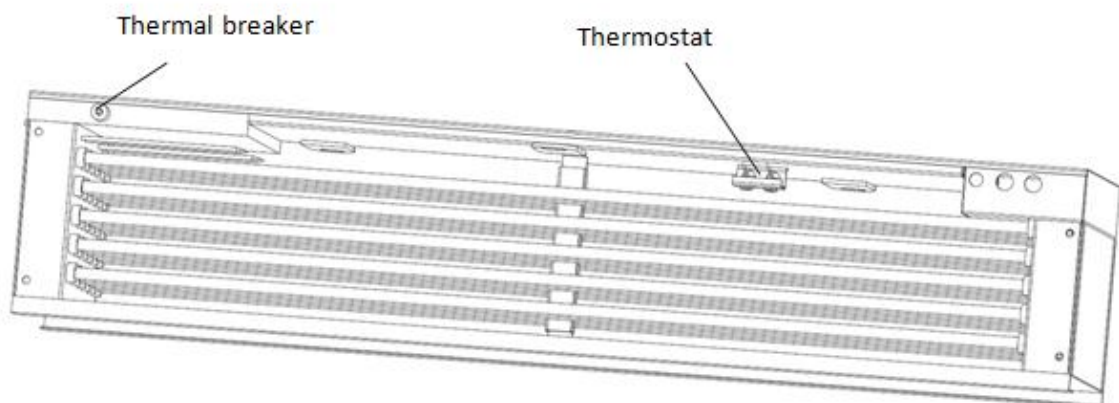
**WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.**

**Down Time:** 0.15 hours

**Team Size:** 2 person

#### Procedure:

1. Open the cover of the HVAC Unit, see 5.4.1.
2. Inspect thermostat for firm seating.
3. Inspect for dirt.
4. Use a handhold heat blower to heat the thermostat without starting the HVAC unit. Use a multimeter to measure the contacts of the thermostat to detect its state(open or close).In the meantime use an infrared thermometer to measure the temperature of thermostat, hold the thermometer ,aim at the heater and push the switch and then read the reading.
5. When the temperature of the sensor of thermostat is higher than the setting value (70°C),the multimeter will detect an open signal.Then stop heat the thermostat.
6. Then the temperature will be reduced. When the temperature is lower than the setting value (50°C), the multimeter will detect a close signal..



*Figure 5.28 Check thermostat of unit heater of saloon*

# AMSTERDAM (Alstom)


## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.17 Check thermostat of cab Aerotherm unit

The thermostat is located on the electrical heater. The thermostat is controlled through the controller FPC. It is necessary to check switch point 50/70°C.

<b>Title: Thermostat - Check</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC Unit</b>	<b>Saloon HVAC unit</b>
<b>Reason for Task:</b> check the thermostat		
<b>System/Equipment Title:</b> cab Aerotherm Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Handhold heat blower, infrared thermometer.		
<b>Materials and Consumables:</b> N.A.		
<b>Essential Parts:</b> Thermostat.		
<b>Parts number:</b> 12.0601.0018		
<b>Illustrations:</b> TBD.		
<b>Reference Drawings:</b> Emerson 36TMH21		
<b>SAFETY PRECAUTIONS:</b> 		
<b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

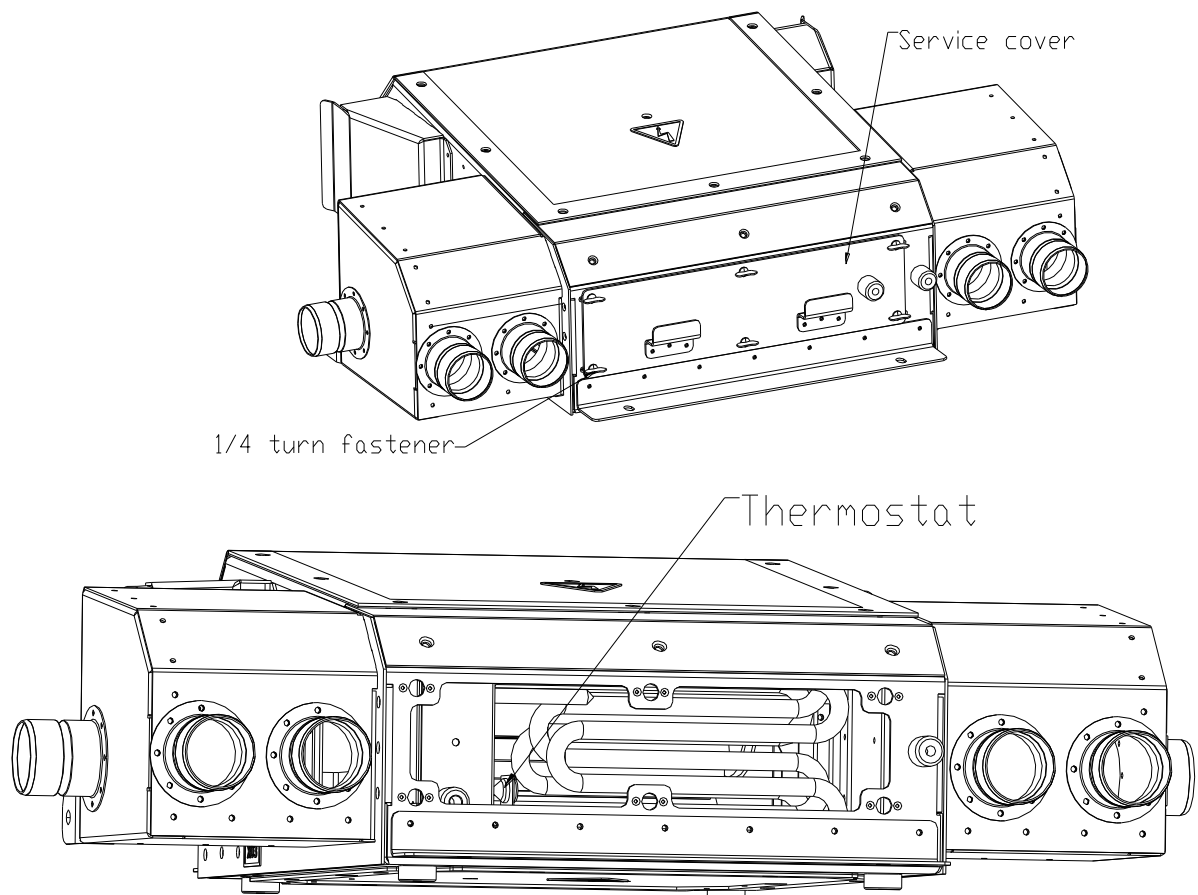
5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

**Team Size:** 1 person

**Procedure:**

1. Open the service cover of the cab Aerotherm Unit.
2. Inspect thermostat for firm seating.
3. Inspect for dirt.
4. Use a handhold heat blower to heat the thermostat. Use a multimeter to measure the contacts of the thermostat to detect its state(open or close).In the meantime use an infrared thermometer to measure the temperature of thermostat, hold the thermometer ,aim at the heater and push the switch and then read the reading.
5. When the temperature of the sensor of thermostat is higher than the setting value (70°C),the multimeter will detect an open signal.Then stop heat the thermostat.
6. Then the temperature will be reduced. When the temperature is lower than the setting value (50°C), the multimeter will detect a close signal..



*Figure 5.29 Check thermostat of cab Aerotherm unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.18 Check thermal breaker of cab HVAC unit

The thermal breaker is located on the electrical heater. It is necessary to check switching point 139°C. The thermostat will short circuit first.

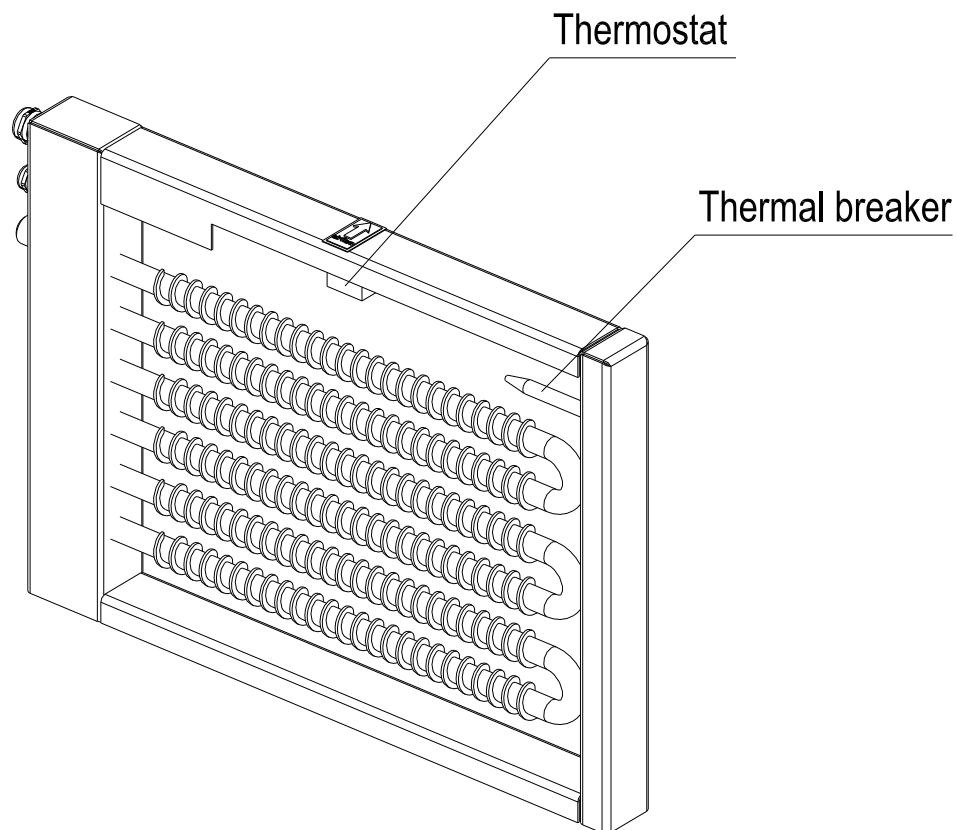
<b>Title: Thermal breaker - Check</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC Unit</b>	<b>Saloon HVAC unit</b>
	<b>X</b>	
<b>Reason for Task:</b> check the thermostat		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Handhold heat blower, multimeter ,infrared thermometer. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Thermal breaker. <b>Parts number:</b> 12.0601.0019		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> Emerson WQB139B. <b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>Wear Required Safety Equipment, All Safety Rules and Regulations Must Be Observed.</b></div>		

**Down Time:** 0.15 hours

**Team Size:** 2 person

**Procedure:**

1. Open the cover of the HVAC Unit, see 5.4.4.
2. Inspect thermal breaker for firm seating.
3. Inspect for dirt.
4. Use a handhold heat blower to heat the thermal breaker without starting the HVAC unit. Use a multimeter to measure the contacts of the thermal breaker to detect its state (open or close). In the meantime use an infrared thermometer to measure the temperature of thermal breaker, hold the thermometer, aim at the heater and push the switch and then read the reading.
5. When the temperature of the sensor of thermal breaker is higher than the setting value ( $139^{\circ}\text{C}$ ), the multimeter will detect an open signal. Then stop heat the thermal breaker.



*Figure 5.30 Check thermal breaker of unit heater of cab*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.19 Check thermal breaker of saloon HVAC unit

The thermal breaker is located on the electrical heater. It is necessary to check switching point 139°C. The thermostat will short circuit first.

<b>Title: Thermal breaker - Check</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC Unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> check the thermal breaker		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Handhold heat blower, multimeter ,infrared thermometer. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Thermal breaker. <b>Parts number:</b> 12.0601.0019		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> Emerson WQB139B <b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>Wear Required Safety Equipment, All Safety Rules and Regulations Must Be Observed.</b></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

#### HVAC System

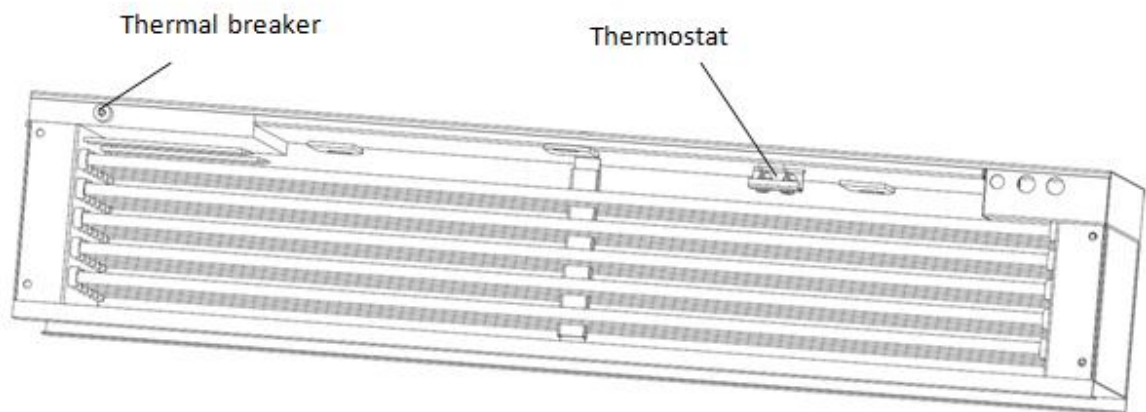
#### 5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

**Team Size:** 2 person

**Procedure:**

1. Open the cover of the HVAC Unit, see 5.4.1.
2. Inspect thermal breaker for firm seating.
3. Inspect for dirt.
4. Use a handheld heat blower to heat the thermal breaker without starting the HVAC unit. Use a multimeter to measure the contacts of the thermal breaker to detect its state (open or close). In the meantime use an infrared thermometer to measure the temperature of thermal breaker, hold the thermometer, aim at the heater and push the switch and then read the reading.
5. When the temperature of the sensor of thermal breaker is higher than the setting value ( $139^{\circ}\text{C}$ ), the multimeter will detect an open signal. Then stop heat the thermal breaker.



*Figure 5.31 check thermal breaker of unit heater of saloon*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.20 Check thermal breaker of cab Aerotherm unit

The thermal breaker is located on the electrical heater. It is necessary to check switching point 139°C. The thermostat will short circuit first.

<b>Title: Thermal breaker - Check</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC Unit</b>	<b>Saloon HVAC unit</b>
<b>Reason for Task:</b> check the thermostat		
<b>System/Equipment Title:</b> Cab Aerotherm Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Handhold heat blower, multimeter ,infrared thermometer. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Thermal breaker. <b>Parts number:</b> 12.0601.0019		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> Emerson WQB139B. <b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>Wear Required Safety Equipment, All Safety Rules and Regulations Must Be Observed.</b></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

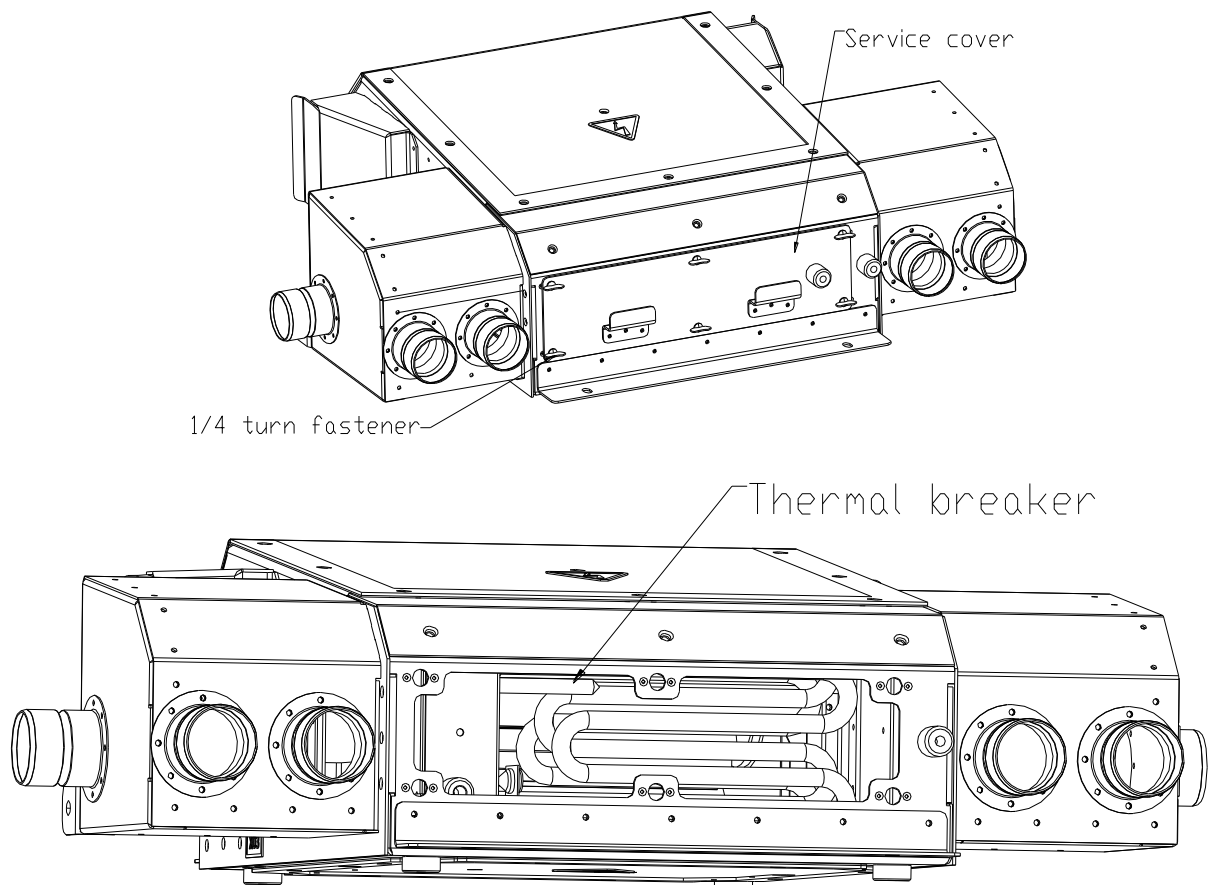
5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

**Team Size:** 2 person

**Procedure:**

1. Open the cover of the cab aerotherm Unit.
2. Inspect thermal breaker for firm seating.
3. Inspect for dirt.
4. Use a handhold heat blower to heat the thermal breaker without starting the HVAC unit. Use a multimeter to measure the contacts of the thermal breaker to detect its state (open or close). In the meantime use an infrared thermometer to measure the temperature of thermal breaker, hold the thermometer, aim at the heater and push the switch and then read the reading.
5. When the temperature of the sensor of thermal breaker is higher than the setting value ( $139^{\circ}\text{C}$ ), the multimeter will detect an open signal. Then stop heat the thermal breaker.



*Figure 5.32 Check thermal breaker of unit heater of cab Aerotherm*


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.21 Check high pressure switch of cab HVAC unit

<b>Title: High Pressure Switch - Check</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	<b>X</b>	
<b>Reason for Task:</b> To insure that high pressure switch is in fully operational condition.		
<b>System/Equipment Title:</b> Cab HVAC unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Mona-service and Maintenance Software Mona, laptop. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> High pressure switch. <b>Parts number:</b> 12.0501.0052 .		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> HS200-926-0087_TRD.		
<b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b></div>		

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

**Team Size:** 2 person

1. Procedure: Switch off the HVAC system.
2. Open the maintenance cover, see 5.4.4.
3. Connect laptop to RS232, start service software MONA.
4. Remove the sealing caps on schrader valves.
5. Connect the pressure gauge to high pressure schrader valve (See figure below, position D).
6. Switch on the HVAC system.
7. Send command from laptop to stop the condenser fan to stop the condenser air cooling the condenser.



**WARNING**

**Live parts!**

**Maintenance work may be performed by authorized qualified personnel only!**



**DANGER – Risk of injury by rotating fan impeller**

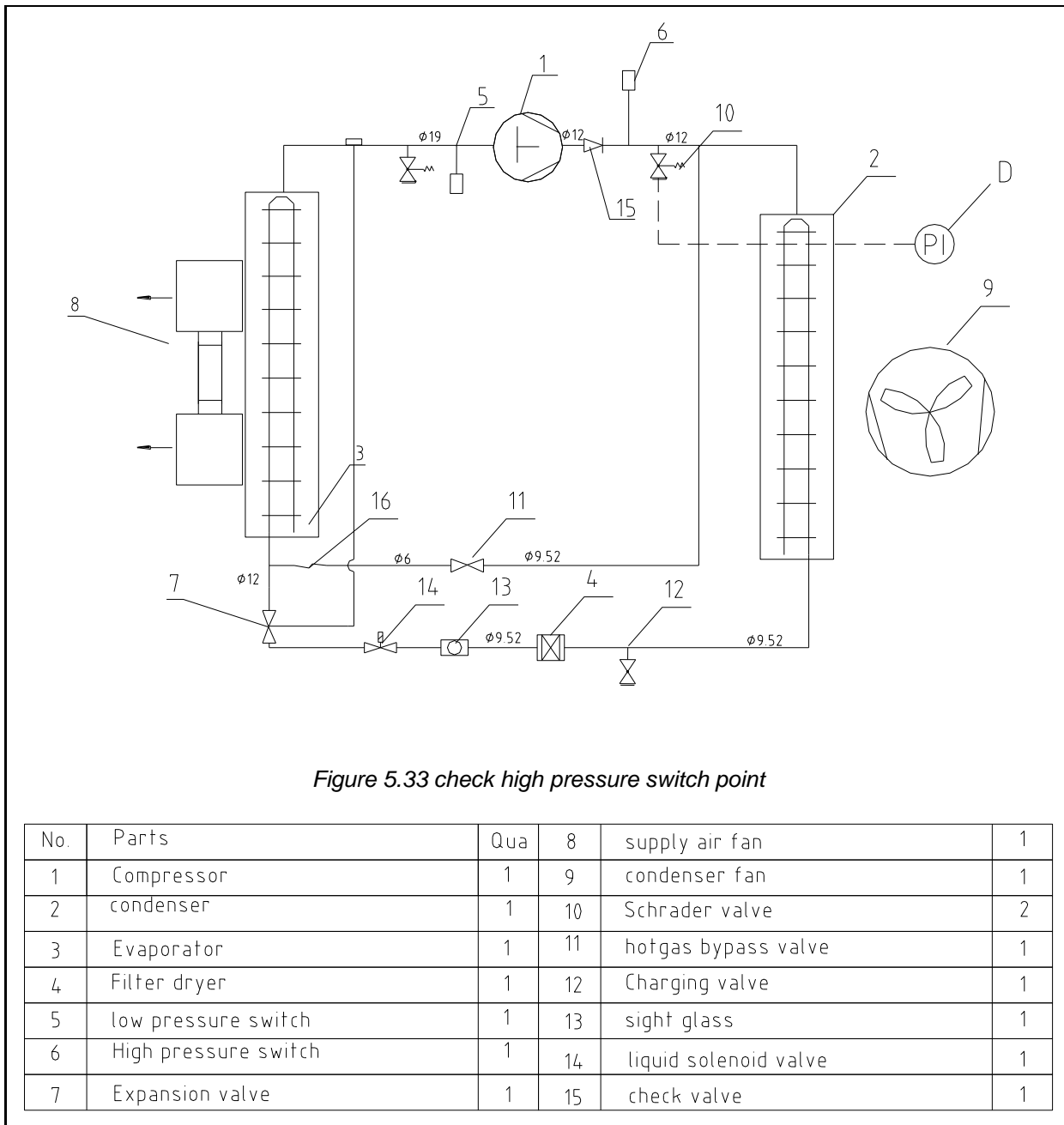
8. Observe the pressure gauge and if the pressure reaches the setting value (29 bar) the high pressure switch switches off and the compressor will stop automatically, otherwise stop the compressor immediately and check the wires between the high pressure switch and the controller FPC24 and the setting value.  
If the wires and the setting value are correct and it still doesn't work, replace the high pressure switch, please refer to 5.5.44.
9. Switch on the condenser fan .
10. Some time later the high pressure will be reduced and when the pressure is reduced to 24 bar, the contact will reset (close), the high pressure switch will switch on.
11. Disconnect the pressure gauge from Schrader valve.
12. Switch off the HVAC system, close the cover.

# AMSTERDAM (Alstom)

## Rolling Stock

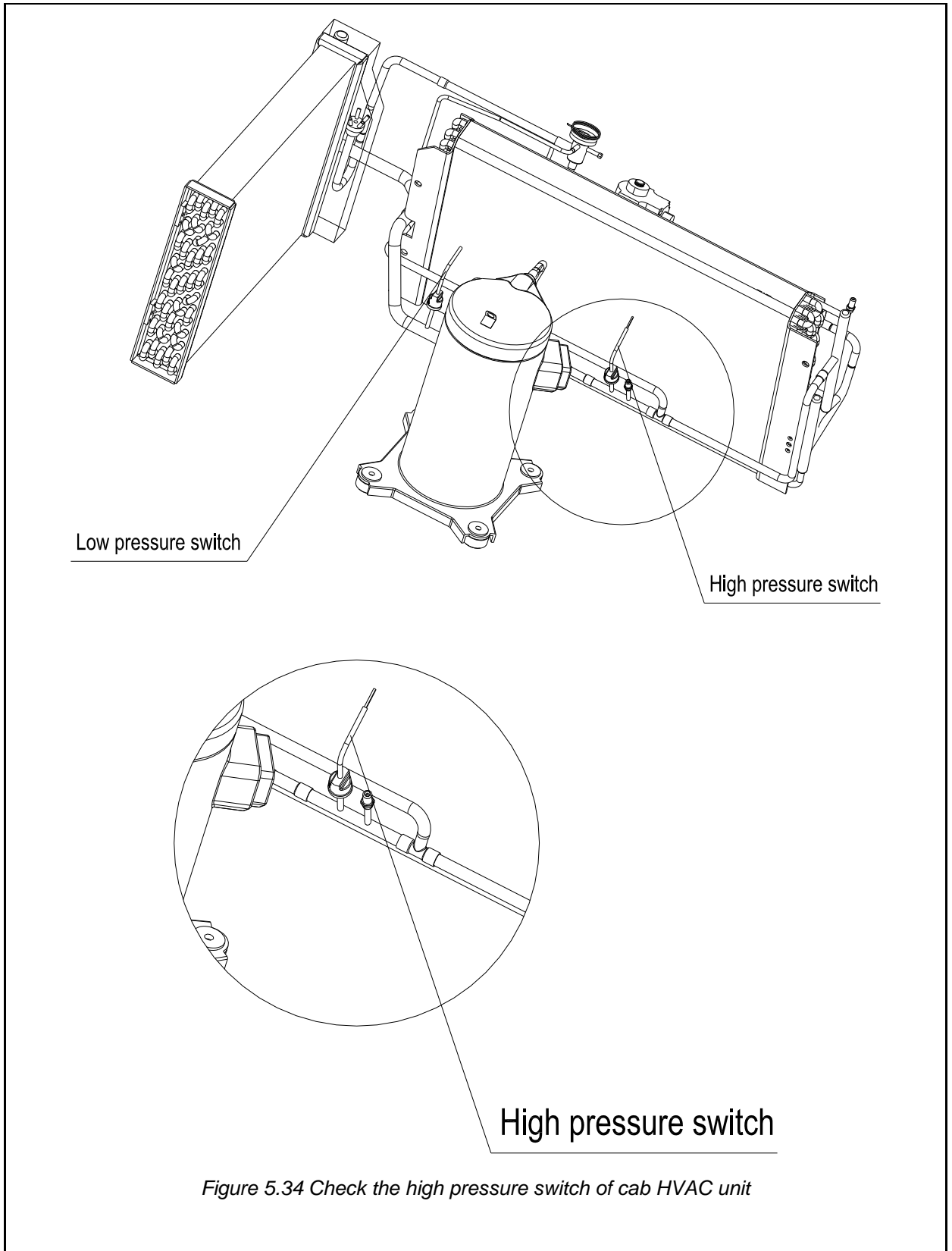
### HVAC System

### 5 Maintenance and Overhaul Procedures



# AMSTERDAM (Alstom)

## Rolling Stock






# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.22 Check high pressure switch of saloon HVAC unit

<b>Title: High Pressure Switch - Check</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		X	
<b>Reason for Task:</b> To insure that high pressure switch is in fully operational condition.			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Mona-service and Maintenance Software Mona, laptop. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> High pressure switch. <b>Parts number:</b> 12.0501.0053.			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> HS200-835-0019			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			
			

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

**Team Size:** 2 person

**Procedure:**

1. Switch off the HVAC system.
2. Open the condenser fan bracket, see 5.4.3.
3. Connect laptop to RS232, start service software MONA.
4. Remove the sealing caps on high pressure schrader valves.
5. Connect the pressure gauge to schrader valve in the outlet of compressor(See figure below,position D).
6. Switch on the HVAC system.
7. Send command from laptop to stop the condenser fan to stop the condenser air cooling the condenser.



**WARNING**

**Live parts!**

**Maintenance work may be performed by  
authorized qualified personnel only!**



**DANGER – Risk of injury by rotating fan  
impeller**

8. Observe the pressure gauge and if the pressure reaches the setting valve (29 bar)the high pressure switch switches off and the compressor will stop automatically, otherwise stop the compressor immediately and check the wires between the high pressure switch and the controller FPC24 and the setting value.  
if the wires and the setting value are correct and it still doesn't work, replace the high pressure switch, please refer to 5.5.45.
9. Switch on the condenser fan.
10. Some time later the high pressure will be reduced and when the pressure is reduced to 24 bar, the contact will reset (close),the high pressure switch will switch on.
11. Disconnect the pressure gauge from Schrader valve.
12. Switch off the HVAC system, close the condenser fan bracket.

# AMSTERDAM (Alstom)

## Rolling Stock

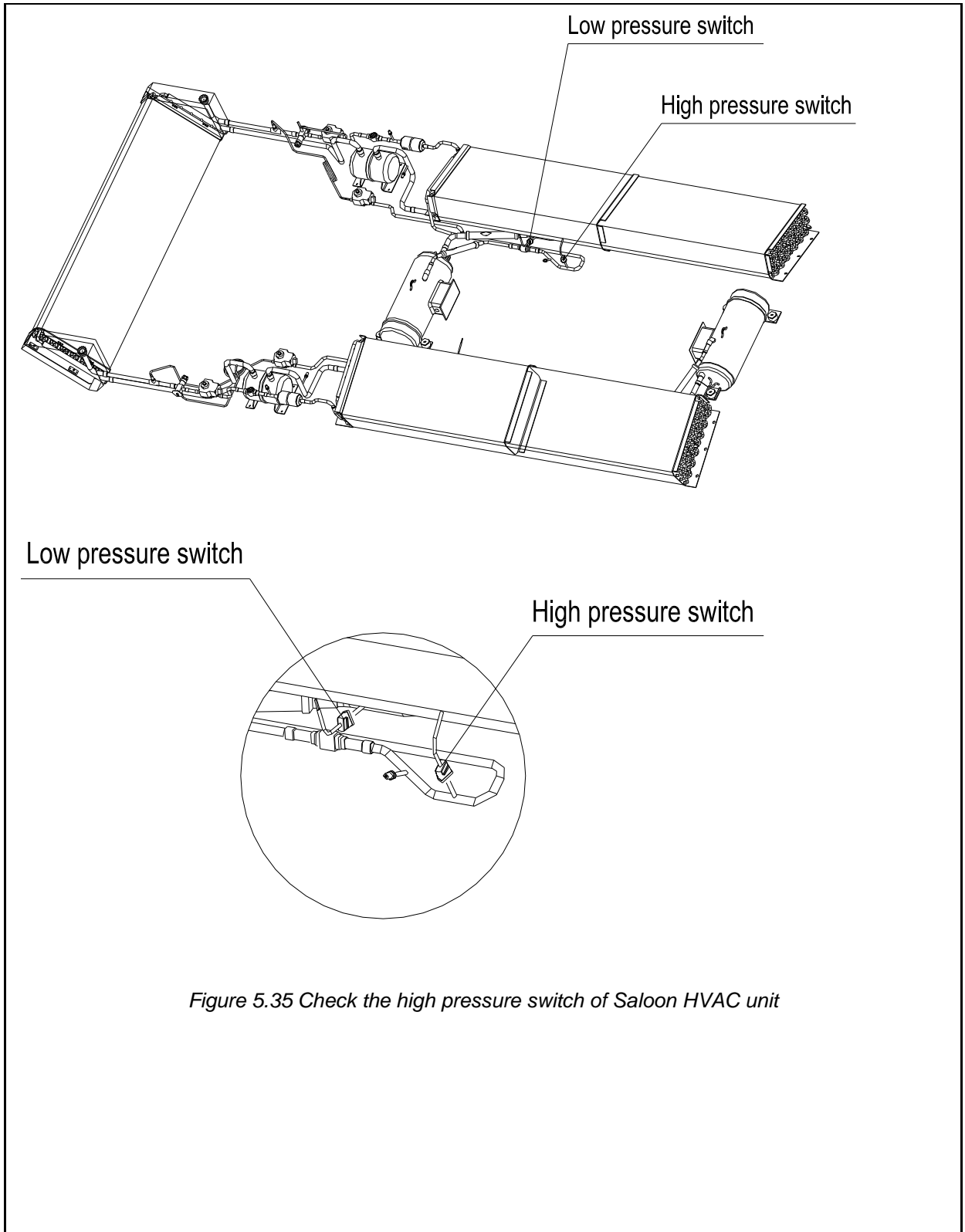


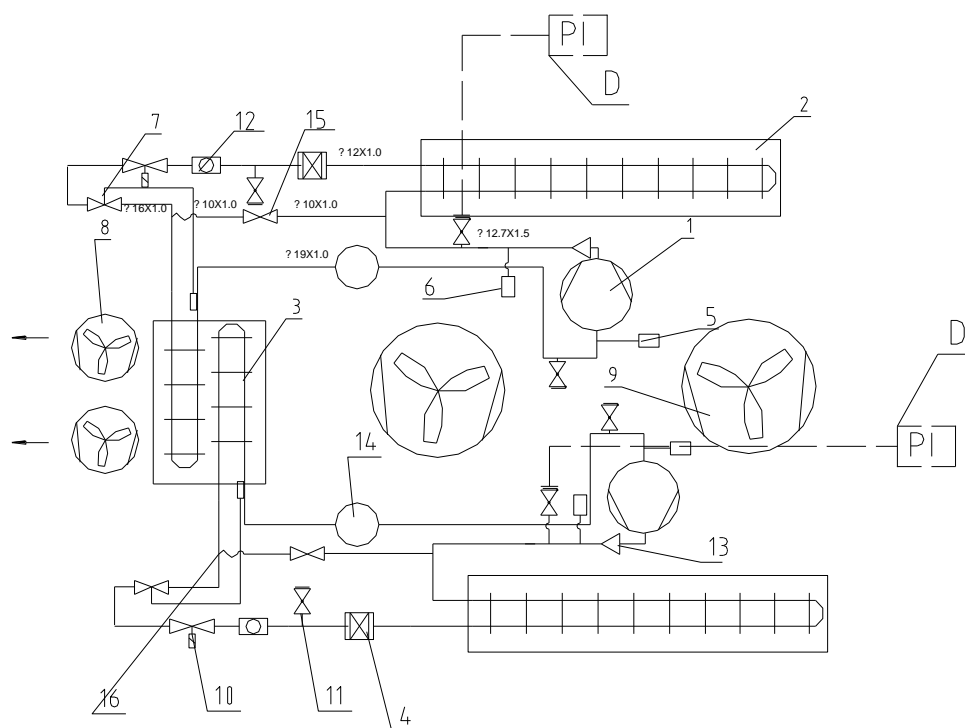
Figure 5.35 Check the high pressure switch of Saloon HVAC unit

# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

### 5 Maintenance and Overhaul Procedures



**Figure 5.36 Check high pressure switch point**

No.	Parts	Qua
1	Compressor	2
2	condenser	2
3	Evaporator	1
4	Filter dryer	2
5	low pressure switch	2
6	High pressure switch	2
7	Expansion valve	2
8	supply air fan	2
9	condenser fan	2
10	liquid solenoid valve	2
11	Charging valve	4
12	sight glass	2
13	Check valve	2
14	accumulator	2
15	Hotgas bypass solenoid valve	2
16	Hotgas bypass capillary tube	2

# AMSTERDAM (Alstom)


## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.23 Check low pressure switch of cab HVAC unit

In order to check low pressure switch, the following procedures shall be observed.

<b>Title: Low Pressure Switch - Check</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	<b>X</b>	
<b>Reason for Task:</b> To insure that low pressure switch is in fully operational condition.		
<b>System/Equipment Title:</b> Cab HVAC unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Mona-service and Maintenance Software Mona. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Low pressure switch. <b>Parts number:</b> 12.0502.0031.		
<b>Illustrations:</b> Figure 2-10: Low pressure sensor of chapter 7 Parts catalogue. <b>Reference Drawings:</b> HS200-926-0088_TRD.		
<b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

**Team Size:** 2 person

**Procedure:**

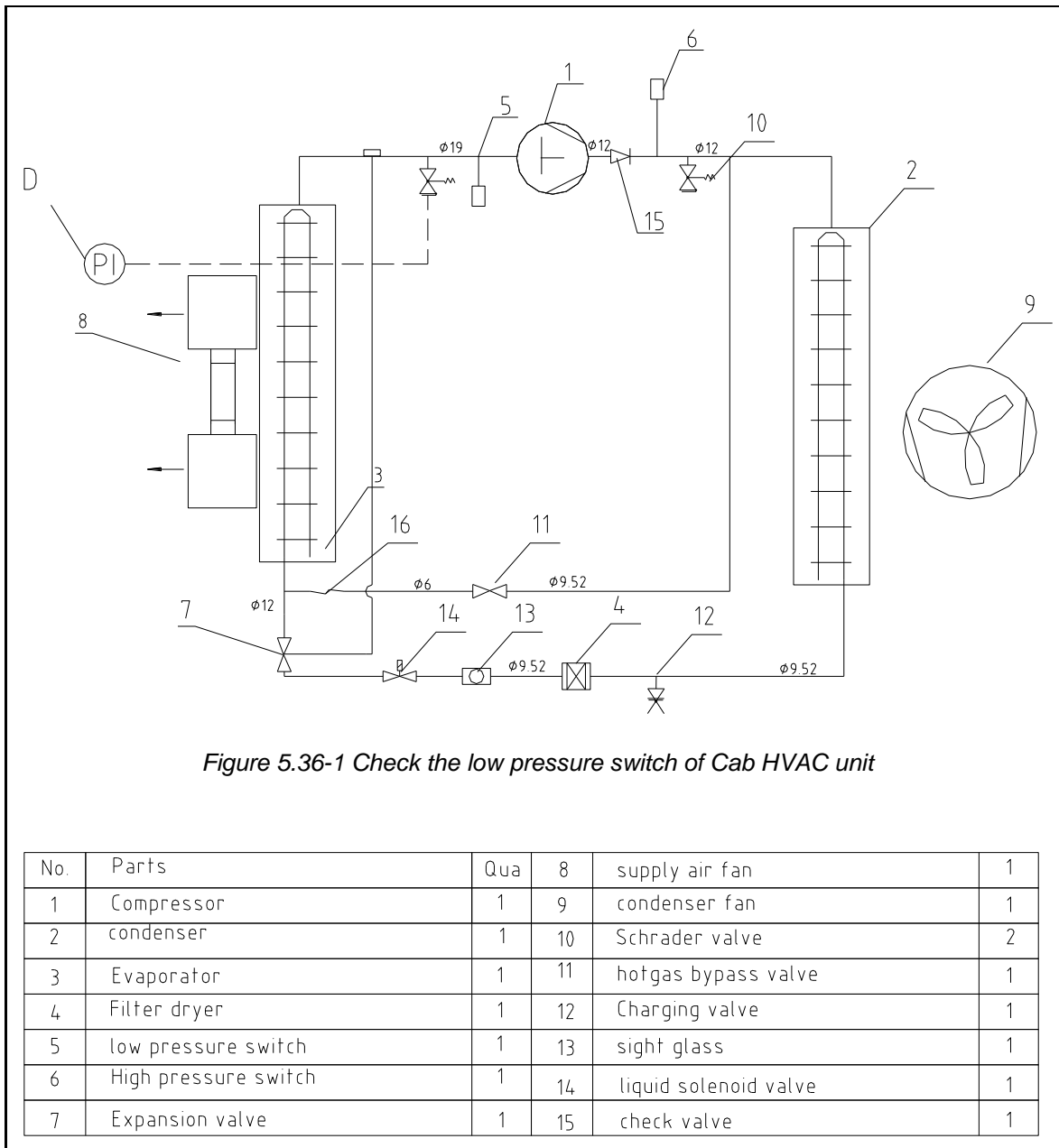
1. Switch off the HVAC system.
2. Open the maintenance cover, see 5.4.4.
3. Connect laptop to RS232, start service software MONA.
4. Open the hatch, connect the gauge to low pressure schrader valve. Please refer to figure 5.27-1.
5. Start supply air fan.
6. Start condenser air fan if the above procedures are ok, otherwise carry out maintenance.
7. Start compressor if the above procedures are ok, otherwise carry out maintenance.
8. If all the above procedures are ok, stop the supply fan via Mona software to reduce the evaporator pressure.
9. Observe the pressure gauge and if the pressure reaches the setting valve the low pressure switch switches off and the controller will receive one signal, otherwise stop the compressor immediately and check the wires between the pressure switch and the controller and the setting value or replace the low pressure switch, please refer to 5.5.46..
10. After a lag, the low pressure will be increased and when the pressure is increased to  $3.2 \pm 1$  Bar the low pressure switch will switch on.
11. Close down Mona SW, close the hatch, secure that the screws are tighten.

# AMSTERDAM (Alstom)

## Rolling Stock

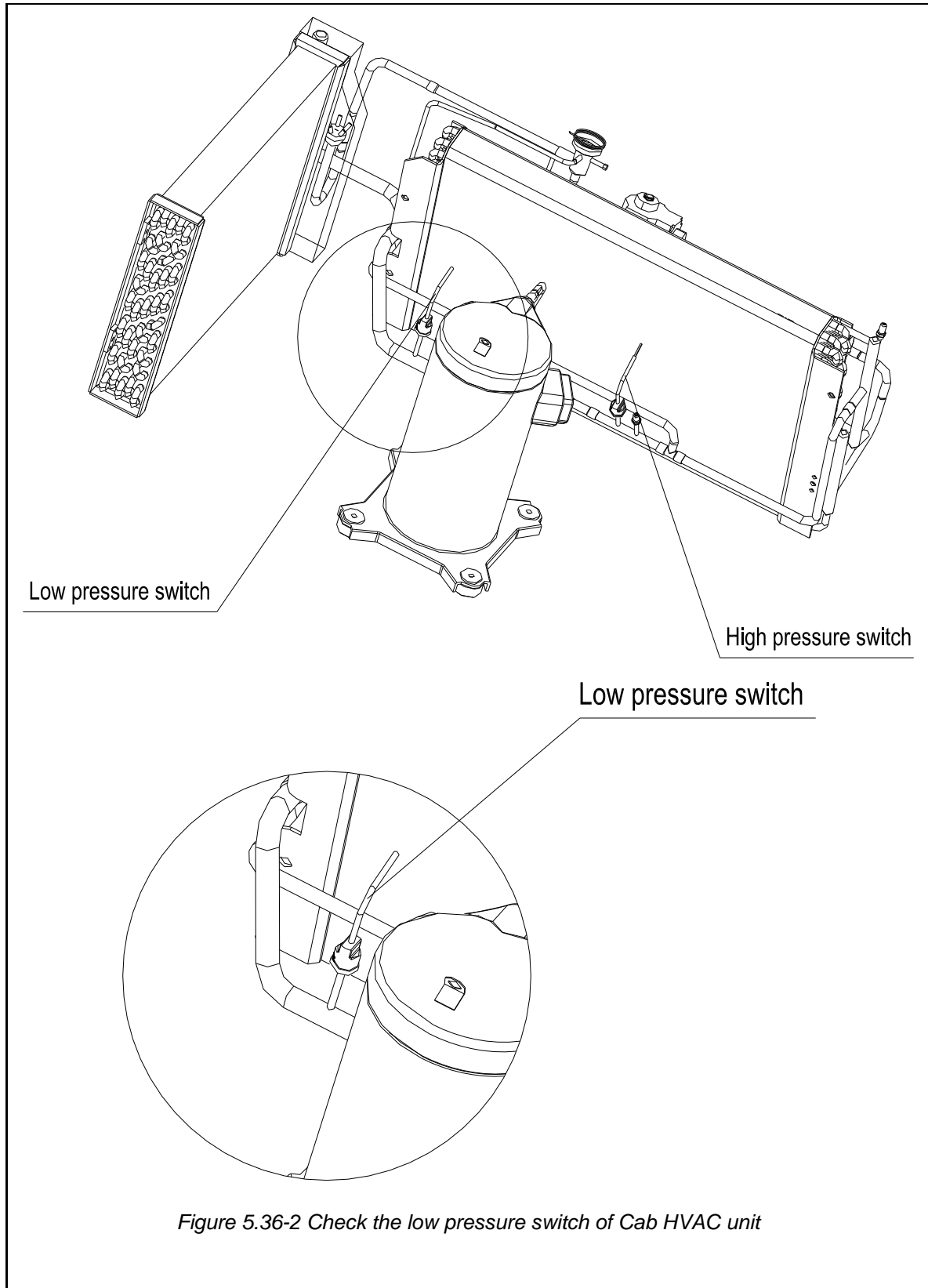
### HVAC System

### 5 Maintenance and Overhaul Procedures



# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)


## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.24 Check low pressure switch of saloon HVAC unit

In order to check low pressure switch, the following procedures shall be observed.

<b>Title: Low Pressure Switch - Check</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To insure that low pressure switch is in fully operational condition.		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Mona-service and Maintenance Software Mona. <b>Materials and Consumables:</b> N.A. <b>Essential Parts:</b> Low pressure switch. <b>Parts number:</b> 12.0502.0032.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> HS200-835-0020		
<b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

**Team Size:** 2 person

**Procedure:**

1. Connect laptop to RS232, start service software MONA.
2. Open the hatch, connect the gauge to suction line Schrader valve. Please refer to figure 5.28-1.
3. Start supply air fan.
4. Start condenser air fan if the above procedures are ok, otherwise carry out maintenance.
5. Start compressor if the above procedures are ok, otherwise carry out maintenance.
6. If all the above procedures are ok, stop the supply fan via Mona software to reduce the evaporator pressure.
7. Observe the pressure gauge and if the pressure reaches the setting valve the low pressure switch switches off and the controller will receive one signal, otherwise stop the compressor immediately and check the wires between the pressure switch and the controller and the setting value or replace the low pressure switch, please refer to 5.5.47..
8. After a lag, the low pressure will be increased and when the pressure is increased to  $3.2 \pm 1$  Bar the low pressure switch will switch on.
9. Close down Mona SW, close the hatch, secure that the screws are tighten.

# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

### 5 Maintenance and Overhaul Procedures

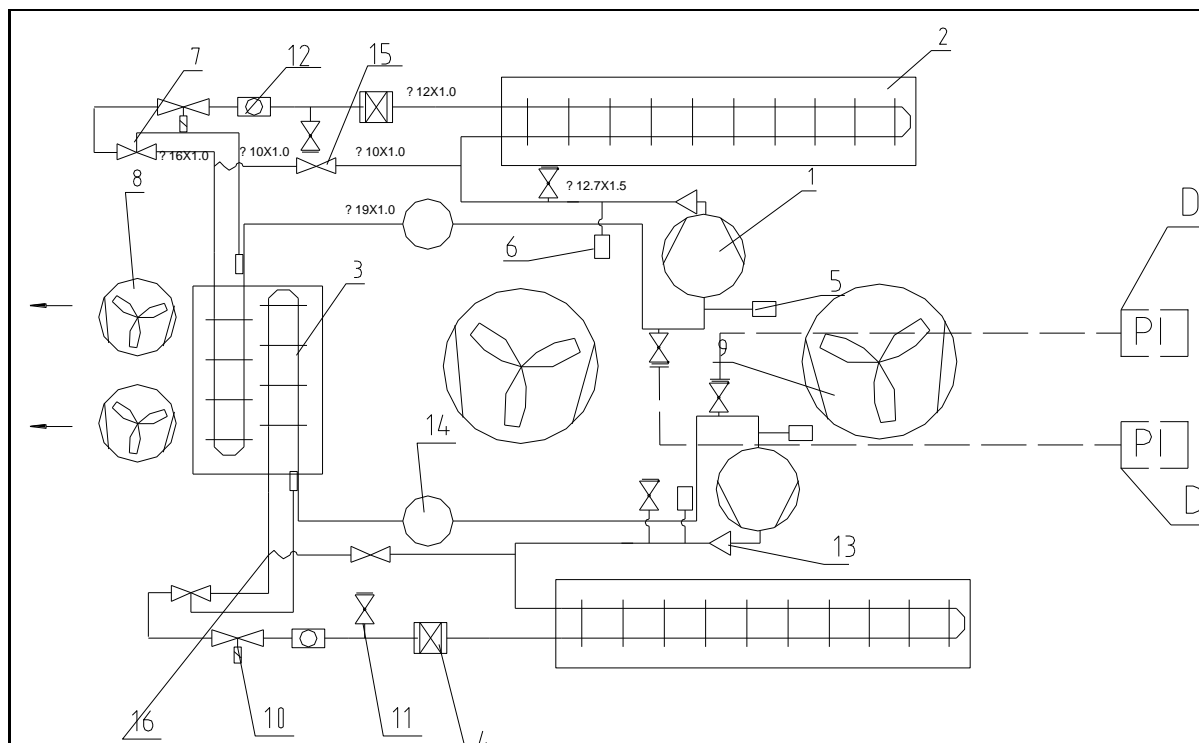


Figure 5.37-1 Check the low pressure switch of Saloon HVAC unit

No.	Parts	Qua
1	Compressor	2
2	condenser	2
3	Evaporator	1
4	Filter dryer	2
5	low pressure switch	2
6	High pressure switch	2
7	Expansion valve	2
8	supply air fan	2
9	condenser fan	2
10	liquid solenoid valve	2
11	Charging valve	4
12	sight glass	2
13	Check valve	2
14	accumulator	2
15	Hotgas bypass solenoid valve	2
16	Hotgas bypass capillary tube	2

# AMSTERDAM (Alstom)

## Rolling Stock

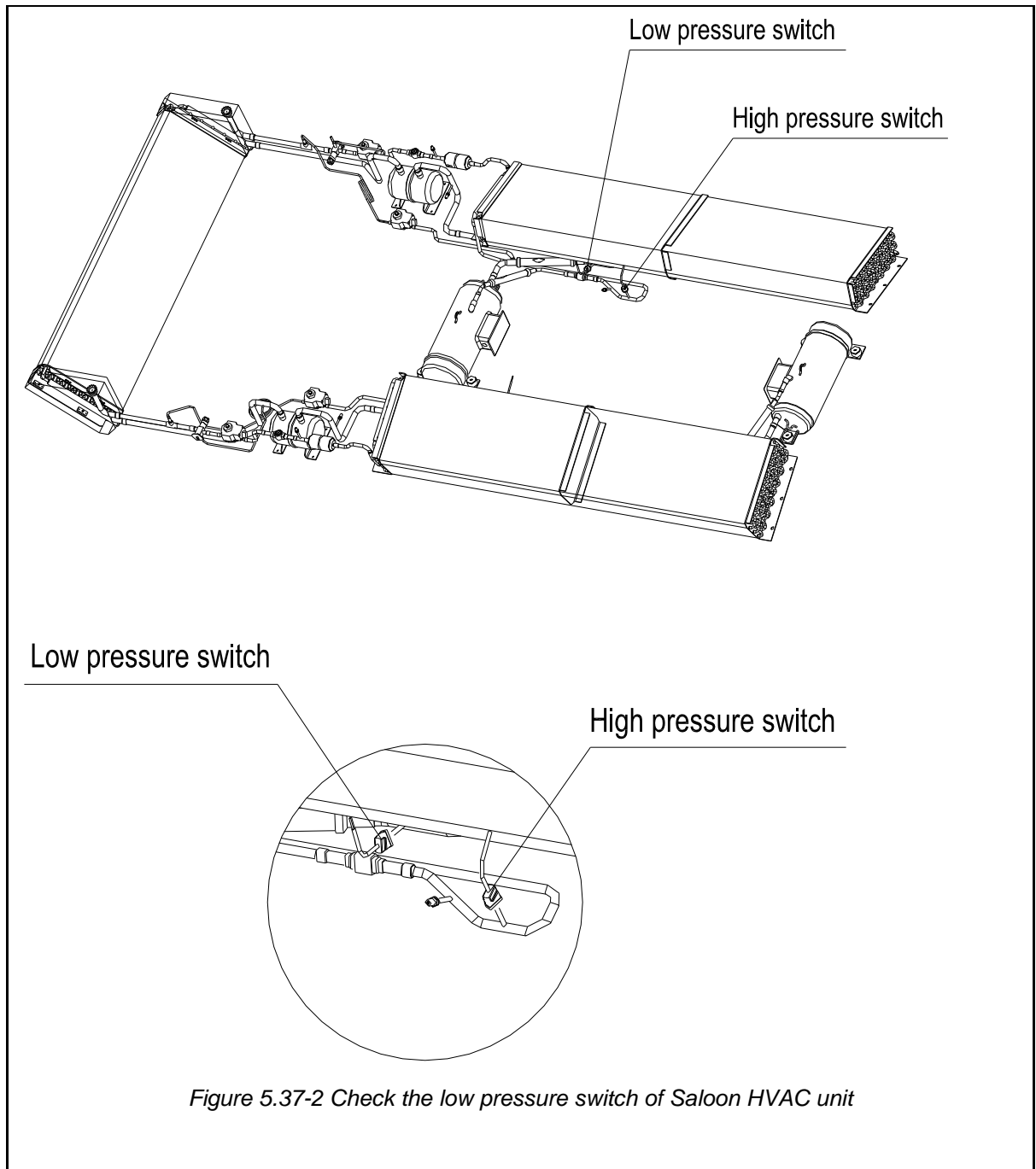


Figure 5.37-2 Check the low pressure switch of Saloon HVAC unit


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.25 Clean condenser of cab HVAC unit

<b>Title: Condenser - Clean</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> Clean and inspect condenser coil.		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Industrial cleaner (vacuum cleaner), comb, soft brush. <b>Materials and Consumables:</b> Dish cleanser. <b>Essential Parts:</b> Condenser left. <b>Parts number:</b> 12.1700.0320.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97C100.210-00A.Z2		
<b>SAFETY PRECAUTIONS:</b>  <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

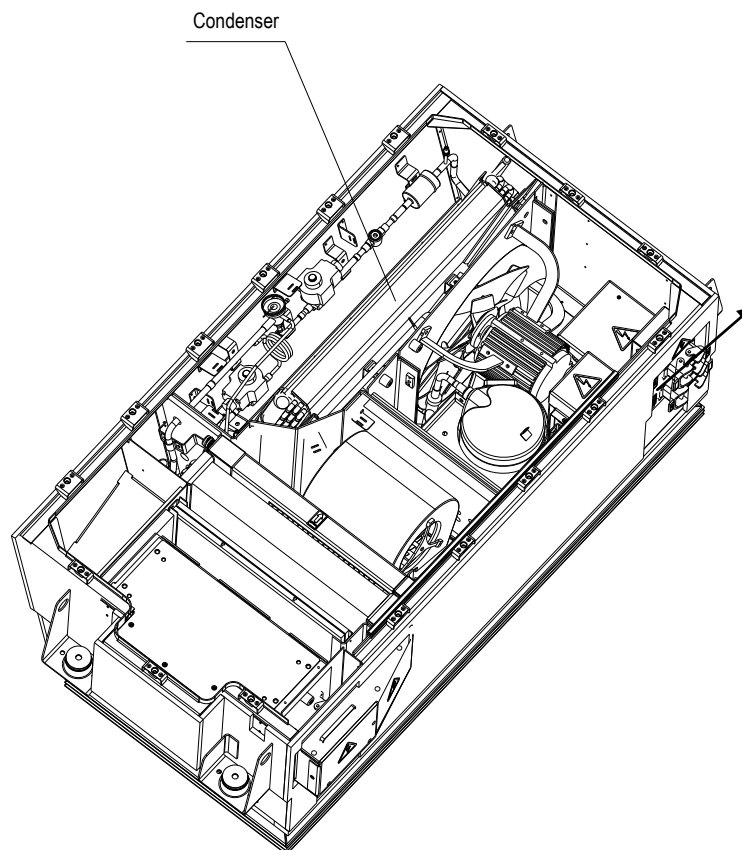
5 Maintenance and Overhaul Procedures

**Down Time:** 0.30 hours

**Team Size:** 2 person

**Procedure:**

1. Disconnect electrical connectors.
2. Open the maintenance cover, see 5.4.4.
3. Clean the condenser assemblies of dirt and dust by using an industrial cleaner, absorb the dust from the side which a lot of dust is adhered to (See the direction in the figure). If the condenser is particularly dirt, we can brush softly with soft feather brush which has been dipped into dish cleanser. Remove greasy accumulations by combing.
4. Visually inspect both coil assemblies and surrounding area for damage and corrosion, paying particular attention to the sharp edge on the cooling fins.
5. Close the maintenance cover.
6. Connect electrical connectors.



*Figure 5.38 Clean the condenser of HVAC unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.4.26 Clean evaporator of cab HVAC unit

<b>Title: Evaporator - Clean</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
	X		
<b>Reason for Task:</b> Clean and inspect evaporator coil.			
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> Industrial cleaner (vacuum cleaner), comb, soft brush.			
<b>Materials and Consumables:</b> Dish cleanser.			
<b>Essential Parts:</b> Evaporator.			
<b>Parts number:</b> 12.1700.0321.			
<b>Illustrations:</b> -			
<b>Reference Drawings:</b> KS97C100.230-00A.Z2			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

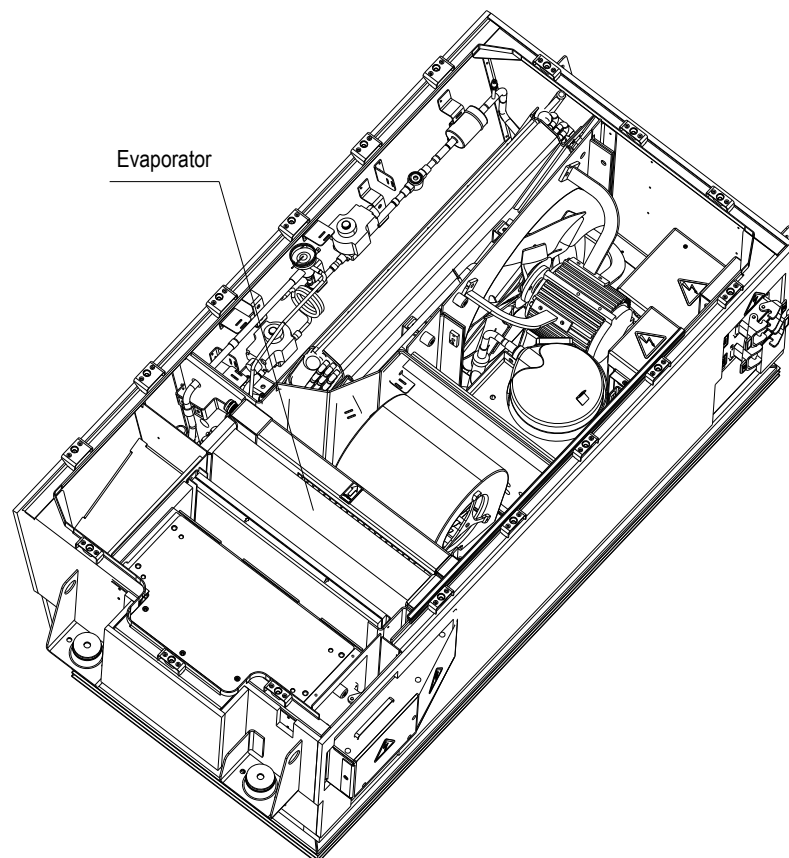
5 Maintenance and Overhaul Procedures

**Down Time:** 0.30 hours

**Team Size:** 2 person

**Procedure:**

1. Disconnect electrical connectors.
2. Open the maintenance cover, see 5.4.4.
3. Clean the evaporator assembly of dirt and dust by using an industrial cleaner, absorb the dust from the side which a lot of dust is adhered to (See the direction in the figure). If the evaporator is particularly dirt, we can brush softly with soft feather brush which has been dipped into dish cleanser. Remove greasy accumulations by combing.
4. Visually inspect both coil assemblies and surrounding area for damage and corrosion, paying particular attention to the sharp edge on the cooling fins.
5. Close the maintenance cover.
6. Connect electrical connectors.



*Figure 5.39 Clean the evaporator of HVAC unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5 Replacement procedures

If a component of the refrigerating circuit fails or if soldering work must be undertaken,

the cab/saloon HVAC unit must be removed and sent for repair. The refrigerant must be drained before the circuit is opened.

The sequence of maintenance for refrigeration circuit is:

1. Empty the refrigerant circuit;
2. Leak test with nitrogen;
3. Vacuum the refrigerant circuit;
4. And after some maintenance activity, filling with refrigerant.

#### 5.5.1 Empty the refrigerant circuit of cab HVAC unit

<b>Title: Empty the refrigerant circuit</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To Empty the refrigerant circuit.		
<b>System/Equipment Title:</b> Cab HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Refrigerant suction equipment, Connecting hose. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> N.A.		

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### Illustrations:

-.

### Reference Drawings:

-. KS97C100.400-00A.Z3

### SAFETY PRECAUTIONS:



It is dangerous for touching the refrigerant. Safeguard devices are needed.

**Down Time:** 0.5 hour

**Team Size:** 2 person

### Procedure:

1. Open maintenance cover of the HVAC unit, see 5.4.4.
2. For connection see the following figure.
3. Remove the sealing caps on Schrader valves.
4. Connect the lines of the suction equipment to the Schrader valves.
5. Switch on the equipment to evacuate the refrigerant
6. When the low pressure gauge on the suction equipment displays 10~15inHg, Switch off the suction equipment. If the actual recovered refrigerant weight does not change in 10 minutes, the compressor will auto stop, Switch off the suction equipment.
7. Disconnect the lines of the suction device on Schrader valves.
8. Install the sealing caps on Schrader valves.

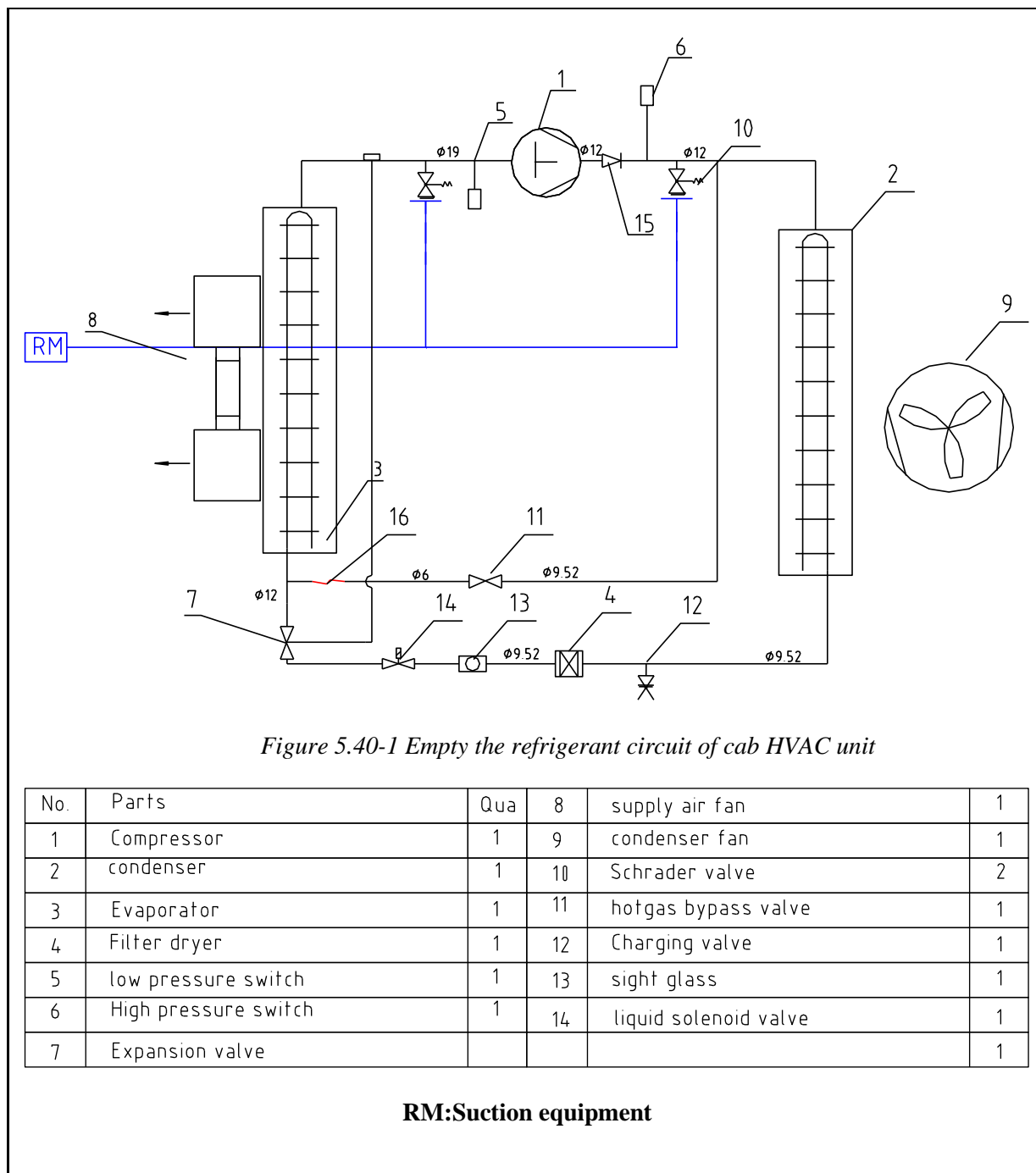
Then the HVAC unit is emptying.

# AMSTERDAM (Alstom)

## Rolling Stock

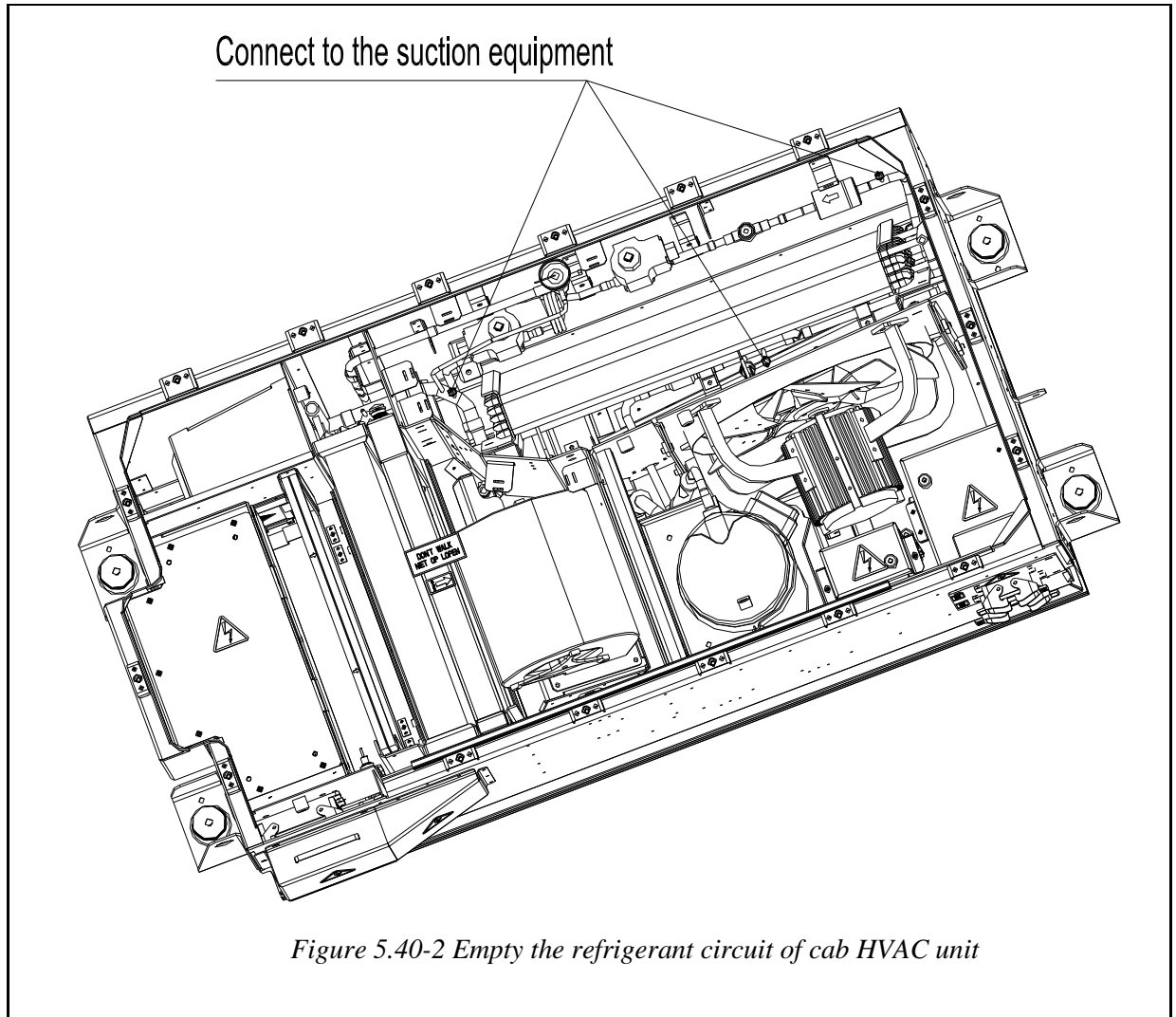
### HVAC System

### 5 Maintenance and Overhaul Procedures



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HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.2 Empty the refrigerant circuit of saloon HVAC unit

<b>Title: Empty the refrigerant circuit</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To Empty the refrigerant circuit.		
<b>System/Equipment Title:</b> Saloon HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Refrigerant suction equipment, Connecting hose. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> N.A.		
<b>Illustrations:</b> -. <b>Reference Drawings:</b> KS97A100.400-00A.Z3.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"><p style="color: red; font-weight: bold;">It is dangerous for touching the refrigerant. Safeguard devices are needed.</p></div>		

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### HVAC System

### 5 Maintenance and Overhaul Procedures

**Down Time:** 0.5 hour

**Team Size:** 2 person

**Procedure:**

1. Open maintenance cover and the condenser fan bracket of the HVAC unit, see 5.4.2 and 5.4.3.
2. For connection see the following figure.
3. Remove the sealing caps on Schrader valves
4. Connect the lines of the suction equipment to the Schrader valves.
5. Open the solenoid valve electrically using an external power source (P), Solenoid valve in liquid line
6. Switch on the equipment to evacuate the refrigerant.
7. When the low pressure gauge on the suction equipment displays 10~15inHg, Switch off the suction equipment. If the actual recovered refrigerant weight does not change in 10 minutes, the compressor will auto stop, Switch off the suction equipment.
8. Disconnect the lines of the suction device on Schrader valves.
9. Install the sealing caps on Schrader valves.

Then the HVAC unit is emptying.

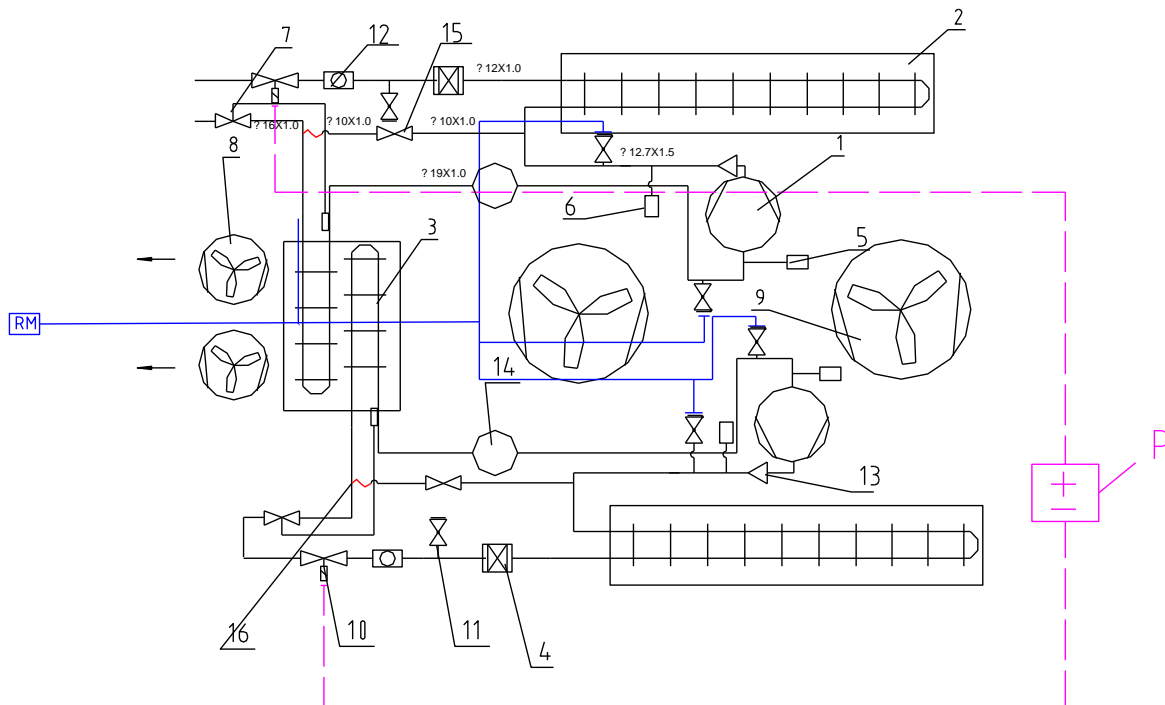


Figure 5.41-1 Empty the refrigerant circuit of saloon HVAC unit

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### HVAC System

### 5 Maintenance and Overhaul Procedures

No.	Parts	Qua
1	Compressor	2
2	condenser	2
3	Evaporator	1
4	Filter dryer	2
5	low pressure switch	2
6	High pressure switch	2
7	Expansion valve	2
8	supply air fan	2
9	condenser fan	2
10	liquid solenoid valve	2
11	Charging valve	4
12	sight glass	2
13	Check valve	2
14	accumulator	2
15	Hotgas bypass solenoid valve	2
16	Hotgas bypass capillary tube	2

RM suction equipment P external power source

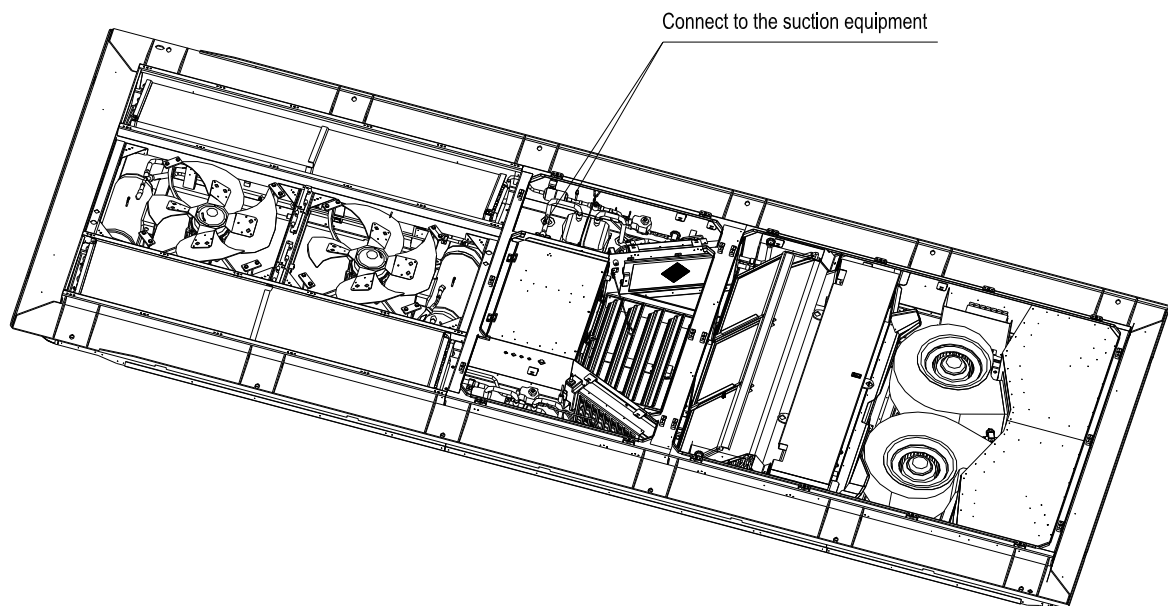


Figure 5.41-2 Empty the refrigerant circuit of saloon HVAC unit


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HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.3 Leak test with nitrogen of cab HVAC unit

<b>Title: Leak test with nitrogen</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To test leakage with nitrogen.		
<b>System/Equipment Title:</b> Cab HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Connecting pipes, precise measuring manometer Kl. 0,6; 0 ÷ 25 bar , Thermometer. <b>Medium:</b> Nitrogen 5.0 (H <sub>2</sub> O= 5 ppm) In steel bottle with pressure reducing valve. <b>Essential Replacement Parts:</b> N.A.		
<b>Illustrations:</b> -.		
<b>Reference Drawings:</b> KS97C100.400-00A.Z3		
<b>SAFETY PRECAUTIONS:</b> The leak test activity should be done after 5.5.1. <div style="border: 2px solid black; padding: 10px; margin-top: 10px;"><p style="color: red; font-weight: bold;">It is dangerous for touching the refrigerant. Safeguard devices are needed.</p></div>		

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HVAC System

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**Down Time:** 0.5 hour

**Team Size:** 2 person

**Procedure:**

1. The activity should be done after the refrigerant has been removed.
2. Open maintenance cover of the HVAC unit, see 5.4.4.
3. For connection see the following figure.
4. Remove the sealing caps on Schrader valve.
5. Connect the line of the nitrogen steel bottle to the Schrader valve.
6. Connect precision pressure gauge (D) to Schrader valve.
7. Slowly open the valve on the nitrogen bottle to build pressure in the air-conditioning unit. If no major leak is detected at the beginning, which would be noted by loud hissing noise, slowly increase the pressure to 22 bar.
8. When the test pressure of 22 bar has established, close valve (C) on the nitrogen bottle.
9. Disconnect the nitrogen bottle with connecting line from Schrader valve.
10. Install the sealing caps on Schrader valve.
11. Inspect the solder points for leaks, apply foaming agent with a brush, repair leaks if necessary.
12. Record the test pressure in the refrigerant circuit and the ambient temperature at the beginning and end of the test.
13. The leak test is considered complete if after 12 hours no pressure drop in the air-conditioning unit (note ambient temperature!) is noted.

Test pressure  $p_0 = 22$  barg

Temperature change	Pressure change
[°K]	[bar]
± 1	± 0,08
± 2	± 0,15
± 3	± 0,23
± 4	± 0,30
± 5	± 0,39

14. Open the Schrader valve after getting conclusion of the examination and nitrogen discharges from the refrigerant circuit slowly.

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### HVAC System

### 5 Maintenance and Overhaul Procedures

15. Disconnect the manometer from Schrader valve.
16. Install the sealing caps on Schrader valve.

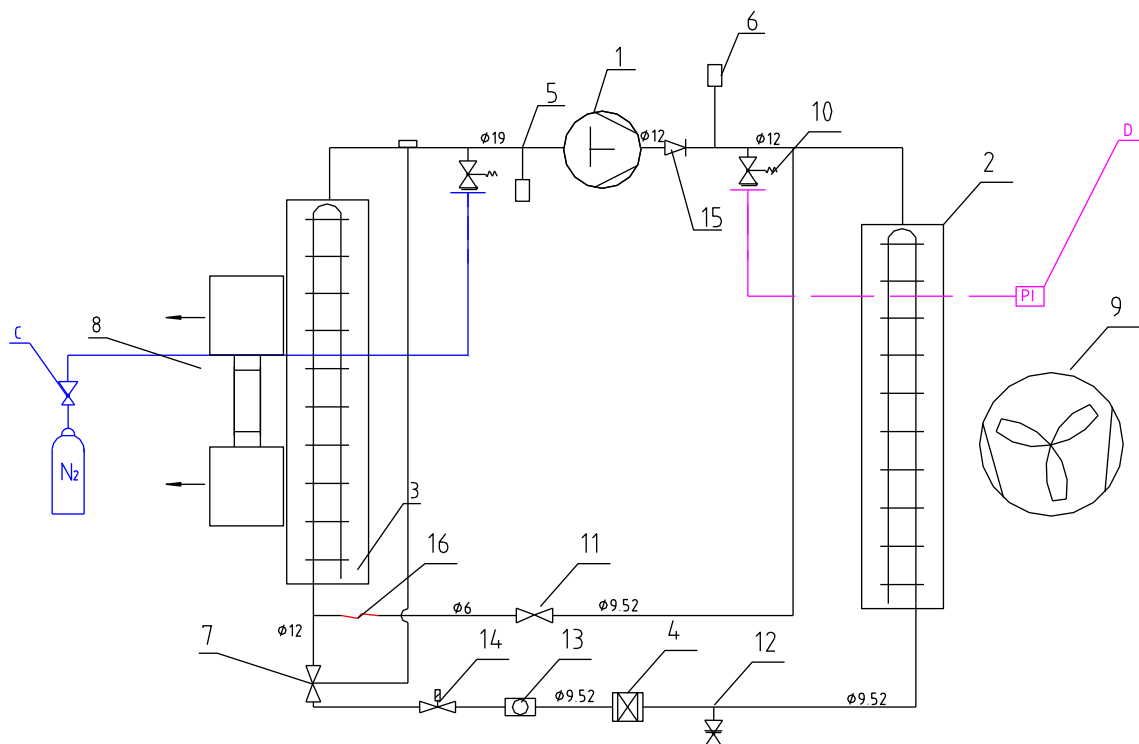


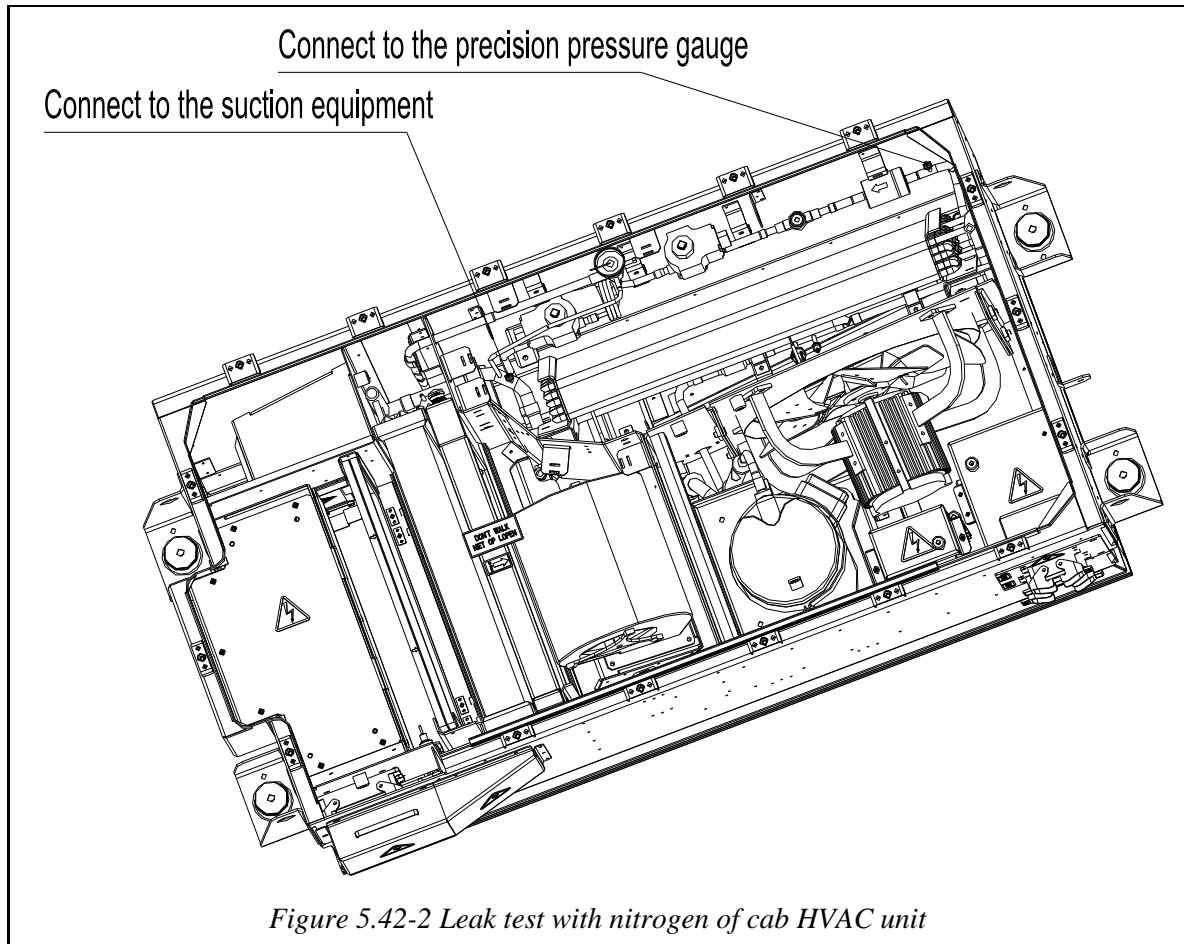
Figure 5.42-1 Leak test with nitrogen of cab HVAC unit

No.	Parts	Qua	8	9	10	11	12	13	14	15
				supply air fan						
1	Compressor	1		condenser fan						
2	condenser	1		Schrader valve						
3	Evaporator	1		hotgas bypass valve						
4	Filter dryer	1		Charging valve						
5	low pressure switch	1		sight glass						
6	High pressure switch	1		liquid solenoid valve						
7	Expansion valve	1		check valve						

**C** reducing valve    **D** precision pressure gauge

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### 5.5.4 Leak test with nitrogen of saloon HVAC unit

<b>Title: Leak test with nitrogen</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To test leakage with nitrogen.		
<b>System/Equipment Title:</b> Saloon HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Connecting pipes, precise measuring manometer Kl. 0,6; 0 ÷ 25 bar , Thermometer. <b>Medium:</b> Nitrogen 5.0 (H <sub>2</sub> O= 5 ppm) In steel bottle with pressure reducing valve. <b>Essential Replacement Parts:</b> N.A.		
<b>Illustrations:</b> -.		
<b>Reference Drawings:</b> KS97A100.400-00A.Z3		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"><p style="color: red; font-weight: bold;">It is dangerous for touching the refrigerant. Safeguard devices are needed.</p></div>		

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HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.5 hour

**Team Size:** 2 person

**Procedure:**

1. Open maintenance cover and the condenser fan bracket of the HVAC unit, see 5.4.2 and 5.4.3..
2. For connection see the following figure.
3. Remove the sealing caps on Schrader valve
4. Connect the line of the nitrogen steel bottle to the Schrader valve.
5. Connect precision pressure gauge (D) to Schrader valve.
6. Open the solenoid valve electrically using an external power source (P).Solenoid valve in liquid line.
7. Slowly open the valve on the nitrogen bottle to build pressure in the air-conditioning unit. If no major leak is detected at the beginning, which would be noted by loud hissing noise, slowly increase the pressure to 22 bar.
8. When the test pressure of 22 bar has established, close valve on the nitrogen bottle.
9. Disconnect the nitrogen bottle with connecting line from Schrader valve .
10. Install the sealing caps on Schrader valve.
11. Inspect the solder points for leaks, apply foaming agent with a brush, repair leaks if necessary.
12. Record the test pressure in the refrigerant circuit and the ambient temperature at the beginning and end of the test.
13. The leak test is considered complete if after 12 hours no pressure drop in the air-conditioning unit (note ambient temperature!) is noted.

Test pressure  $p_0 = 22$  barg

Temperature change	Pressure change
[°K]	[bar]
± 1	± 0,08
± 2	± 0,15
± 3	± 0,23
± 4	± 0,30
± 5	± 0,39

14. Open the Schrader valve after getting conclusion of the examination and nitrogen discharges from the refrigerant circuit slowly.

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15. Disconnect the manometer from Schrader valve .

16. Install the sealing caps on Schrader valve.

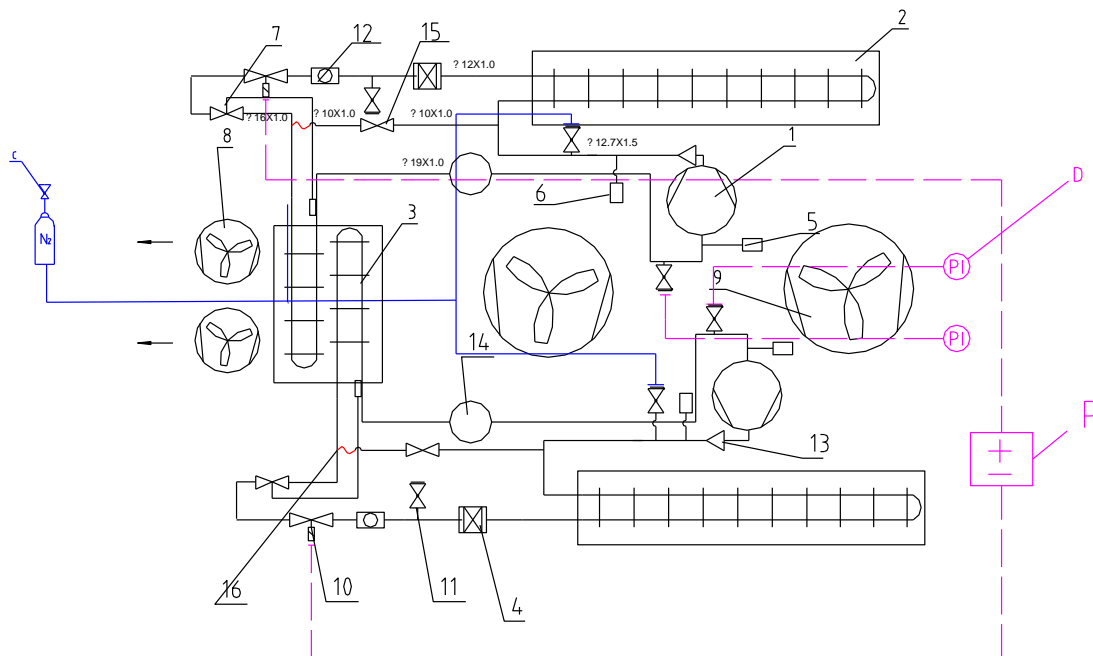


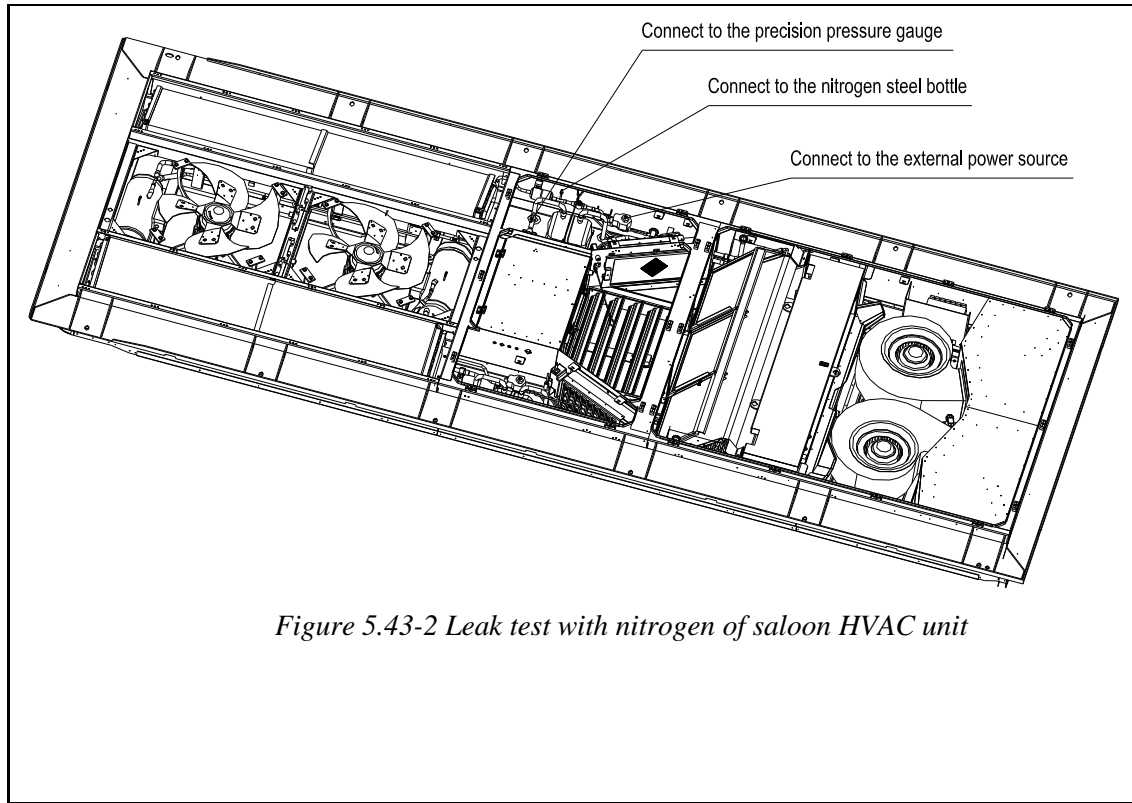
Figure 5.43-1 Leak test with nitrogen of saloon HVAC unit

No.	Parts	Qua
1	Compressor	2
2	condenser	2
3	Evaporator	1
4	Filter dryer	2
5	low pressure switch	2
6	High pressure switch	2
7	Expansion valve	2
8	supply air fan	2
9	condenser fan	2
10	liquid solenoid valve	2
11	Charging valve	4
12	sight glass	2
13	Check valve	2
14	accumulator	2
15	Hotgas bypass solenoid valve	2
16	Hotgas bypass capillary tube	2

C reducing valve D precision pressure gauge P external power source

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HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.5 Vacuum the refrigerant circuit of the cab HVAC unit

<b>Title: Vacuum</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To vacuum the refrigerant circuit.		
<b>System/Equipment Title:</b> Cab HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Vacuum pump, Connecting hose, Absolute vacuum meter 0-150 mbar, 1 mbar step. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> N.A.		
<b>Illustrations:</b> -. <b>Reference Drawings:</b> KS97C100.400-00A.Z3		
<b>SAFETY PRECAUTIONS:</b> N.A.		

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HVAC System

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**Down Time:** 1.5 hour

**Team Size:** 2 person

**Procedure:**

1. Open maintenance cover of the HVAC unit, see 5.4.4.
  2. For connection see the following figure.
  3. Remove the sealing caps on Schrader valves
  4. Connect the lines of the Vacuum pump to the Schrader valves.
  5. Remove the sealing caps on Schrader valves.
  6. Connect absolute vacuum meter to Schrader valves.
  7. Open the solenoid valve electrically using an external power source, solenoid valve in liquid line.
  8. Open manual shutoff valve (A) in the connecting line and start the vacuum pump.
  9. Switch on the equipment to evacuate the refrigerant
  10. Evacuate up to a pressure less than 5 mbar.
  11. Switch off the vacuum pump.
  12. Disconnect the pipes between the vacuum pump and the Schrader valves .
  13. Examination of vacuum-tightness is made by a service life of 1 hour.
  14. Record the values of pressure and time from the beginning to the end of the vacuum-tightness test.
  15. The vacuum-tightness test is considered successful only if there is no readable pressure drop during the 1 hour's service life.
  16. Disconnect the absolute vacuum meter from the Schrader valves .
- Afterwards, the circuit must be filled with refrigerant as soon as possible

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### HVAC System

### 5 Maintenance and Overhaul Procedures

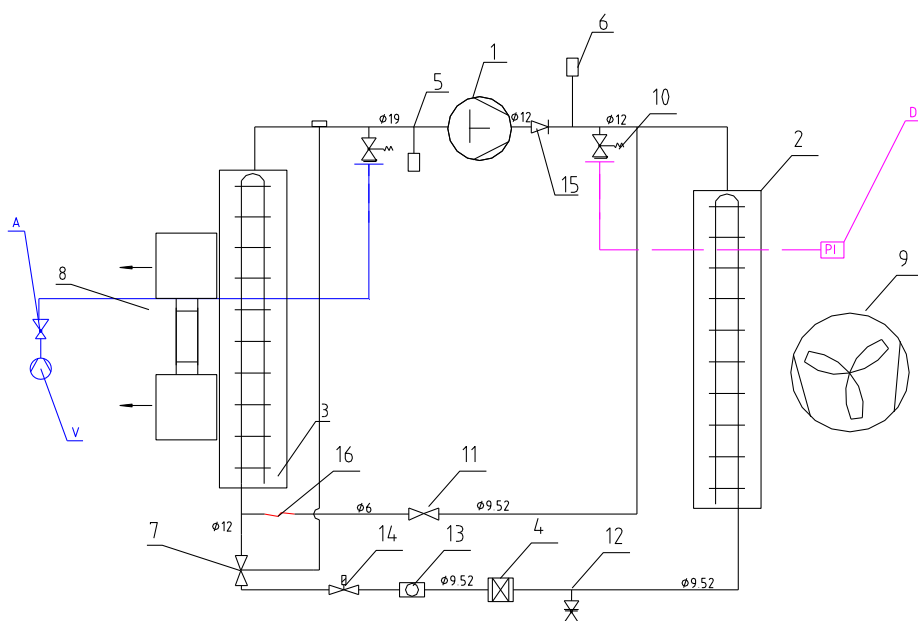


Figure 5.44-1 Vacuum the refrigerant circuit of cab HVAC unit

No.	Parts	Qua	8	supply air fan	1
1	Compressor	1	9	condenser fan	1
2	condenser	1	10	Schrader valve	2
3	Evaporator	1	11	hotgas bypass valve	1
4	Filter dryer	1	12	Charging valve	1
5	low pressure switch	1	13	sight glass	1
6	High pressure switch	1	14	liquid solenoid valve	1
7	Expansion valve	1		check valve	1

**V** vacuum pump    **D** precision pressure gauge    **A** shutoff valve

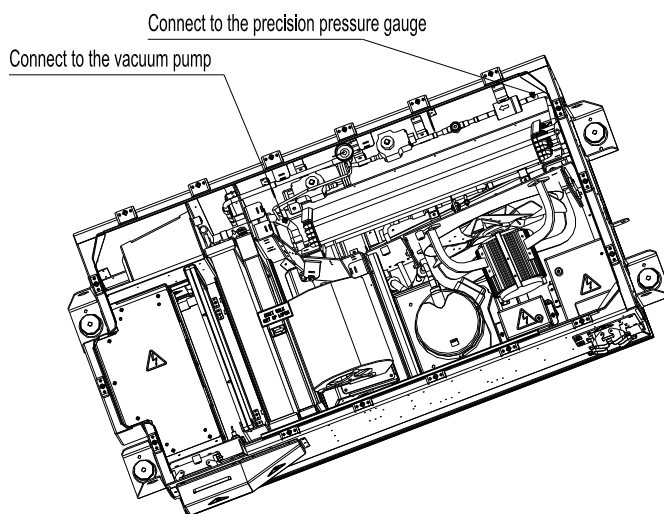


Figure 5.44-2 Vacuum the refrigerant circuit of cab HVAC unit

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HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.6 Vacuum the refrigerant circuit of the saloon HVAC unit

<b>Title: Vacuum</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To vacuum the refrigerant circuit.		
<b>System/Equipment Title:</b> Saloon HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Vacuum pump, Connecting hose, Absolute vacuum meter 0-150 mbar, 1 mbar step. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> N.A.		
<b>Illustrations:</b> -. <b>Reference Drawings:</b> KS97A100.400-00A.Z3		
<b>SAFETY PRECAUTIONS:</b> N.A.		

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5 Maintenance and Overhaul Procedures

**Down Time:** 1.5 hour

**Team Size:** 2 person

**Procedure:**

1. Open maintenance cover and the condenser fan bracket of the HVAC unit, see 5.4.2 and 5.4.3.
  2. For connection see the following figure.
  3. Remove the sealing caps on Schrader valve
  4. Connect the lines of the Vacuum pump to the Schrader valve.
  5. Open the solenoid valve electrically using an external power source (P), solenoid valve (1) in liquid line.
  6. Remove the sealing caps on Schrader valve.
  7. Connect absolute vacuum meter to Schrader valve.
  8. Open manual shutoff valve (A) in the connecting line and start the vacuum pump.
  9. Switch on the equipment to evacuate the refrigerant
  10. Evacuate up to a pressure less than 5 mbar.
  11. Switch off the vacuum pump.
  12. Disconnect the pipes between the vacuum pump and the Schrader valve.
  13. Examination of vacuum-tightness is made by a service life of 1 hour.
  14. Record the values of pressure and time from the beginning to the end of the vacuum-tightness test.
  15. The vacuum-tightness test is considered successful only if there is no readable pressure drop during the 1 hour's service life.
  16. Disconnect the absolute vacuum meter from the Schrader valve.
- Afterwards, the circuit must be filled with refrigerant as soon as possible

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### HVAC System

### 5 Maintenance and Overhaul Procedures

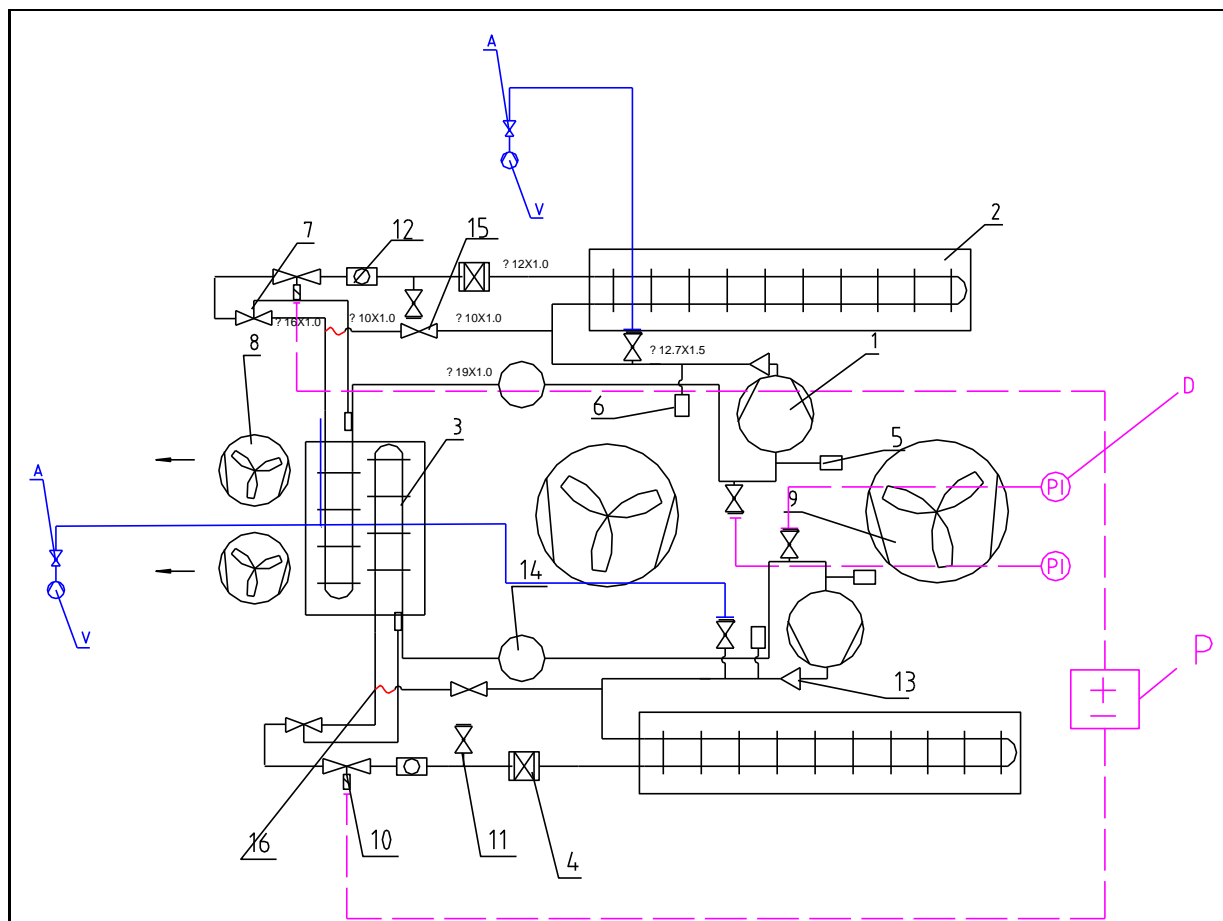


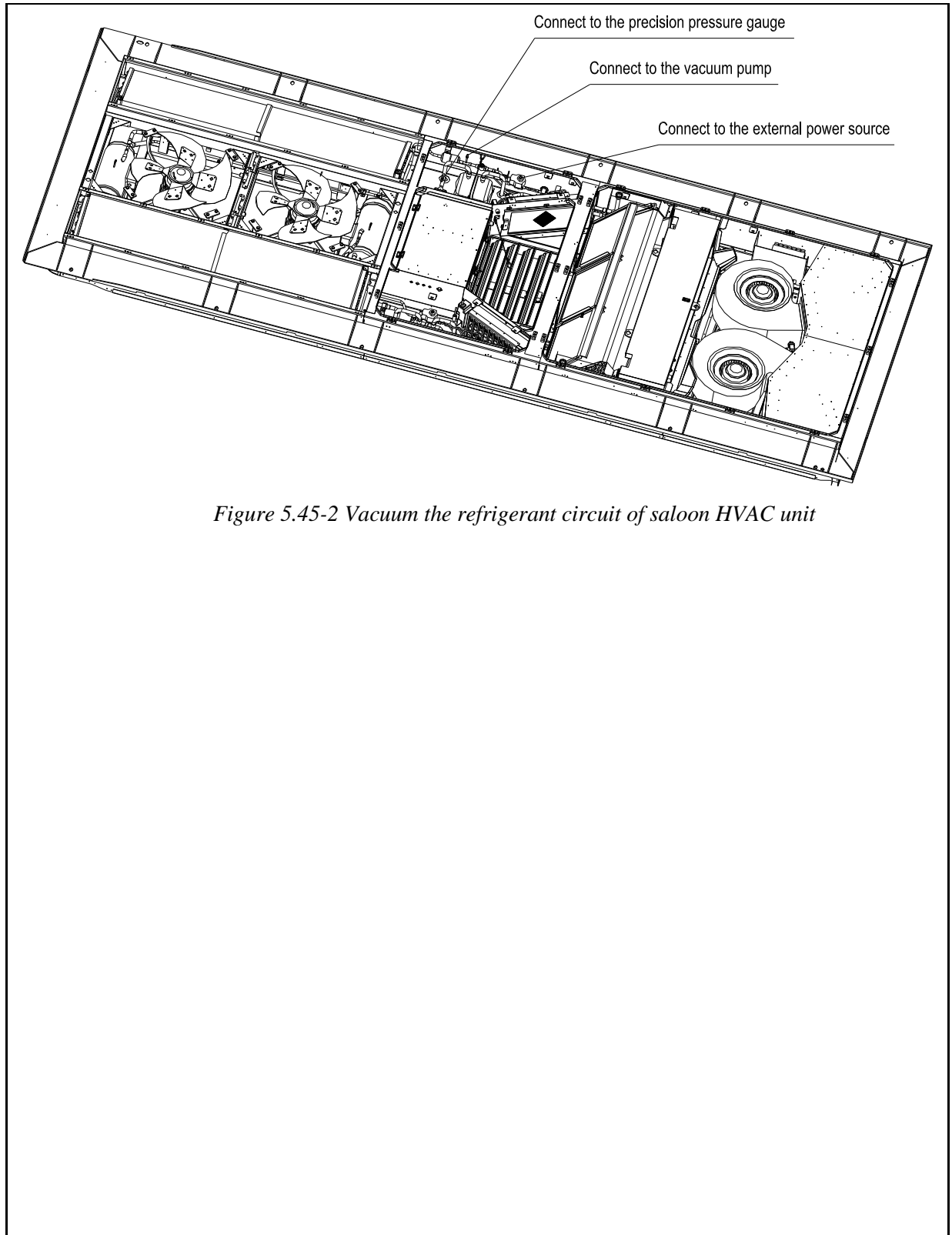
Figure 5.45-1 Vacuum the refrigerant circuit of saloon HVAC unit

No.	Parts	Qua
1	Compressor	2
2	condenser	2
3	Evaporator	1
4	Filter dryer	2
5	low pressure switch	2
6	High pressure switch	2
7	Expansion valve	2
8	supply air fan	2
9	condenser fan	2
10	liquid solenoid valve	2
11	Charging valve	4
12	sight glass	2
13	Check valve	2
14	accumulator	2
15	Hotgas bypass solenoid valve	2
16	Hotgas bypass capillary tube	2

**V** vacuum pump    **D** precision pressure gauge    **A** shutoff valve    **P** external power source

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*Figure 5.45-2 Vacuum the refrigerant circuit of saloon HVAC unit*


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HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.7 Filling with refrigerant for cab HVAC unit

<b>Title: Filling with refrigerant</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To Filling the refrigerant circuit with refrigerant.		
<b>System/Equipment Title:</b> Cab HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Refrigerant recharging system, Connecting hose. <b>Materials and Consumables:</b> Refrigerant R407C. <b>Essential Replacement Parts:</b> N.A.		
<b>Illustrations:</b> -. <b>Reference Drawings:</b> KS97C100.400-00A.Z3		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"><p style="color: red; text-align: center;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p></div>		

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HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 1.5 hour

**Team Size:** 2 person

**Procedure:**

1. Open maintenance cover of the HVAC unit, see 5.4.4.
2. Remove the sealing caps on Schrader valve
3. Connect the pipes of the filling equipment the suction line schrader valve.
4. Open the valve (E) of the filling equipment.
5. Fill a fixed amount (2.2Kg)of refrigerant.
6. Close the valve (E) of the filling equipment.
7. Disconnect the pipes between the filling equipment and the schrader valve.
8. Install the sealing caps on Schrader valve.

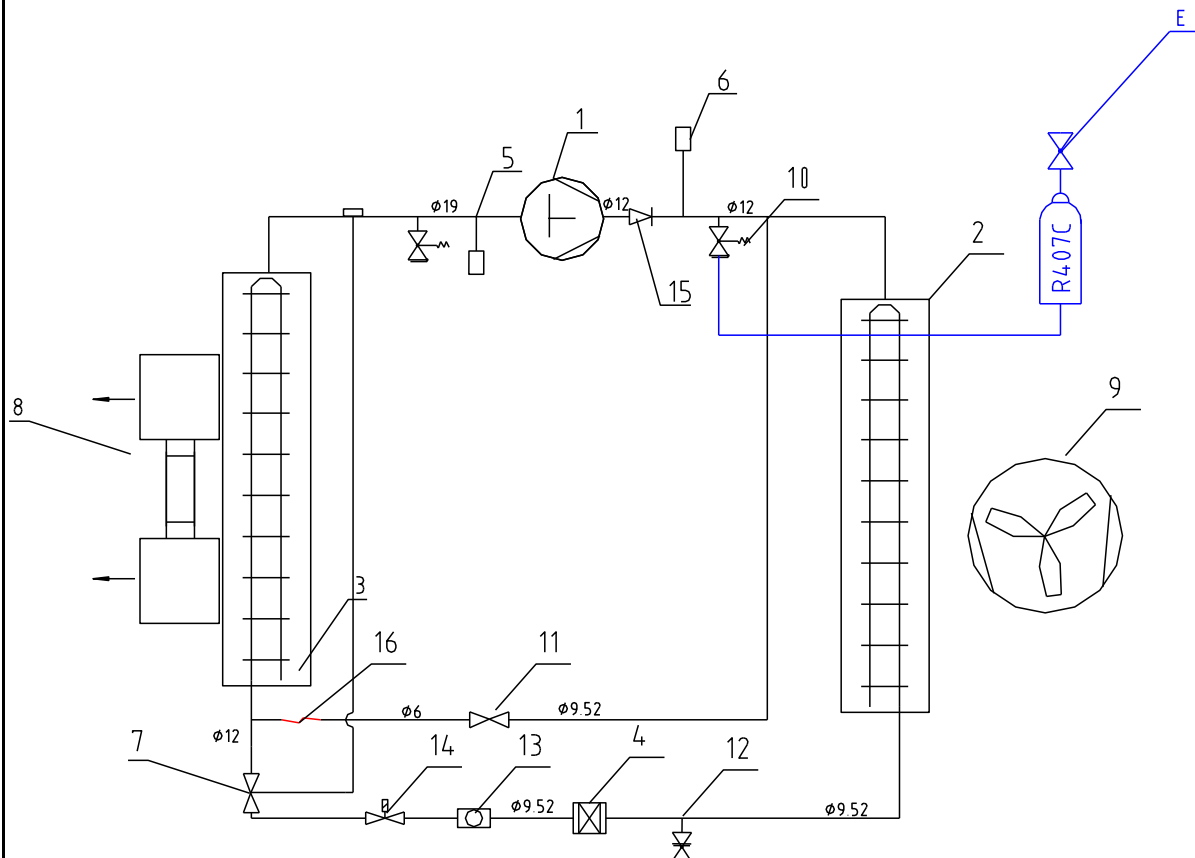


Figure 5.46-1 Filling the refrigerant circuit for cab HVAC unit

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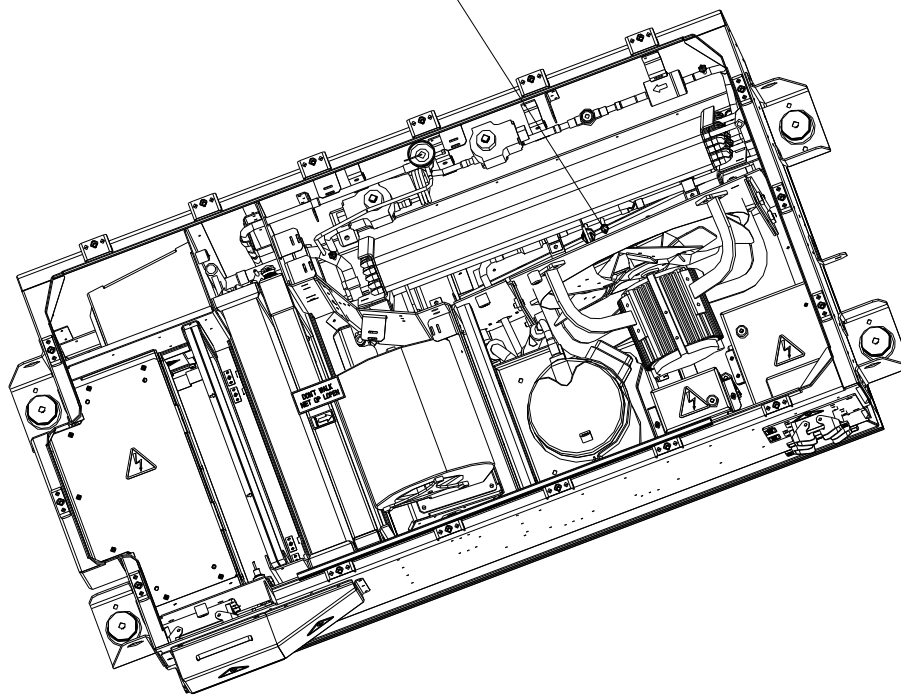
### HVAC System

### 5 Maintenance and Overhaul Procedures

No.	Parts	Qua	8	supply air fan	1
1	Compressor	1	9	condenser fan	1
2	condenser	1	10	Schrader valve	2
3	Evaporator	1	11	hot gas bypass valve	1
4	Filter dryer	1	12	Charging valve	1
5	low pressure switch	1	13	sight glass	1
6	High pressure switch	1	14	liquid solenoid valve	1
7	Expansion valve	1			1

**E** open valve

Connect to the filling equipment



*Figure 5.46-2 Filling the refrigerant circuit for cab HVAC unit*


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5 Maintenance and Overhaul Procedures

### 5.5.8 Filling with refrigerant for saloon HVAC unit

<b>Title: Filling with refrigerant</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To Filling the refrigerant circuit with refrigerant.		
<b>System/Equipment Title:</b> Saloon HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Refrigerant recharging system, Connecting hose. <b>Materials and Consumables:</b> Refrigerant R407C. <b>Essential Replacement Parts:</b> N.A.		
<b>Illustrations:</b> -. <b>Reference Drawings:</b> KS97A100.400-00A.Z3		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"><p style="color: red; text-align: center;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p></div>		

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**Down Time:** 1.5 hour

**Team Size:** 2 person

**Procedure:**

1. Open maintenance cover and the condenser fan bracket of the HVAC unit, see 5.4.2 and 5.4.3..
2. Remove the sealing caps on Schrader valve
3. Connect the pipes of the filling equipment the suction line schrader valve.
4. Open the solenoid valves electrically using an external power source (P) Solenoid valve (1) in liquid line.
5. Open the valve (E) of the filling equipment.
6. Fill a fixed amount (4.8 Kg)of refrigerant of each circuit.
7. Close the valve (E) of the filling equipment.
8. Disconnect the pipes between the filling equipment and the schrader valve.
9. Install the sealing caps on Schrader valve.

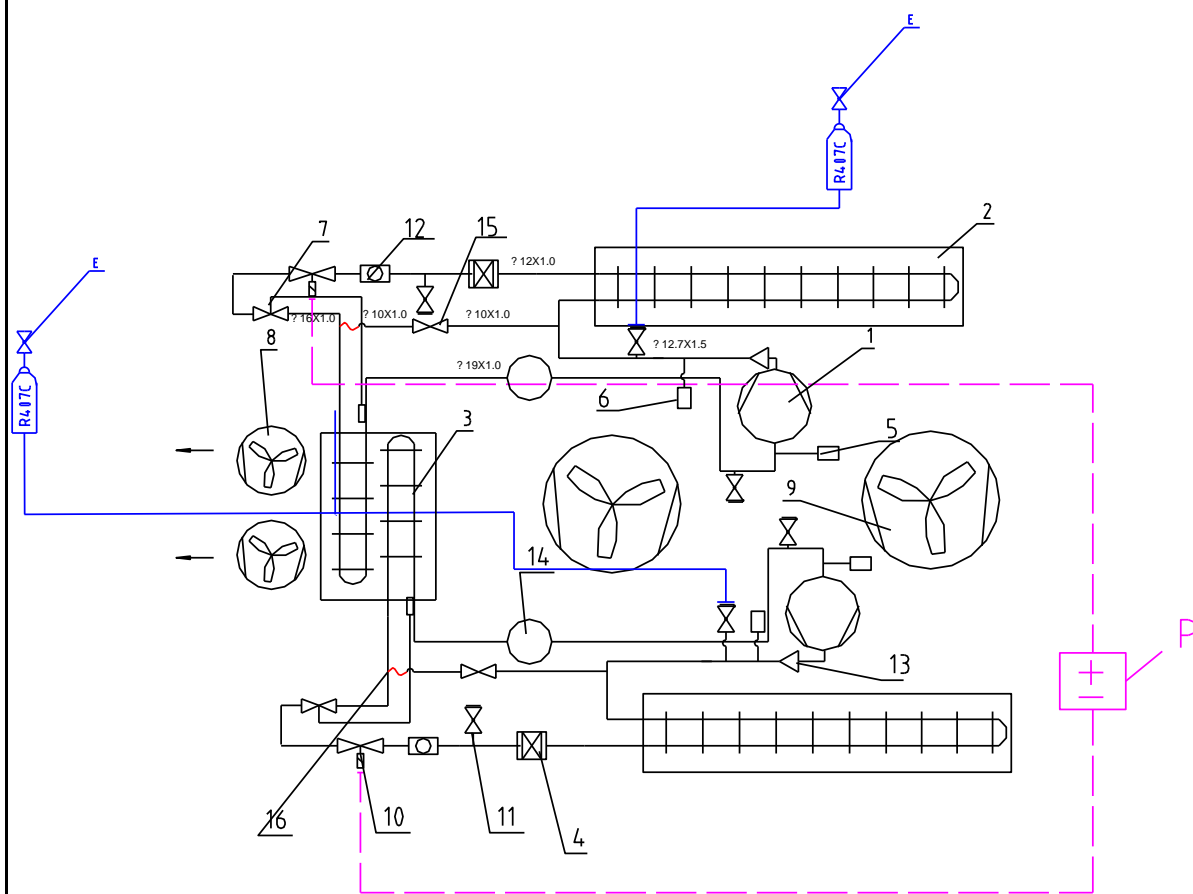


Figure 5.47-1 Filling the refrigerant circuit for saloon HVAC unit

# AMSTERDAM (Alstom)

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No.	Parts	Qua
1	Compressor	2
2	condenser	2
3	Evaporator	1
4	Filter dryer	2
5	low pressure switch	2
6	High pressure switch	2
7	Expansion valve	2
8	supply air fan	2
9	condenser fan	2
10	liquid solenoid valve	2
11	Charging valve	4
12	sight glass	2
13	Check valve	2
14	accumulator	2
15	Hotgas bypass solenoid valve	2
16	Hotgas bypass capillary tube	2

### E open valve

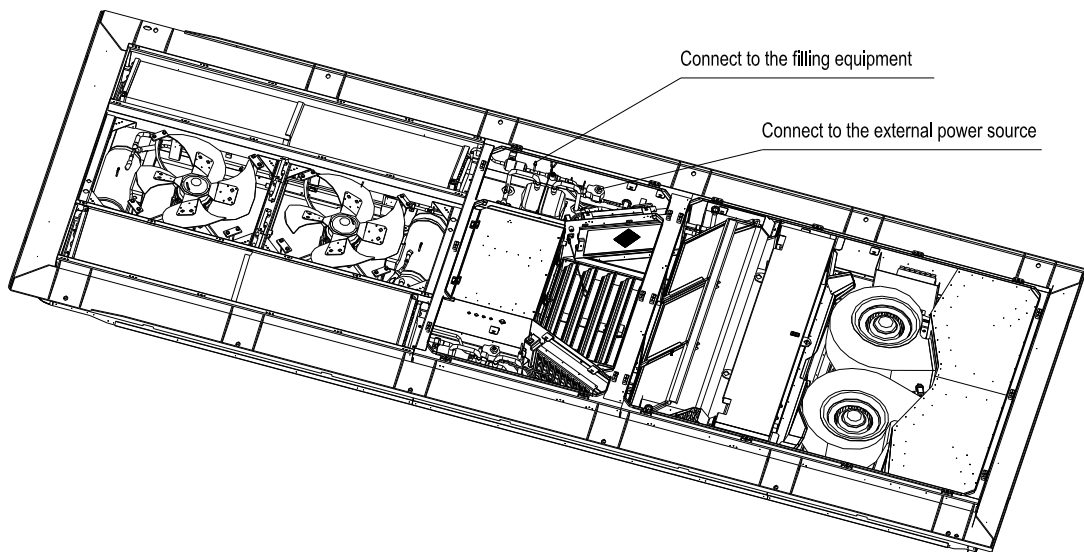


Figure 5.47-2 Filling the refrigerant circuit for saloon HVAC unit

# AMSTERDAM (Alstom)

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HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.9 Electronic leakage detection

<b>Title: Filling with refrigerant</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	<b>X</b>	<b>X</b>
<b>Reason for Task:</b> To Filling the refrigerant circuit with refrigerant.		
<b>System/Equipment Title:</b> Cab HVAC unit/ Saloon HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Electronic Leakage Detector. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> N.A.		
<b>Illustrations:</b> -. <b>Reference Drawings:</b> N.A.		
<b>SAFETY PRECAUTIONS:</b> N.A.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 1.5 hour

**Team Size:** 1 person

**Procedure:**

1. Detect all joints of assembling and/or repairing (solder, welding and bolt connections.
2. Detect all valves and/or connectors which are repaired or operated during assembly or maintenance.

Since the refrigerant gas is heavier than the air, the leakage detection must begin from the most highly arranged junction points.

The searching speed should be selected in such a way that enough time at the potential leakage point is guaranteed.

Do the leakage detection test thoroughly.




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.10 Replace supply air fan of cab HVAC Unit

<b>Title: Supply air Fan -Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
	<b>X</b>		
<b>Reason for Task:</b> To replace Supply air Fan. (every 5 years or failure)			
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Supply air Fan. <b>Parts number:</b> 12.0201.0067			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> D2E146-AP43-C9			
<b>SAFETY PRECAUTIONS:</b>  <table border="1" data-bbox="352 1603 564 1655"><tr><td> <b>CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			 <b>CAUTION</b>
 <b>CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.20 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

1. Cut off the power supply.
2. Remove all the screws(M8) which fix the maintenance cover to the frame of HVAC unit.
3. Open the cover and remove it, see 5.4.4.
4. Disconnect the connector of supply air fan.
5. Remove the screws (M6X16) of the supply air fan by using an articulated wrench (see following figure), which fix the fan to the frame of HVAC Unit.
6. Remove the fan out of HVAC Unit.

**Assembly:**

1. Place supply air fan in the right location.
2. Tighten the fixing screws (M6X16) of supply air fan.
3. Reconnect the the connector of supply air fan.
4. Replace the cover.
5. Tighten the screws(M8) which fix the cover to the frame.

The special tool needed in this procedure is showed in following:

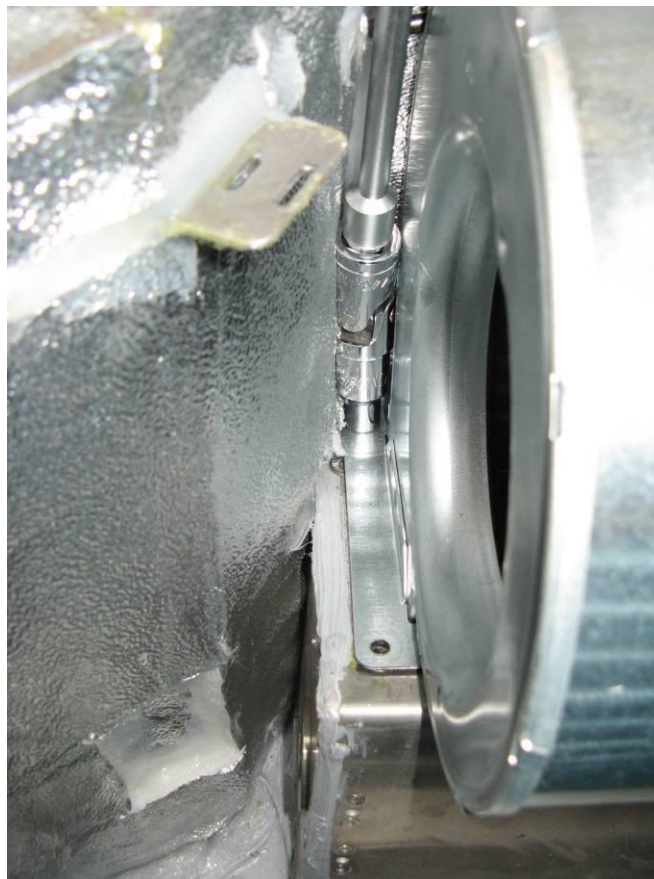
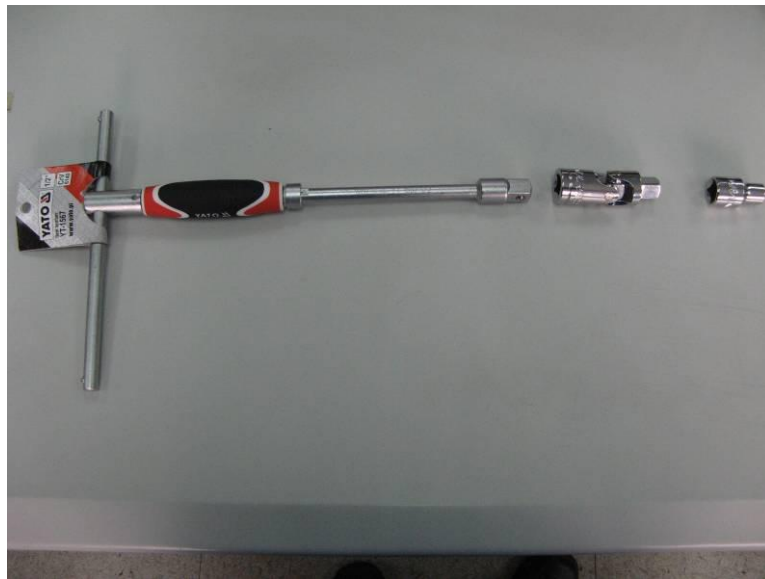


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures



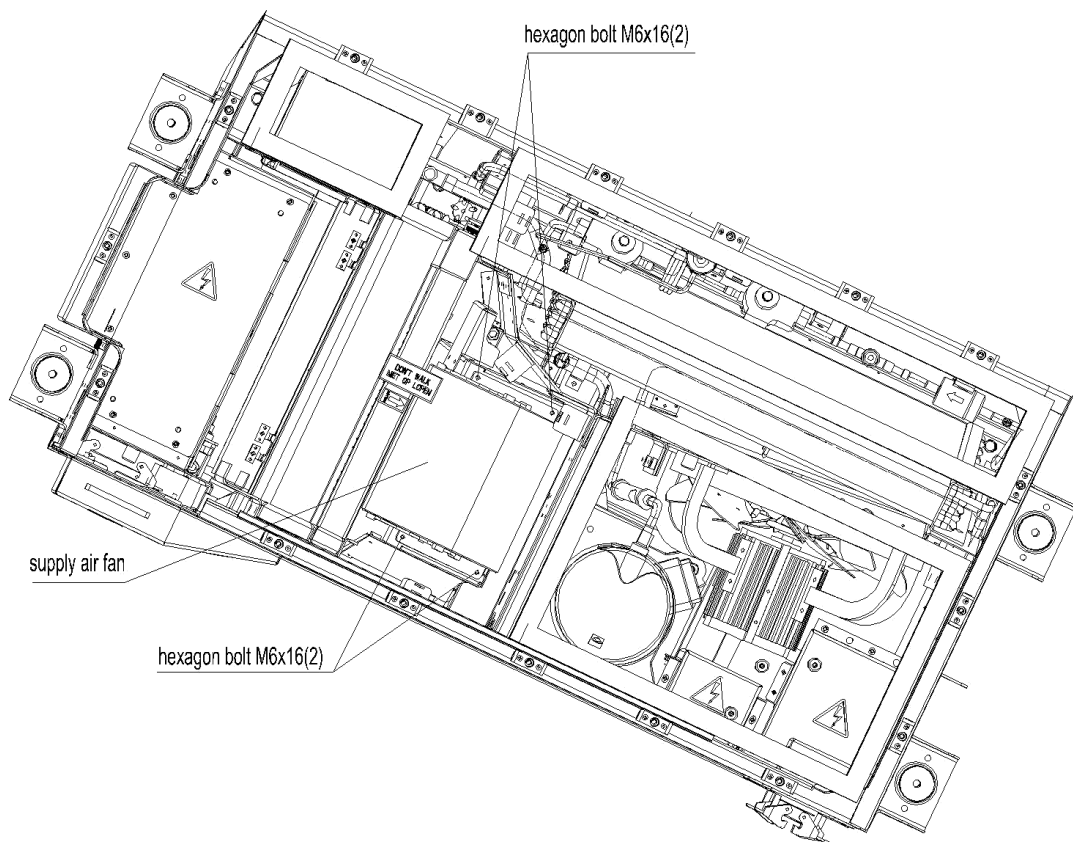
*Figure 5.48 Articulated wrench*

# AMSTERDAM (Alstom)

## Rolling Stock

The wrench is composed of three parts.

1. T-socket wrench YATO YT-1567 1/2"
2. Universal joint ENDURA E4551
3. Hexagon sleeve ENDURA E3510



*Figure 5.49 Replace supply air fan of cab HVAC unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.11 Replace supply air fan motor/impeller of saloon HVAC unit

<b>Title:</b> Supply air Fan motor /impeller-Replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace Supply air Fan motor/impeller. (every 5 years or failure)		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Supply air Fan motor/impeller. <b>Parts number:</b> 12.0203.2012(L); 12.0203.2013(R), 12.0203.0039		
<b>Illustrations:</b> -. <b>Reference Drawings:</b> ERAD 281-4A-L; ERAD 281-4A-R		
<b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"><b>▲ CAUTION</b></div> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.50 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

1. Cut off the power supply.
2. Remove all the screws(M8) which fix the maintenance cover to the frame of HVAC unit.
3. Open the cover and remove it.
4. Disconnect the connector of the supply air fans.
5. Remove the screws (M8X50) of the supply air fans, which fix the fans onto the bottom of HVAC Unit.
6. Remove the fans out of HVAC Unit.
7. Release the motor flange
8. Uninstall the 4 bolts fixing the fan assembly to the fan housing, pull out the fan slowly from the volute of the fan.
9. Loosen the fastening bolts from the motor plane, pull put the lead cable slowly.
10. Loosen fastening impeller screws; remove the motor/impeller from the fan assembly.

**Assembly:**

1. Place a new motor/impeller in the right location, tighten the fastening impeller screws.
2. Lead cable through the motor plane hole, tighten motor plate bolts and attention to torque prevent injury screws
3. Put the fan into the fan housing, the impeller do not touch the housing to prevent the deformation
4. Tighten motor flange bolt, note lead cable position.
5. Place supply air fans in the right location.
6. Tighten the fixing screws (M8X50) of supply air fan.
7. Reconnect the connector of the supply air fan.
8. Replace the cover.
9. Tighten the screws(M8) which fix the cover to the frame.

# AMSTERDAM (Alstom)

## Rolling Stock

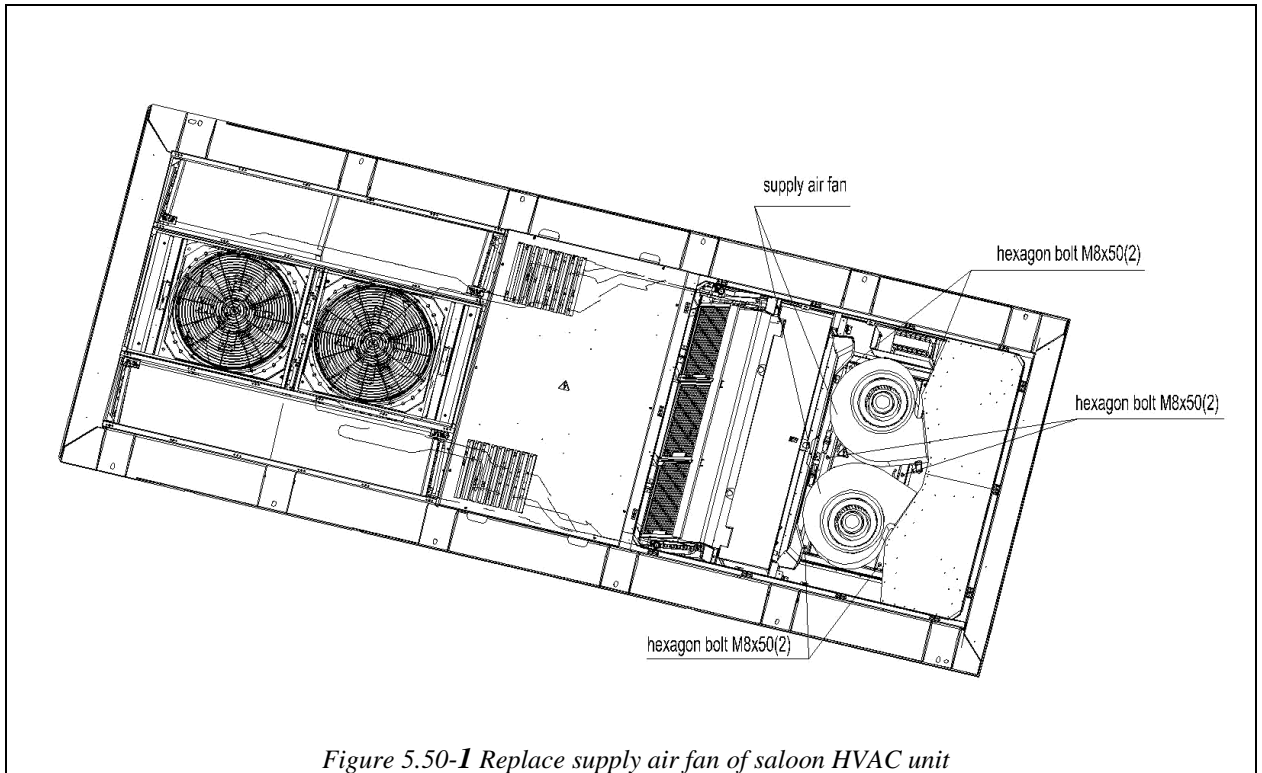
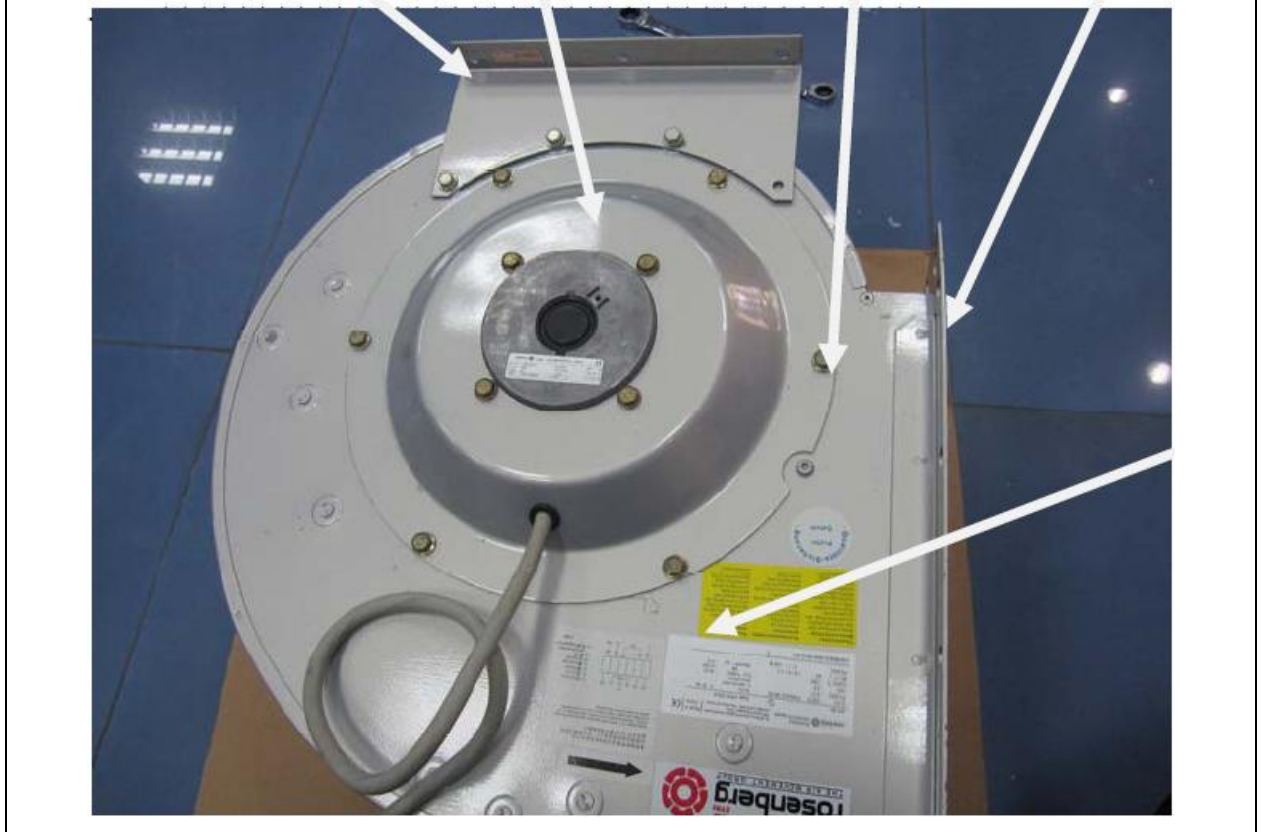


Figure 5.50-I Replace supply air fan of saloon HVAC unit



# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

### 5 Maintenance and Overhaul Procedures



*Figure 5.50-2 Replace supply air fan of saloon HVAC unit*


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.12 Replace supply air fan bumper of saloon HVAC unit

<b>Title:</b> Supply air Fan bumper -Replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> To replace Supply air Fan bumper.		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Supply air Fan bumper. <b>Parts number:</b> 12.0201.0185; 12.0201.0186		
<b>Illustrations:</b> -. <b>Reference Drawings:</b> ERAD 281-4-L; ERAD 281-4-R		
<b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.50 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

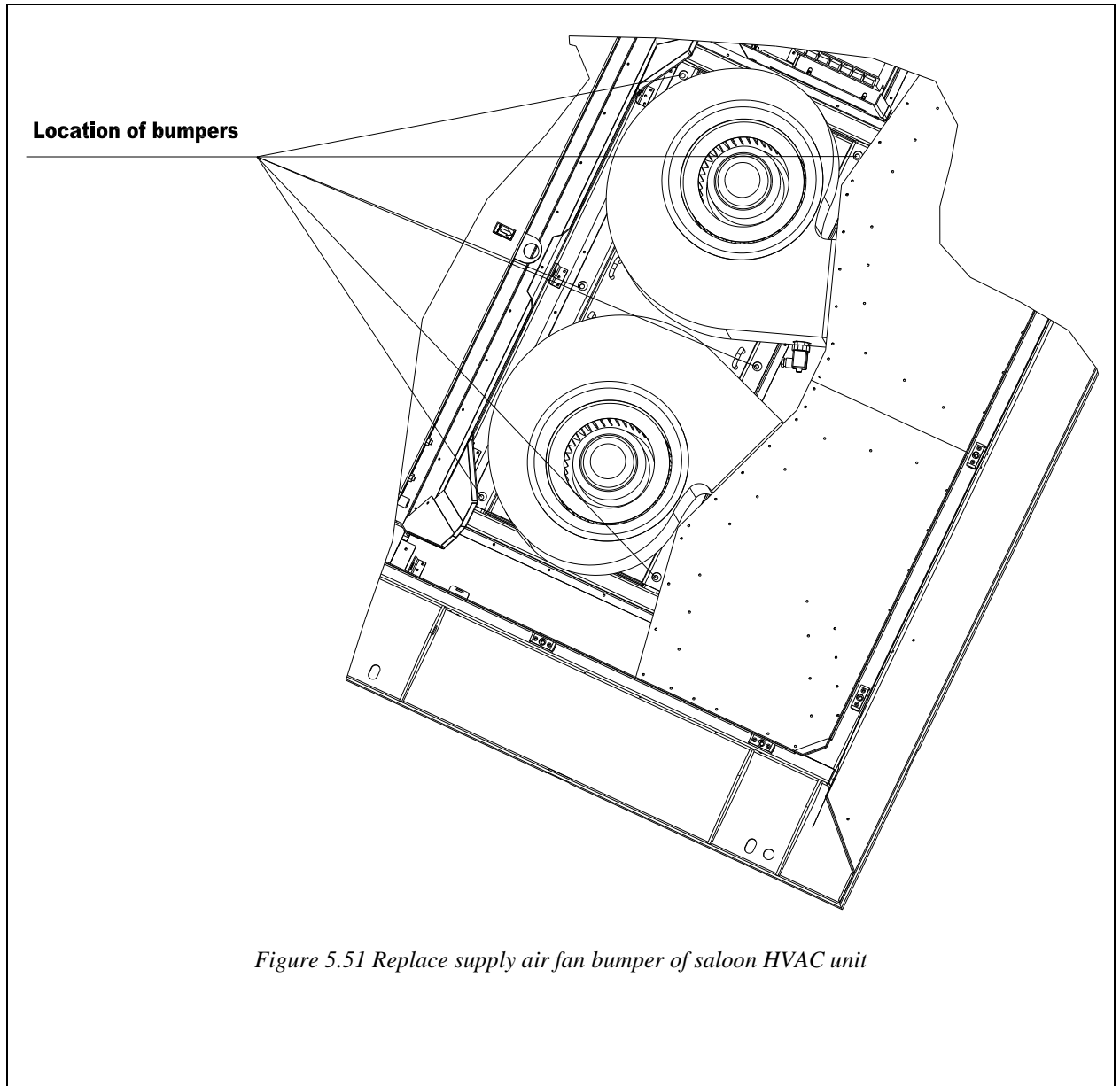
1. Cut off the power supply.
2. Remove all the screws(M8) which fix the maintenance cover to the frame of HVAC unit.
3. Open the cover and remove it.
4. Disconnect the connector of the supply air fans.
5. Remove the 6 screws (M8X50) of the supply air fans, which fix the fans onto the bottom of HVAC Unit.
6. Remove the fans out of HVAC Unit.
7. Remove the bumper(s) out of HVAC unit.

**Assembly:**

1. Place bumper(s) in the right location.
2. Place supply air fans in the right location.
3. Tighten the fixing screws (M8X50)of supply air fan.
4. Reconnect the connector of the supply air fan.
5. Replace the cover.
6. Tighten the screws(M8) which fix the cover to the frame.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.51 Replace supply air fan bumper of saloon HVAC unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.13 Replace transformer of saloon HVAC unit

<b>Title: Transformer -Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To replace transformer.			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Transformer. <b>Parts number:</b> 12.0511.0015			
<b>Illustrations:</b> . <b>Reference Drawings:</b> SOG-2-0.4/0.14-0.35			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

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**Down Time:** 0.30 hours

**Team Size:** 1 person

**Procedure:**

**Disassembly:**

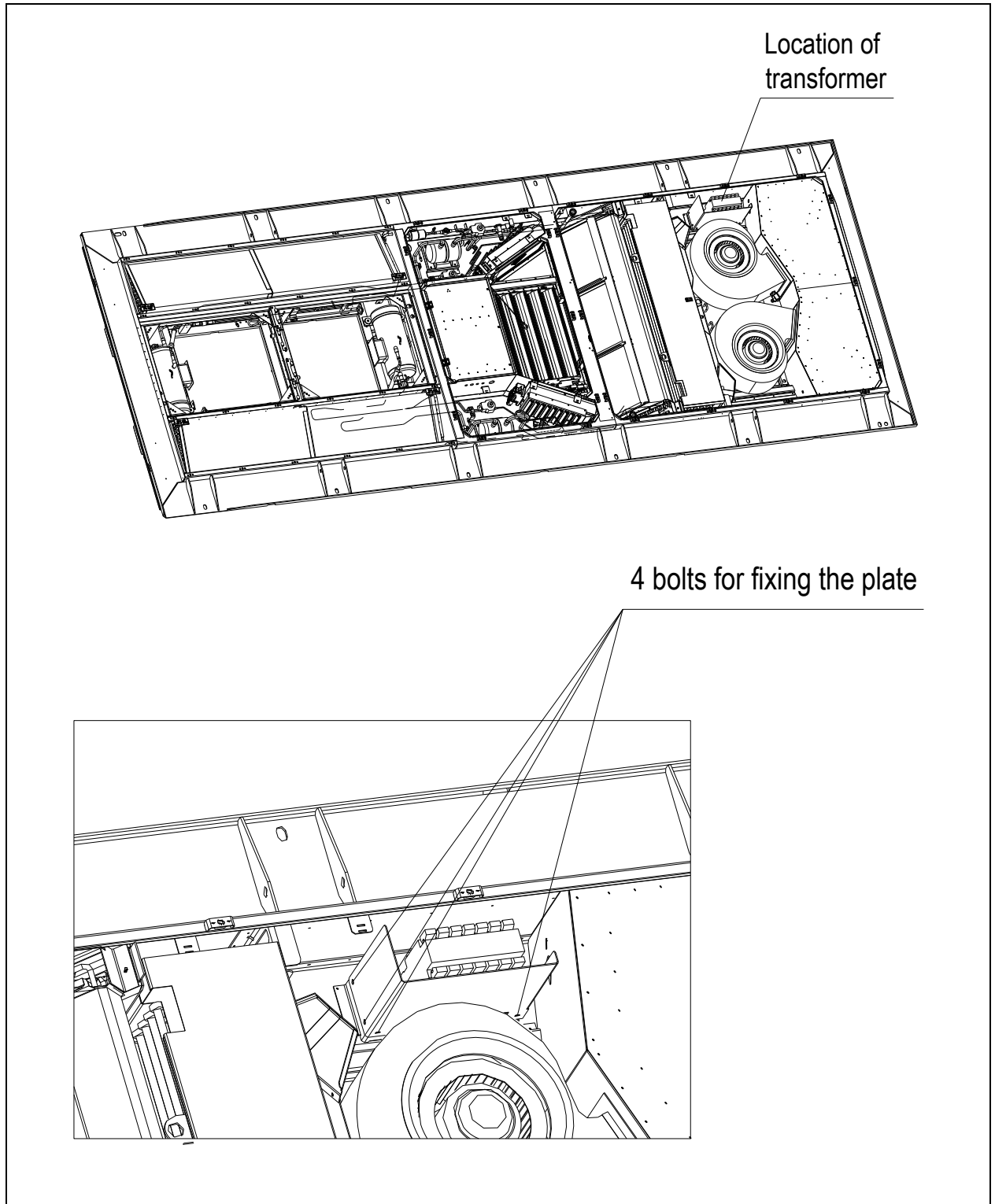
1. Cut off the power supply.
2. Open the cover and remove it, see 5.4.1.
3. Find the location of the transformer, Use a wrench to loosen the 4 bolts for fixing the plate and remove the plate.
4. Use a wrench to loosen the 3 bolts for fixing the transformer. Then take out the clamp.
5. Remove the transformer out of HVAC Unit.

**Assembly:**

1. Place a new transformer in the right location.
2. Replace the clamp, then replace the 3 bolts for fixing the transformer and tighten them.
3. Replace the plate and then replace the 3 bolts for fixing the transformer and tighten them.
4. Replace the cover.
5. Tighten the screws which fix the cover to the frame.

# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock

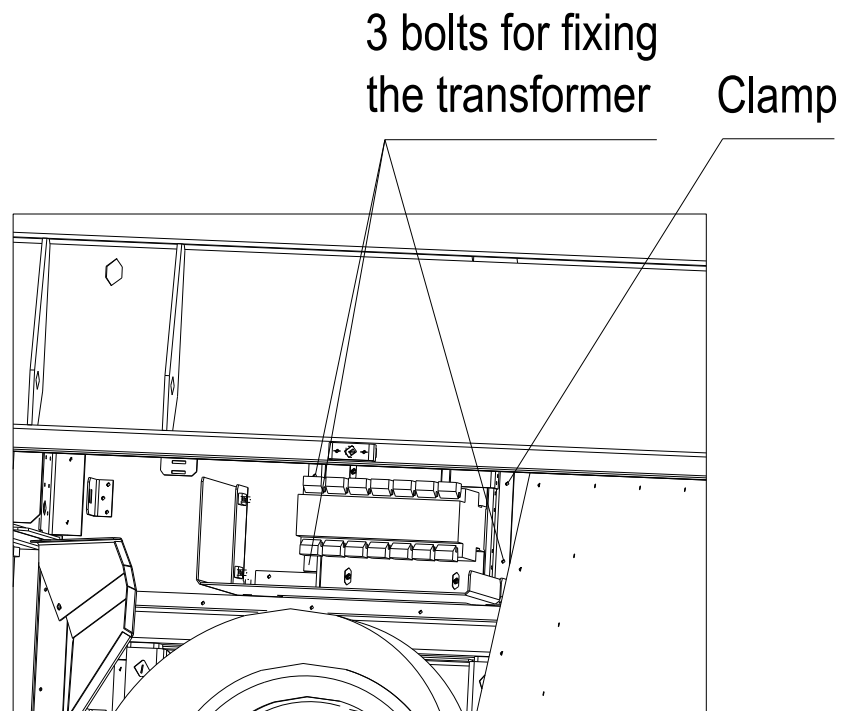


Figure 5.52 Replace transformer of saloon HVAC unit

### 5.5.14 Replace condenser fan of saloon HVAC unit

<b>Title: Condenser Fan - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Reason for Task:** To replace the Condenser Fan.(in case of failure)

**System/Equipment Title:** Saloon HVAC Unit

**Manufacturer:** SFRT

**Type/Model No:** KS97

**Location of unit to be maintained:** on the ground.

**Special Tools and Facilities:**

Wrench, screwdriver.

**Materials and Consumables:**

N.A.

**Essential Replacement Parts:**

Condenser fan.

**Parts number:**

12.0202.0095

**Illustrations:**

TBD.

**Reference Drawings:**

KS97A100.000-02A.Z3

**SAFETY PRECAUTIONS:**

**▲CAUTION**

**SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS**

**REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.**

**WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.**

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.50 hours

**Team Size:** 2 person

**Procedure:Disassembly:**

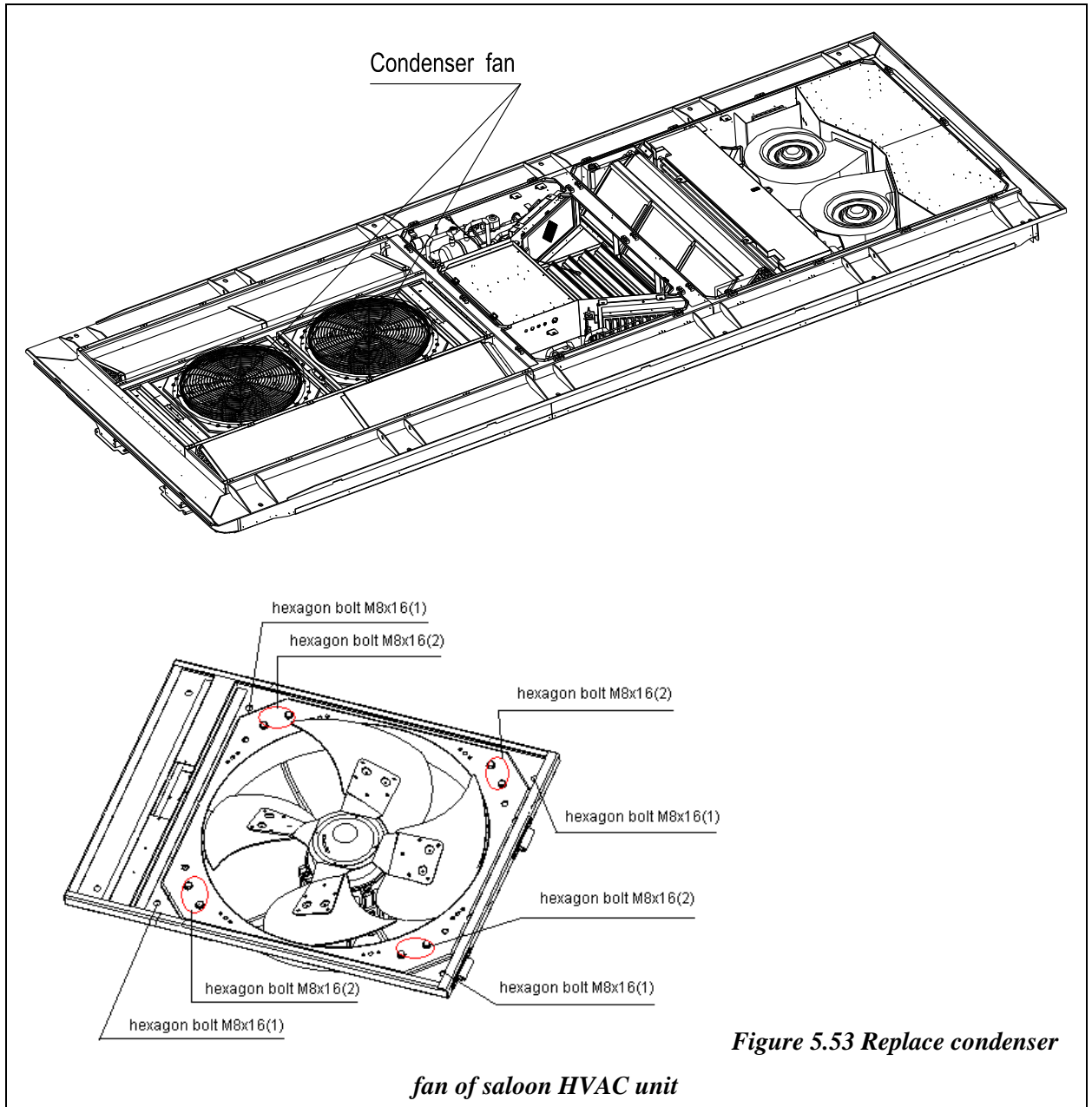
1. Open the condenser fan bracket of the HVAC unit, see 5.4.3.
2. Loosen the screws (M8X16)which fix the condenser fan to the frame.
3. Cut the ties which fix the cables to the frame.
4. Open the terminal box on the condenser fan motor.
5. Disconnect the power supply electric lines at the terminal board in the terminal box of condenser fan.
6. Loose gland of terminal box.
7. Draw the cable out of the gland.
8. Remove the butterfly pin from the hole of pin. And pull out the pin from the hole of hinges.
9. Remove the condenser fan assembly from the HVAC unit.
10. Loose the 4 bolts (4) fixing the fan assembly to the frame, and then remove fan assembly.

**Assembly:**

1. Tighten the screws(M8X16) fixing the fan assembly to the frame.
2. Place a new condenser fan in the right location.
3. Tighten the fixing screws that fix the condenser fan to the girder of the frame.
4. Plug the pin into the hole of hinges that connect the condenser fan assembly with the frame. And fix the butterfly pin.
5. Reconnect the wire to the terminal box of condenser fan.
6. Fix the cables to the frame via the tapes.
7. Reconnect the electric power supply.
8. Close the condenser fan bracket.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.53 Replace condenser*

*fan of saloon HVAC unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.15 Replace bumper for condenser fan of saloon HVAC unit

<b>Title: Bumper for condenser Fan - Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To replace the Bumper for Condenser Fan.			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.			
<b>Special Tools and Facilities:</b> Wrench, screwdriver. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Bumper for Condenser fan. <b>Parts number:</b> 12.0202.0095			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97A100.000-02A.Z3			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

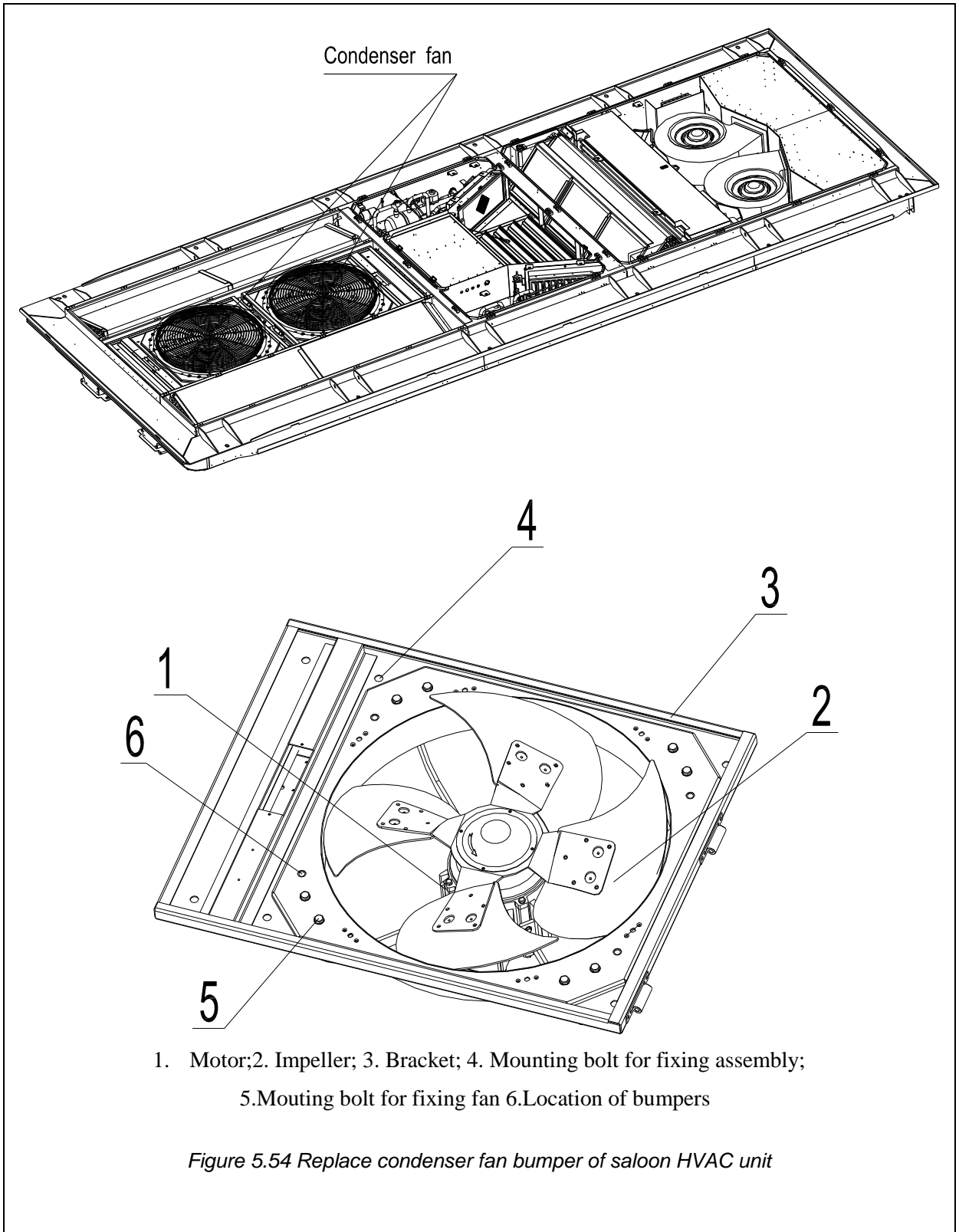
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**Down Time:** 0.50 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the condenser fan from HVAC unit, please refer to 5.5.14.
2. Uninstall the 8 bolts (5) in the following figure and remove the fan panel, then uninstall bolts (6) and remove the bumper for condenser fan.
3. Place new bumpers in right position, replace fan panel, install the bolts(6) and bolts(5).
4. Replace the condenser fan to HVAC unit, please refer to 5.5.14.



# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.16 Replace condenser fan motor of saloon HVAC unit

<b>Title: Condenser Fan motor - Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		X	
<b>Reason for Task:</b> To replace the Condenser Fan motor. (in case of failure)			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> Wrench, screw driver. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Condenser fan motor. <b>Part number:</b> 12.0202.0095			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97A100.000-02A.Z3			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲ CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲ CAUTION</b>
<b>▲ CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.50 hours

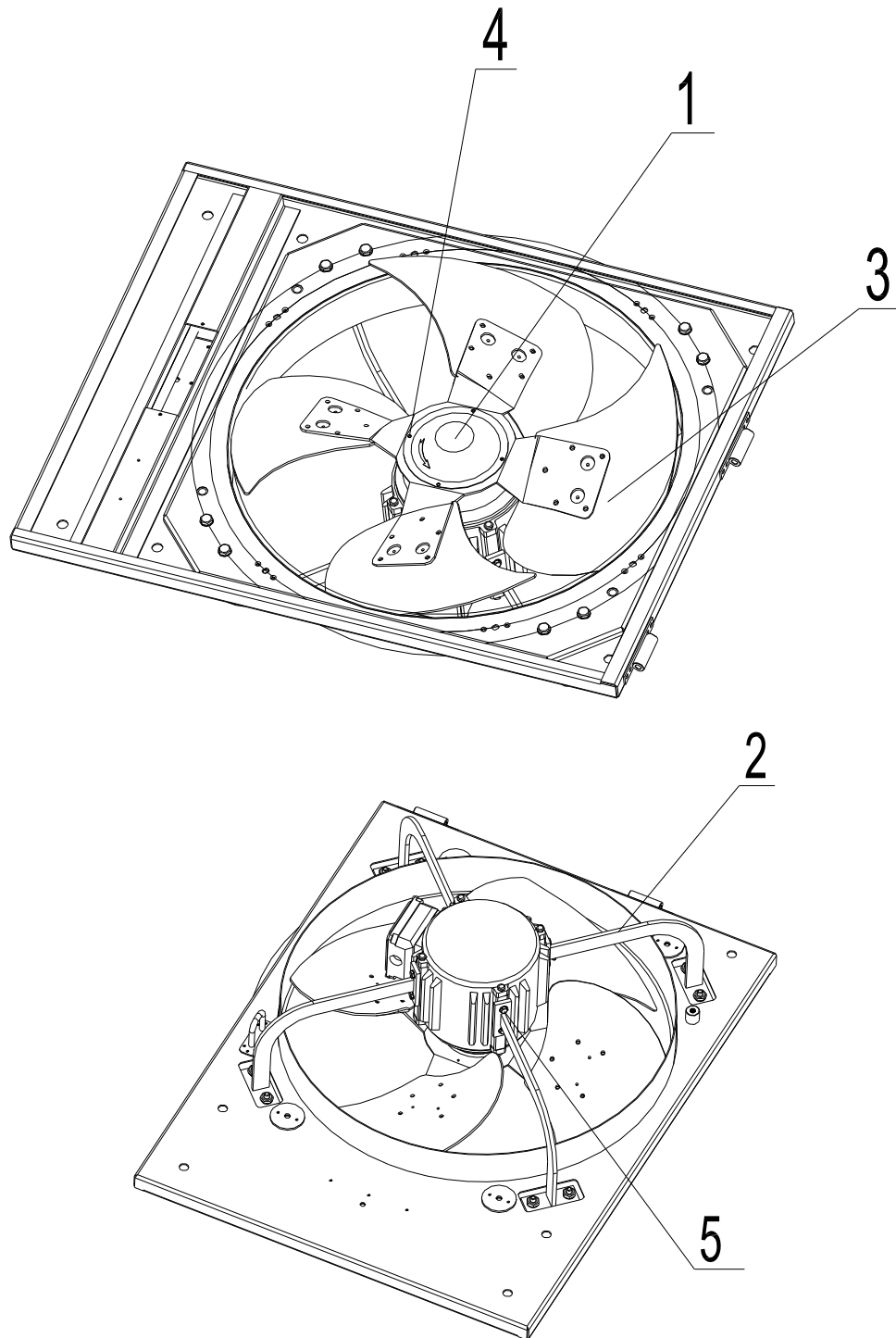
**Team Size:** 2 person

**Procedure:**

1. Remove the condenser fan assembly from the Saloon HVAC Unit.
2. Remove fan ring mount (2) Figure 5.55 from the fan motor housing. At first Use a wrench to loosen hexagon nuts (5) Figure 5.55.
3. Loosen the bolts (4) Figure 5.55 and pull cover hood (1) Figure 5.55,loosen the hexagon bolts which fix the fan impeller and the motor, and then separate the condenser fan impeller and the fan motor shaft.
4. Install the replacement condenser motor in reverse order.
5. Assembly of condenser fan.

# AMSTERDAM (Alstom)

## Rolling Stock



1. Cover hood    2. Fan ring mount    3. Condenser fan impeller  
4. Bolts    5. Hexagon nut

*Figure 5.55 Replace condenser fan motor*


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.17 Replace condenser fan motor bearing of saloon HVAC unit

<b>Title: Condenser Fan motor bearing - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the Condenser Fan motor bearing.(every 10 years or failure)		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Wrench, screwdriver. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Condenser fan motor bearing. <b>Parts number:</b> 12.0202.0095		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97A100.000-02A.Z3		
<b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.50 hours

**Team Size:** 2 person

**Procedure:**

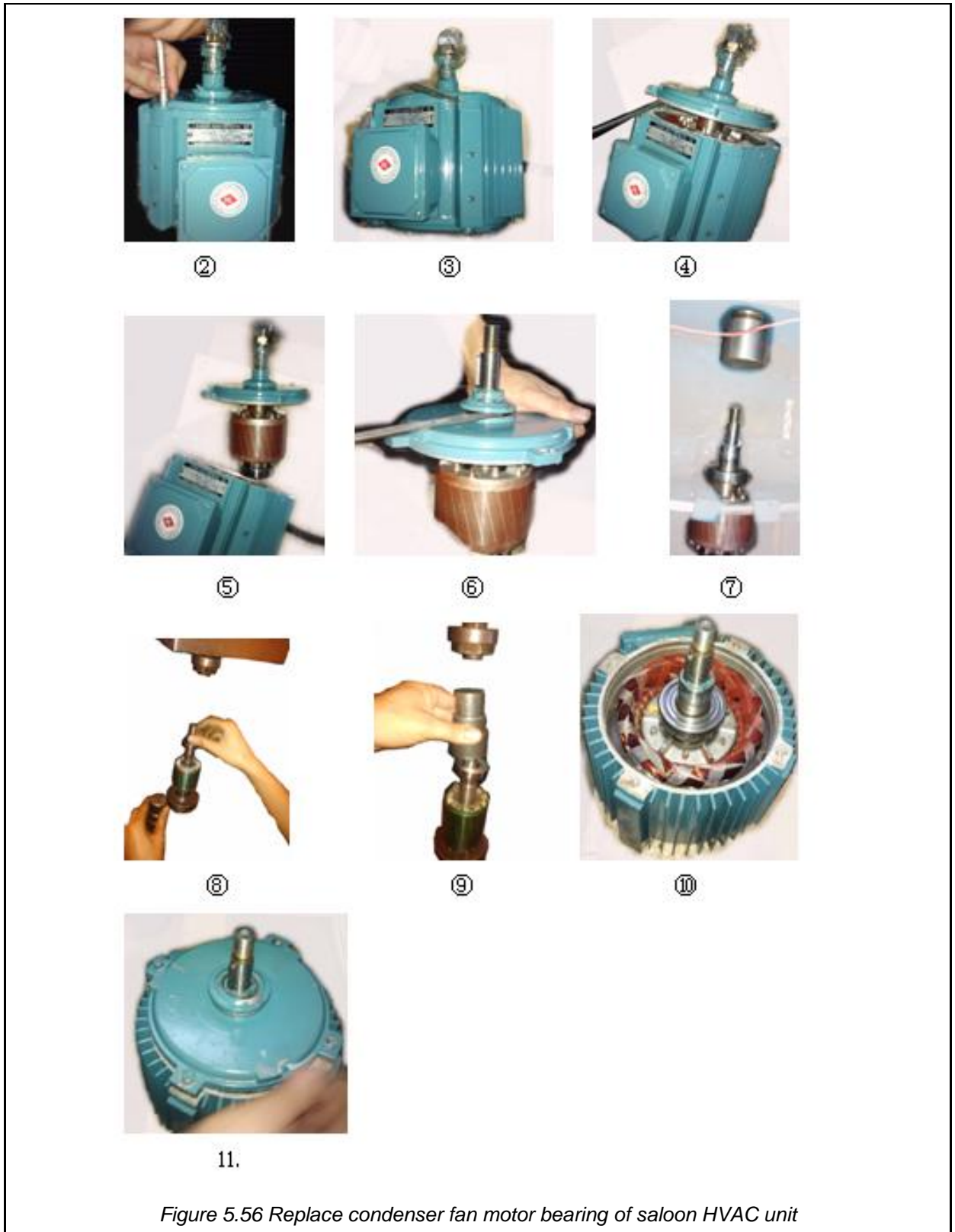
1. Remove fan from HVAC unit and then uninstall the motor from fan assembly, please refer to 5.5.16 and 5.5.17.
2. Use a wrench to open the motor cover.
3. Pry the motor cover with a flat screwdriver.
4. Take out the motor cover.
5. Take the rotor out.
6. Pry the waterproof cover open.
7. Press out the bearing with hydraulic.
8. Change the new bearing with hydraulic.
9. Press the bearing back with hydraulic.
10. Put the rotor into the base after changing the bearing.
11. Fit the motor cover.
12. Install the motor to fan assembly and then replace fan to HVAC unit, please refer to 5.5.16 and 5.5.17.

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures



# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.18 Replace condenser fan impeller of saloon HVAC unit

<b>Title:</b> Condenser fan impeller - Replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the Condenser fan impeller. (in case of failure)		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Wrench. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Condenser fan impeller. <b>Part number:</b> 12.0202.0095		
<b>Illustrations:</b> Figure 1-2: Condenser Fan of Chapter 7 Parts Catalogue. <b>Reference Drawings:</b> KS97A100.000-02A.Z3		
<b>SAFETY PRECAUTIONS:</b>  <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-bottom: 10px;"> <b>▲ CAUTION</b> </div> <p style="text-align: center; margin: 0;"><b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b></p> <p style="text-align: center; margin: 0;"><b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b></p> <p style="text-align: center; margin: 0;"><b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b></p>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

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**Down Time:** 0.50 hours

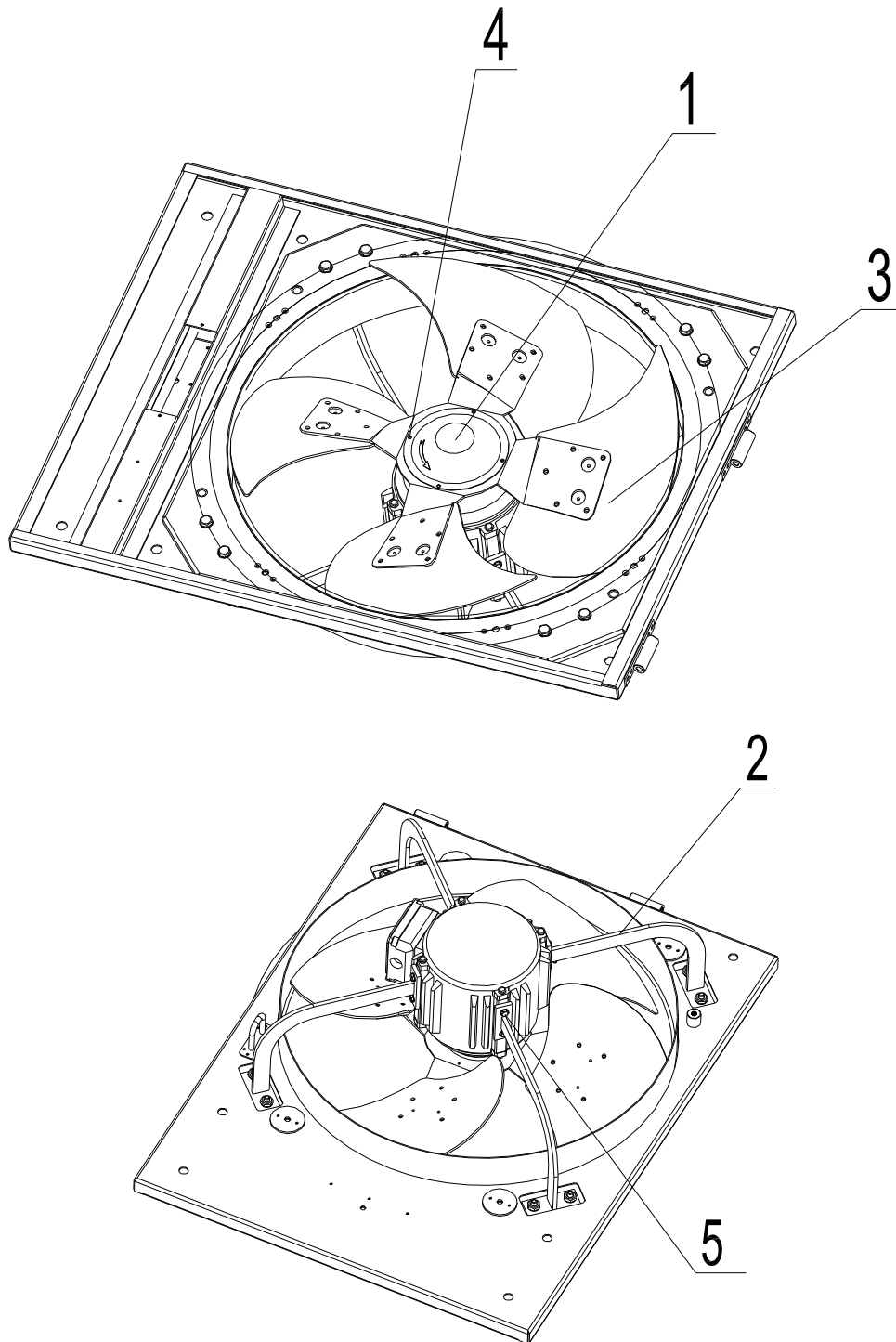
**Team Size:** 2 person

**Procedure:**

1. Remove the condenser fan assembly from the Saloon HVAC Unit.
2. Remove fan ring mount (2) Figure 5.57 from the fan motor housing. At first Use a wrench to loosen hexagon nuts (5) Figure 5.57.
3. Loosen the bolts (4) Figure 5.57 and pull cover hood (1) Figure 5.57, loosen the hexagon bolts which fix the fan impeller and the motor, and then separate the condenser fan impeller and the fan motor shaft.
4. Install the replacement condenser fan impeller in reverse order.
5. Assembly of condenser fan.

# AMSTERDAM (Alstom)

## Rolling Stock



1. Cover hood    2. Fan ring mount    3. Condenser fan impeller  
4. bolts    5. Hexagon nut

*Figure 5.57 Replace condenser fan impeller*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.19 Replace cab HVAC condenser fan

<b>Title: Condenser fan - Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
	X		
<b>Reason for Task:</b> To replace the Condenser fan. (in case of failure)			
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Condenser fan. <b>Parts number:</b> 12.0202.0099.			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97C100.000-02A.Z3.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.50 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

1. Open the cover and remove it, see 5.4.4.
2. Draw the cable of the condenser fan out of the connection terminal which located on the control panel.
3. Cut the tapes which fix the cable to the frame.
4. Remove the screws (M8X20) that fix the condenser fan and the fan grille to the frame.
5. Remove the condenser fan from the unit.

**Assembly:**

1. Place a new condenser fan in the right location.
2. Tighten the fixing screws (M8X20) that fix the condenser fan and the fan grille to the cover.
3. Reconnect the cable of the condenser fan to the connection terminal.
4. Fix the cable to the frame via the tapes.
5. Reconnect the electric power supply.
6. Close the cover of the unit.

# AMSTERDAM (Alstom)

## Rolling Stock

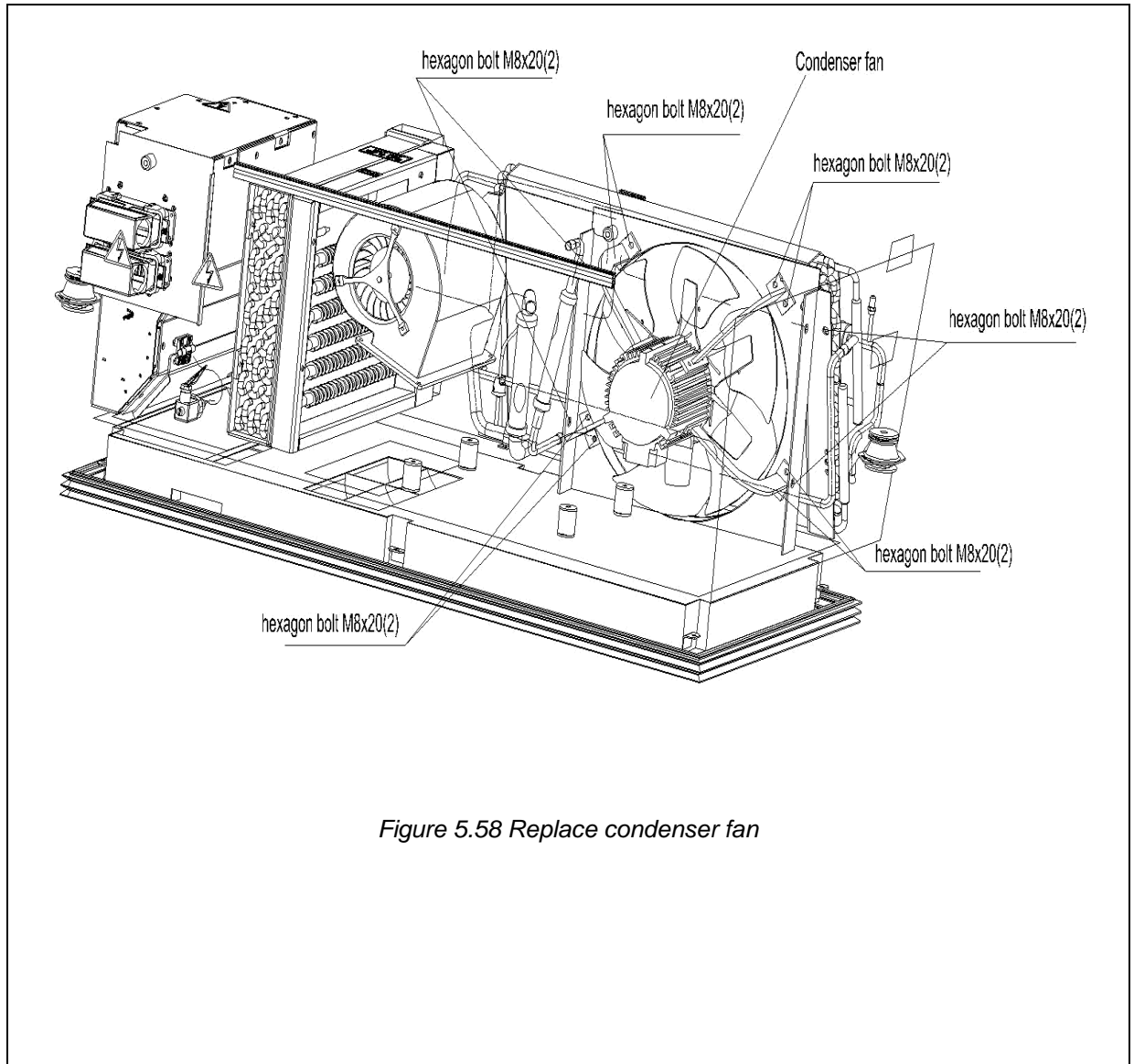


Figure 5.58 Replace condenser fan

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.20 Replace condenser fan motor of cab HVAC unit

<b>Title: Condenser fan motor - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	<b>X</b>	
<b>Reason for Task:</b> To replace the Condenser fan motor. (every 10 years or failure)		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Socket wrench, cross screwdriver. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Condenser fan motor. <b>Parts number:</b> 12.0202.0099		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97C100.000-02A.Z3		
<b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"><b>▲ CAUTION</b></div> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

---

**Down Time:** 0.50 hours

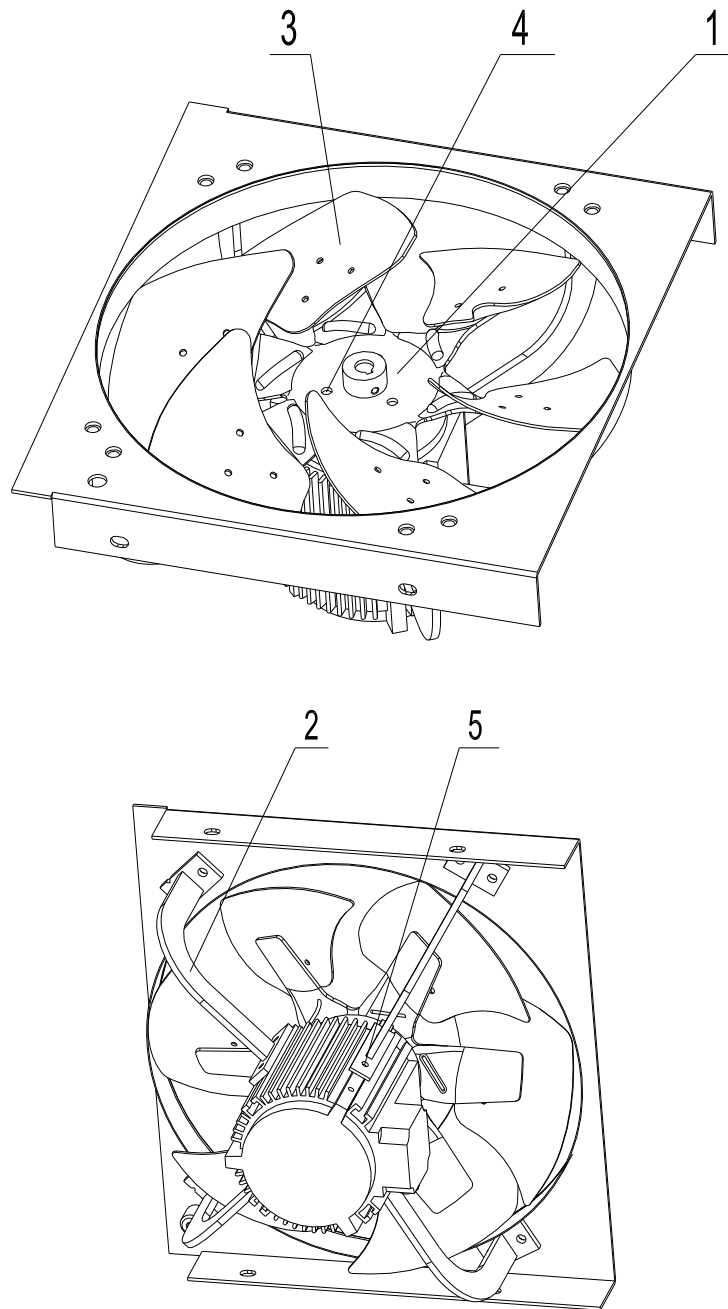
**Team Size:** 2 person

**Procedure:**

1. Remove the condenser fan assembly from the cab HVAC Unit.
2. Remove fan ring mount [(2) Figure 5.59] from the fan motor housing. At first loosen hexagon nuts [(5) Figure 5.59].
3. Loosen the four screws[ (4) Figure 5.59] and pull cover hood, spacer bush[ (1) Figure 5.59 ],and then loose the bolt which fix the motor and impeller,Separate the impeller and the motor.
4. Install the replacement condenser motor in reverse order.
5. Assembly of condenser fan.

# AMSTERDAM (Alstom)

## Rolling Stock



1. Cover hood with spacer bush    2. Fan ring mount    3. Condenser fan impeller  
4. Screw    5.Hexagon nut

*Figure 5.59 Replace condenser fan motor*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.21 Replace condenser fan impeller of cab HVAC unit

<b>Title: Condenser fan impeller - Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
	X		
<b>Reason for Task:</b> To replace the Condenser fan impeller. (in case of failure)			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Condenser fan impeller. <b>Parts number:</b> 12.0202.0099			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97C100.000-02A.Z3			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.50 hours

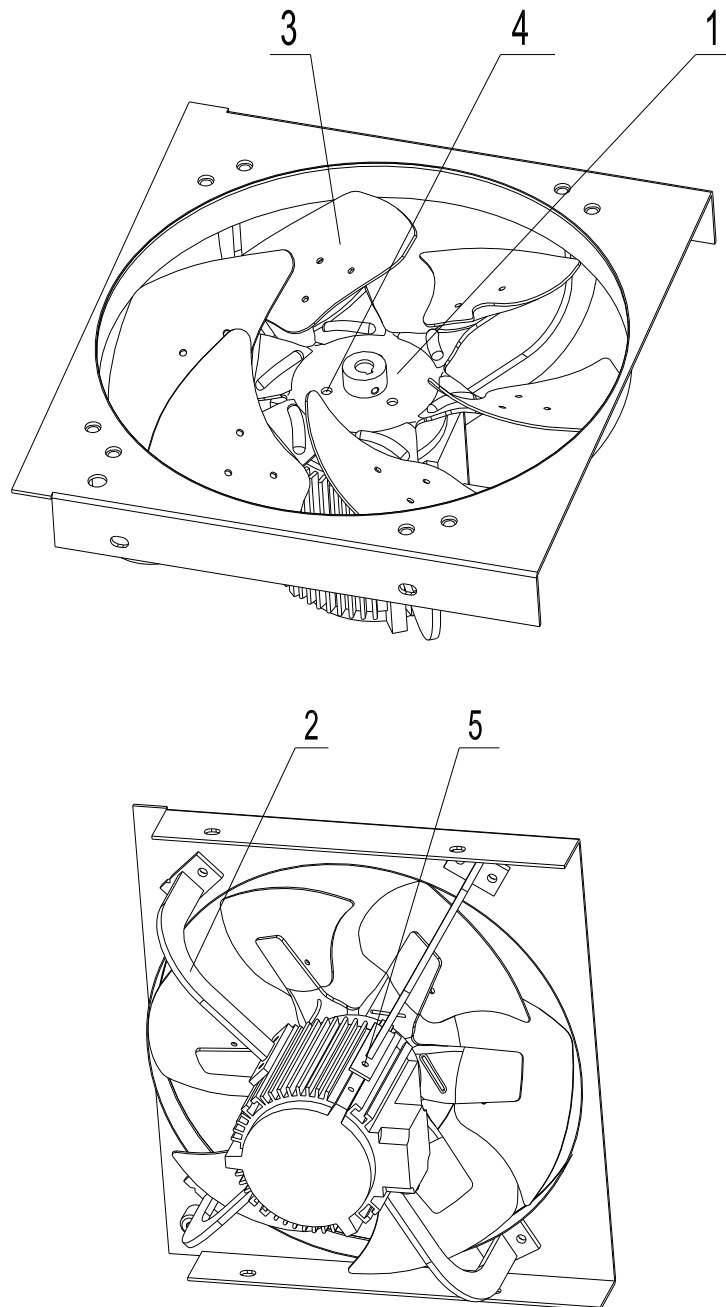
**Team Size:** 2 person

**Procedure:**

1. Remove the condenser fan assembly from the cab HVAC Unit.
2. Remove fan ring mount [(2) Figure 5.60] from the fan motor housing. At first loosen hexagon nuts [(5) Figure 5.60].
3. Loosen the four screws[ (4) Figure 5.60] and pull cover hood, spacer bush[ (1) Figure 5.60],and then loose the bolt which fix the motor and impeller,Separate the impeller and the motor.
4. Install the replacement condenser fan impeller in reverse order.
5. Assembly of condenser fan.

# AMSTERDAM (Alstom)

## Rolling Stock



1. Cover hood with spacer bush    2. Fan ring mount    3. Condenser fan impeller  
4. Screw    5.Hexagon nut

*Figure 5.60 Replace condenser fan impeller*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.22 Replace mixed air filter material of saloon HVAC unit

<b>Title: Mixed air filter material - replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To replace the mixed air filter material.			
<b>System/Equipment Title:</b> Mixed air filter material. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> Not applicable. <b>Essential Replacement Parts:</b> Return air filter material. <b>Parts number:</b> 12.1200.0155.			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97C100.000-05A.Z3.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1" data-bbox="352 1603 564 1653"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

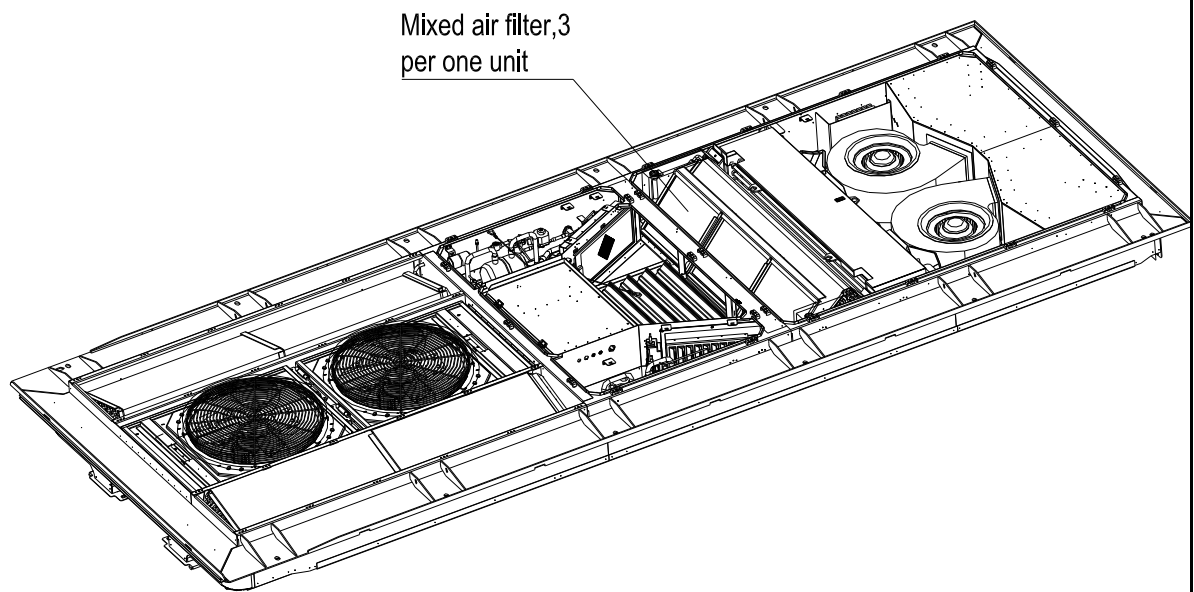
5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

**Team Size:** 1 person

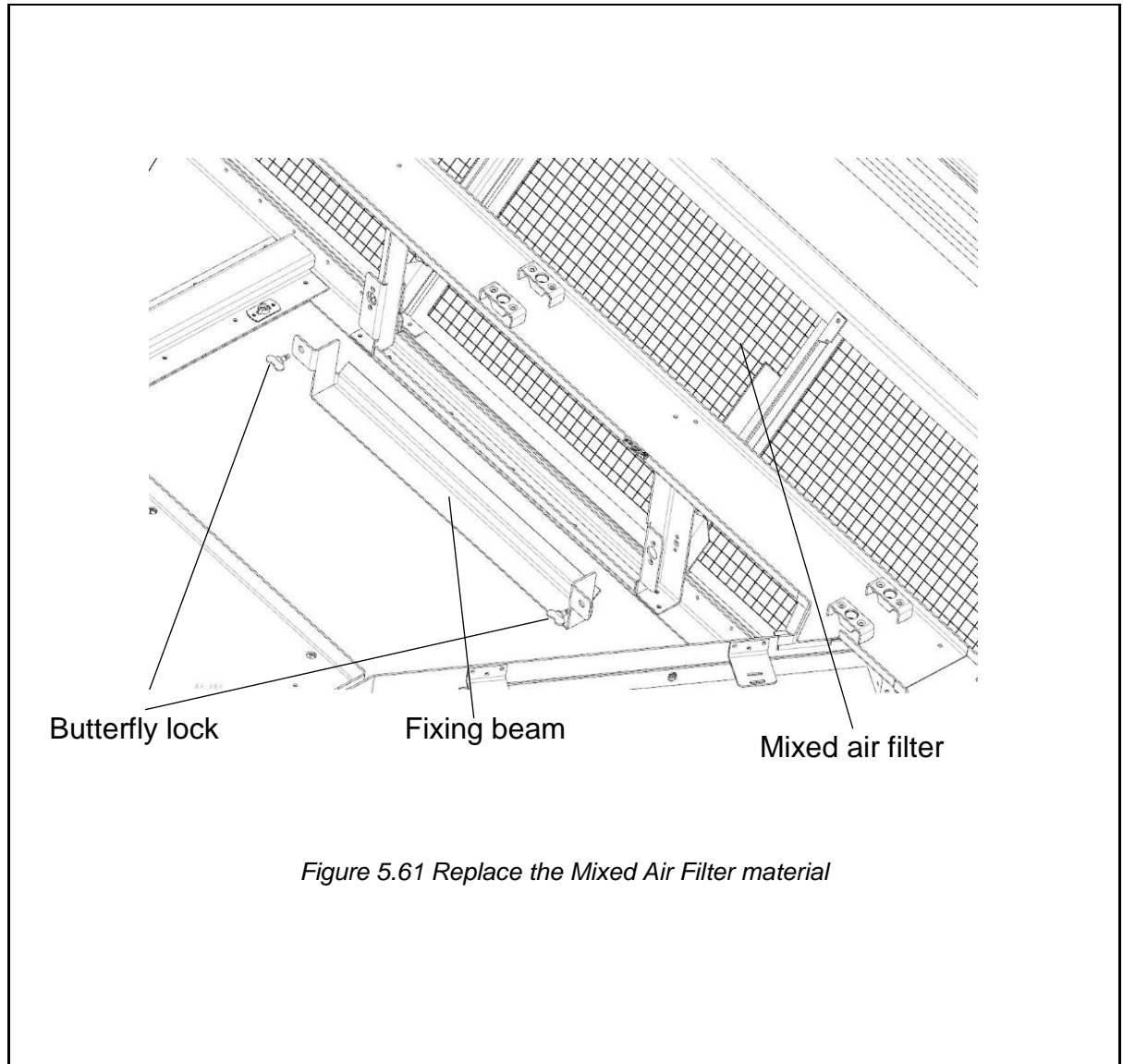
**Procedure:**

1. Use a stepladder for climbing small heights, reach the return air grille.
2. Remove the return air damper to get to the return air chamber.
3. Remove the Mixed air filter.
  - ☞ Loose the fixing bolt of the filter frame;
  - ☞ Take the frame away;
  - ☞ Draw the middle filter out of the filter frame.
  - ☞ Draw the two side filters out of the filter frame.
4. Replace the filter material.
5. Replace new filters by a reverse of the removal process.
6. Reinstall the return air damper.



# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.61 Replace the Mixed Air Filter material*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.23 Replace fresh air filter material of Saloon

<b>Title:</b> Fresh air filter material - replace	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To replace the Fresh air filter material.			
<b>System/Equipment Title:</b> Saloon HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> Stepladder. <b>Materials and Consumables:</b> Not applicable. <b>Essential Replacement Parts:</b> Fresh air filter material. <b>Parts number:</b> 12.1200.0156.			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97A100.000-09A.Z3.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

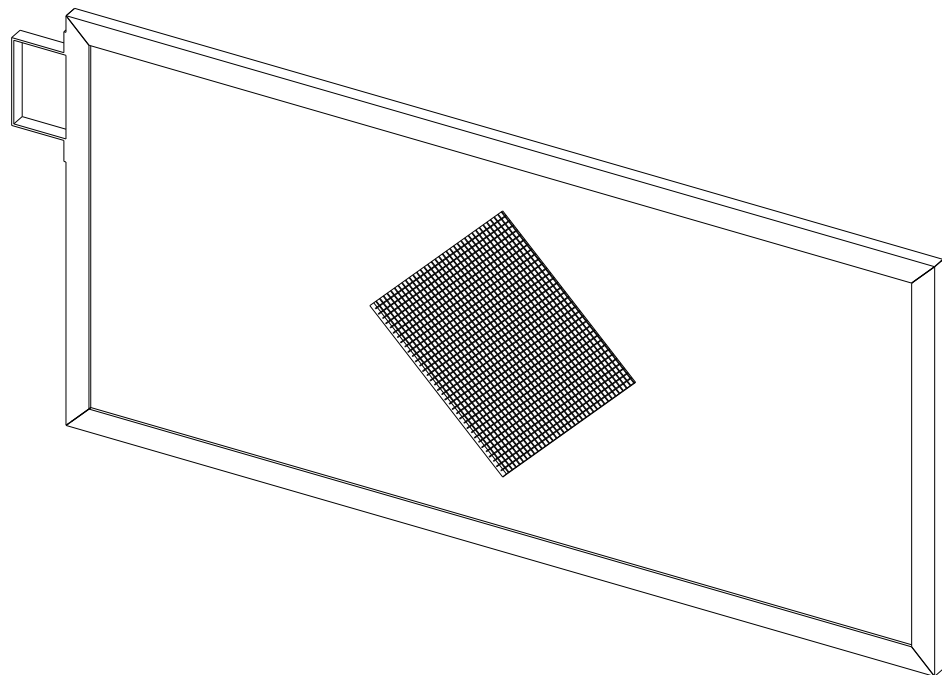
5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

**Team Size:** 1 person

**Procedure:.**

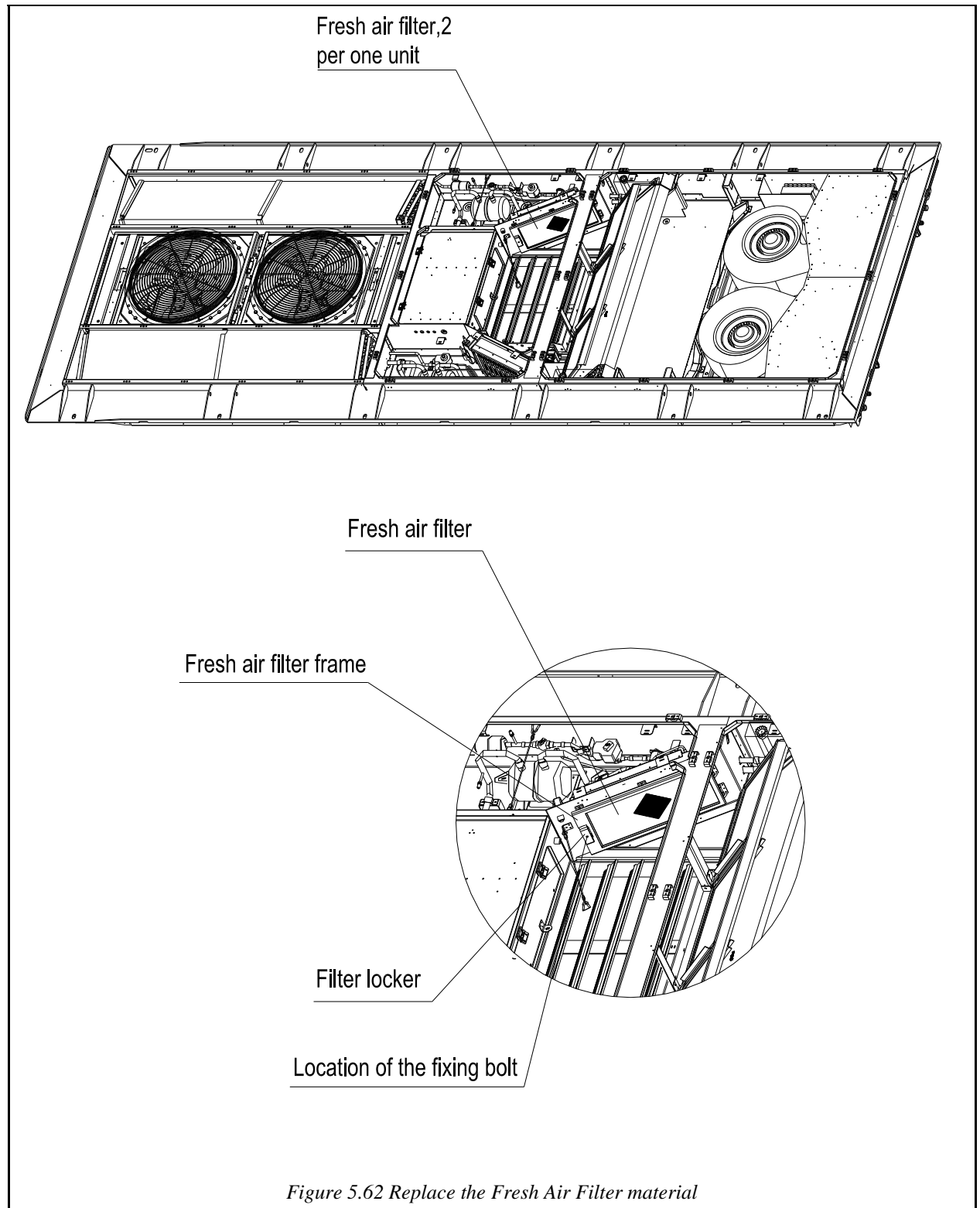
1. Use a stepladder for climbing small heights, reach into the return air plenum.
2. Loosen the fast locks of the return air damper and turn it round, get to the return air chamber.
3. Remove the Fresh filter, which is positioned at the two sides of return air chamber.
  - ☞ Loose the fixing bolt of the filter locker;
  - ☞ Take the locker away and turn the filter frame;
  - ☞ Draw the filter out of the filter frame.
4. Replace the filter material.
5. Replace new filters by a reverse of the removal process.
6. Tighten the fast locks to fix the return air damper to the unit frame.



*(not the picture of the real filter, only a model)*

# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.24 Replace mixed air filter material of cab HVAC unit

<b>Title: Mixed air filter material- replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
	<b>X</b>		
<b>Reason for Task:</b> To replace the mixed air filter material.			
<b>System/Equipment Title:</b> HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> Stepladder..			
<b>Materials and Consumables:</b> N.A.			
<b>Essential Replacement Parts:</b> Mixed air filter material.			
<b>Parts number:</b> 12.1200.0163.			
<b>Illustrations:</b> TBD.			
<b>Reference Drawings:</b> KS97C100.000-03A.Z3.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1" style="margin-left: auto; margin-right: auto;"><tr><td style="text-align: center;"><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

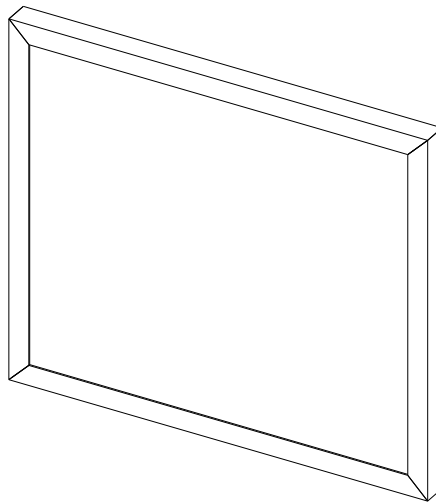
5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

**Team Size:** 1 person

**Procedure:**

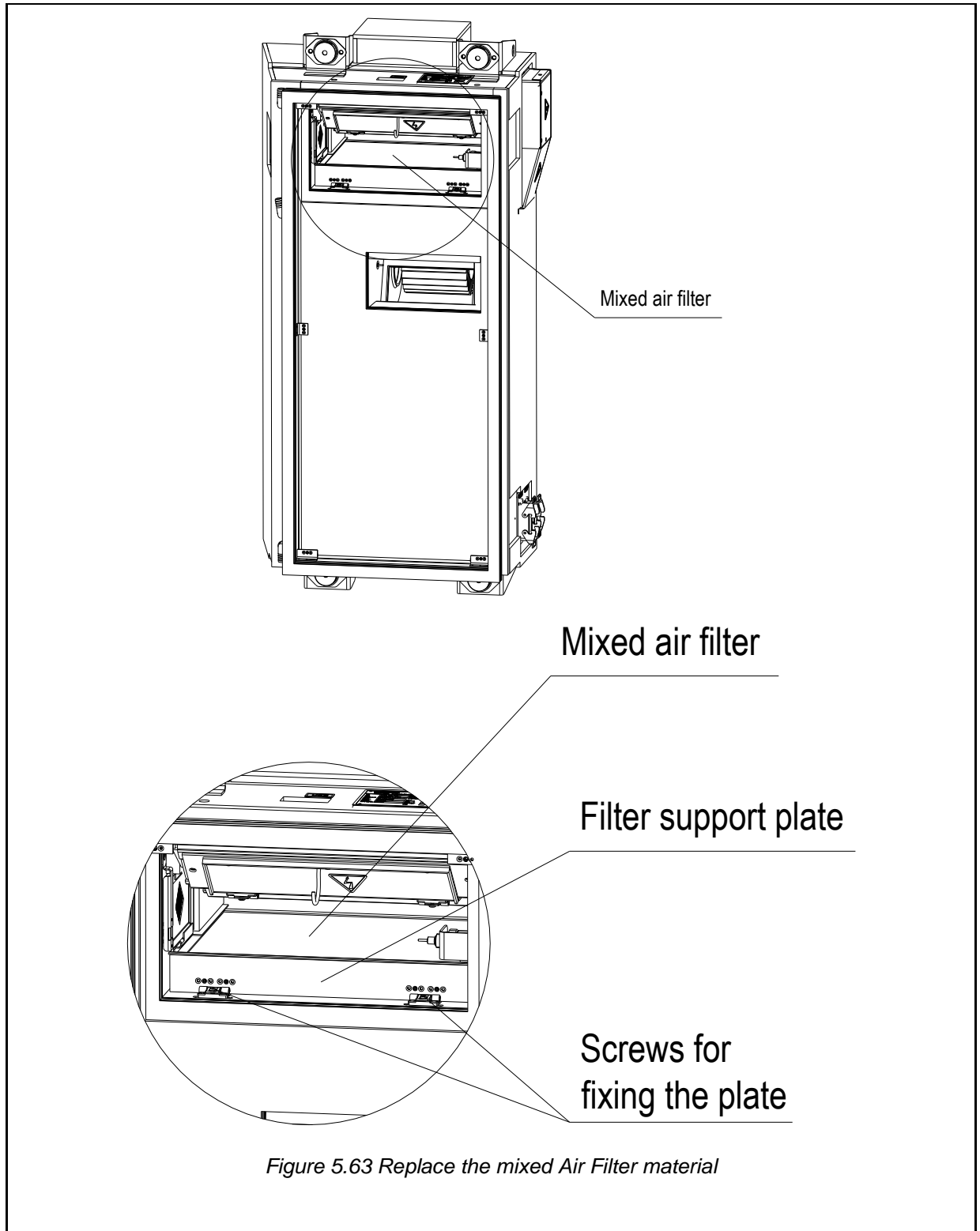
1. Use a stepladder for climbing small heights, reach to the service hatch.
2. Open the service hatch.
3. Loosen the two fixing screws of the filter support plate.
4. Turn the filter support plate and take out the filter support plate.
5. Draw the mixed air filter out.
6. Replace the filter material.
7. Replace new filter by a reverse of the removal process.
8. Close the return ceiling door.



*(not the picture of the real filter, only a model)*

# AMSTERDAM (Alstom)

## Rolling Stock




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.25 Replace fresh air filter material of cab HVAC unit

<b>Title:</b> Fresh air filter material - replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the Fresh air filter material.		
<b>System/Equipment Title:</b> cab HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.		
<b>Special Tools and Facilities:</b> Stepladder. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Fresh air filter material. <b>Parts number:</b> 97.1733.0006.		
<b>Illustrations:</b> Figure 2-21: FA Filter of chapter 7 Parts Catalogue. <b>Reference Drawings:</b> KS97C100.000-06A.Z4.		
<b>SAFETY PRECAUTIONS:</b>  <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

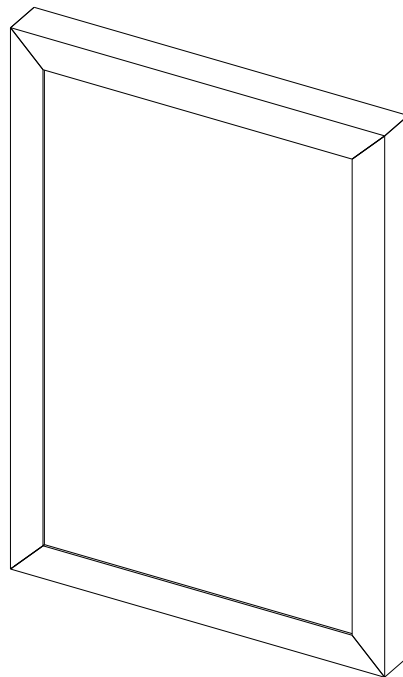
5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hour

**Team Size:** 1 person

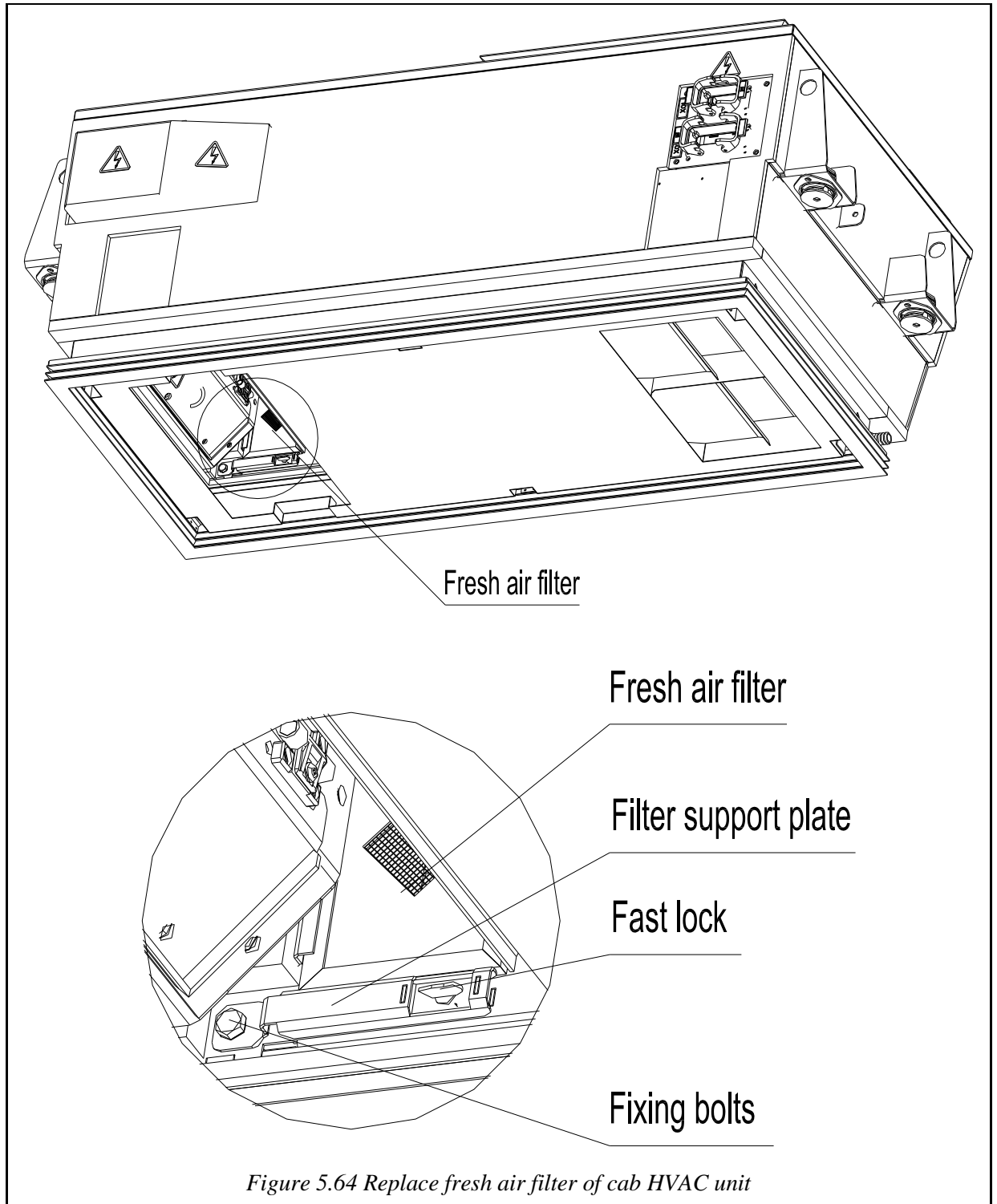
**Procedure:**

1. Use a stepladder for climbing small heights, reach to the service hatch.
2. Open the service hatch.
3. Unlock the fast lock of the filter support plate.
4. Turn the filter support plate around the axis of the fixing bolt, and then take out the fresh air filter.
5. Draw the fresh air filter out.
6. Replace the filter material.
7. Replace new filter by a reverse of the removal process.
8. Close the return ceiling door.



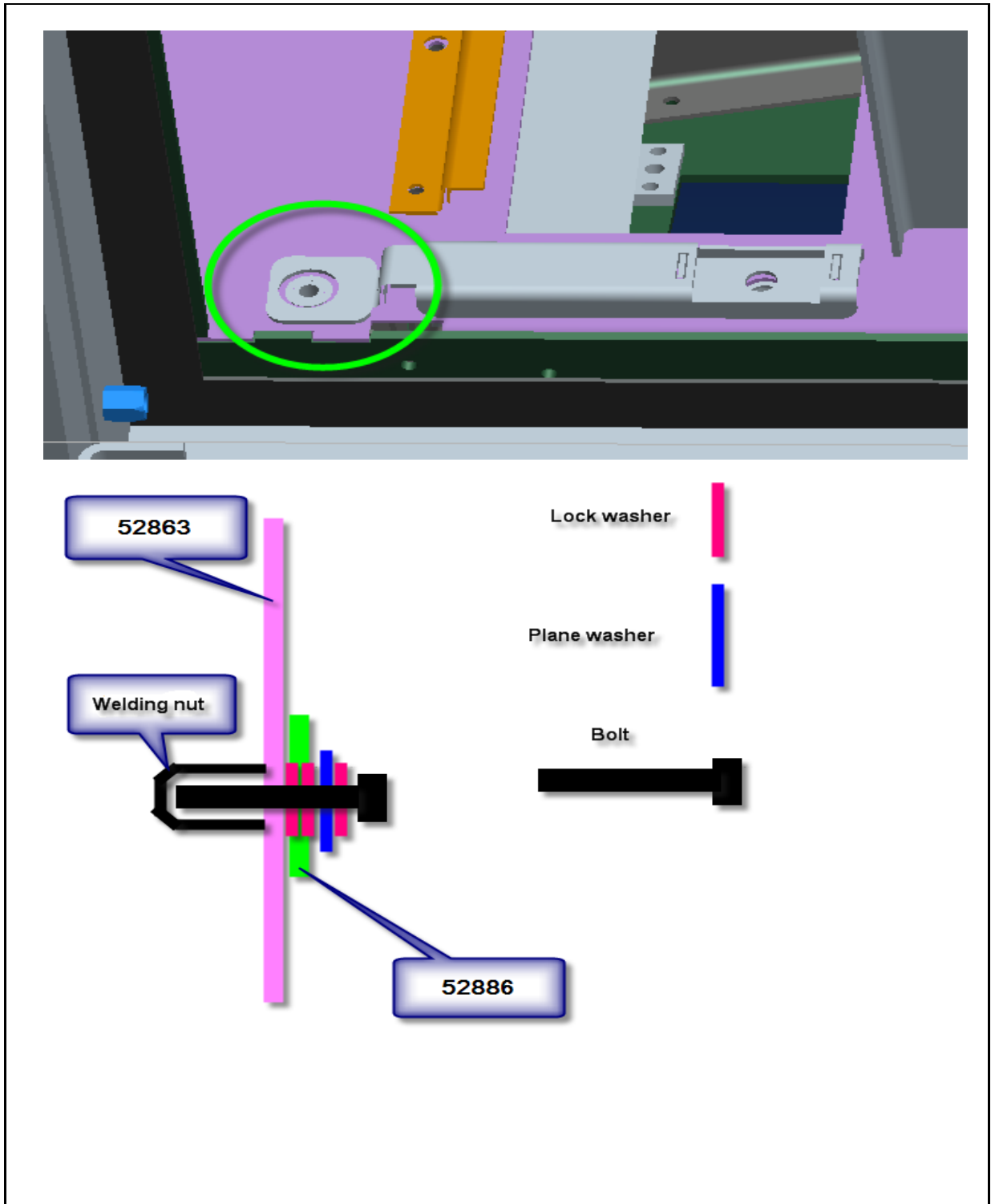
# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.26 Replace compressor of cab HVAC unit

<b>Title: Refrigerant Compressor - Replace New One</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> Replace compressor with new compressor (every 15 years or failure)		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant recharging system, vacuum pump, Electronic Leakage Detector, wrench, screwdriver. <b>Materials and Consumables:</b> Refrigerant R407C, Brazing material, solder. <b>Essential Replacement Parts:</b> Compressor. <b>Parts number:</b> 12.0100.0032.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> ZR24KTE-TFD-522.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"> <b>It is dangerous for touching the refrigerant. Safeguard devices are needed.</b> <b>Under no circumstances should liquid refrigerant be filled over suction line.</b></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.85 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop.
  - 1) Switch off both the AC and DC power supplies to the HVAC system.
  - 2) Disconnect the power supply and control plugs from the HVAC unit.
  - 3) Disconnect grounding cable by loosening M8 screws.
  - 4) Disconnect electrical connectors (X01, X02).
  - 5) Unbolt the 4x M10 mounting bolts.
  - 6) Fit lifting apparatus to the lifting gussets of the HVAC unit.
  - 7) Use a crane to lift the HVAC unit from the vehicle.
2. Open the cover, see 5.4.4.
3. Empty the refrigerant circuit of Cab HVAC unit, please refer to 5.5.1.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve. At that time, the liquid side schrader valve shall be opened to purge the nitrogen gas.
5. If necessary, use the wet protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Remove the wiring connections from the compressor electrical terminal box.
7. Unbolt the compressor to remove from the frame of HVAC unit when step 8 described below.
8. All work of step 9 thorough step 11 shall be done consecutively within 10 minutes to prevent any moisture of the air from entering inside of the refrigeration circuit.
9. Unbrazed all copper connecting to the compressor, liquid line filter dryer. Miscellaneous assembly around these components with Flexible metal pipe by brazing should be completed beforehand of this procedure so that the duration to braze can be minimized.
10. Remove the compressor from the HVAC frame.

## AMSTERDAM (Alstom)

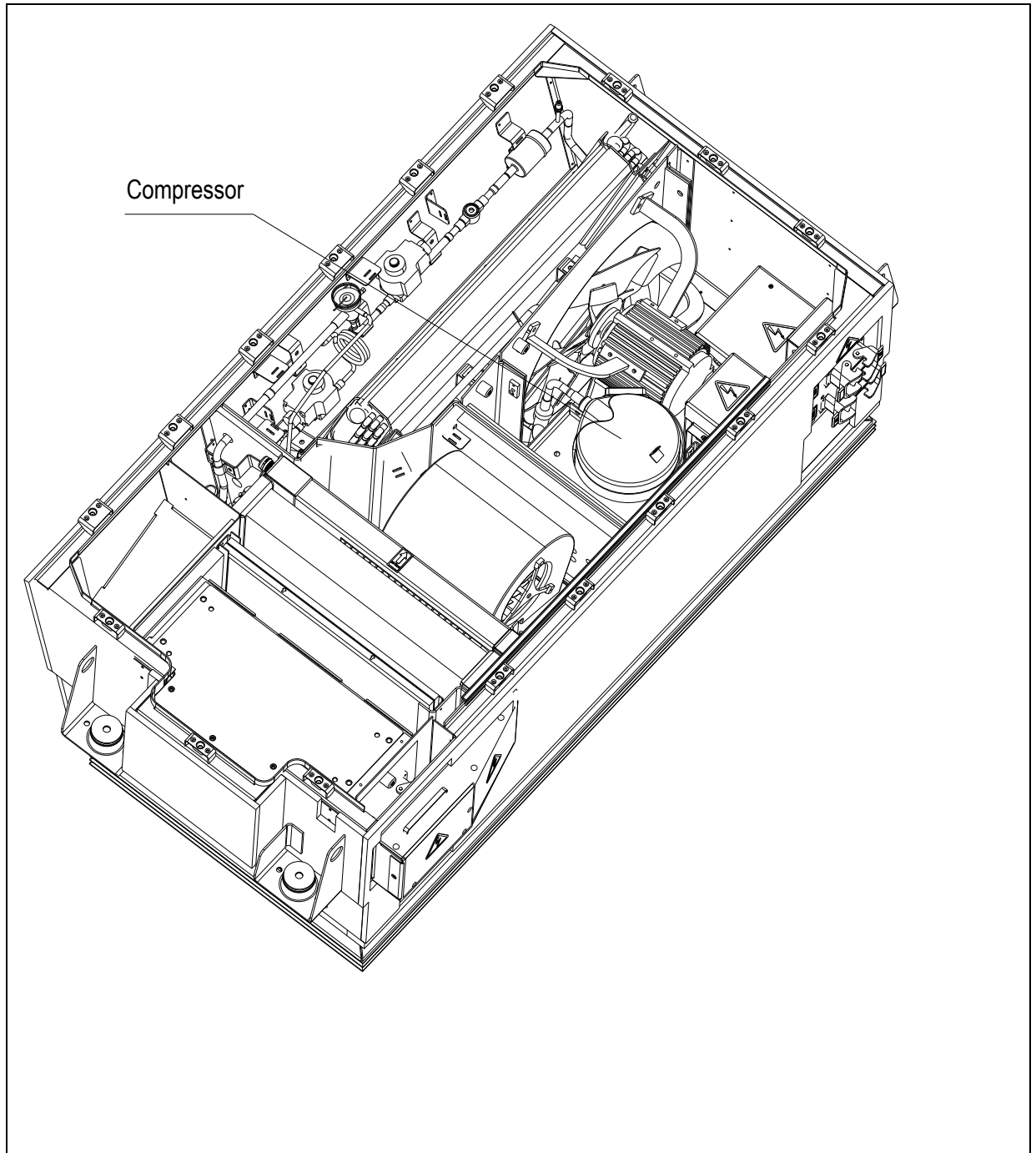
### Rolling Stock

11. Place a new compressor in the right position. Then, braze all copper connection points unbrazed.
12. Stop the purging of nitrogen through the cycle.
13. Tighten the bolts to fix the compressor to the HVAC frame. Recommended torque to tighten of the bolt is 1300Nm.
14. Leak test the refrigerant circuit, see chapter 5.5.3.
15. Evacuate the refrigerant circuit, see chapter 5.5.5.
16. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
17. Close the cover.
18. Install the HVAC unit onto the vehicle.
  - 1)Installation is a reverse of the removal process with the following notes;
  - 2)Ensure the aperture in the vehicle roof is free of obstructions.
  - 3)Make sure Mounting Bolts be tightened.

The special tool needed in this procedure you can refer to figure5.47.

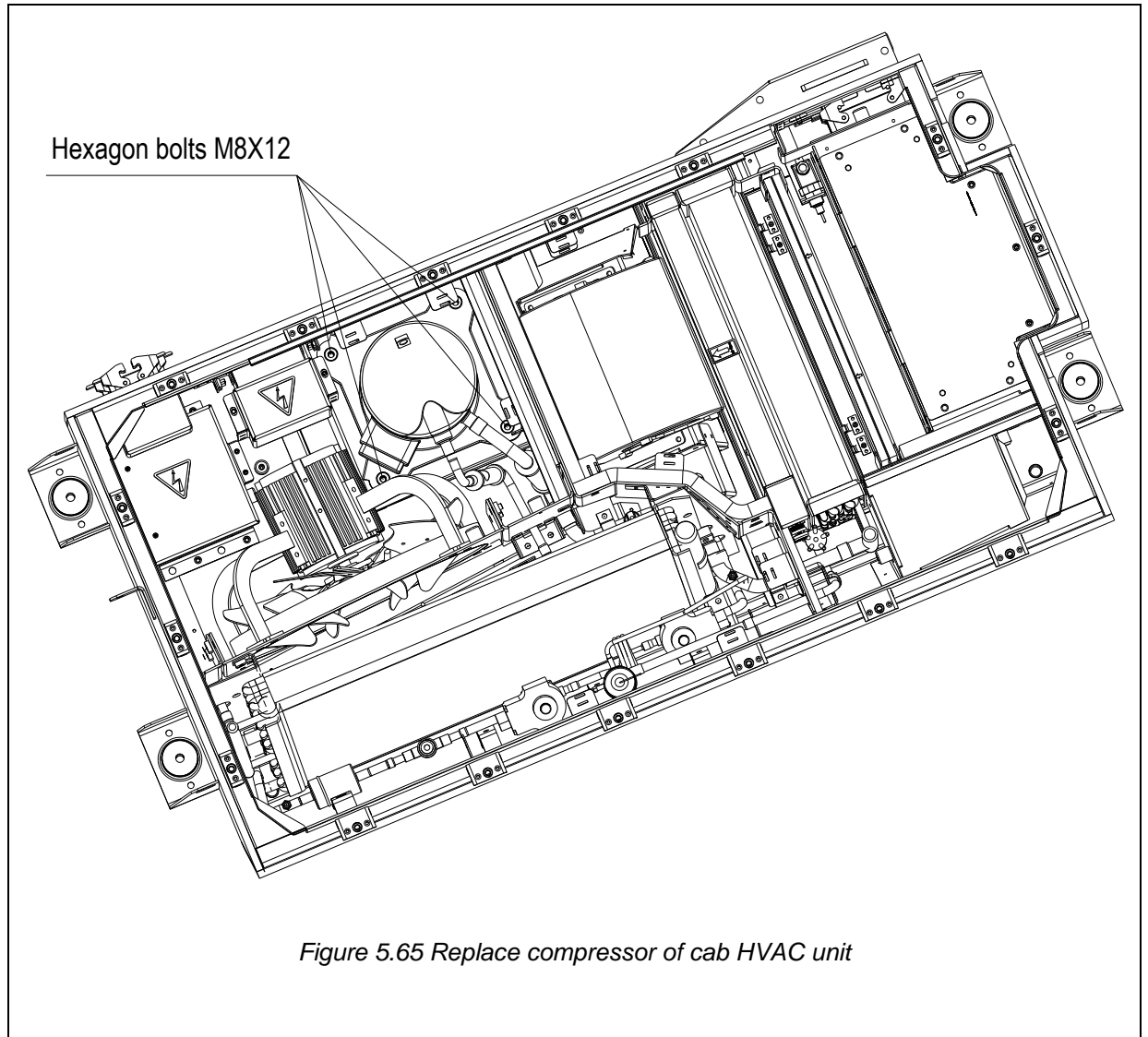
# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.27 Replace compressor of saloon HVAC unit

<b>Title: Refrigerant Compressor - Replace New One</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> Replace compressor with new compressor (every 15 years or failure)		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant recharging system, vacuum pump, Electronic Leakage Detector. <b>Materials and Consumables:</b> Refrigerant R407C, Brazing material, solder. <b>Essential Replacement Parts:</b> Compressor. <b>Parts number:</b> 12.0100.0073.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> G600DL-90DTP.N4.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"><p style="color: red;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.85 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop
  - 1) Switch off both the AC and DC power supplies to the HVAC system.
  - 2) Disconnect the power supply and control plugs from the HVAC unit.
  - 3) Disconnect grounding cable by loosening M8 screws.
  - 4) Disconnect electrical connectors (X01, X02, X03 and X04).
  - 5) Unbolt the twelve M16 mounting bolts.
  - 6) Fit lifting apparatus to the lifting gussets of the HVAC unit.
  - 7) Use a crane to lift the HVAC unit from the vehicle.
2. Open the condenser fan bracket of HVAC unit.
3. Open the relevant condenser fan assembly.
4. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2.
5. Charge the system with dry nitrogen gas through the vapour side schrader valve. At that time, the liquid side schrader valve shall be opened to purge the nitrogen gas.
6. If necessary, use the wet protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
7. Remove the wiring connections from the compressor electrical terminal box.
8. Unbolt the compressor to remove from the frame of HVAC unit when step 8 described below.
9. All work of step 9 thorough step 11 shall be done consecutively within 10 minutes to prevent any moisture of the air from entering inside of the refrigeration circuit.
10. Unbrazed all copper connecting to the compressor, liquid line filter dryer. Miscellaneous assembly around these components with Flexible metal pipe by brazing should be completed beforehand of this procedure so that the duration to braze can be minimized.
11. Loosen the 3 bolts in the following sequence: Loosen bolts(1),(2),then turn the compressor for a appropriate angle and then loosen bolt (3).Remove the compressor from the HVAC frame.

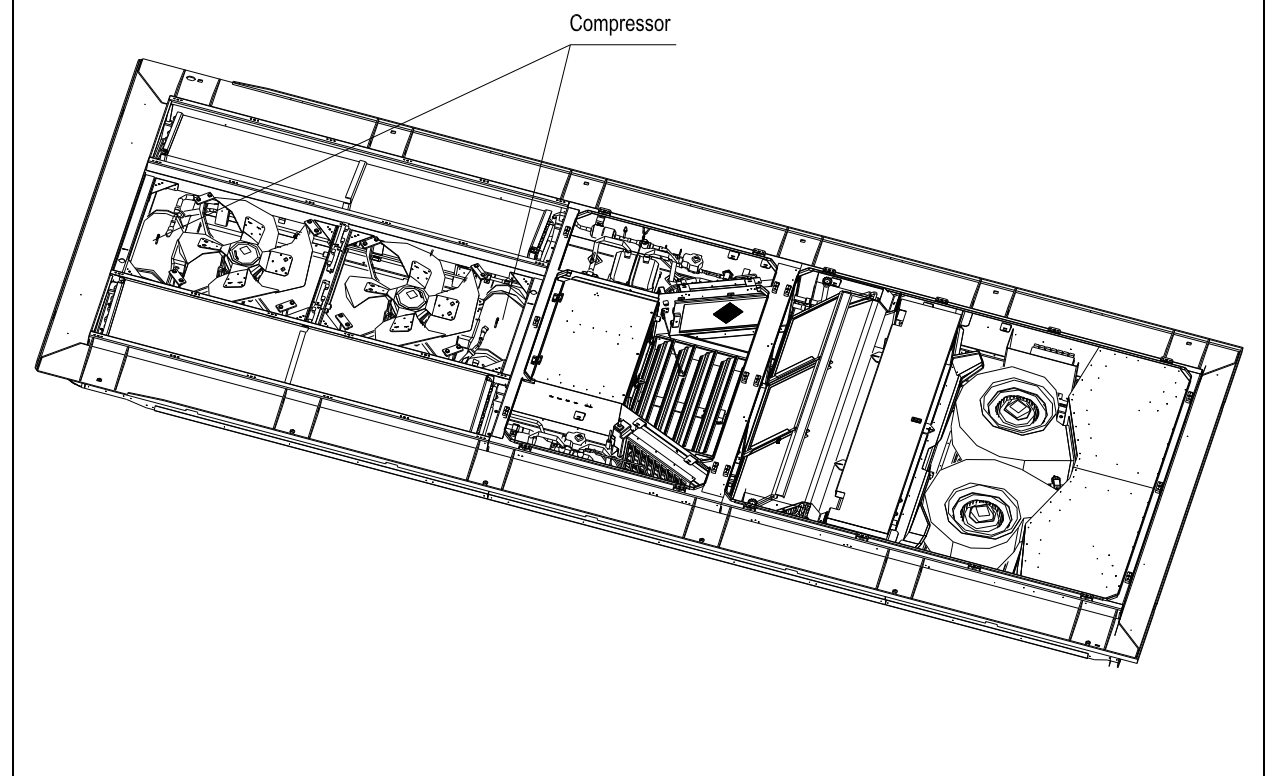
## AMSTERDAM (Alstom)

### Rolling Stock

#### HVAC System

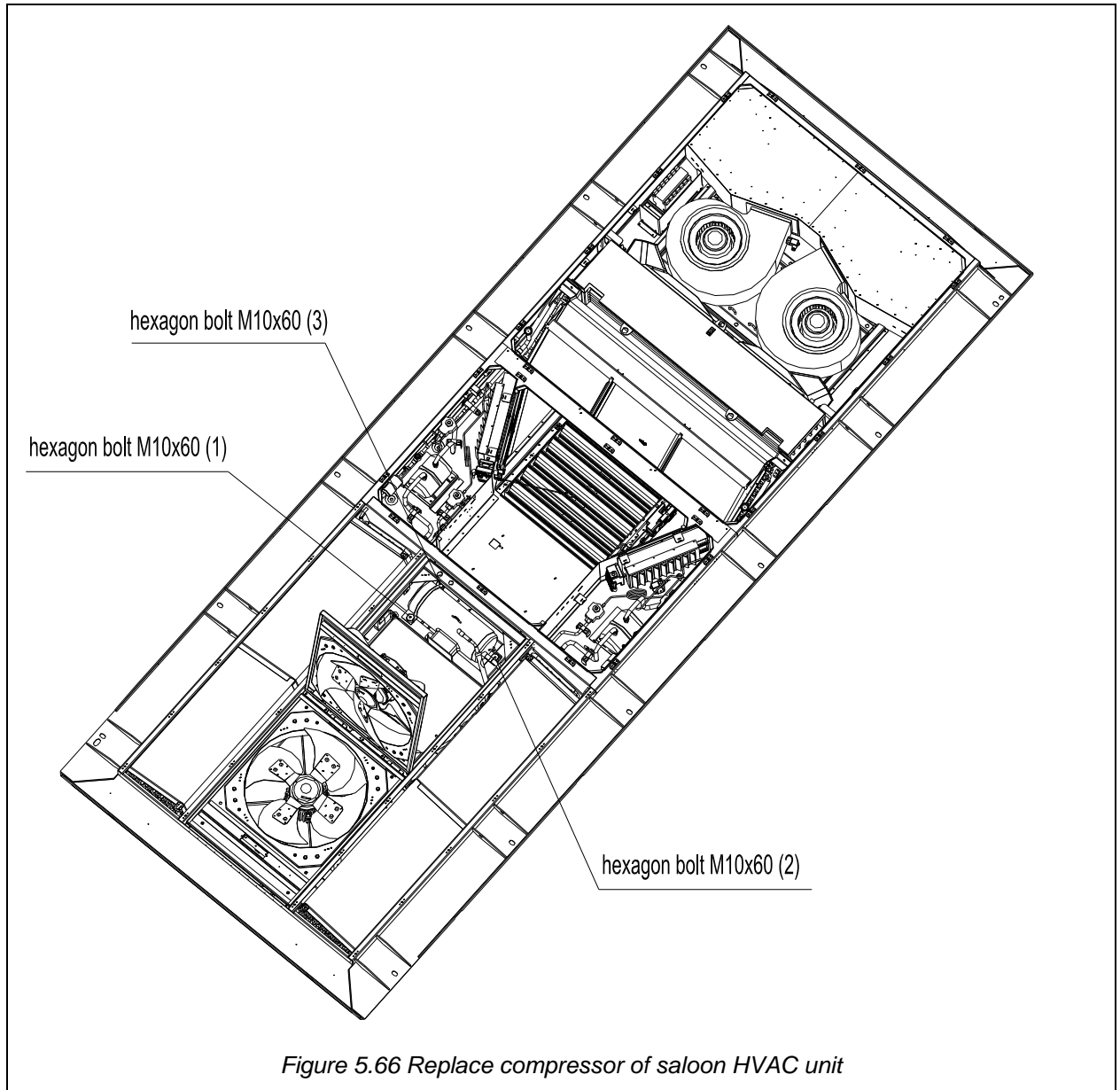
#### 5 Maintenance and Overhaul Procedures

12. Place a new compressor in the right position. Then, braze all copper connection points unbrazed.
13. Stop the purging of nitrogen through the cycle.
14. Tighten the bolts to fix the compressor to the HVAC frame. Recommended torque to tighten of the bolt is 1300Nm.
15. Leak test the refrigerant circuit, see chapter 5.5.4.
16. Evacuate the refrigerant circuit, see chapter 5.5.6.
17. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
18. Close the condenser fan bracket.
19. Install the HVAC unit onto the vehicle.
  - 1) Installation is a reverse of the removal process with the following notes;
  - 2) Ensure the aperture in the vehicle roof is free of obstructions.
  - 3) Make sure Mounting Bolts be tightened.



# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.28 Replace compressor vibration damper of cab HVAC unit

<b>Title: Compressor vibration damper - Replace New One</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> Replace compressor vibration damper with new one		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant recharging system ,Vacumm pump,Electronic Leakage Detector . <b>Materials and Consumables:</b> Brazing material, solder. <b>Essential Replacement Parts:</b> Compressor vibration damper. <b>Parts number:</b> 13.0501.0013.		
<b>Illustrations:</b> TBD <b>Reference Drawings:</b> N.A.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

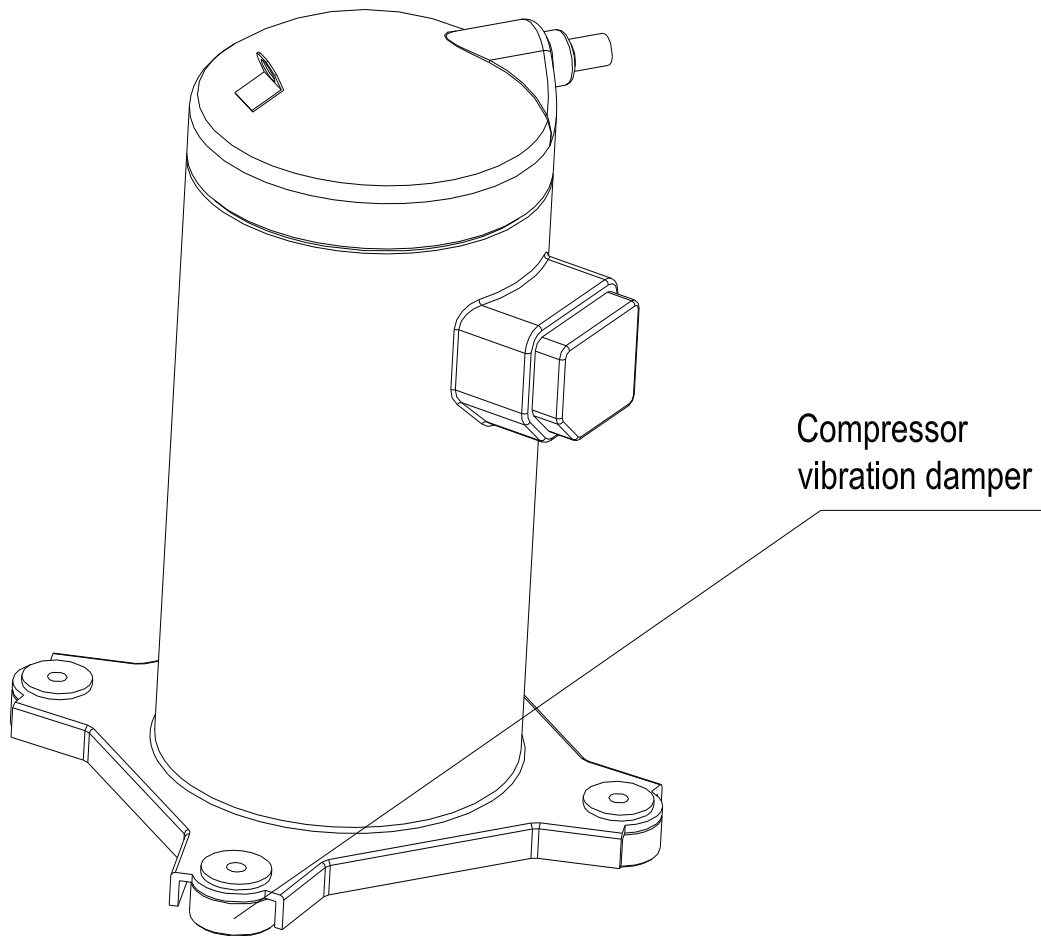
5 Maintenance and Overhaul Procedures

**Down Time:** 2.85 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Remove compressor from HVAC unit, refer to 5.5.26.
3. Replace compressor vibration damper.
4. Place compressor by the reverse procedure of removal. refer to 5.5.26.



*Figure 5.67 Replace compressor vibration damper of cab HVAC unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.29 Replace compressor vibration damper of saloon HVAC unit

<b>Title: Compressor vibration damper - Replace New One</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> Replace compressor vibration damper with new one		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant recharging system, Vacuum pump, Electronic Leakage Detector . <b>Materials and Consumables:</b> Brazing material, solder. <b>Essential Replacement Parts:</b> Compressor vibration damper. <b>Parts number:</b> 13.0501.0011, 13.0501.0012.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> N.A.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

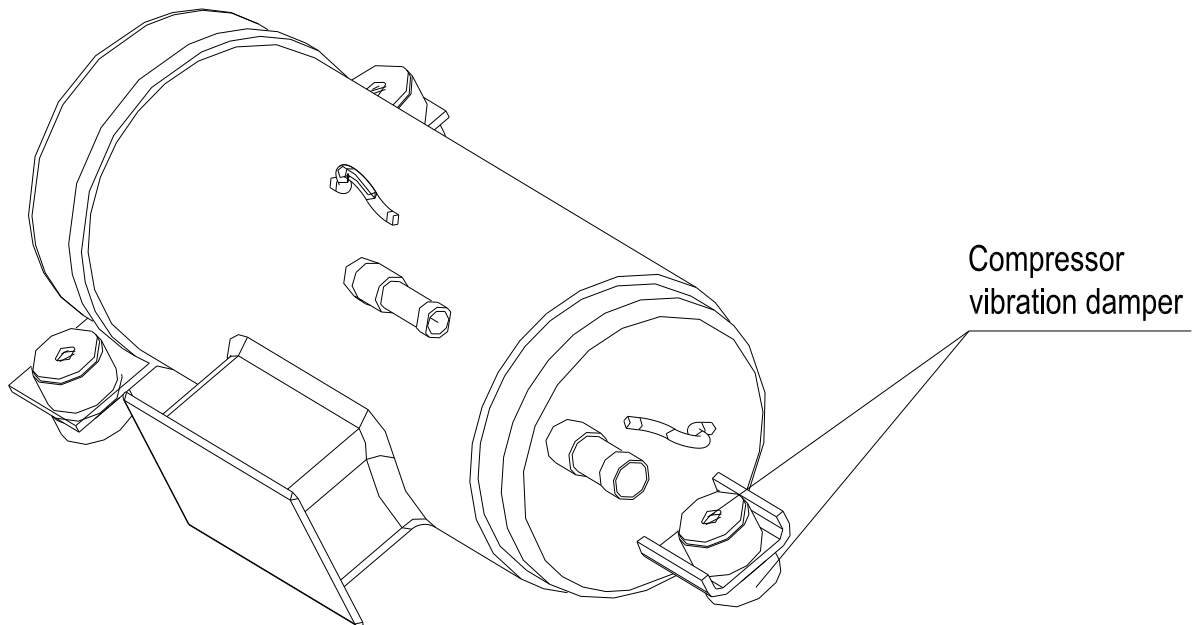
5 Maintenance and Overhaul Procedures

**Down Time:** 2.85 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Remove compressor from HVAC unit, refer to 5.5.27.
3. Loose the bolts which fix the damper in the unit.
4. Remove up damper, remove compressor, and then remove down damper.
5. Replace with new ones in the right place.
6. Place compressor by the reverse procedure of removal. refer to 5.5.27, tighten the bolts.



*Figure 5.68 Replace compressor vibration damper of saloon HVAC unit*


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.30 Replace condenser of cab HVAC unit

<b>Title: Condenser - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	<b>X</b>	
<b>Reason for Task:</b> To replace the condenser (every 15 years or corrosion severely)		
<b>System/Equipment Title:</b> cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector. <b>Materials and Consumables:</b> R407C, Brazing material. <b>Essential Replacement Parts:</b> Condenser. <b>Parts number:</b> 12.1700.0320.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97C100.210-00A.Z2		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"> <b>It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</b></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.60 hours

**Team Size:** 2 person

**Procedure:**

**Replacement**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.4.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.1.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the Condenser
7. Remove the Condenser from the refrigeration circuit by bolt (M8X16).
8. Install new Condenser by bolt (M8X16).
9. Stop the purging of nitrogen through the cycle.
10. Evacuate the refrigeration cycle.
11. Leak test the refrigerant circuit, see chapter 5.5.3.
12. Evacuate the refrigerant circuit, see chapter 5.5.5.
13. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
14. Close the cover.
15. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

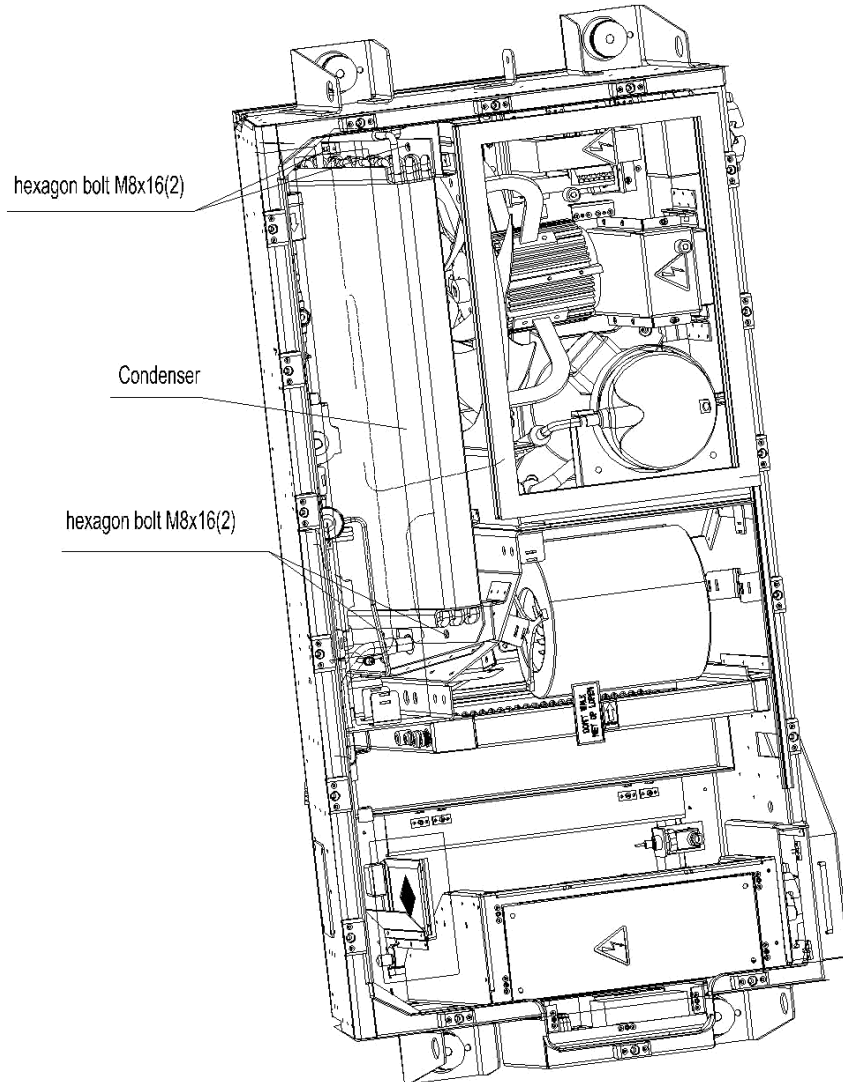


Figure 5.69 Replace condenser of Cab HVAC unit


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.31 Replace condenser of saloon HVAC unit

<b>Title: Condenser - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the condenser (every 15 years or corrosion severely)		
<b>System/Equipment Title:</b> Saloon HVAC Unit		
<b>Manufacturer:</b> SFRT		
<b>Type/Model No:</b> KS97		
<b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector		
<b>Materials and Consumables:</b> R407C, Brazing material.		
<b>Essential Replacement Parts:</b> Condenser.		
<b>Parts number:</b> 12.1700.0308, 12.1700.0309.		
<b>Illustrations:</b> TBD.		
<b>Reference Drawings:</b> KS97A100.210-00A.Z2, KS97A100.220-00A.OZ		
<b>SAFETY PRECAUTIONS:</b>		
<div style="border: 2px solid black; padding: 10px; display: inline-block;">  <p style="color: red; margin: 0;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p> </div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.60 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Open the condenser cover of HVAC unit. Open the Condenser fan bracket of the HVAC unit, see 5.4.3.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2.
4. Charge the system with dry nitrogen gas through the vapour side Schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the Condenser
7. Remove the Condenser from the refrigeration circuit by bolt(M8X16).
8. Install new Condenser by bolt(M8X16).
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.4.
11. Evacuate the refrigerant circuit, see chapter 5.45.6.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

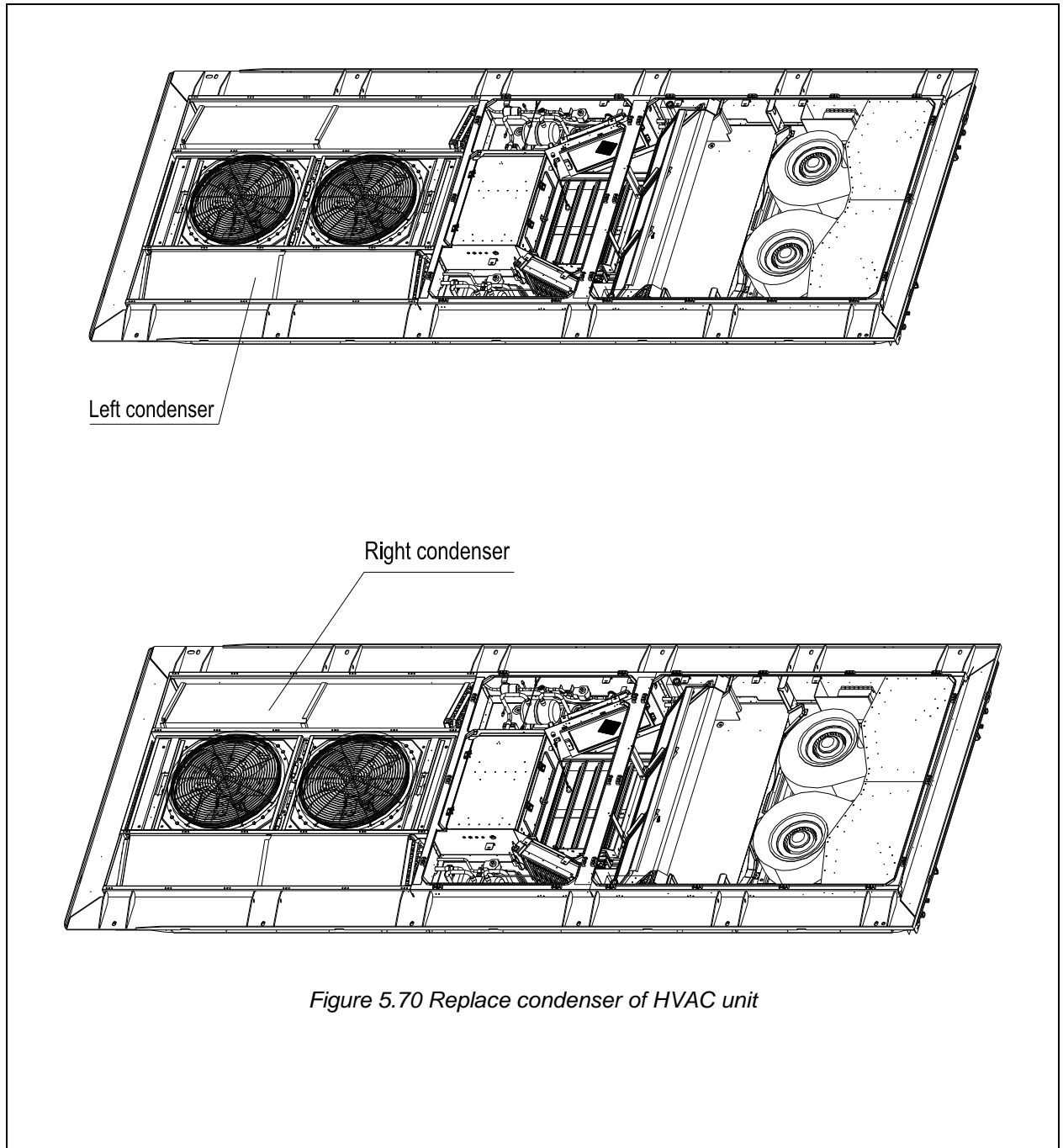


Figure 5.70 Replace condenser of HVAC unit

# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

### 5 Maintenance and Overhaul Procedures

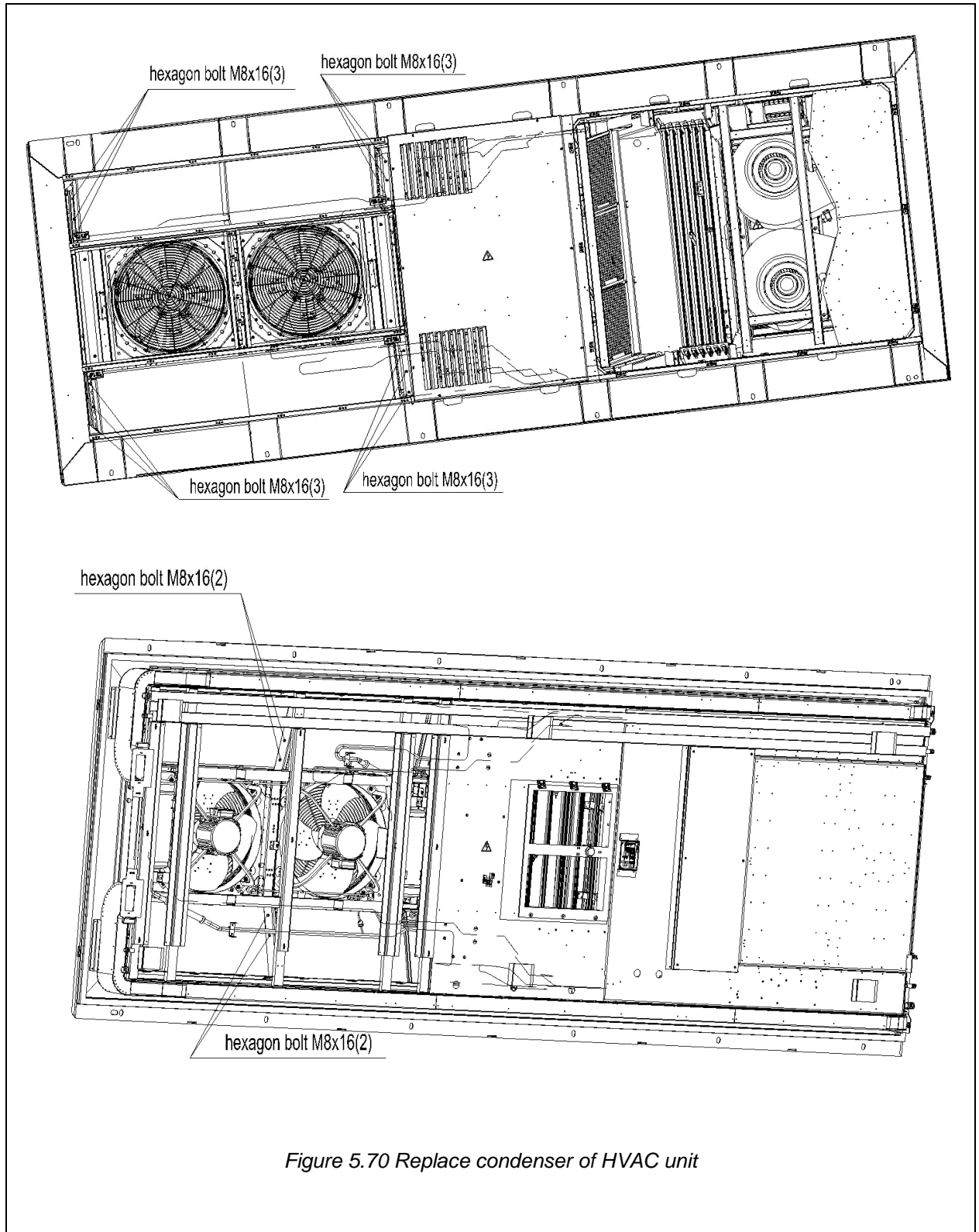


Figure 5.70 Replace condenser of HVAC unit


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.32 Replace evaporator of cab HVAC unit

<b>Title: Evaporator - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	<b>X</b>	
<b>Reason for Task:</b> To replace the evaporator.(every 15 years or corrosion severely)		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment,Vacumm pump, Electronic Leakage Detector. <b>Materials and Consumables:</b> Refrigerant R407C,Brazing material. <b>Essential Replacement Parts:</b> Evaporator. <b>Parts number:</b> 12.1700.0321.		
<b>Illustrations:</b> -. <b>Reference Drawings:</b> KS97C100.230-00A.Z2		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;">  <p style="color: red; margin: 0;">It is dangerous for touching the refrigerant. Safeguard devices are needed.</p> <p style="color: red; margin: 0;">Under no circumstances should liquid refrigerant be filled over suction line.</p> </div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.4.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.1.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the Evaporator.
7. Remove the Evaporator from the refrigeration circuit by bolt(M8X20).
8. Install new Evaporator by bolt(M8X20).
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.3.
11. Evacuate the refrigerant circuit, see chapter 5.5.5.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
13. Close the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

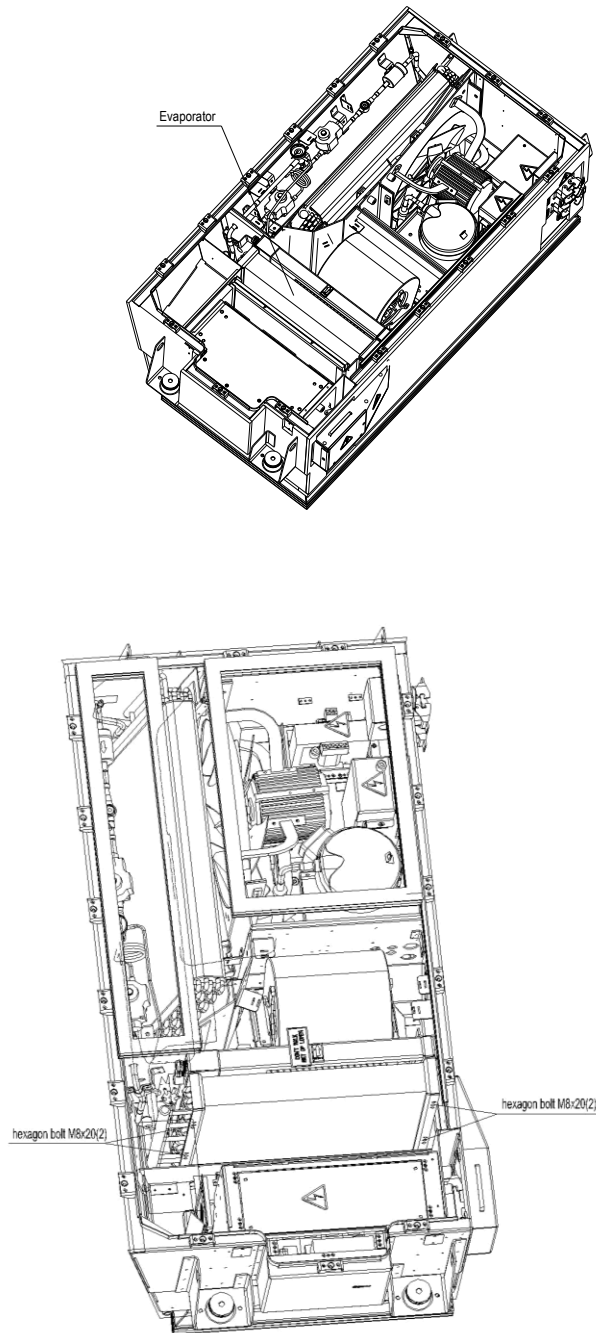


Figure 5.71 Replace evaporator of HVAC unit

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.33 Replace evaporator of saloon HVAC unit

<b>Title: Evaporator - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the evaporator. (every 15 years or corrosion severely)		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector <b>Materials and Consumables:</b> Refrigerant R407C, Brazing material. <b>Essential Replacement Parts:</b> Evaporator. <b>Parts number:</b> 12.1700.0310.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KS97A100.230-00A.Z3.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"> <b>It is dangerous for touching the refrigerant. Safeguard devices are needed.</b> <b>Under no circumstances should liquid refrigerant be filled over suction line.</b></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Open the cover of HVAC unit, see 5.4.1.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the Evaporator.
7. Remove the Evaporator from the refrigeration circuit by bolt (M8X12)..
8. Install new Evaporator by bolt (M8X12)..
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.4.
11. Evacuate the refrigerant circuit, see chapter 5.5.6.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

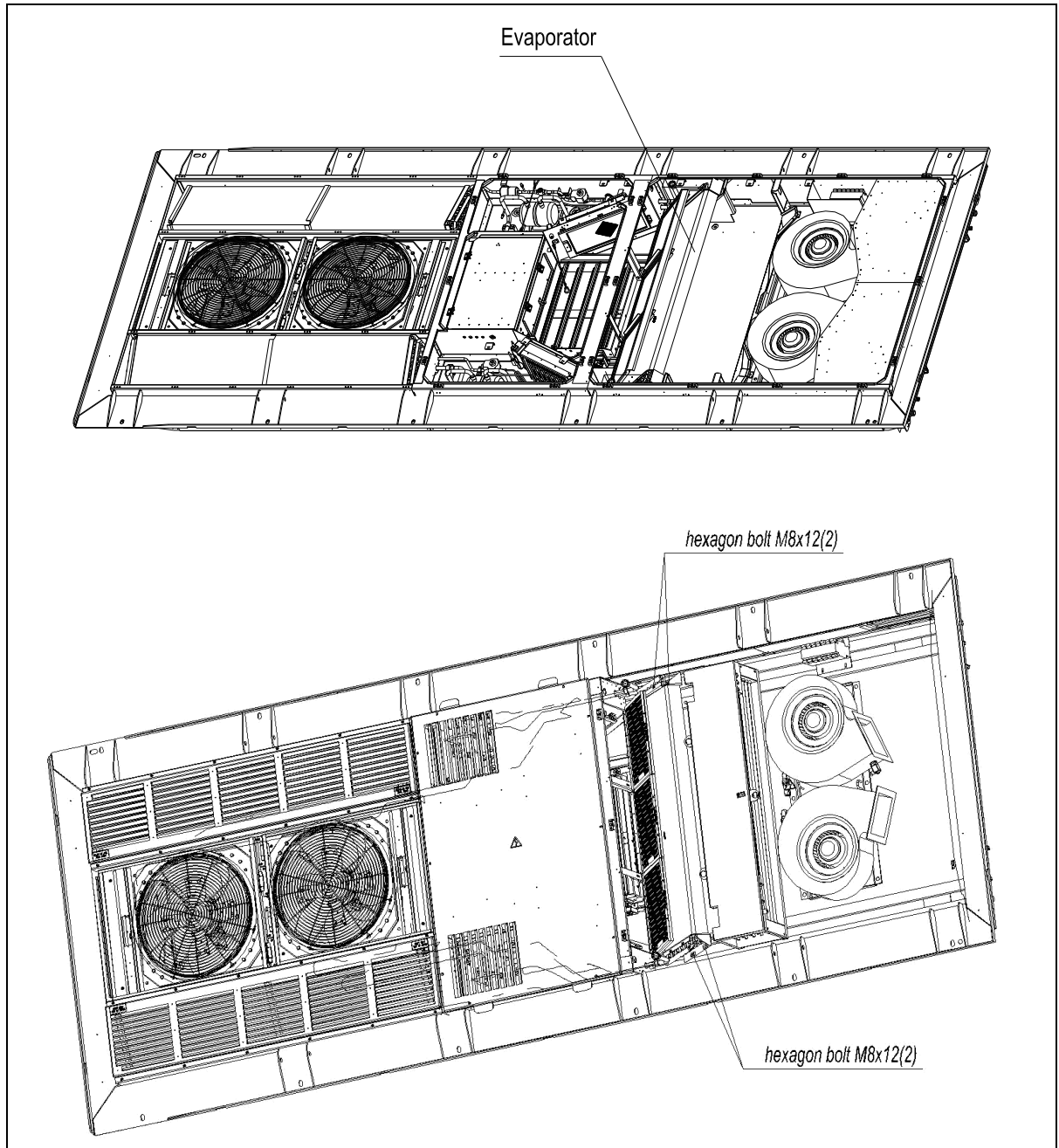


Figure 5.72 Replace evaporator of HVAC unit


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.34 Replace filter dryer of cab HVAC unit

<b>Title: liquid line filter Dryer - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the filter dryer		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector. <b>Materials and Consumables:</b> Refrigerant R407C, Brazing material. <b>Essential Replacement Parts:</b> Filter dryer. <b>Parts number:</b> 12.0700.0026.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> 023Z5050.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"><p style="color: red; text-align: center;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.4.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.1.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the liquid line filter drier.
7. Remove the liquid line filter dryer from the refrigeration circuit.
8. Install new filter dryer.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.3.
11. Evacuate the refrigerant circuit, see chapter 5.5.5.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

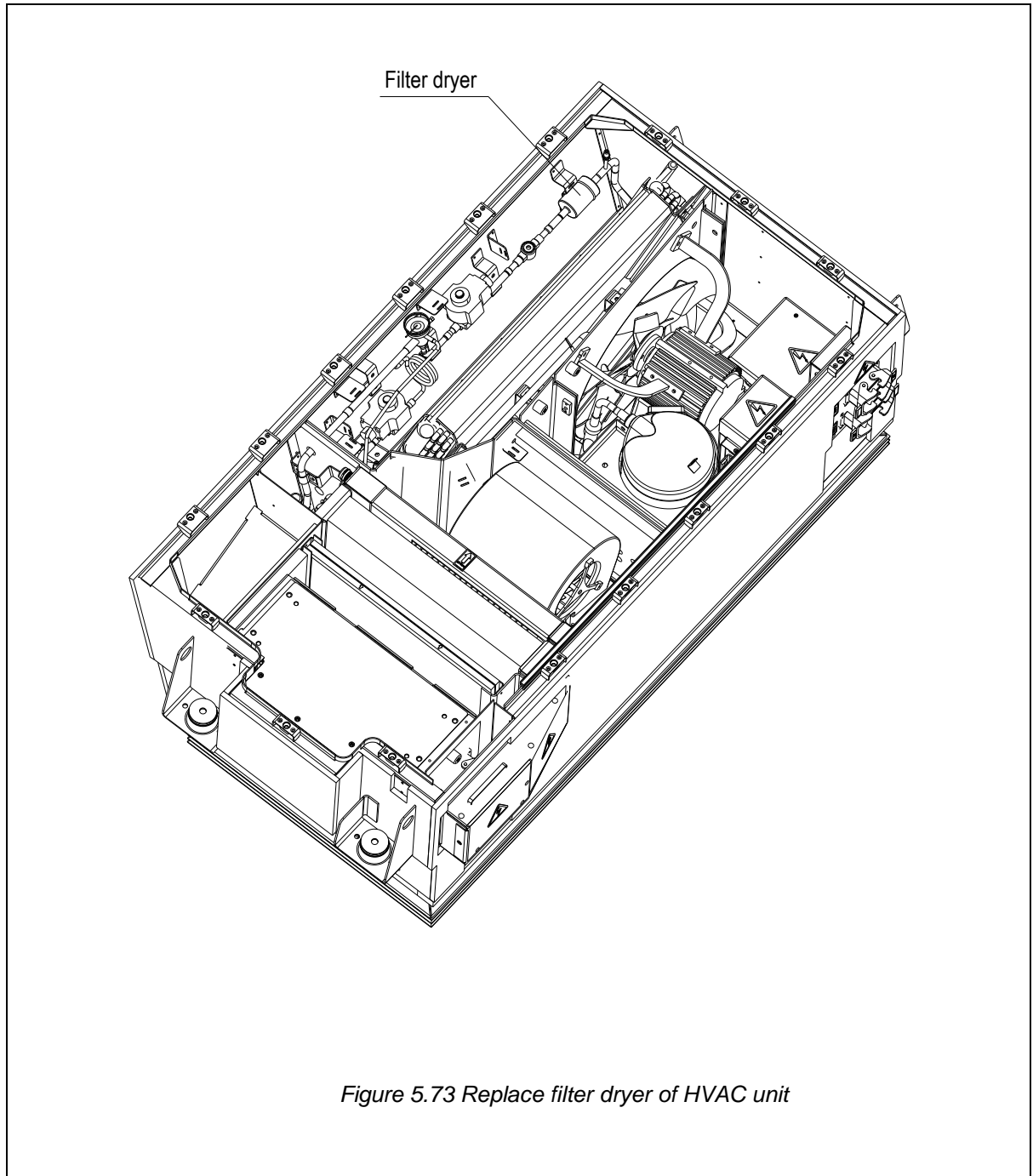


Figure 5.73 Replace filter dryer of HVAC unit

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.35 Replace filter dryer of Saloon HVAC unit

<b>Title:</b> liquid line filter dryer - Replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the filter dryer		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacumm pump, Electronic Leakage Detector <b>Materials and Consumables:</b> Refrigerant R407C, Brazing material. <b>Essential Replacement Parts:</b> Filter dryer. <b>Parts number:</b> 12.0700.0005.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> 023Z5060.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;">  <p style="color: red; text-align: center;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p> </div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Open the cover of HVAC unit, see 5.4.2.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the liquid line filter dryer.
7. Remove the liquid line filter dryer from the refrigeration circuit.
8. Install new filter dryer.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.4.
11. Evacuate the refrigerant circuit, see chapter 5.5.6.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

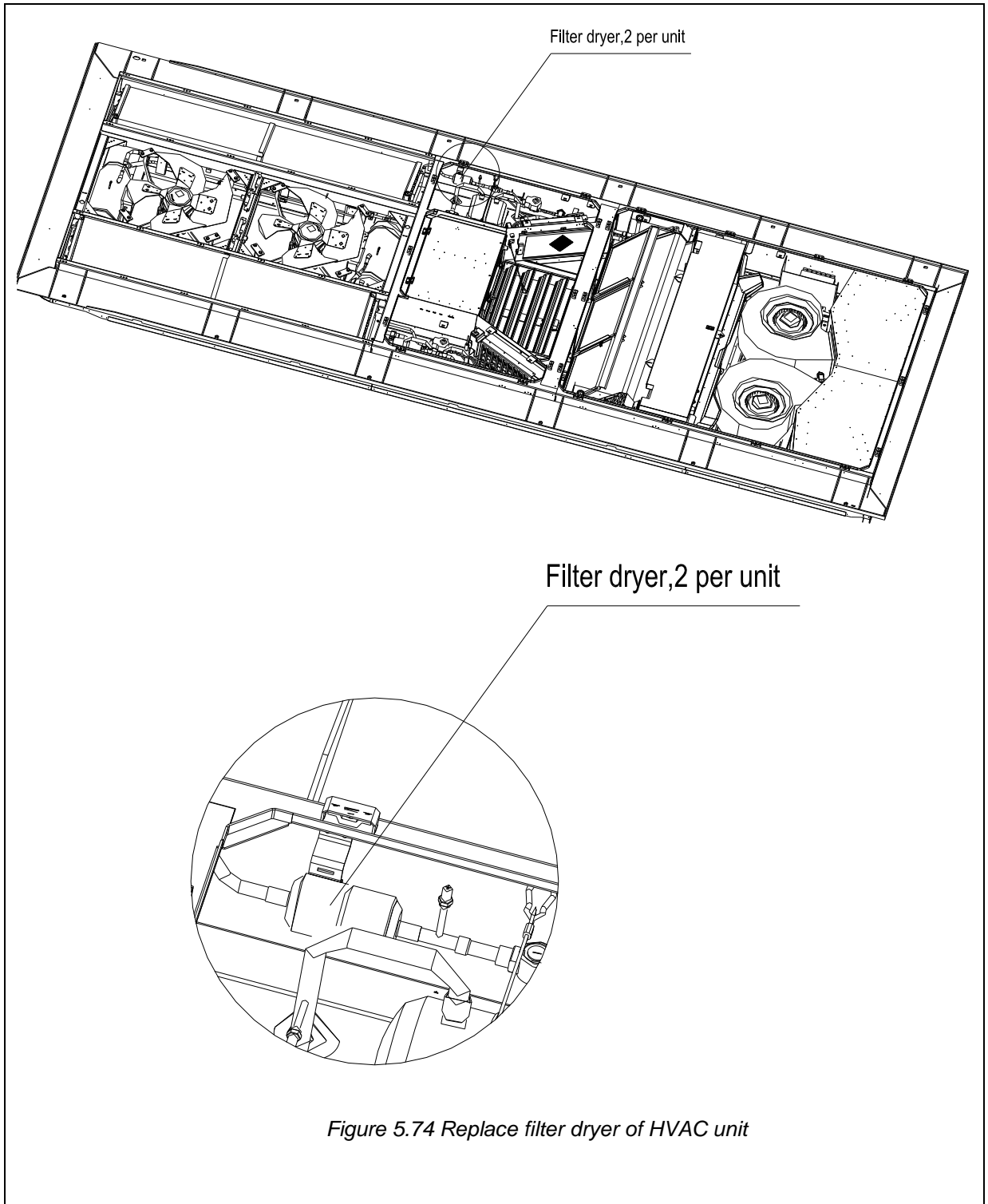


Figure 5.74 Replace filter dryer of HVAC unit

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.36 Replace sight glass of cab HVAC unit

<b>Title:</b> Sight glass - Replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the sight glass		
<b>System/Equipment Title:</b> Cab HVAC Unit		
<b>Manufacturer:</b> SFRT		
<b>Type/Model No:</b> KS97		
<b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector		
<b>Materials and Consumables:</b> Refrigerant R407C, Brazing material.		
<b>Essential Replacement Parts:</b> Sight glass.		
<b>Parts number:</b> 12.1000.0140.		
<b>Illustrations:</b> TBD.		
<b>Reference Drawings:</b> 014-0182.		
<b>SAFETY PRECAUTIONS:</b>		
<div style="border: 2px solid black; padding: 10px; margin: 10px auto; width: 80%;">  <p style="color: red; text-align: center;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p> </div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

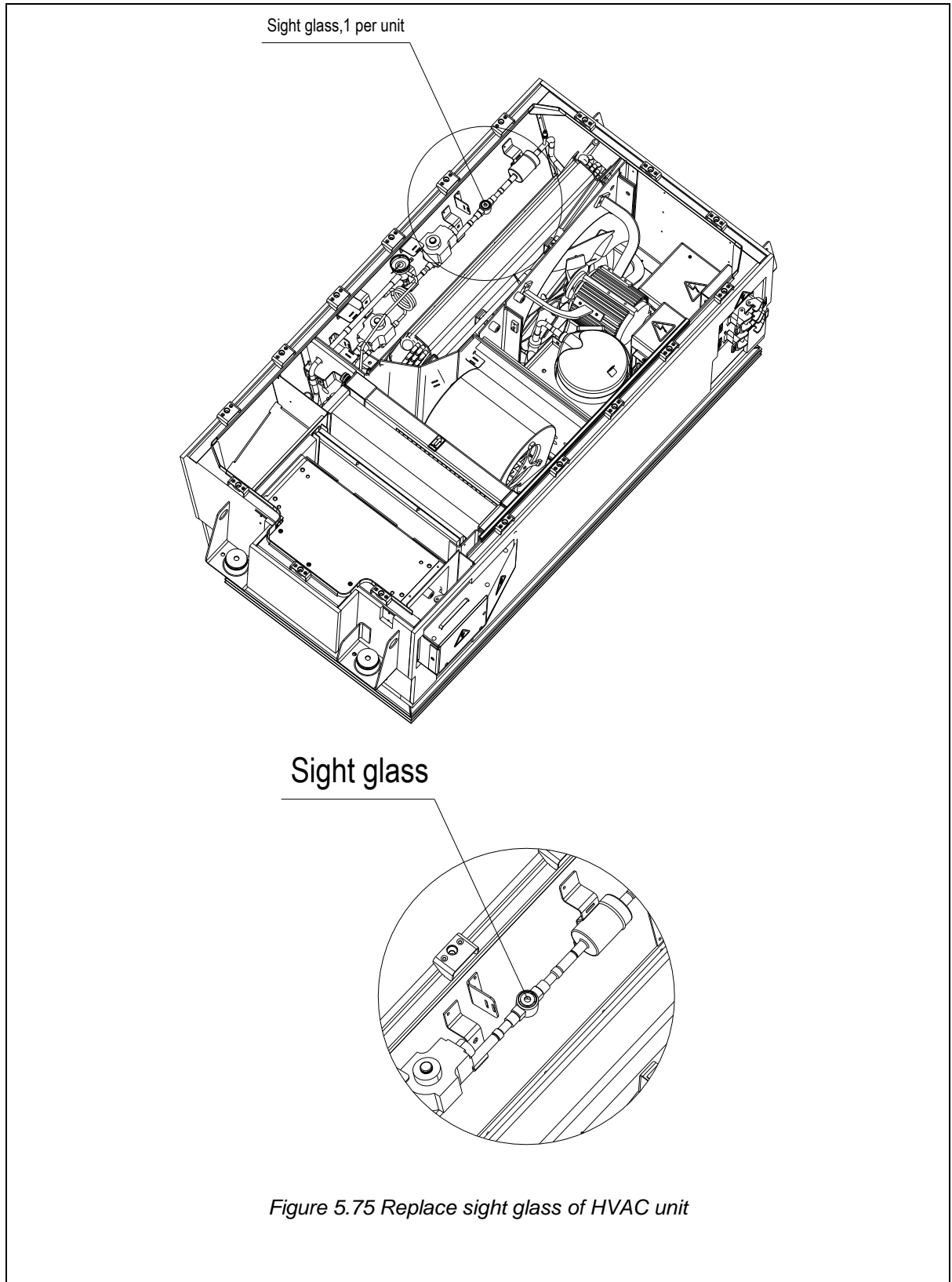
**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.4.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.1.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the liquid line sight glass.
7. Remove the liquid line sight glass from the refrigeration circuit.
8. Install new sight glass.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.3.
11. Evacuate the refrigerant circuit, see chapter 5.5.5.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.37 Replace sight glass of saloon HVAC unit

<b>Title: Sight glass - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> To replace the sight glass		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector <b>Materials and Consumables:</b> Refrigerant R407C, Brazing material. <b>Essential Replacement Parts:</b> Sight glass. <b>Parts number:</b> 12.1000.0065.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> 014-0183.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"><p style="color: red; text-align: center;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Open the cover of HVAC unit, see 5.4.2.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the liquid line sight glass.
7. Remove the liquid line sight glass from the refrigeration circuit.
8. Install new sight glass.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.4.
11. Evacuate the refrigerant circuit, see chapter 5.5.6.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

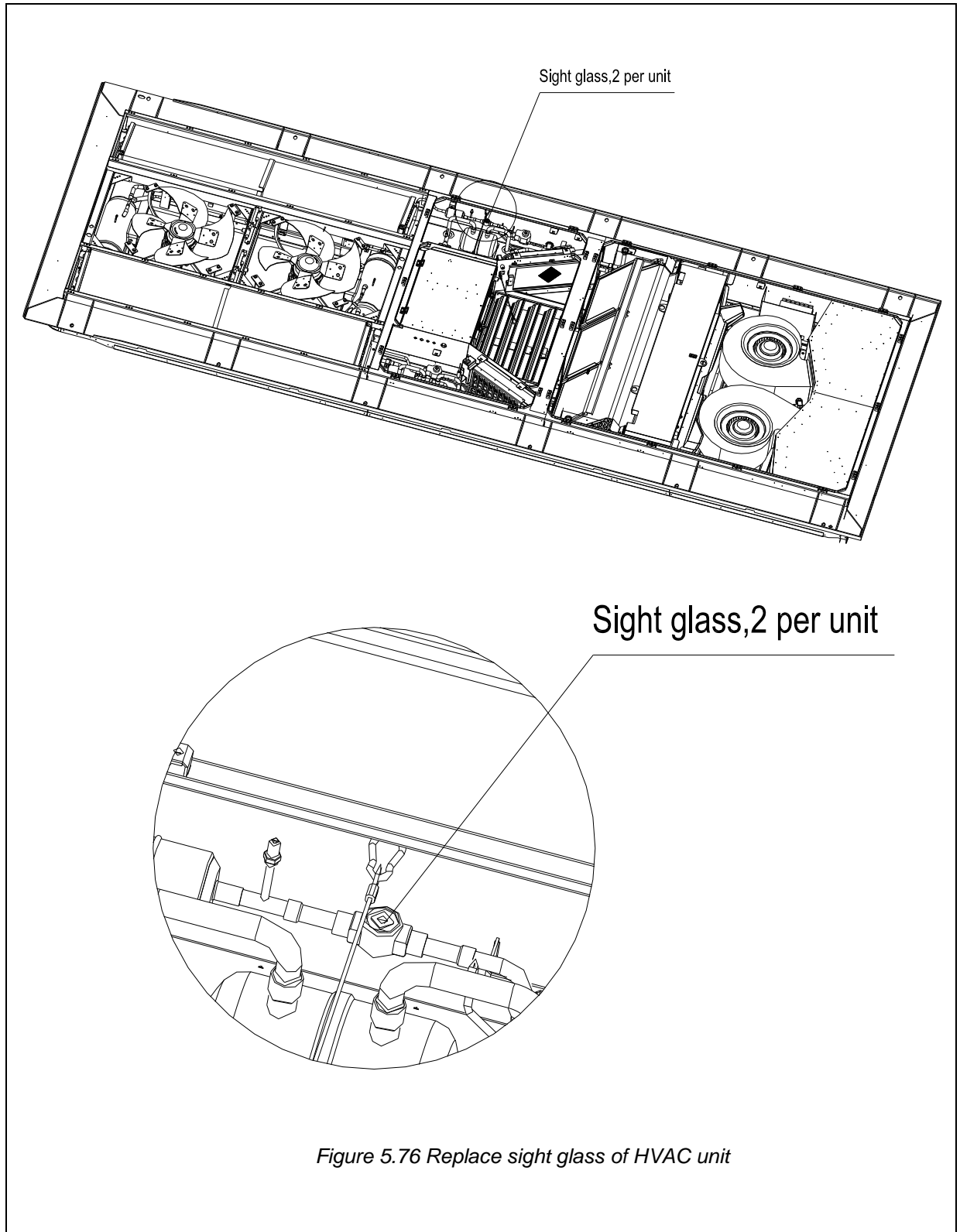


Figure 5.76 Replace sight glass of HVAC unit

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.38 Replace electrical heater of cab HVAC unit

<b>Title: Electrical heater -Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
	<b>X</b>		
<b>Reason for Task:</b> To replace electrical heater.			
<b>System/Equipment Title:</b> Cab HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> N.A.			
<b>Materials and Consumables:</b> N.A.			
<b>Essential Replacement Parts:</b> Electrical heater.			
<b>Parts number:</b> 12.0400.0108.			
<b>Illustrations:</b> TBD.			
<b>Reference Drawings:</b> KS97C100.000-04A.Z3.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1" style="margin-left: auto; margin-right: auto;"><tr><td style="text-align: center;"><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 1 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

1. Cut off the power supply.
2. Remove all the screws which fix the cover to the frame of HVAC unit.
3. Open the cover of the HVAC unit, see 5.4.1.
4. Loosen the two bolts of the heater top cover, and remove the cover.



*Figure 5.77 Loosen the bolts of heater cover*

5. Use a screw driver to insert in the holes of terminal block, press the spring, at the same time draw out the cables from the terminal block.

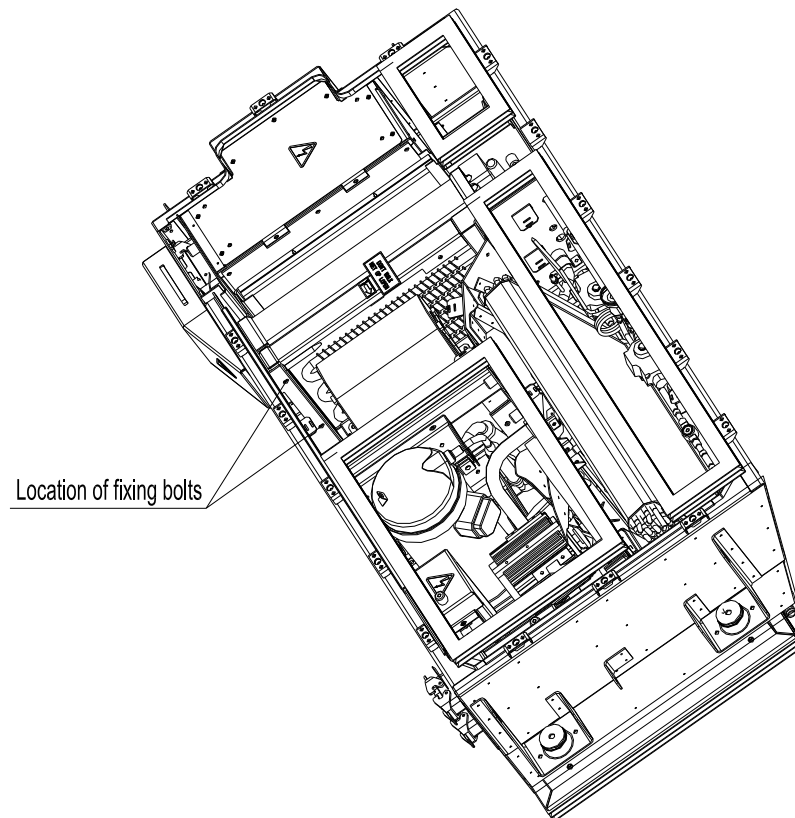


*Figure 5.78 draw out the cables from the terminal block*

## AMSTERDAM (Alstom)

### Rolling Stock

6. Disconnect the grounding cable.
7. Turn the cable gland counterclockwise and draw the cables out from heater.
8. Disconnect cables for thermal breaker/ switch.
9. Loosen the fixing bolts (M8X20) of the electrical heater that fix the heater to the frame.



*Figure 5.79 Loosen the fixing bolts of the electrical heater*

10. Remove the electrical heater out of HVAC unit.

#### **Assembly:**

1. Place electrical heater in the right location.
2. Tighten the fixing screws (M8X20) of electrical heater that fix the heater to the frame.
3. Connect cables for thermal breaker/ switch.

## AMSTERDAM (Alstom)

### Rolling Stock

#### HVAC System

#### 5 Maintenance and Overhaul Procedures

4. Connect the wires to the terminal box (under the top cover) of electrical heater, notice the wires which are connect to the main circuit and which are connect to the control circuit. And close the cover of the terminal box.
5. Connect the grounding cable.
6. Close the cover.
7. Tighten the screws which fix the cover to the frame.
8. Reconnect the electric power supply.

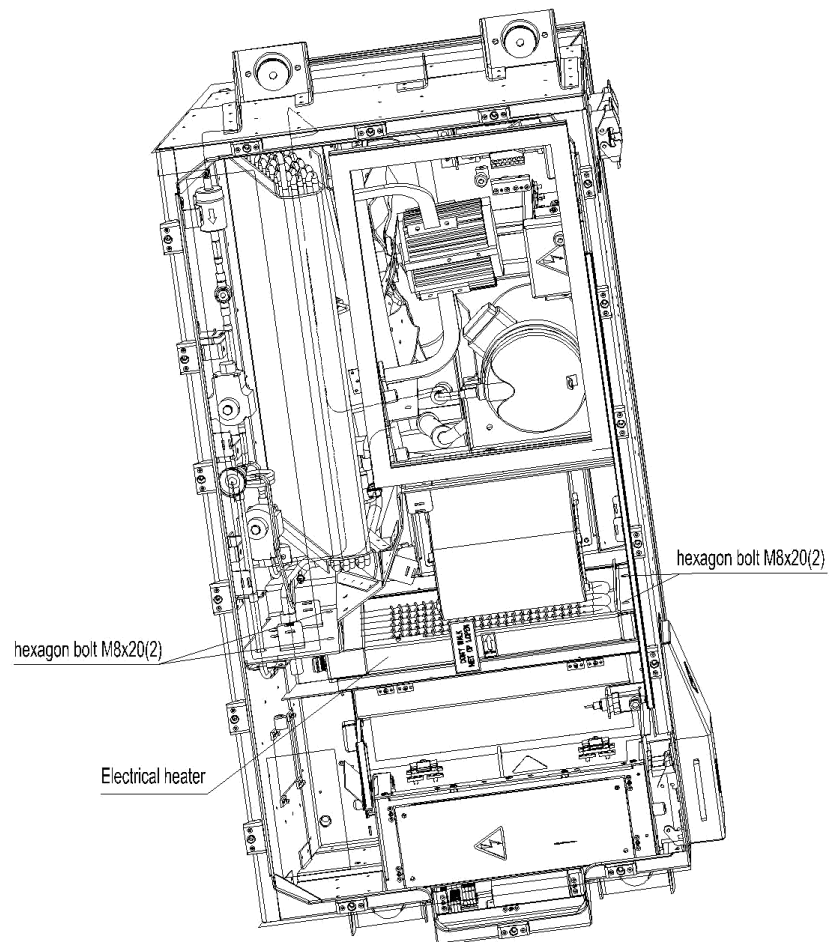


Figure 5.80 Replace electrical heater

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

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# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.39 Replace electrical heater of saloon HVAC unit

<b>Title:</b> Electrical heater -Replace	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To replace electrical heater.			
<b>System/Equipment Title:</b> Saloon HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> N.A.			
<b>Materials and Consumables:</b> N.A.			
<b>Essential Replacement Parts:</b> Electrical heater. <b>Parts number:</b> 12.0400.0101.			
<b>Illustrations:</b> TBD.			
<b>Reference Drawings:</b> KS97A100.000-04A.Z3.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲ CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲ CAUTION</b>
<b>▲ CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 1 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

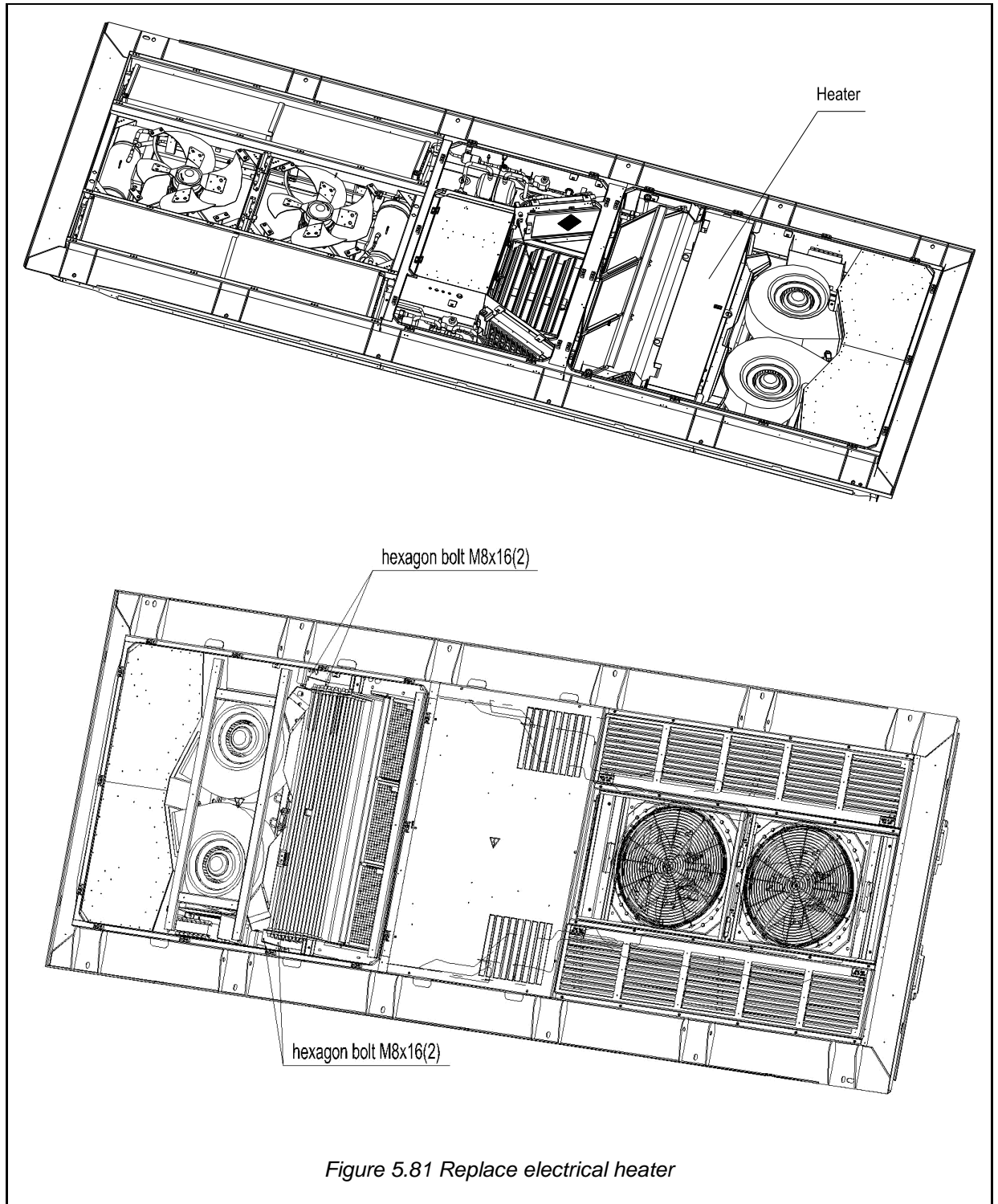
1. Cut off the power supply.
2. Remove all the screws(M8) which fix the cover to the frame of HVAC unit.
3. Open the cover of the HVAC unit, see 5.4.1.
4. Loose the screws of the terminal box on the electrical heater and open the cover of the terminal box.
5. Loose the terminal screw and disconnect the power supply wire.
6. Loose the gland and draw out the cables.
7. Disconnect cables for thermal breaker/ switch.
8. Remove the fixing screws (M8X16)of the electrical heater that fix the heater and evaporator to the frame.
9. Remove the electrical heater out of HVAC unit.

**Assembly:**

1. Place electrical heater in the right location.
2. Tighten the fixing screws (M8X16)of electrical heater that fix the heater and evaporator to the frame.
3. Connect cables for thermal breaker/ switch.
4. Connect the wire to the terminal box of electrical heater, notice the wires which are connect to the main circuit and which are connect to the control circuit. And close the cover of the terminal box.
5. Close the cover.
6. Tighten the screws(M8) which fix the cover to the frame.
7. Reconnect the electric power supply.

# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.40 Replace thermostat/thermal breaker of cab HVAC unit

<b>Title:</b> Thermostat/thermal breaker -Replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace thermostat/thermal breaker.		
<b>System/Equipment Title:</b> Cab HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.		
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Thermostat / thermal breaker. <b>Parts number:</b> 12.0601.0018/ 12.0601.0019		
<b>Illustrations:</b> Location of thermostat/thermal breaker. <b>Reference Drawings:</b> Emerson 36TMH21/ Emerson WQB139B		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 1px solid black; padding: 5px; display: inline-block;"><b>▲ CAUTION</b></div> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

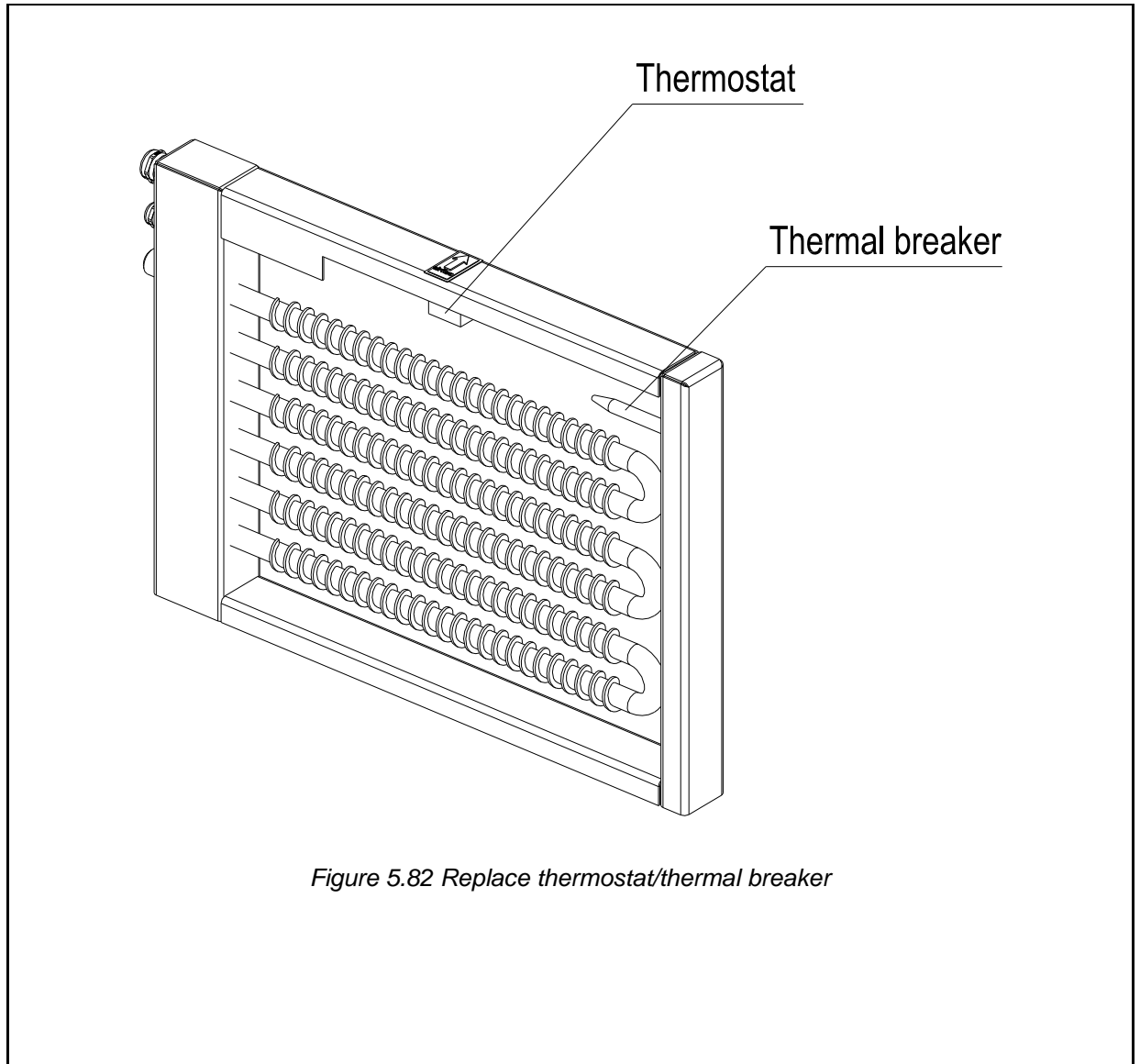
1. Cut off the power supply.
2. Open the cover and remove it, see 5.4.1.
3. Loose the screws(M8) which fix the top cover of the heater.
4. Open the top cover of the heater, and then remove side cover.
5. Loose the screws which fix the thermostat/thermal breaker.
6. Replace the thermostat/thermal breaker with a new one.

**Assembly:**

1. Tighten the fixing screws of thermostat/thermal breaker
2. Install the top cover and the side cover of the heater.
3. Screw down the screws which fix the top cover of the heater.
4. Close the cover.
5. Tighten the screws(M8) which fix the cover to the frame.
6. Reconnect the electric power supply.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.82 Replace thermostat/thermal breaker*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.41 Replace thermostat/thermal breaker of saloon HVAC unit

<b>Title:</b> Thermostat/thermal breaker -Replace	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To replace thermostat/thermal breaker.			
<b>System/Equipment Title:</b> Saloon HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> N.A.			
<b>Materials and Consumables:</b> N.A.			
<b>Essential Replacement Parts:</b> Thermostat / thermal breaker.			
<b>Parts number:</b> 12.0601.0018/ 12.0601.0019			
<b>Illustrations:</b> Location of thermostat/thermal breaker.			
<b>Reference Drawings:</b> Emerson 36TMH21/ Emerson WQB139B			
<b>SAFETY PRECAUTIONS:</b>  <table border="1" data-bbox="352 1621 564 1675"><tr><td><b>▲ CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲ CAUTION</b>
<b>▲ CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

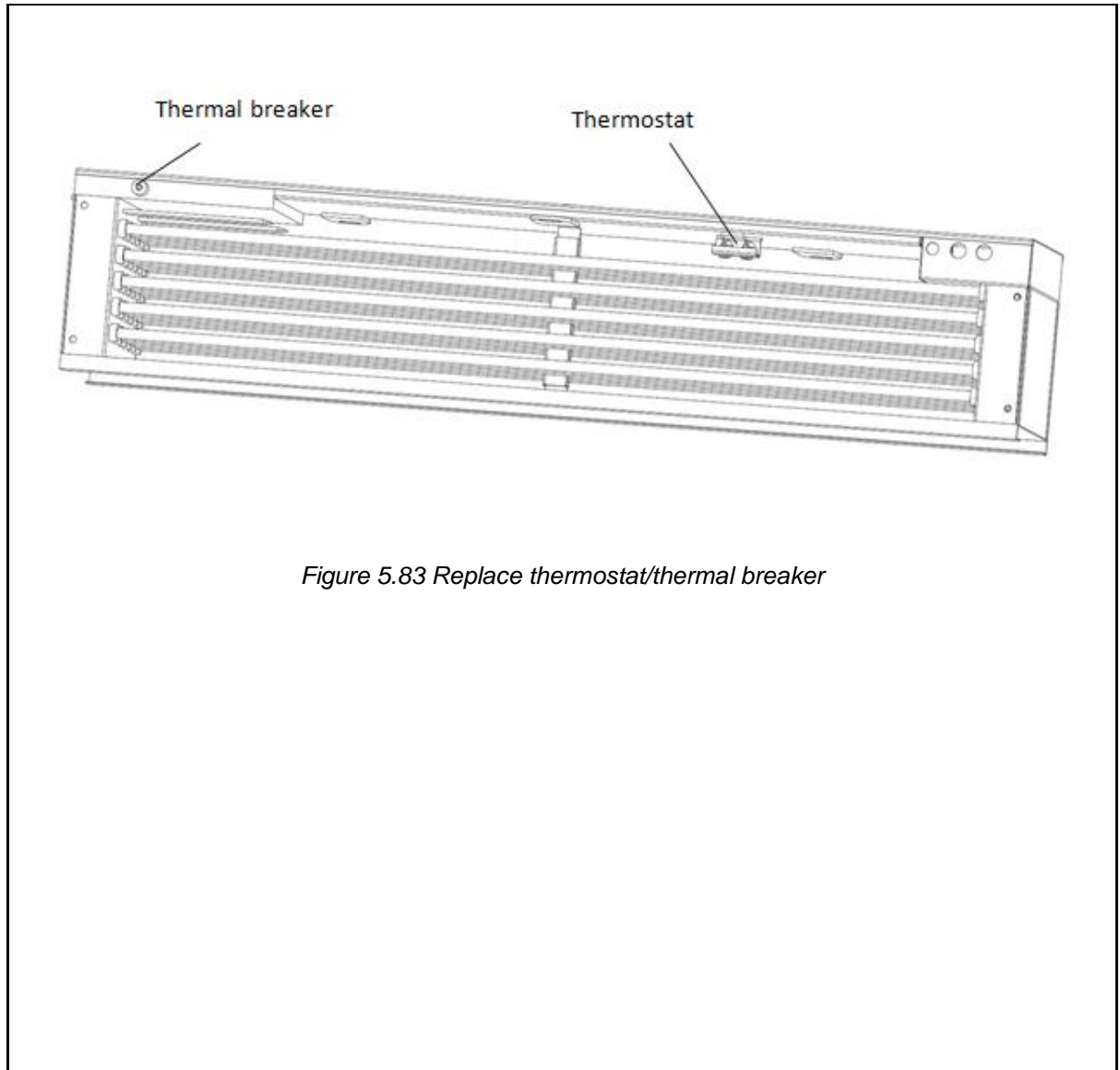
1. Cut off the power supply.
2. Open the cover and remove it, see 5.4.1.
3. Loose the screws(M8) which fix the top cover of the heater.
4. Open the top cover of the heater, and then remove side cover.
5. Loose the screws which fix the thermostat/thermal breaker.
6. Replace the thermostat/thermal breaker with a new one .

**Assembly:**

1. Tighten the fixing screws of thermostat/thermal breaker
2. Install the top cover and the side cover of the heater.
3. Screw down the screws which fix the top cover of the heater.
4. Close the cover.
5. Tighten the screws(M8) which fix the cover to the frame.
6. Reconnect the electric power supply.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.83 Replace thermostat/thermal breaker*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.42 Replace thermostat/thermal breaker of Cab Aerotherm unit

<b>Title:</b> Thermostat/thermal breaker -Replace	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To replace thermostat/thermal breaker.			
<b>System/Equipment Title:</b> Cab Aerotherm unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Thermostat / thermal breaker. <b>Parts number:</b> 12.0601.0018/ 12.0601.0019			
<b>Illustrations:</b> Location of thermostat/thermal breaker. <b>Reference Drawings:</b> Emerson 36TMH21/ Emerson WQB139B.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲ CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲ CAUTION</b>
<b>▲ CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

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**Down Time:** 0.15 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

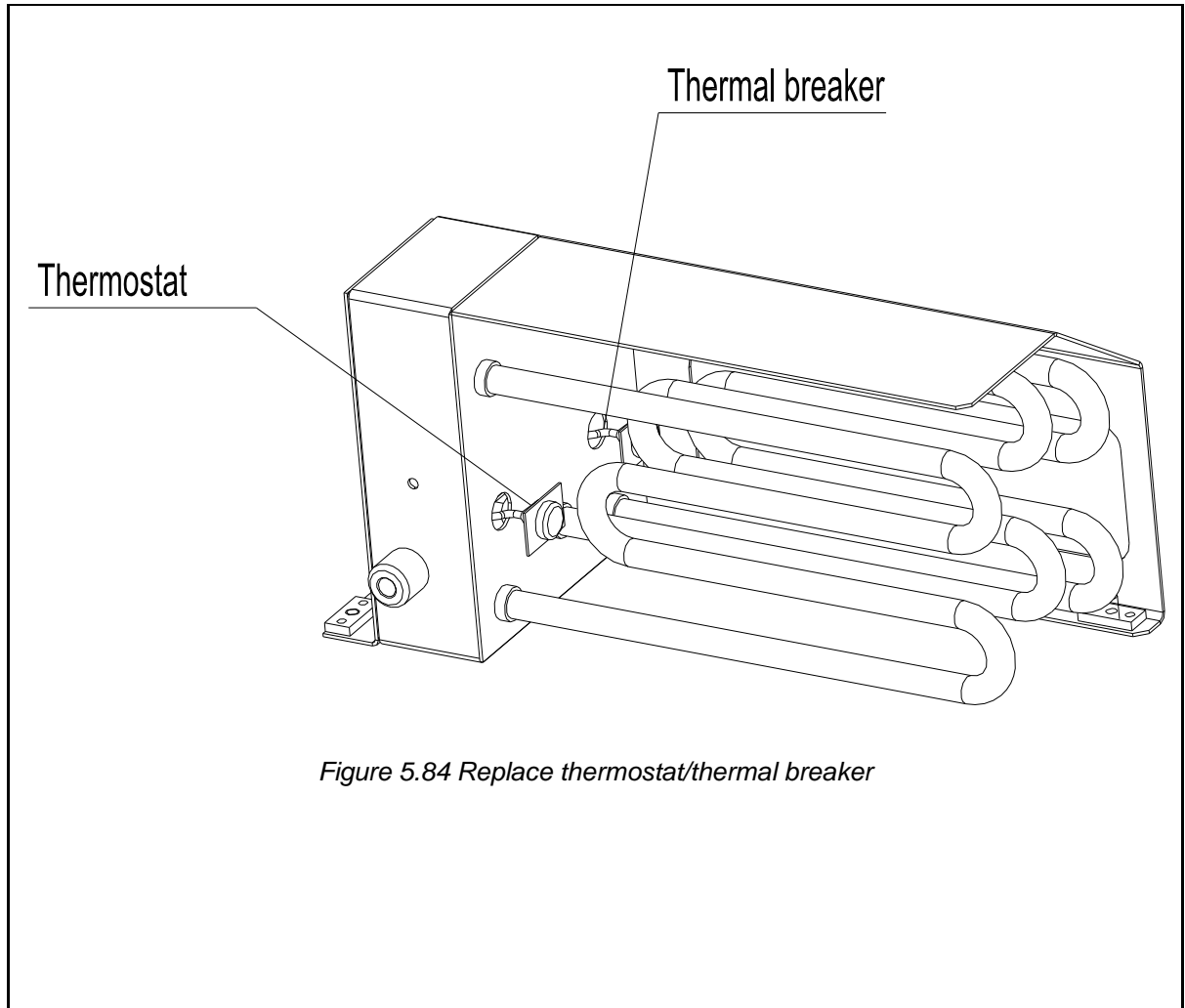
7. Cut off the power supply.
8. Open the cover and remove it,
9. Loose the screws which fix the top cover of the heater.
10. Open the top cover of the heater, and then remove side cover.
11. Loose the screws which fix the thermostat/thermal breaker.
12. Replace the thermostat/thermal breaker with a new one .

**Assembly:**

7. Tighten the fixing screws of thermostat/thermal breaker
8. Install the top cover and the side cover of the heater.
9. Screw down the screws which fix the top cover of the heater.
10. Close the cover.
11. Tighten the screws which fix the cover to the frame.
12. Reconnect the electric power supply.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.84 Replace thermostat/thermal breaker*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.43 Replace heating rod of cab HVAC unit

<b>Title: Heating rod - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	<b>X</b>	
<b>Reason for Task:</b> To replace heating rod.		
<b>System/Equipment Title:</b> Cab HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.		
<b>Special Tools and Facilities:</b> N.A.		
<b>Materials and Consumables:</b> N.A.		
<b>Essential Replacement Parts:</b> Heating rod. <b>Parts number:</b> 12.0401.0006		
<b>Illustrations:</b> Location of heating rod.		
<b>Reference Drawings:</b> N.A.		
<b>SAFETY PRECAUTIONS:</b>  <div style="border: 1px solid black; padding: 5px; display: inline-block;"><b>▲ CAUTION</b></div> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

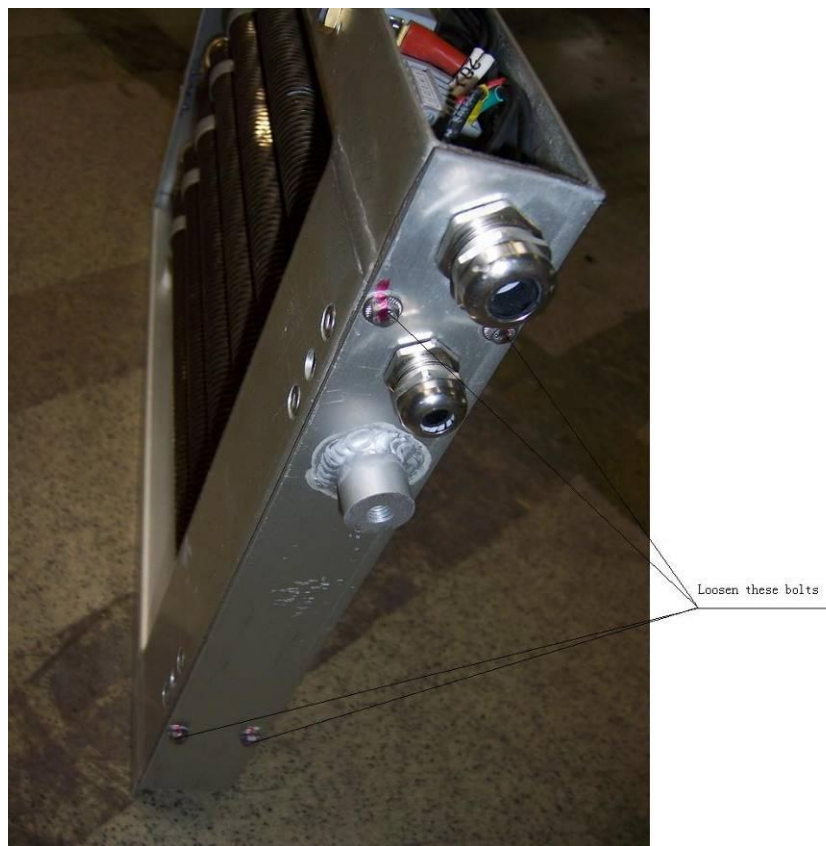
**Down Time:** 0.3 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

1. Remove the heater from the HVAC unit, please refer to 5.5.38.
2. Loosen the 4 bolts(M8) which fix the side cover to the heater, and then remove the cover, see the following figure.



*Figure 5.85 Remove the side cover of the heater*

3. Loosen the 6 white caps, see the following figure.

# AMSTERDAM (Alstom)

## Rolling Stock



Figure 5.86 Loosen the 6 white caps

4. Loosen the 6 screw nuts which fix the cable, and draw the cable out; loosen the 6 screw nuts which fix the heating rods to the heater frame.

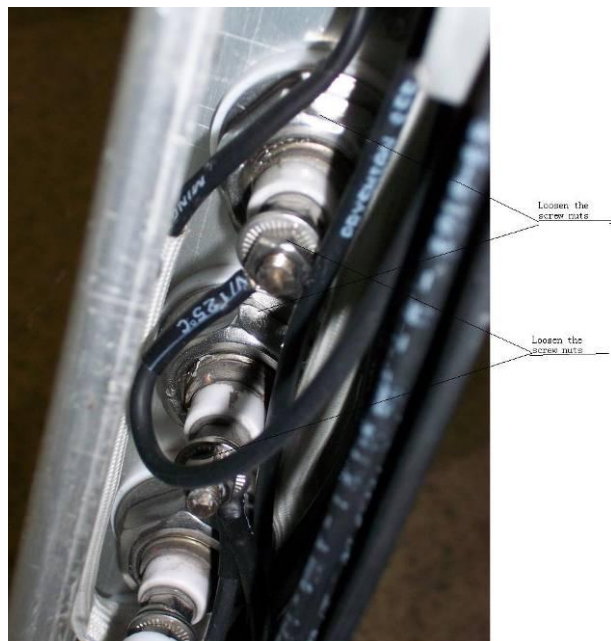


Figure 5.87 Loosen the screw nuts

5. Remove the heating rods from the heater frame ,see the following figure.

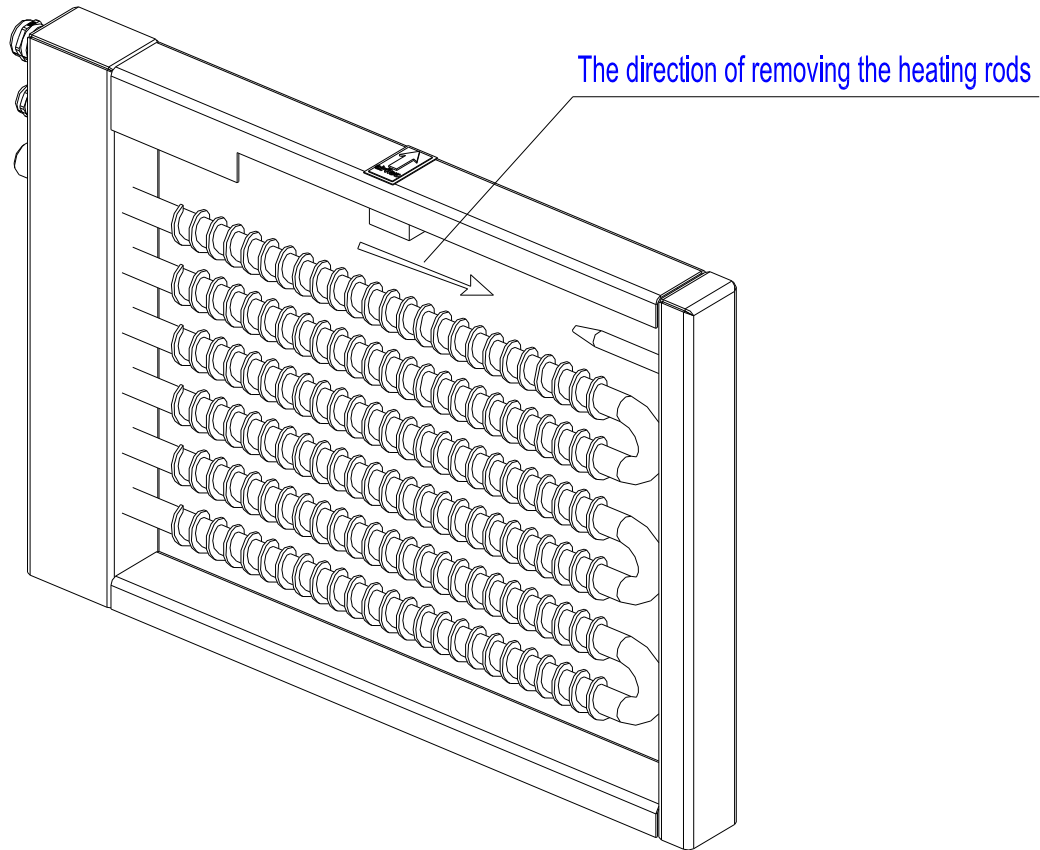


Figure 5.88 Remove the heating rods

**Assembly:**

1. Replace new heating rod(s) by a reverse of the removal process.
2. Replace the heater to the HVAC unit, see 5.5.38.

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.44 Replace heating rod of saloon HVAC unit

<b>Title: Heating rod -Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To replace heating rod.			
<b>System/Equipment Title:</b> Saloon HVAC unit. <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> N.A.			
<b>Materials and Consumables:</b> N.A.			
<b>Essential Replacement Parts:</b> Heating rod.			
<b>Parts number:</b> 12.0401.0005			
<b>Illustrations:</b> Location of heating rod.			
<b>Reference Drawings:</b> N.A.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲ CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲ CAUTION</b>
<b>▲ CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.3 hours

**Team Size:** 2 person

**Procedure:**

**Disassembly:**

1. Remove the heater from the HVAC unit, please refer to 5.5.39.
2. Open the 4 heater covers by loosening the bolts(M8), see following figure.



*Figure 5.89 Open the heater covers*

3. Loosen the caps, draw out the cables and take out the metal in both two sides.see the following figure.



*Figure 5.90 Remove the caps and the cables and metal*

4. loosen the screw nuts which fix the heating rods to the heater frame.
5. Remove the heating rods from the heater frame.

**Assembly:**

1. Replace new heating rod(s) by a reverse of the removal process.
2. Replace the heater to the HVAC unit, see 5.5.39.


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.45 Replace high pressure switch of cab HVAC unit

<b>Title:</b> High pressure switch - Replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the high pressure switch		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector <b>Materials and Consumables:</b> Brazing material. <b>Essential Replacement Parts:</b> High pressure switch. <b>Parts number:</b> 12.0501.0053.		
<b>Illustrations:</b> -; <b>Reference Drawings:</b> HS200-835-0019.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;">  <p style="color: red; margin: 0;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p> </div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.4.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.1
4. Charge the system with dry nitrogen gas through the vapour side Schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the high pressure switch.
7. Take out the high pressure switch.
8. Put new high pressure switch into the HVAC unit, solder it.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.3.
11. Evacuate the refrigerant circuit, see chapter 5.5.5.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.
15. Check the high pressure switch, refer to 5.4.20.

# AMSTERDAM (Alstom)

## Rolling Stock

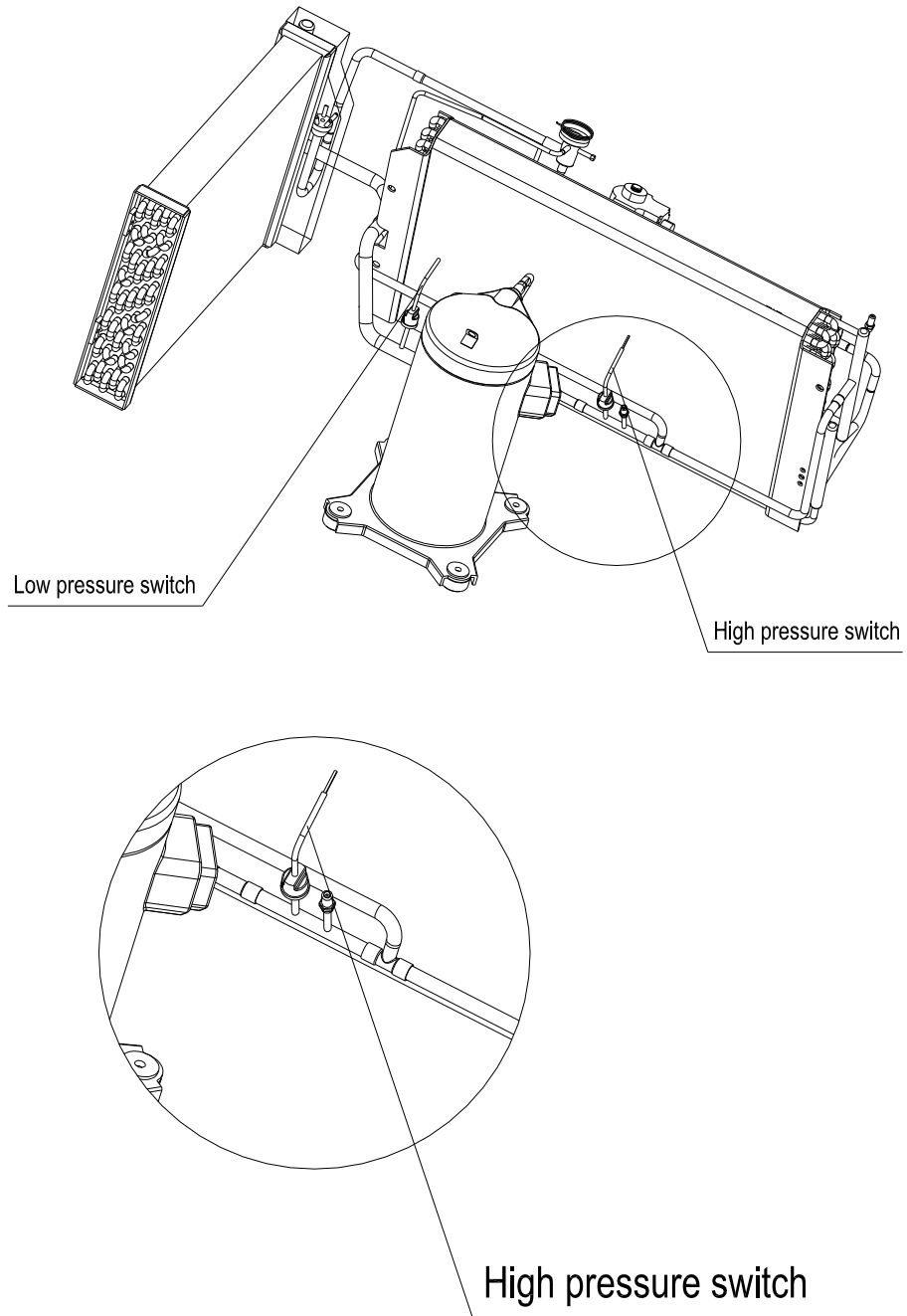


Figure 5.91 Replace high pressure switch


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.46 Replace high pressure switch of saloon HVAC unit

<b>Title: High pressure switch - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		X
<b>Reason for Task:</b> To replace the high pressure switch		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector. <b>Materials and Consumables:</b> Brazing material. <b>Essential Replacement Parts:</b> High pressure switch. <b>Parts number:</b> 12.0501.0053.		
<b>Illustrations:</b> TBD; <b>Reference Drawings:</b> HS200-835-0019.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"> It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

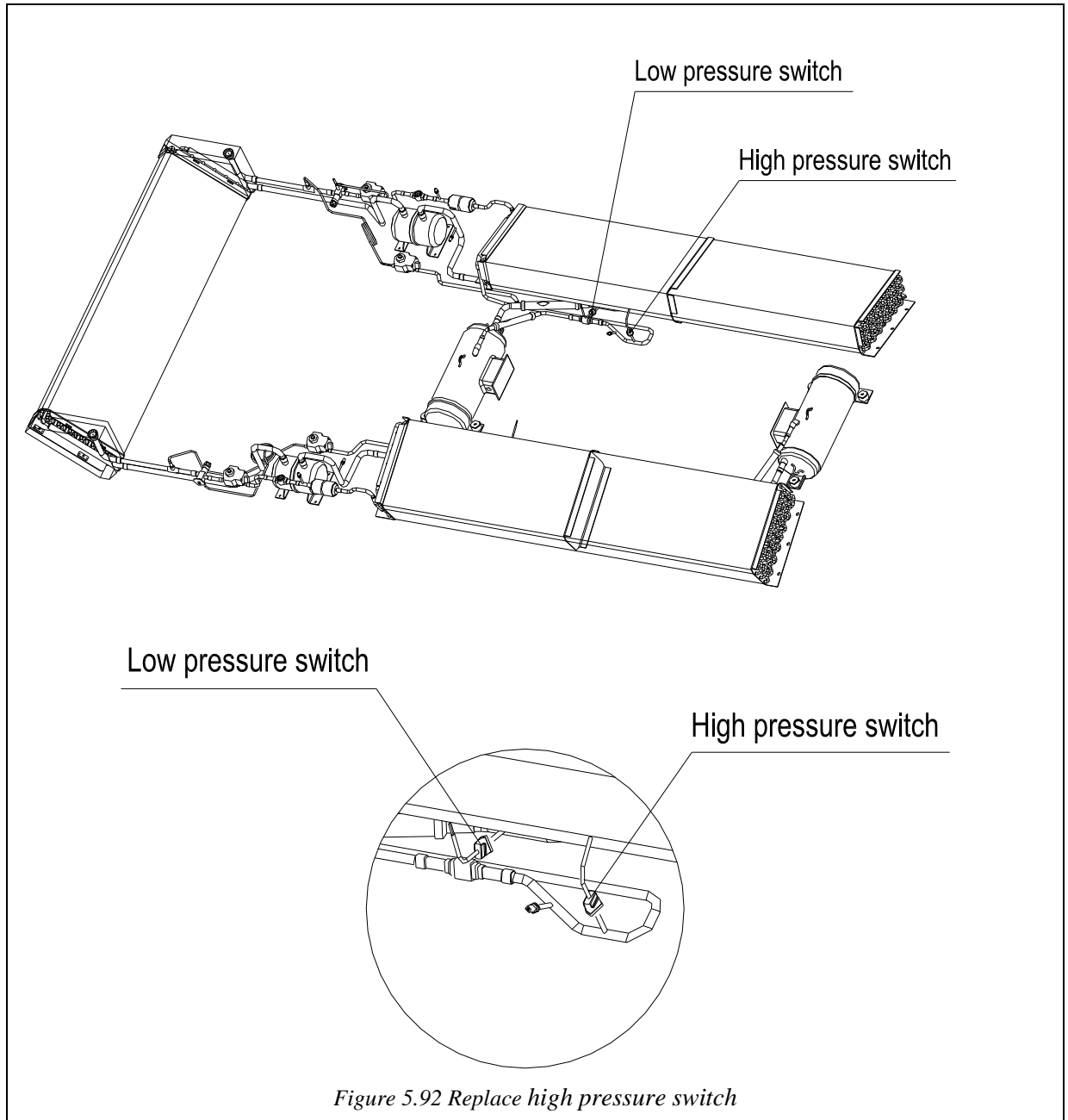
**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Open the condenser fan bracket of HVAC unit, see 5.4.3.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the high pressure switch.
7. Take out the high pressure switch.
8. Put new high pressure switch into the HVAC unit ,and solder it
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.4.
11. Evacuate the refrigerant circuit, see chapter 5.5.6.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
13. Close the condenser fan bracket.
14. Install the HVAC unit onto the vehicle.
15. Check the high pressure switch, refer to 5.4.21.

# AMSTERDAM (Alstom)

## Rolling Stock




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.47 Replace low pressure switch of cab HVAC unit

<b>Title: Low pressure switch - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the low pressure switch		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector		
<b>Materials and Consumables:</b> Brazing material.		
<b>Essential Replacement Parts:</b> low pressure switch.		
<b>Parts number:</b> 12.0502.0031.		
<b>Illustrations:</b> TBD.		
<b>Reference Drawings:</b> HS200-926-0088_TRD.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"> It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.4.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.1
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the low pressure switch.
7. Take out the low pressure switch.
8. Put new low pressure switch into the HVAC unit, solder it.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.3.
11. Evacuate the refrigerant circuit, see chapter 5.5.5.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.
15. Check the low pressure switch, refer to 5.4.22.

# AMSTERDAM (Alstom)

## Rolling Stock

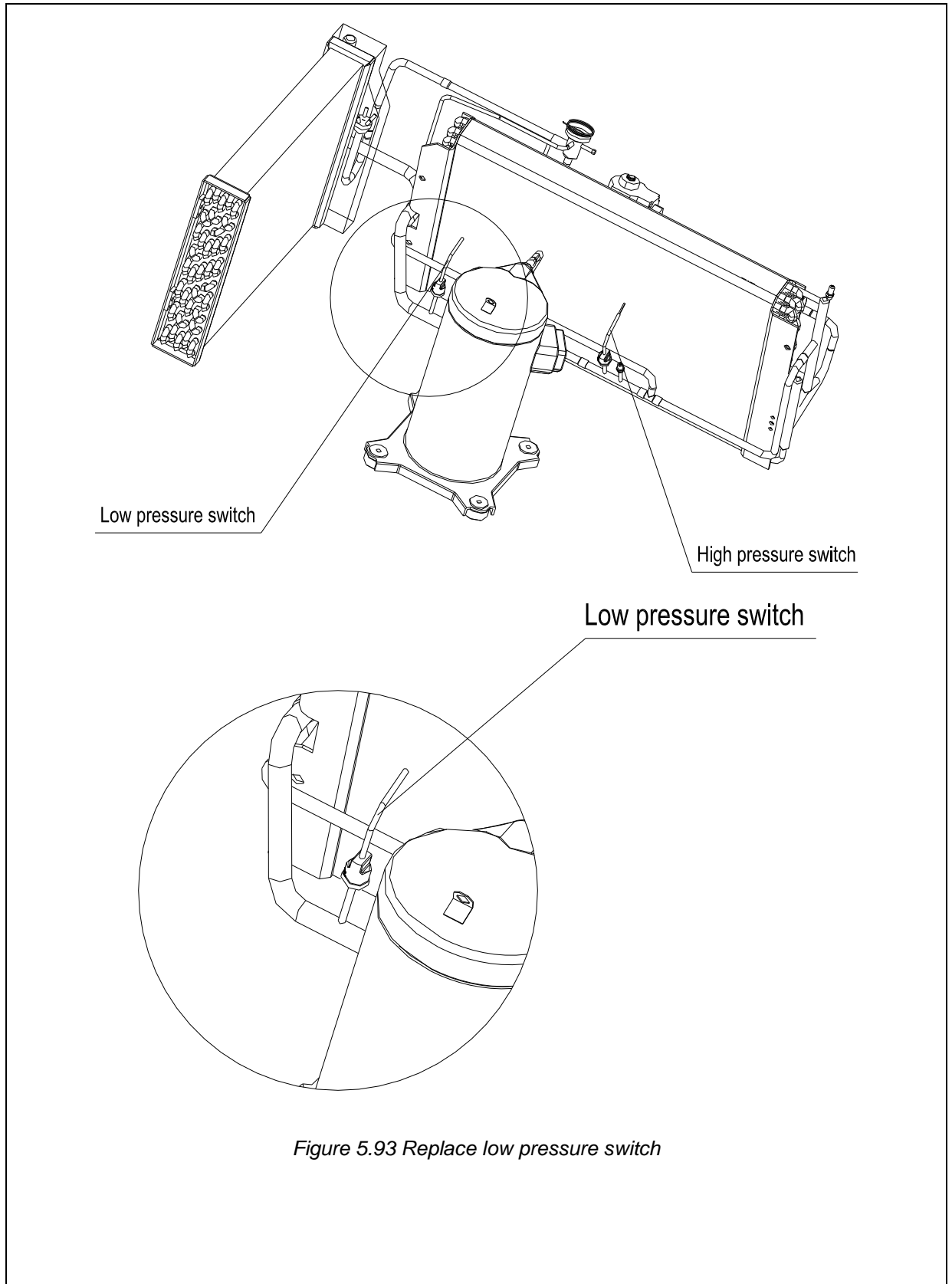


Figure 5.93 Replace low pressure switch


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.48 Replace low pressure switch of saloon HVAC unit

<b>Title:</b> Low pressure switch - Replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the low pressure switch		
<b>System/Equipment Title:</b> Saloon HVAC Unit		
<b>Manufacturer:</b> SFRT		
<b>Type/Model No:</b> KS97		
<b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacumm pump, Electronic Leakage Detector		
<b>Materials and Consumables:</b> Brazing material.		
<b>Essential Replacement Parts:</b> Low pressure switch.		
<b>Parts number:</b> 12.0502.0032.		
<b>Illustrations:</b> TBD.		
<b>Reference Drawings:</b> HS200-835-0020.		
<b>SAFETY PRECAUTIONS:</b>		
<div style="border: 2px solid black; padding: 10px; margin: 10px auto; width: 80%;">  <p style="color: red; margin: 0;">It is dangerous for touching the refrigerant. Safeguard devices are needed.</p> <p style="color: red; margin: 0;">Under no circumstances should liquid refrigerant be filled over suction line.</p> </div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Open the condenser fan bracket of HVAC unit.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2
4. Charge the system with dry nitrogen gas through the vapour side Schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the low pressure switch.
7. Take out the low pressure switch.
8. Put new low pressure switch into the HVAC unit ,and solder it
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.4.
11. Evacuate the refrigerant circuit, see chapter 5.5.6.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
13. Close the condenser fan bracket.
14. Install the HVAC unit onto the vehicle.
15. Check the low pressure switch, refer to 5.4.23.

# AMSTERDAM (Alstom)

## Rolling Stock

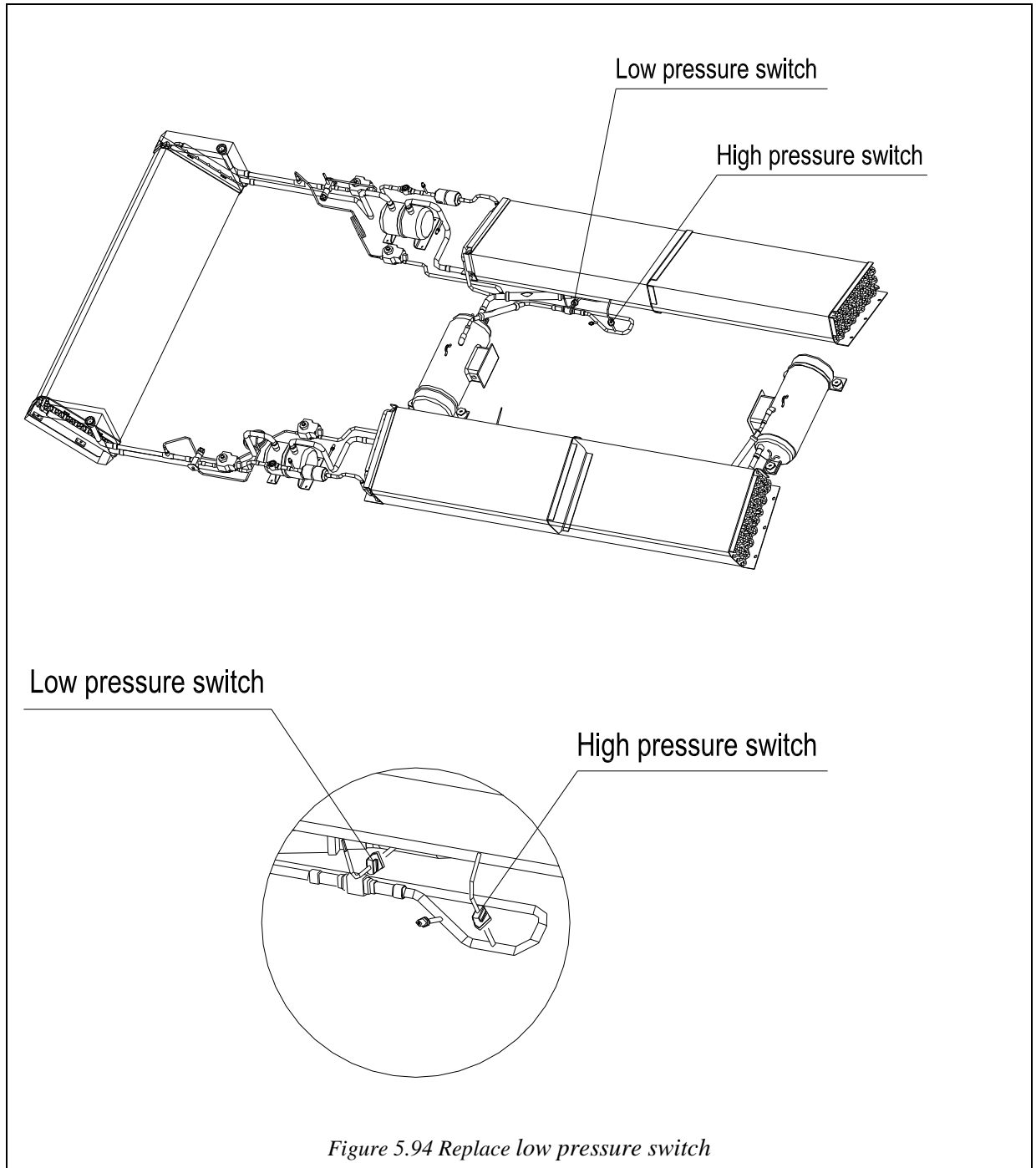


Figure 5.94 Replace low pressure switch


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.49 Replace return air temperature sensor of cab HVAC unit

<b>Title: Temperature Sensor - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	<b>X</b>	
<b>Reason for Task:</b> To Replace the return Temperature Sensor.		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.		
<b>Special Tools and Facilities:</b> N.A.		
<b>Materials and Consumables:</b> N.A.		
<b>Essential Replacement Parts:</b> Temperature sensor.		
<b>Parts number:</b> 12.0603.0005.		
<b>Illustrations:</b> TBD.		
<b>Reference Drawings:</b> KT38A000.000-21A.Z4.		
<b>SAFETY PRECAUTIONS:</b> 		
<b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b>		
<b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b>		
<b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

**Team Size:** 1 person

**Procedure:**

1. Cut off the power supply.
2. Use a stepladder for climbing small heights, reach to the service hatch.
3. Open the service hatch.
4. Find the location of the return air temperature sensor. See figure 5.95-1.
5. Loose the screw on the end of the temperature sensor(Position 6 of Figure 5.95-2).
6. Draw out the plug of return air temperature sensor.
7. Loose the terminal screw (terminal 1 and terminal 2 of Figure 5.95-3)and remove the electrical wire.
8. Take down the sensor from the socket by turning it widdershins.
9. Remove the sensor out of the HVAC unit.
10. Place the socket of a new sensor in the right location.
11. Install the new sensor by turning it deasil.
12. Connect the wire to the plug.
13. Connect the wire to the terminal (terminal 1 and terminal 2 of Figure 5.95-3)and fix it by screw down the terminal screw.
14. Insert the plug into the socket, screw down the screw on the end of the temperature sensor (Position 6 of Figure 5.95-2).
15. Close the service hatch.

# AMSTERDAM (Alstom)

## Rolling Stock

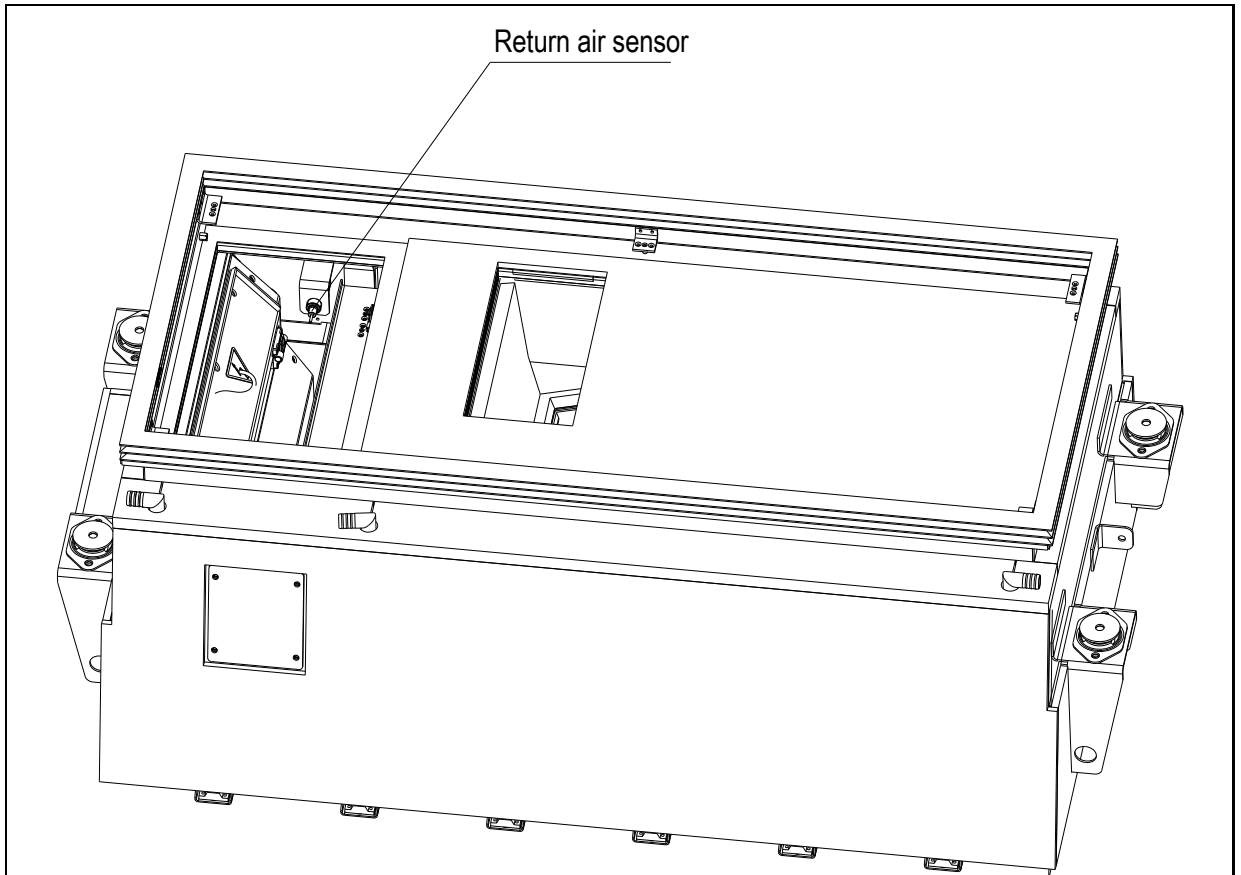
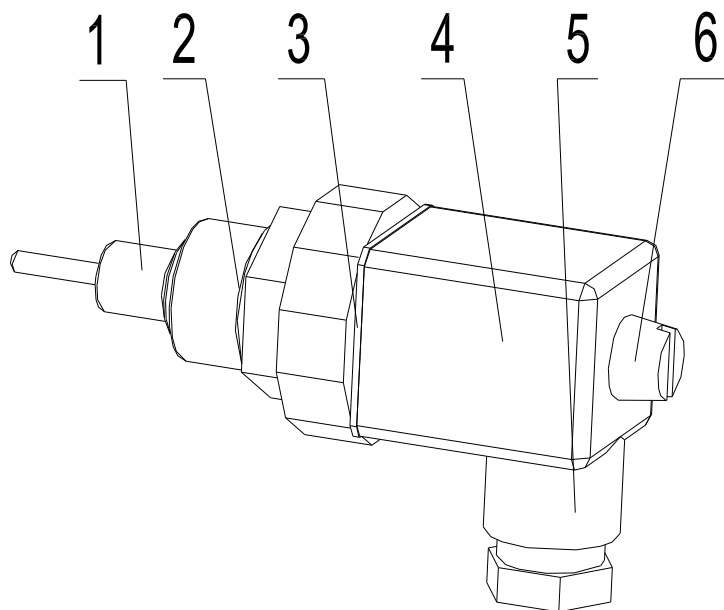


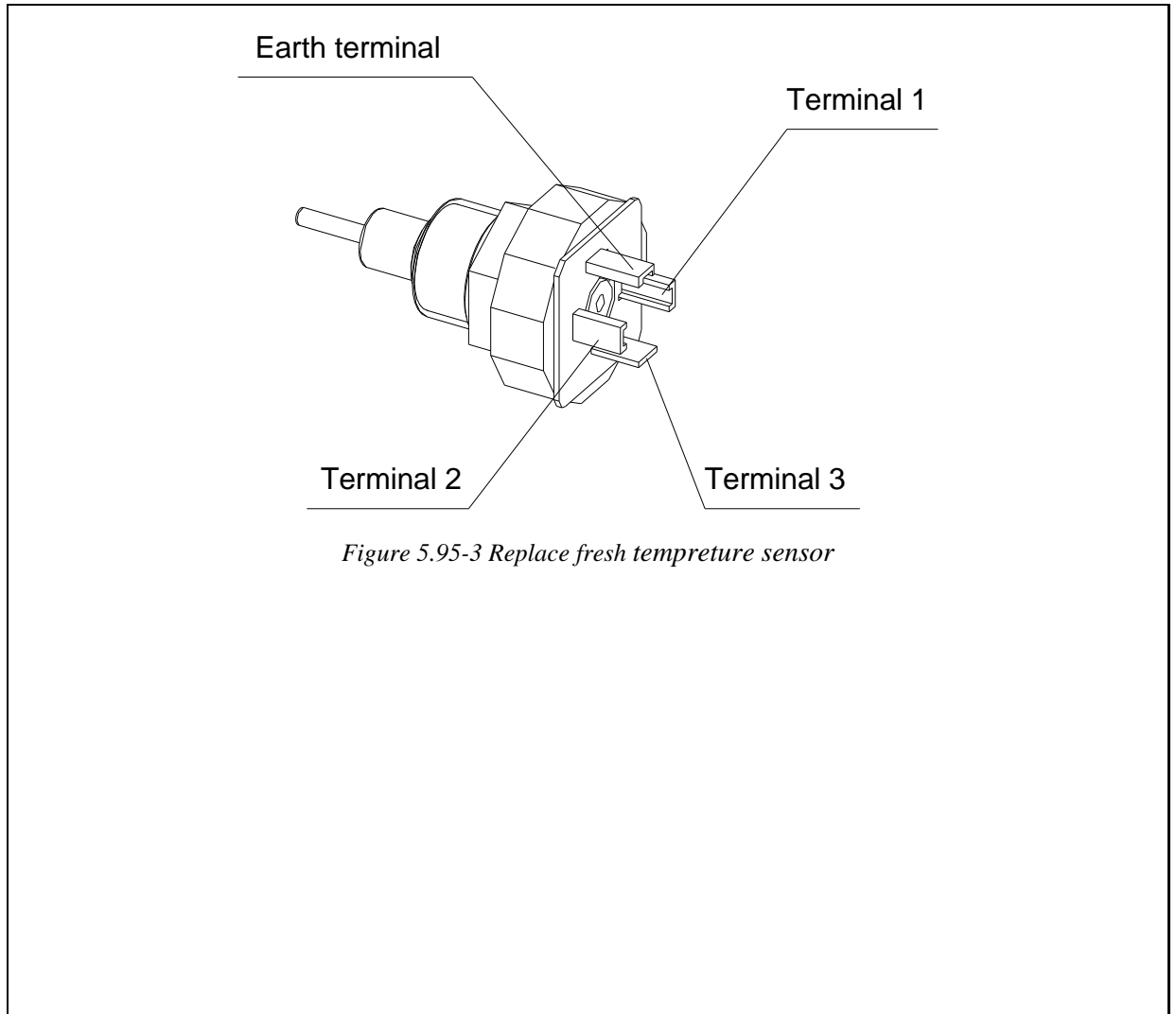
Figure 5.95-1 Replace return air temperature sensor



1 Temperature detector	2 O-ring M20*1.5
3 Flat gasket	4 Cable socket
5 Cable gland M16*1.5	6 Socket fixed screw

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.95-3 Replace fresh temperature sensor*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.50 Replace supply air temperature sensor of cab HVAC unit

<b>Title: Temperature sensor - Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
	<b>X</b>		
<b>Reason for Task:</b> To Replace the Supply Temperature Sensor.			
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> N.A.			
<b>Materials and Consumables:</b> N.A.			
<b>Essential Replacement Parts:</b> Temperature sensor.			
<b>Parts number:</b> 12.0603.0005.			
<b>Illustrations:</b> TBD.			
<b>Reference Drawings:</b> KT38A000.000-21A.Z4.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1" style="margin-left: auto; margin-right: auto;"><tr><td style="text-align: center;"><b>▲ CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲ CAUTION</b>
<b>▲ CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

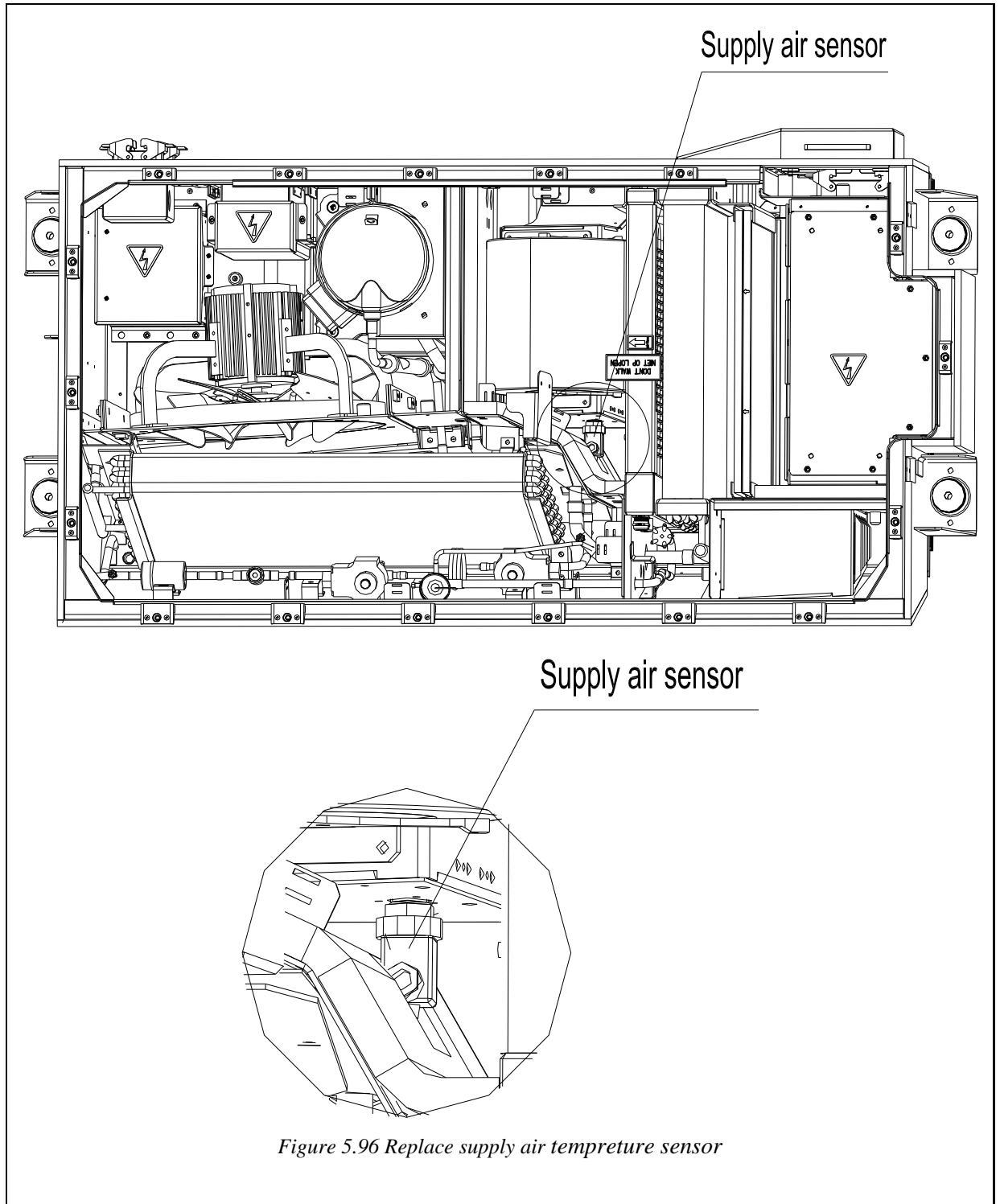
**Team Size:** 2 person

**Procedure:**

1. Cut off the power supply.
2. Remove all the screws which fix the cover to the frame of HVAC unit.
3. Open the cover and remove it, see 5.5.4.
4. Find the location of the supply air temperature sensor. See figure 5.95-1.
5. Loose the screw on the end of the temperature sensor(Position 6 of Figure 5.95-2).
6. Draw out the plug of supply air temperature sensor.
7. Loose the terminal screw (terminal 1 and terminal 2 of Figure 5.95-3)and remove the electrical wire.
8. Take down the sensor from the socket by turning it widdershins.
9. Remove the sensor out of the HVAC unit.
10. Place the socket of a new sensor in the right location.
11. Install the new sensor by turning it deasil.
12. Connect the wire to the plug.
13. Connect the wire to the terminal (terminal 1 and terminal 2 of Figure 5.95-4)and fix it by screw down the terminal screw.
14. Insert the plug into the socket, screw down the screw on the end of the temperature sensor (Position 6 of Figure 5.95-2).
15. Close the cover.
16. Tighten the screws which fix the cover to the frame.

# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.51 Replace fresh air temperature sensor of saloon HVAC unit

<b>Title: Temperature Sensor – Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To Replace the Fresh Temperature Sensor.			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> N.A.			
<b>Materials and Consumables:</b> N.A.			
<b>Essential Replacement Parts:</b> Temperature sensor.			
<b>Parts number:</b> 12.0603.0005.			
<b>Illustrations:</b> TBD.			
<b>Reference Drawings:</b> KT38A000.000-21A.Z4.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1" style="margin-left: auto; margin-right: auto;"><tr><td style="text-align: center;"><b>▲ CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲ CAUTION</b>
<b>▲ CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

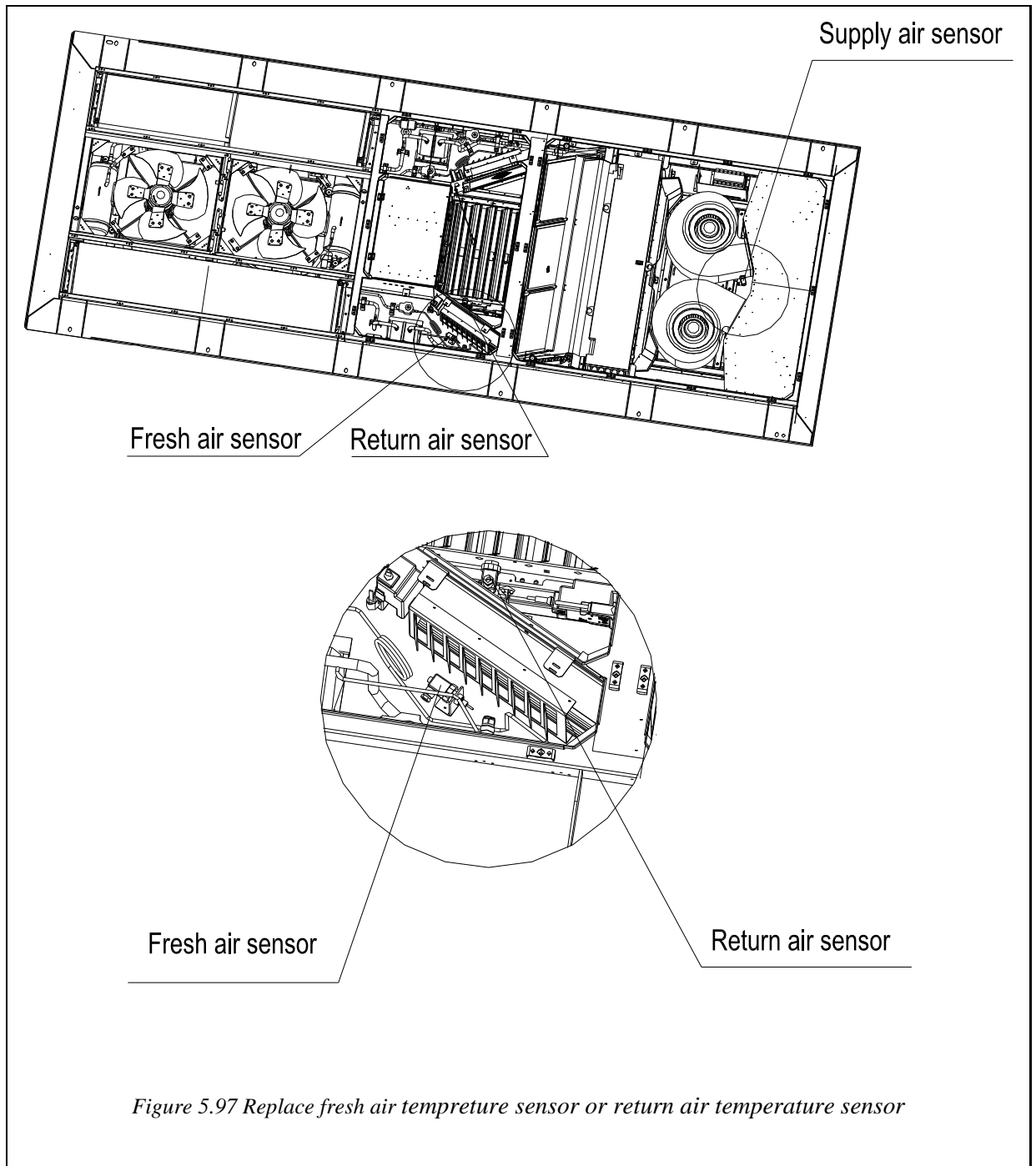
**Team Size:** 2 person

**Procedure:**

1. Cut off the power supply.
2. Remove all the screws which fix the cover to the frame of HVAC unit.
3. Open the cover and remove it.
4. Find the location of the fresh air temperature sensor. See figure 5.97.
5. Loose the screw on the end of the temperature sensor (Position 6 of Figure 5.95-2).
6. Draw out the plug of fresh air temperature sensor.
7. Loose the terminal screw (terminal 1 and terminal 2 of Figure 5.95-3) and remove the electrical wire.
8. Take down the sensor from the socket by turning it widdershins.
9. Remove the sensor out of the HVAC unit.
10. Place the socket of a new sensor in the right location.
11. Install the new sensor by turning it deasil.
12. Connect the wire to the plug.
13. Connect the wire to the terminal (terminal 1 and terminal 2 of Figure 5.95-3)and fix it by screw down the terminal screw.
14. Insert the plug into the socket, screw down the screw on the end of the temperature sensor(Position 6 of Figure 5.95-2).
15. Close the cover.
16. Tighten the screws which fix the cover to the frame.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.97 Replace fresh air temperature sensor or return air temperature sensor*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.52 Replace return air temperature sensor of saloon HVAC unit

<b>Title:</b> Temperature sensor – Replace	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To Replace the Return Temperature Sensor.			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> Stepladder. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Temperature sensor. <b>Parts number:</b> 12.0603.0005.			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KT38A000.000-21A.Z4.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

**Team Size:** 1 person

**Procedure:**

1. Cut off the power supply.
2. Use a stepladder for climbing small heights, reach the return air grille.
3. Open the return air grille.
4. Find the location of the return air temperature sensor, it is mounted in the bottom off unit, next to electrical connections. (Figure 5.97)
5. Loose the screw on the end of the temperature sensor (Position 6 of Figure 5.95-2).
6. Draw out the plug of return air temperature sensor.
7. Loose the terminal screw (terminal 1 and terminal 2 of Figure 5.95-4)and remove the electrical wire.
8. Take down the sensor from the socket by turning it widdershins.
9. Remove the sensor out of the HVAC unit.
10. Place the socket of a new sensor in the right location.
11. Install the new sensor by turning it deasil.
12. Connect the wire to the plug.
13. Connect the wire to the terminal (terminal 1 and terminal 2 of Figure 5.95-4)and fix it by screw down the terminal screw.
14. Insert the plug into the socket, screw down the screw on the end of the temperature sensor (Position 6 of Figure 5.95-2).

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.53 Replace supply air temperature sensor of saloon HVAC unit

<b>Title:</b> Temperature sensor – Replace	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		X	
<b>Reason for Task:</b> To Replace the Supply temperature sensor.			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Temperature sensor. <b>Parts number:</b> 12.0603.0005.			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> KT38A000.000-21A.Z4.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

**Team Size:** 2 person

**Procedure:**

1. Cut off the power supply.
2. Remove all the screws which fix the cover to the frame of HVAC unit.
3. Open the cover and remove it..
4. Find the location of the Supply air temperature sensor. See Figure 5.98.
5. Loose the screw on the end of the temperature sensor (Position 6 of Figure 5.95-2).
6. Draw out the plug of supply air temperature sensor.
7. Loose the terminal screw (terminal 1 and terminal 2 of Figure 5.95-4) and remove the electrical wire.
8. Take down the sensor from the socket by turning it widdershins.
9. Remove the sensor out of the HVAC unit.
10. Place the socket of a new sensor in the right location.
11. Install the new sensor by turning it deasil.
12. Connect the wire to the plug.
13. Connect the wire to the terminal (terminal 1 and terminal 2 of Figure 5.95-4) and fix it by screw down the terminal screw.
14. Insert the plug into the socket, screw down the screw on the end of the temperature sensor (Position 6 of Figure 5.95-2).
15. Close the cover.
16. Tighten the screws which fix the cover to the frame.

# AMSTERDAM (Alstom)

## Rolling Stock

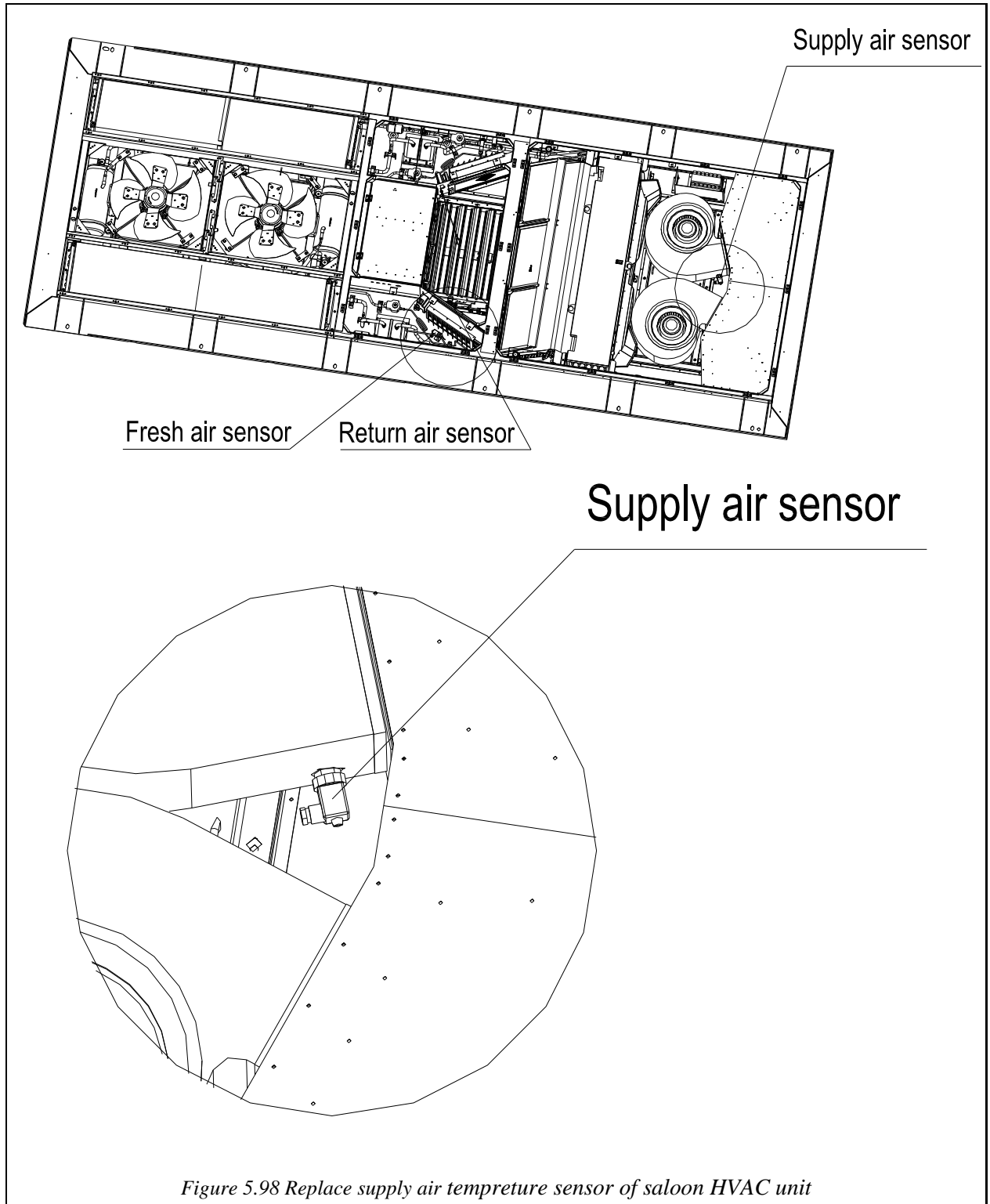


Figure 5.98 Replace supply air temperature sensor of saloon HVAC unit

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.54 Replace check valve of cab HVAC unit

Check valve is located on the outlet pipe of compressor.

<b>Title: Check valve - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the check valve		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector <b>Materials and Consumables:</b> Brazing material. <b>Essential Replacement Parts:</b> Check valve. <b>Parts number:</b> 12.1000.0097		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> 020-1038.		
<b>SAFETY PRECAUTIONS:</b> N.A.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.20 hours

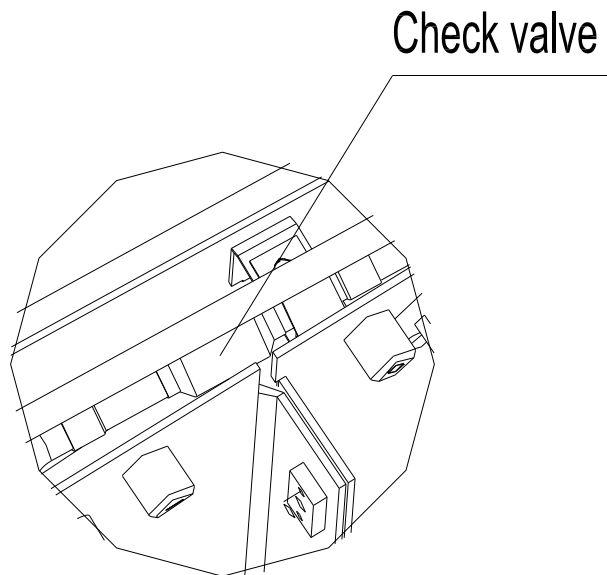
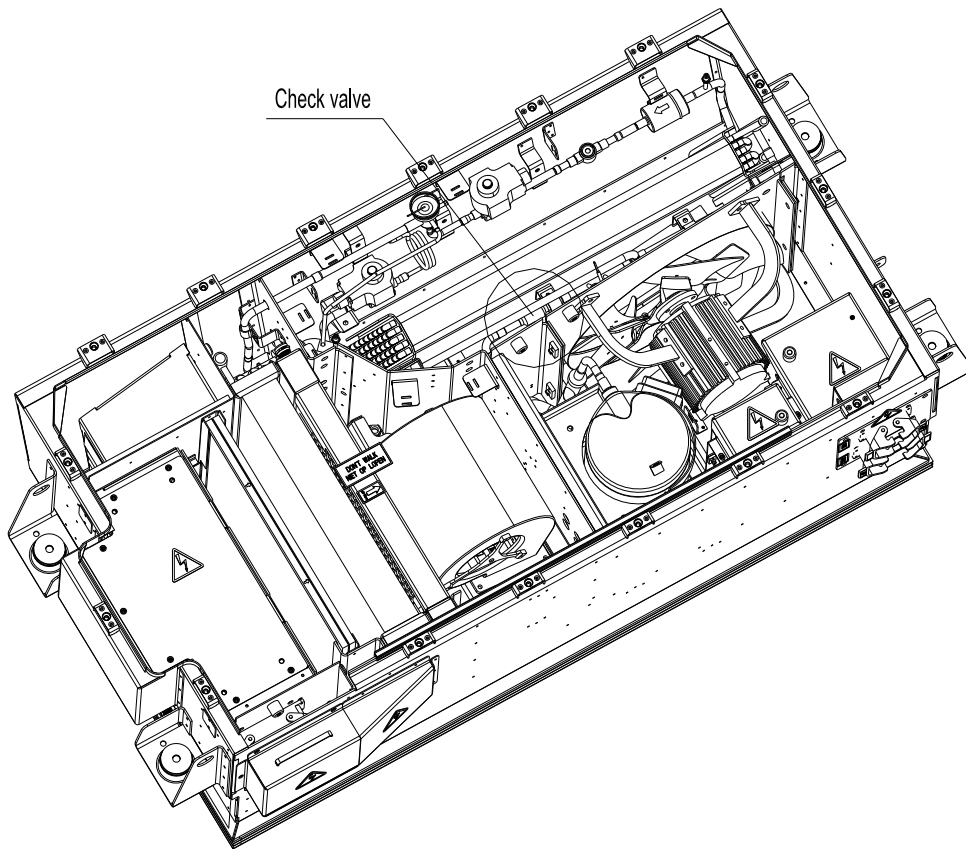
**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.4.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2.
4. Charge the system with dry nitrogen gas through the vapour side Schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the check valve.
7. Remove the check valve from the refrigeration circuit.
8. Install a new check valve by the reverse procedure of uninstall.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.4.
11. Evacuate the refrigerant circuit, see chapter 5.5.6.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.99 Replace check valve of Cab HVAC unit*

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

#### 5.5.55 Replace check valve of saloon HVAC unit

Check valve is located on the outlet pipe of compressor.

<b>Title: Check valve - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the check valve		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector <b>Materials and Consumables:</b> Brazing material. <b>Essential Replacement Parts:</b> Check valve. <b>Parts number:</b> 12.1000.0066.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> 020-1038.		
<b>SAFETY PRECAUTIONS:</b> N.A.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.20 hours

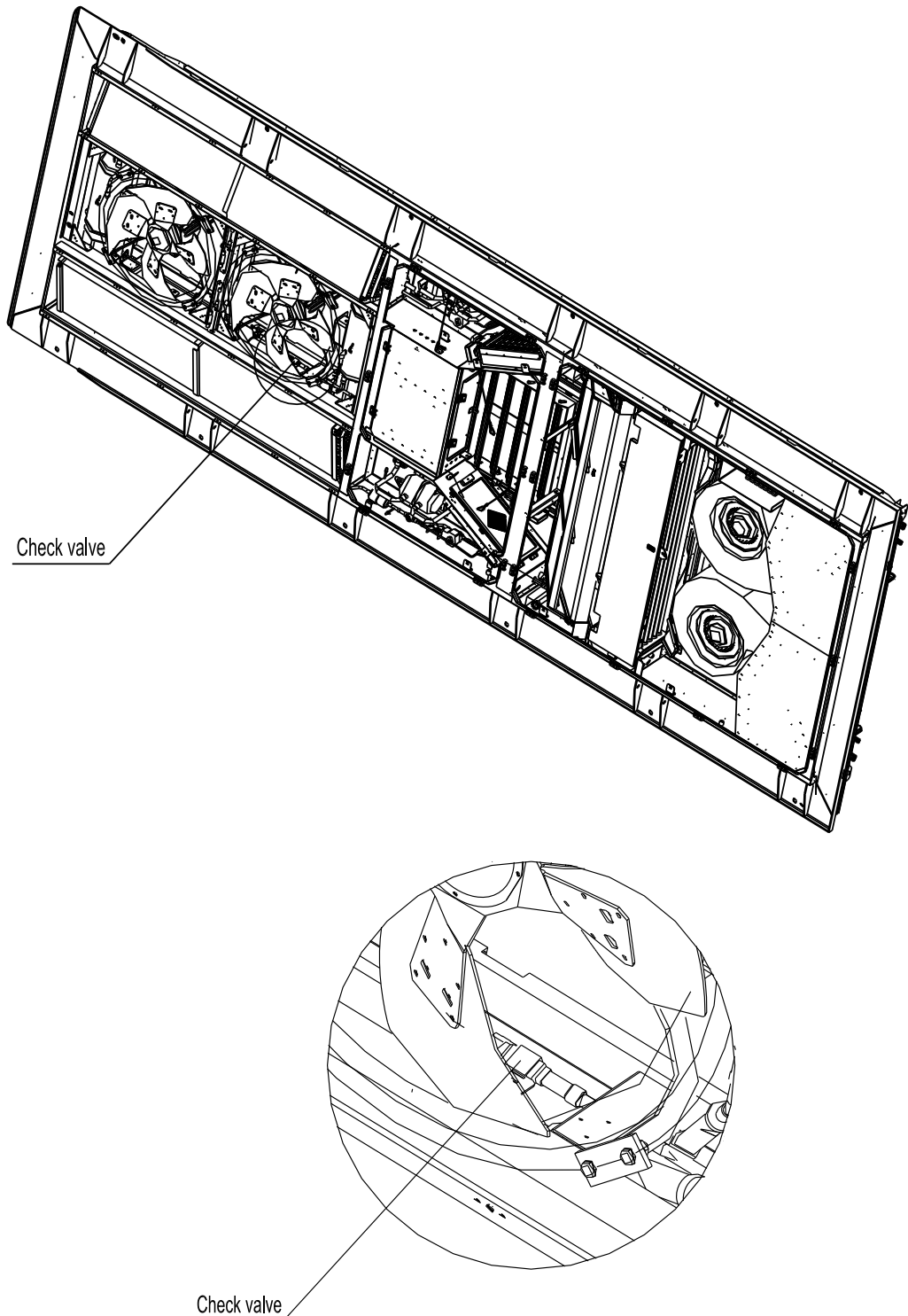
**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Open the condenser fan bracket of HVAC unit, see 5.4.3.
3. Remove the Condenser fan.
4. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2.
5. Charge the system with dry nitrogen gas through the vapour side schrader valve.
6. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
7. Unsolder all copper connecting to the check valve.
8. Remove the check valve from the refrigeration circuit .
9. Install a new check valve by the reverse procedure of uninstall.
10. Stop the purging of nitrogen through the cycle.
11. Leak test the refrigerant circuit, see chapter 5.5.4.
12. Evacuate the refrigerant circuit, see chapter 5.5.6.
13. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
14. Place the condenser fan.
15. Close the condenser fan bracket.
16. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.100 Replace check valve*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.56 Replace liquid/hotgas bypass solenoid valve of cab HVAC unit

<b>Title: Solenoid valve - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the solenoid valve		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector. <b>Materials and Consumables:</b> Brazing material. <b>Essential Replacement Parts:</b> Solenoid valve/Expansion valve. <b>Parts number:</b> 12.1000.0139.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> 032F1213_TRD .		
<b>SAFETY PRECAUTIONS:</b> N.A.		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

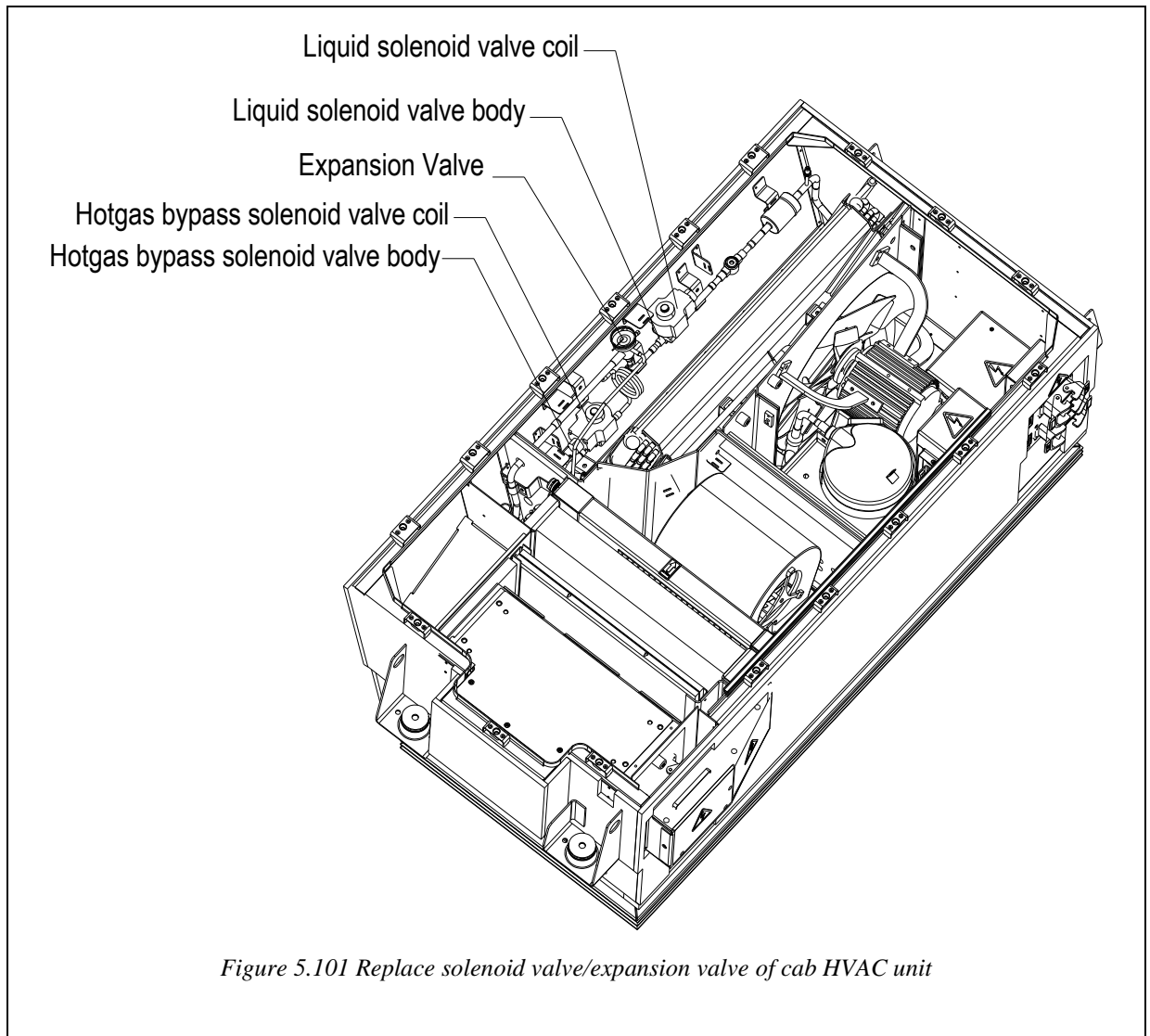
**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.4.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.1.
4. Remove the solenoid valve coil.
5. Charge the system with dry nitrogen gas through the vapour side Schrader valve.
6. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
7. Unsolder all copper connecting to the solenoid valve.
8. Remove the solenoid valve from the refrigeration circuit.
9. Install a new solenoid valve by the reverse procedure of uninstall.
10. Stop the purging of nitrogen through the cycle.
11. Leak test the refrigerant circuit, see chapter 5.5.3.
12. Evacuate the refrigerant circuit, see chapter 5.5.5.
13. Install the solenoid valve coil.
14. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
15. Install the cover.
16. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.57 Replace expansion valve of cab HVAC unit

<b>Title:</b> Solenoid valve/Expansion valve - Replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the expansion valve		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector.		
<b>Materials and Consumables:</b> Brazing material.		
<b>Essential Replacement Parts:</b> Solenoid valve.		
<b>Parts number:</b> 12.1000.0151.		
<b>Illustrations:</b> TBD.		
<b>Reference Drawings:</b> 068U1916_TRD.		
<b>SAFETY PRECAUTIONS:</b> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"> It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.4.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.1.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the expansion valve, please refer to 5.100
7. Remove the expansion valve from the refrigeration circuit, , please refer to 5.100
8. Install a new expansion valve by the reverse procedure of uninstall.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.3.
11. Evacuate the refrigerant circuit, see chapter 5.5.5.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.58 Replace liquid/hotgas bypass solenoid valve of saloon HVAC unit

<b>Title: Solenoid valve - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the solenoid valve		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector. <b>Materials and Consumables:</b> Brazing material. <b>Essential Replacement Parts:</b> Solenoid valve. <b>Parts number:</b> 12.1000.0006(Liquid),. 12.1000.0139(hotgas bypass)		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> 032F1209_TRD(Liquid),. 032F1213_TRD(hotgas bypass)		

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### SAFETY PRECAUTIONS:



It is dangerous for touching the refrigerant. Safeguard devices are needed.  
Under no circumstances should liquid refrigerant be filled over suction line.

**Down Time:** 2.40 hours

**Team Size:** 2 person

### Procedure:

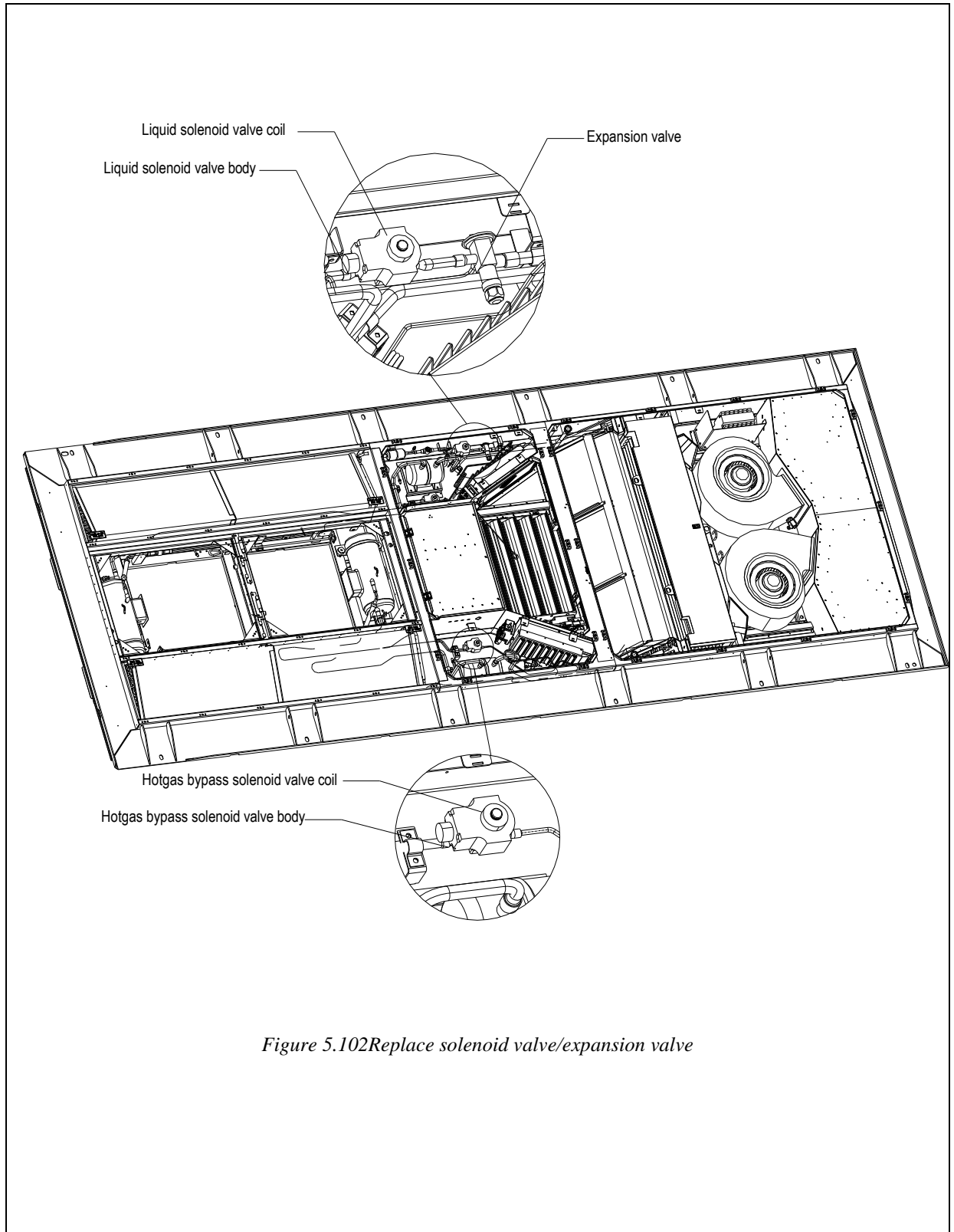
1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Open the cover of HVAC unit, see 5.4.2.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2.
4. Remove the solenoid valve coil.
5. Charge the system with dry nitrogen gas through the vapour side schrader valve.
6. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
7. Unsolder all copper connecting to the solenoid valve/expansion valve.
8. Remove the solenoid valve/expansion valve from the refrigeration circuit.
9. Install a new solenoid valve/expansion valve by the reverse procedure of uninstall.
10. Stop the purging of nitrogen through the cycle.
11. Leak test the refrigerant circuit, see chapter 5.5.4.
12. Evacuate the refrigerant circuit, see chapter 5.5.6.
13. Install the solenoid valve coil.
14. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
15. Install the cover.
16. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

### 5 Maintenance and Overhaul Procedures




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.59 Replace expansion valve of saloon HVAC unit

<b>Title:</b> Expansion valve - Replace	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the expansion valve		
<p><b>System/Equipment Title:</b> Saloon HVAC Unit  <b>Manufacturer:</b> SFRT  <b>Type/Model No:</b> KS97  <b>Location of unit to be maintained:</b> on the ground.</p>		
<p><b>Special Tools and Facilities:</b>  Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector.</p> <p><b>Materials and Consumables:</b>  Braze material.</p> <p><b>Essential Replacement Parts:</b>  Expansion valve.</p> <p><b>Parts number:</b>  12.1000.0102.</p>		
<p><b>Illustrations:</b>  TBD.</p> <p><b>Reference Drawings:</b>  067N4043_TRD.</p>		
<p><b>SAFETY PRECAUTIONS:</b></p> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;">  <p style="color: red;">It is dangerous for touching the refrigerant. Safeguard devices are needed.</p> <p style="color: red;">Under no circumstances should liquid refrigerant be filled over suction line.</p> </div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 2.40 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Open the cover of HVAC unit, see 5.4.2.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2.
4. Charge the system with dry nitrogen gas through the vapour side Schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the expansion valve, please refer to 5.101.
7. Remove the expansion valve from the refrigeration circuit, please refer to 5.101.
8. Install a new expansion valve by the reverse procedure of uninstall.
9. Adjust the expansion valve (setting at 2,5 x 360° turns from the full open position).
10. Stop the purging of nitrogen through the cycle.
11. Leak test the refrigerant circuit, see chapter 5.5.4.
12. Evacuate the refrigerant circuit, see chapter 5.5.6.
13. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
14. Install the cover.
15. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.60 Replace solenoid valve coil of cab HVAC unit

<b>Title: Solenoid valve coil- Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
	X		
<b>Reason for Task:</b> To replace the solenoid valve coil			
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> Not necessary. <b>Materials and Consumables:</b> Not necessary. <b>Essential Replacement Parts:</b> Solenoid valve coil. <b>Parts number:</b> 12.1000.0101.			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> 018F6860_TRD.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

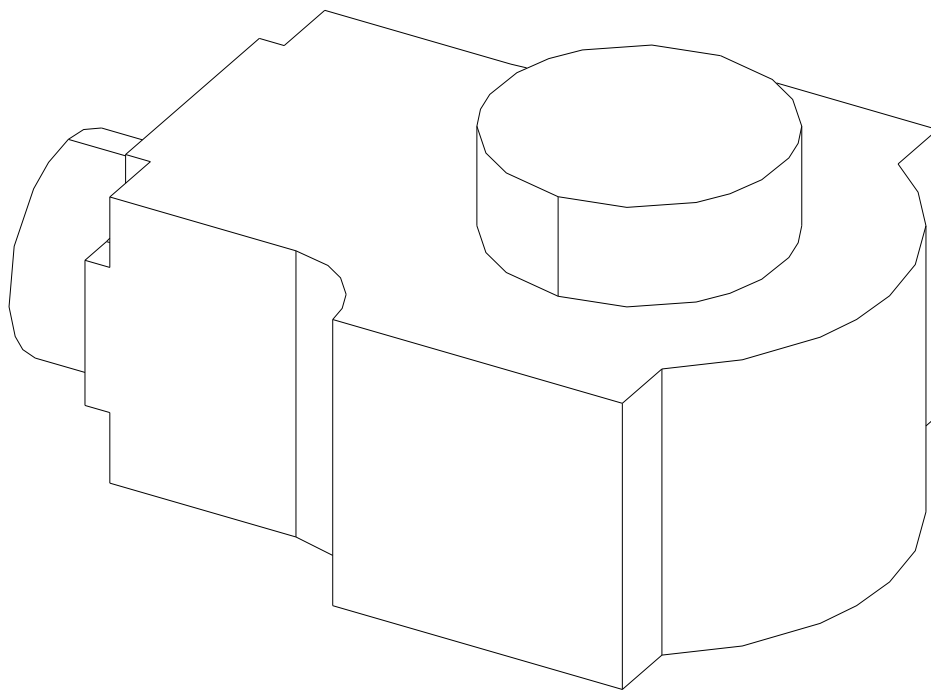
5 Maintenance and Overhaul Procedures

**Down Time:** 0.20 hours

**Team Size:** 2 person

**Procedure:**

1. Open the cover of HVAC unit, see 5.4.4.
2. Find the location of the solenoid valve, refer to figure 5.100.
3. Loosen the screws on the cover, open the cover.
4. Draw out the connecting cable from the solenoid valve coil.
5. Draw out the solenoid valve coil from the valve body, refer to figure 5.100.
6. Insert a new solenoid valve coil to the valve body.
7. Connect the cable to the solenoid valve coil.
8. Install the cover, Screw down the screws.
9. Install the cover of HVAC unit.



*Figure 5.103 Replace solenoid valve coil*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.61 Replace solenoid valve coil of saloon HVAC unit

<b>Title: Solenoid valve coil - Replace</b>		<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To replace the solenoid valve coil			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> Not necessary. <b>Materials and Consumables:</b> Not necessary. <b>Essential Replacement Parts:</b> Solenoid valve coil. <b>Parts number:</b> 12.1000.0101.			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> 018F6860_TRD.			
<b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"><b>▲ CAUTION</b></div> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

---

**Down Time:** 0.20 hours

**Team Size:** 2 person

**Procedure:**

1. Open the cover of HVAC unit, see 5.4.2.
2. Find the location of the solenoid valve.
3. Loose the screws on the cover, open the cover.
4. Draw out the connecting cable from the solenoid valve coil, refer to figure 5.101
5. Draw out the solenoid valve coil from the valve body, refer to figure 5.101.
6. Insert a new solenoid valve coil to the valve body.
7. Connect the cable to the solenoid valve coil.
8. Install the cover, Screw down the screws.
9. Install the covers of HVAC unit.


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.62 Replace gas liquid separator of saloon HVAC unit

<b>Title: Gas liquid separator - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the gas liquid separator		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacuum pump, Electronic Leakage Detector. <b>Materials and Consumables:</b> Refrigerant R407C, Brazing material. <b>Essential Replacement Parts:</b> Gas liquid separator. <b>Parts number:</b> 12.1600.0005		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> <b>KS07A100.000-13A.Z3</b>		
<div style="border: 2px solid black; padding: 10px;"><p style="color: red; margin: 0;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**own Time:** 2.30 hours

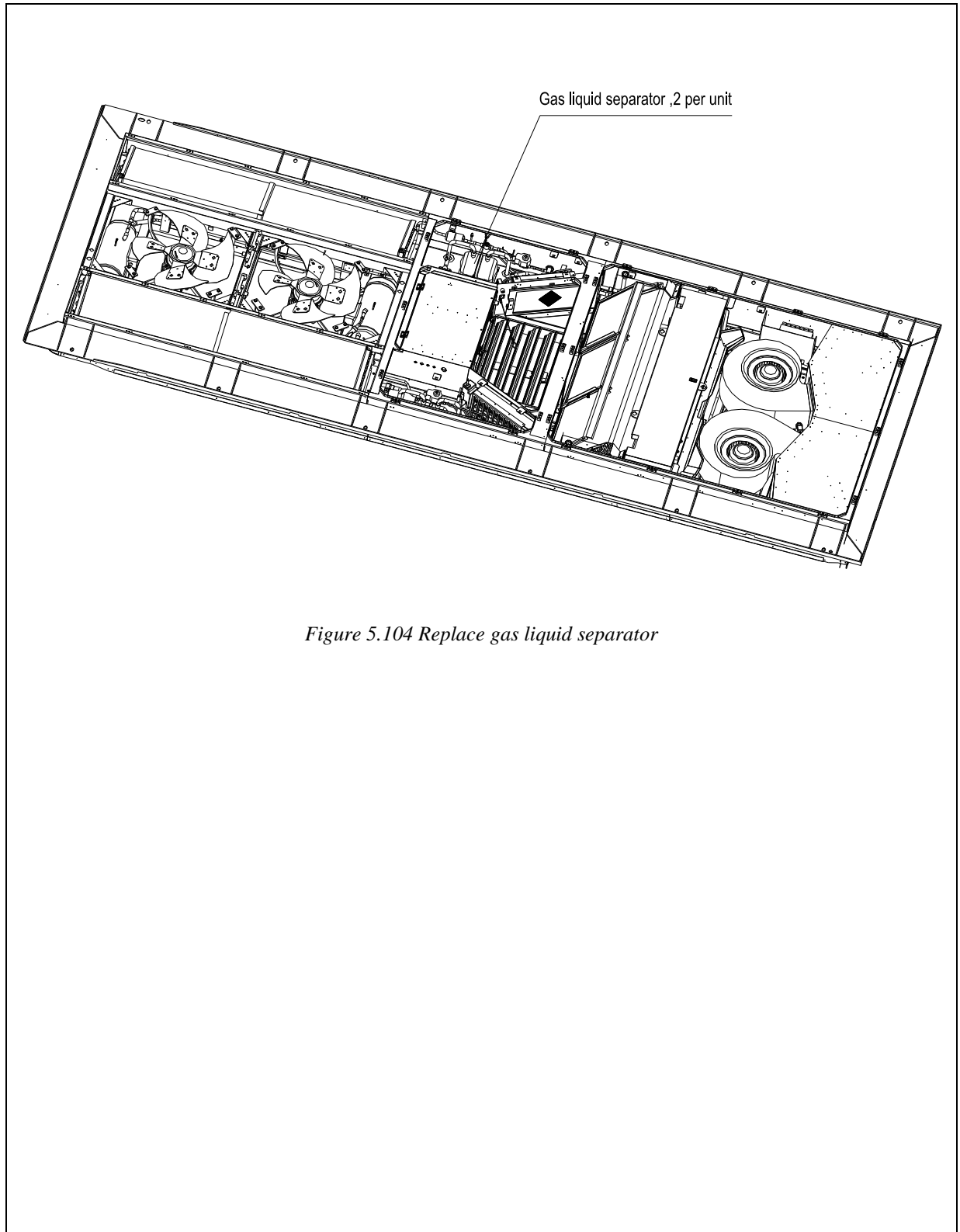
**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.2.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.1.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the gas liquid separator.
7. Remove the gas liquid separator from the refrigeration circuit.
8. Install a new gas liquid separator by the reverse procedure of uninstall.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.3.
11. Evacuate the refrigerant circuit, see chapter 5.5.5.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.63 Replace schrader valve of cab HVAC unit

<b>Title: Schrader valve - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the schrader valve		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacumm pump, Electronic Leakage Detector. <b>Materials and Consumables:</b> Refrigerant R407C , Brazing material. <b>Essential Replacement Parts:</b> schrader valve. <b>Parts number:</b> 12.1000.0009.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b>		
<div style="border: 2px solid black; padding: 10px;"><p style="color: red; font-weight: bold;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**own Time:** 2.30 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.26.
2. Open the cover of HVAC unit, see 5.4.4
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.1.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the schrader valve.
7. Remove the schrader valve from the refrigeration circuit.
8. Install a new schrader valve by the reverse procedure of uninstall.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.3.
11. Evacuate the refrigerant circuit, see chapter 5.5.5.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.7.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

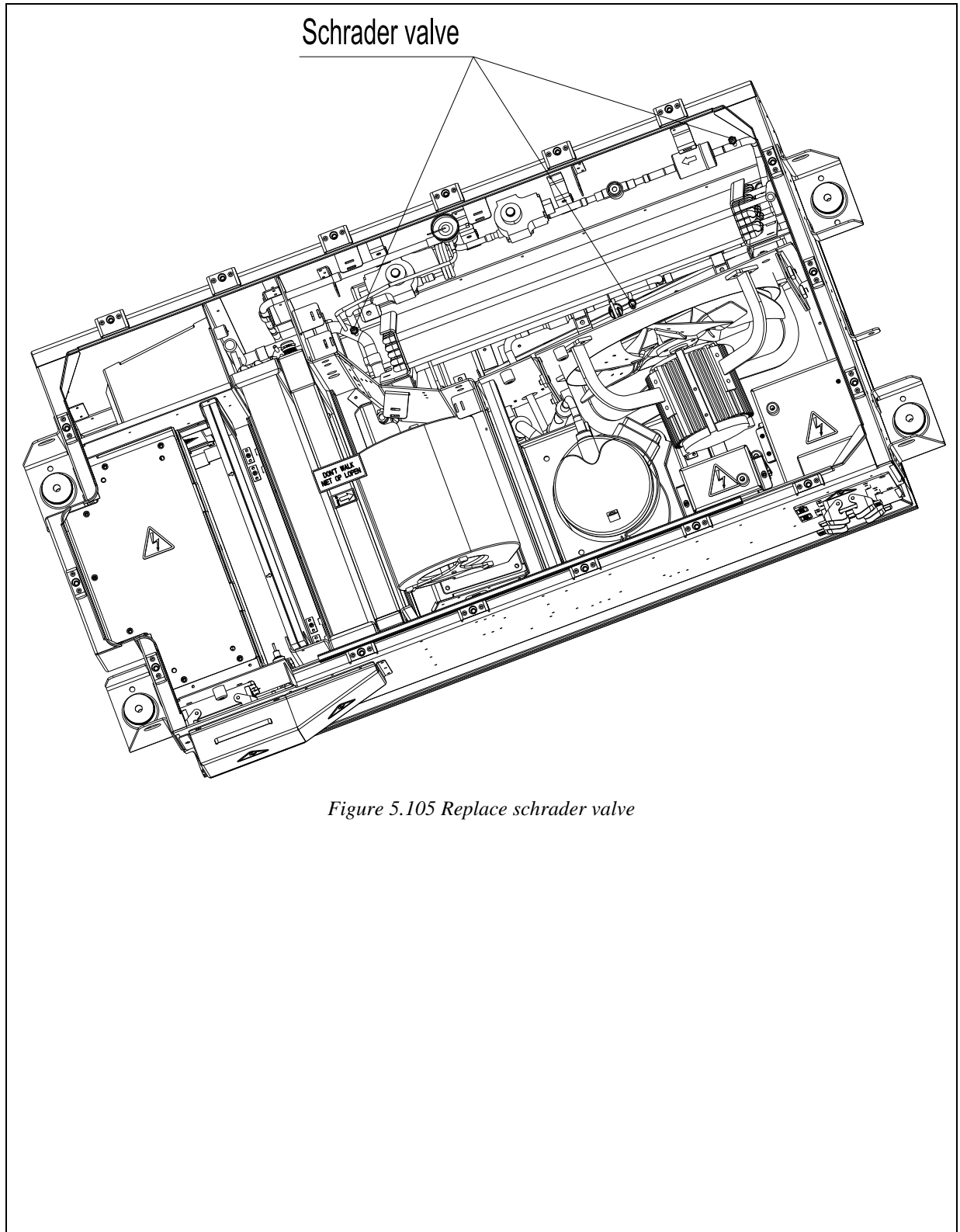


Figure 5.105 Replace schrader valve


# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.64 Replace schrader valve of saloon HVAC unit

<b>Title: Schrader valve - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To replace the Injection valve SCHRADER VALVE		
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the ground.		
<b>Special Tools and Facilities:</b> Two-way manifold including gauges and hoses, Refrigerant management equipment, Vacumm pump, Electronic Leakage Detector. <b>Materials and Consumables:</b> Refrigerant R407C ,Brazing material. <b>Essential Replacement Parts:</b> Schrader valve. <b>Parts number:</b> 12.1000.0009.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b>		
<div style="border: 2px solid black; padding: 10px;"><p style="color: red; margin: 0;">It is dangerous for touching the refrigerant. Safeguard devices are needed. Under no circumstances should liquid refrigerant be filled over suction line.</p></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**own Time:** 2.30 hours

**Team Size:** 2 person

**Procedure:**

1. Remove the HVAC unit from vehicle to workshop, refer to 5.5.27.
2. Open the cover of HVAC unit, see 5.4.2.
3. Empty the refrigerant circuit of HVAC unit, please refer to 5.5.2.
4. Charge the system with dry nitrogen gas through the vapour side schrader valve.
5. If necessary, use the protect cloth to prevent damaging thermal insulation and wiring during the brazing process.
6. Unsolder all copper connecting to the schrader valve.
7. Remove the schrader valve from the refrigeration circuit.
8. Install a new schrader valve by the reverse procedure of uninstall.
9. Stop the purging of nitrogen through the cycle.
10. Leak test the refrigerant circuit, see chapter 5.5.4.
11. Evacuate the refrigerant circuit, see chapter 5.5.6.
12. Charge the refrigerant circuit with refrigerant, see chapter 5.5.8.
13. Install the cover.
14. Install the HVAC unit onto the vehicle.

# AMSTERDAM (Alstom)

## Rolling Stock

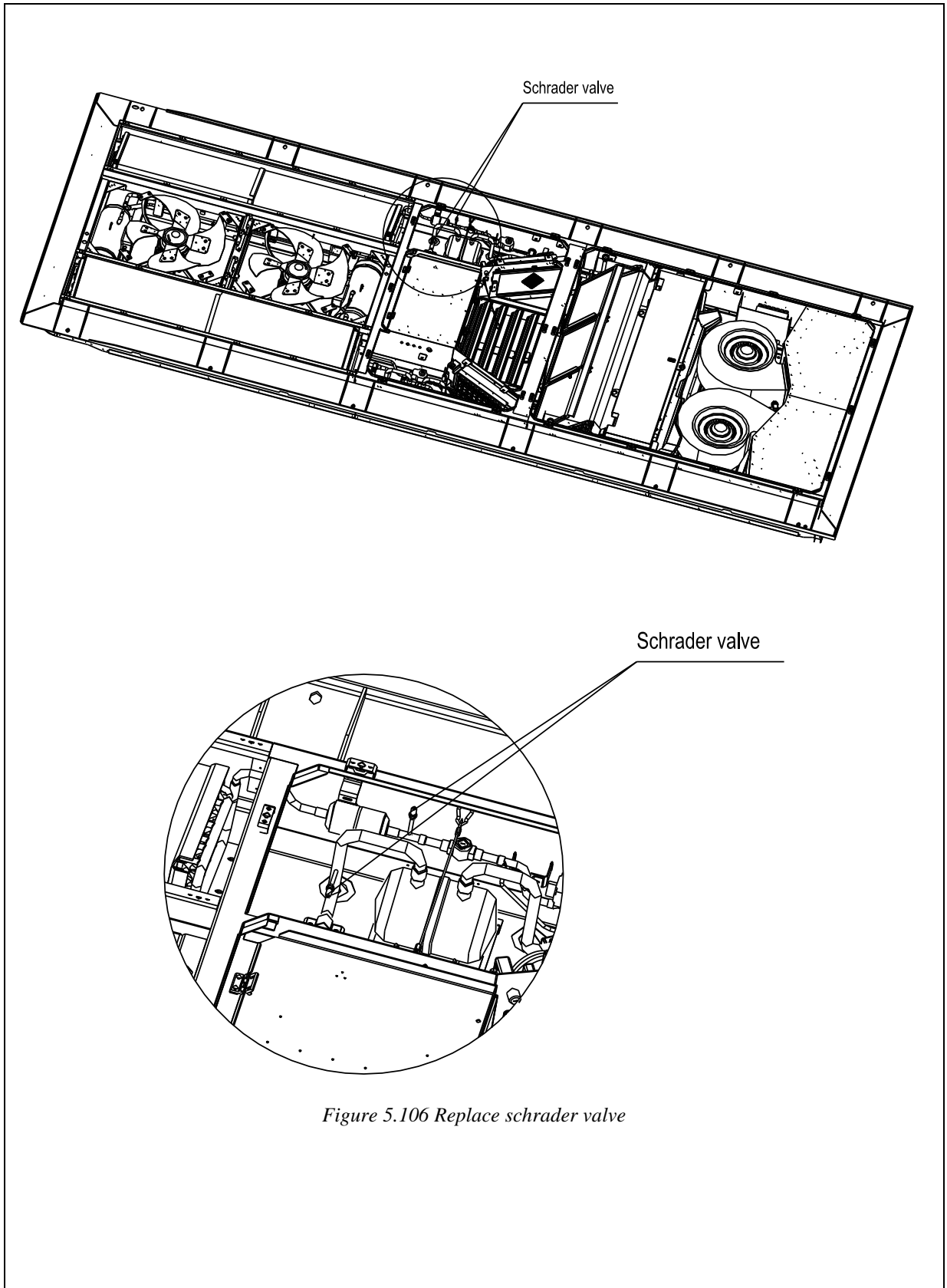


Figure 5.106 Replace schrader valve

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.65 Replace fresh air damper actuator of saloon HVAC unit

<b>Title: Damper actuator - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
		<b>X</b>
<b>Reason for Task:</b> To Replace the fresh air damper actuator.		
<b>System/Equipment Title:</b> Saloon HVAC Unit		
<b>Manufacturer:</b> SFRT		
<b>Type/Model No:</b> KS97		
<b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.		
<b>Special Tools and Facilities:</b> N.A.		
<b>Materials and Consumables:</b> N.A.		
<b>Essential Replacement Parts:</b> Fresh air damper actuator.		
<b>Parts number:</b> 12.1000.0098 (SN2010001-SN2014115), 12.1000.0127, 12.1000.0129 (From SN2014116)		
<b>Illustrations:</b> TBD.		
<b>Reference Drawings:</b> TRD		
<b>SAFETY PRECAUTIONS:</b>		
<div style="border: 1px solid black; display: inline-block; padding: 2px 5px;"><b>▲ CAUTION</b></div>		
<p><b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b></p> <p><b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b></p> <p><b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b></p>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.30 hours

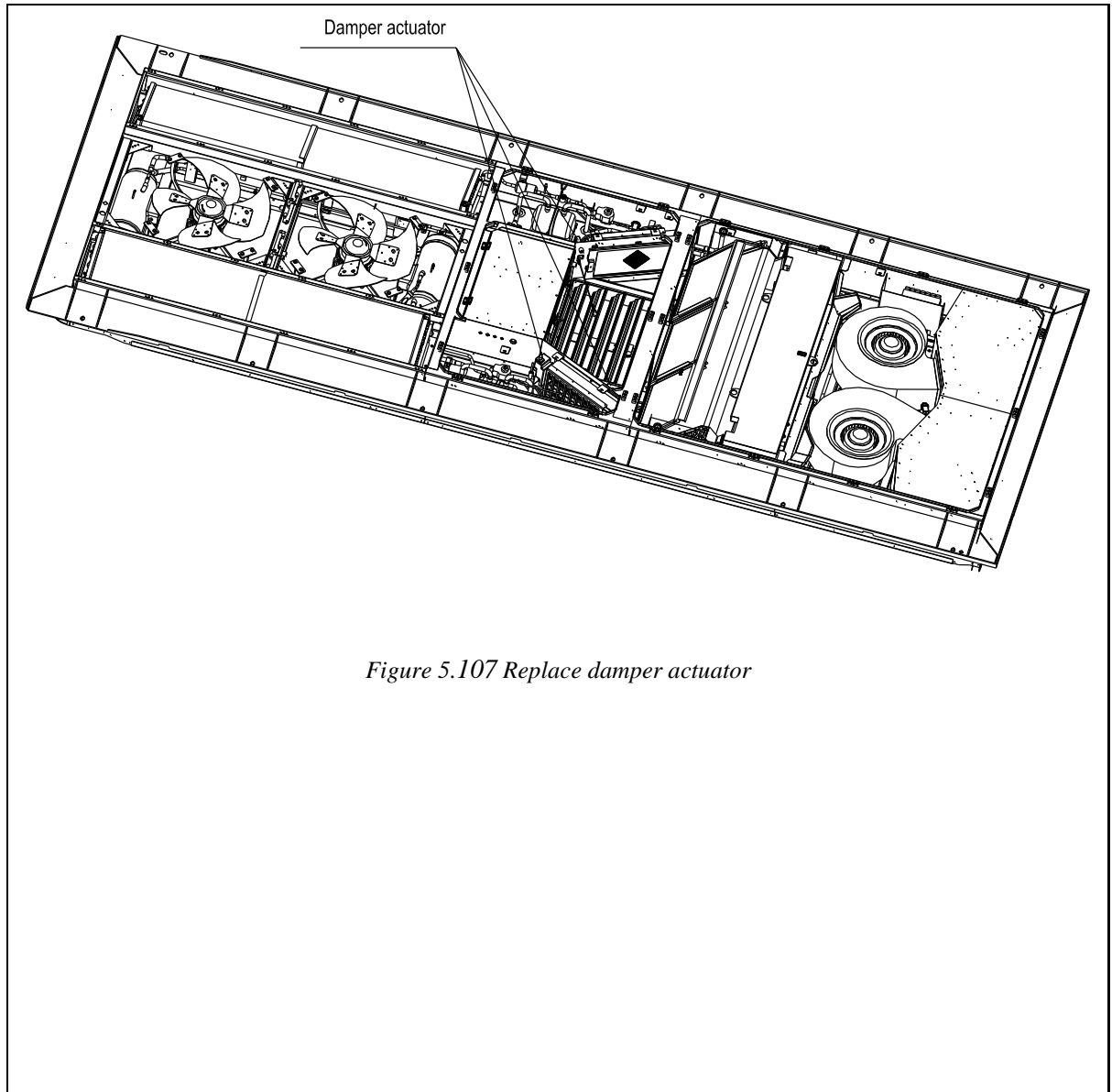
**Team Size:** 2 person

**Procedure:**

1. Cut off the power supply.
2. Open the cover and remove it, see 5.4.2.
3. Loosen the screws which fix the fresh air damper to unit frame.
4. Remove the fresh air damper.
5. Disconnect the cables from the plug.
6. Loosen the screw of damper actuator.
7. Remove damper actuator.
8. Place a new actuator in the right location.
9. Tighten the screws of damper actuator.
10. Connect the cable to the plug.
11. Replace the fresh air damper and tighten the screws.
12. Close the cover.
13. Tighten the screws which fix the cover to the frame.
14. Reconnect the electric power supply.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.107 Replace damper actuator*




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.66 Replace return air damper actuator of saloon HVAC unit

<b>Title: Damper actuator - Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		<b>X</b>	
<b>Reason for Task:</b> To Replace the return air damper actuator.			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> N.A.			
<b>Materials and Consumables:</b> N.A.			
<b>Essential Replacement Parts:</b> Return air damper actuator.			
<b>Parts number:</b> 12.1000.0098 (SN2010001-SN2014115), 12.1000.0127, 12.1000.0129 (From SN2014116)			
<b>Illustrations:</b> TBD.			
<b>Reference Drawings:</b> TRD			
<b>SAFETY PRECAUTIONS:</b>  <table border="1" data-bbox="352 1621 564 1675"><tr><td> <b>CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			 <b>CAUTION</b>
 <b>CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.30 hours

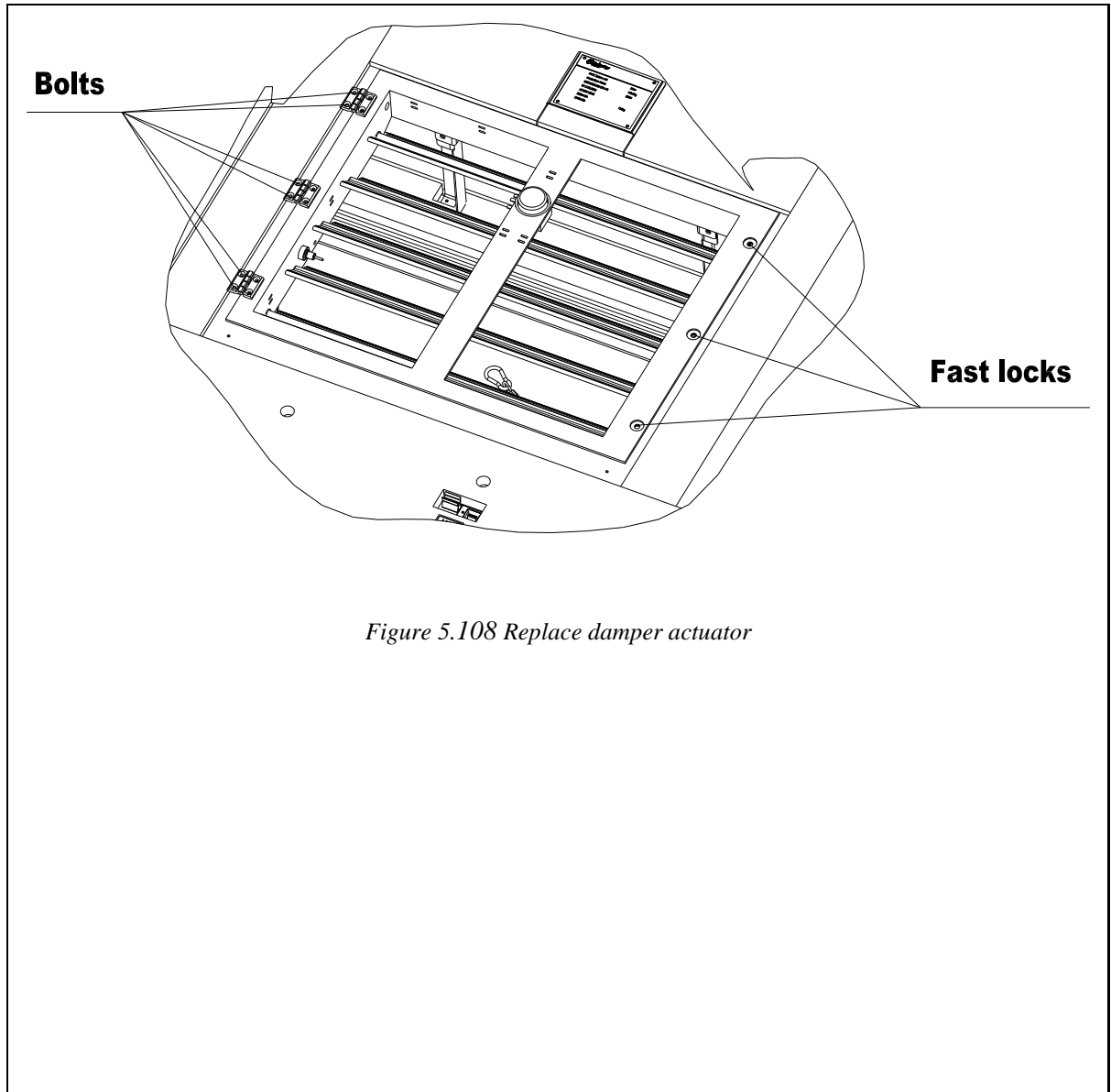
**Team Size:** 2 person

**Procedure:**

1. Cut off the power supply.
2. Use a stepladder to get close to the return air damper.
3. Use screwdriver to loosen the 3 fast locks and 6 bolts which fix the return air damper to the unit frame.
4. Remove the return air damper.
5. Disconnect the cables from the plug.
6. Loosen the screw of damper actuator.
7. Remove damper actuator.
8. Place a new actuator in the right location.
9. Tighten the screws of damper actuator.
10. Connect the cable to the plug.
11. Replace the return air damper and tighten the bolts.
12. Reconnect the electric power supply.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.108 Replace damper actuator*

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

#### 5.5.67 Replace controller of cab HVAC unit

The controller is hardcore component of HVAC unit control system. It receives and analyses various data and information from sensors then sends orders to measure the unit running. The controller is in the HVAC unit system.

<b>Title: HVAC Controller - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the HVAC Controller.		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.		
<b>Special Tools and Facilities:</b> Mona-service and Maintenance Software Mona. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Controller FPC08. <b>Parts number:</b> 12.0301.0016.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> FPC24 DC110V.		
<b>SAFETY PRECAUTIONS:</b> Remove <b>750 VDC Power From Car, Isolate HVAC System from all electrical supplies.Wear Required Safety Equipment, All Safety Rules and Regulations Must Be Observed.</b>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

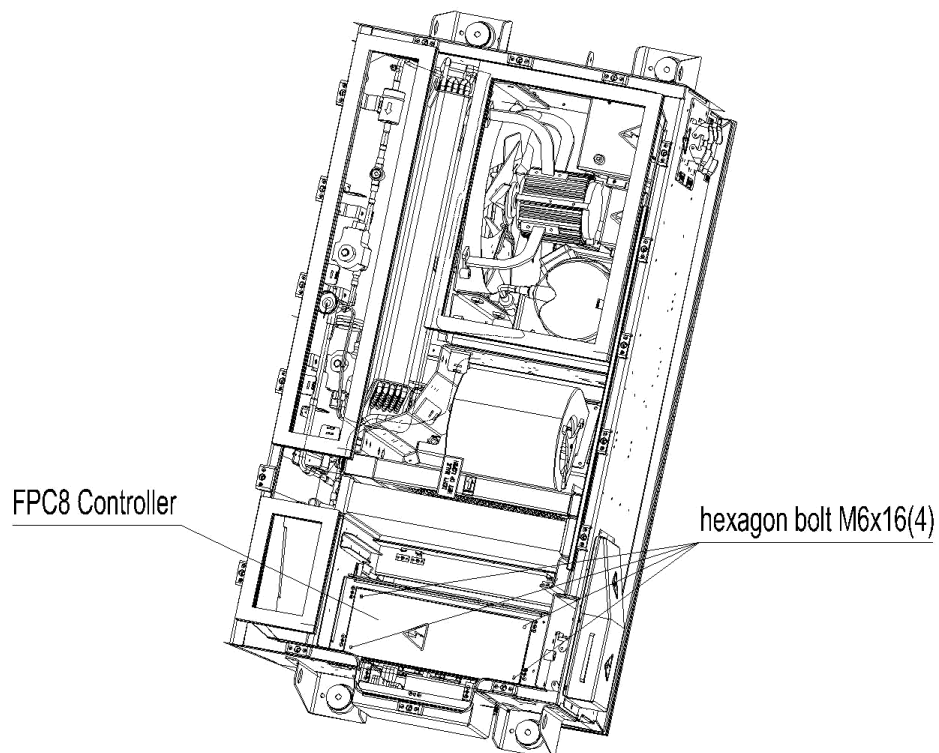
5 Maintenance and Overhaul Procedures

**Down Time:** 0.25 hours

**Team Size:** 2 person

**Procedure:**

1. Cut off the power supply.
2. Open the maintenance cover, see 5.4.2.
3. Take out the Control panel from the HVAC unit, refer to 5.4.5.
4. Open the cover of the Control panel, find the position of the controller.
5. Loose the 4 fixing bolts.
6. Replace the controller
7. Tighten the fixing bolts, close the cover.
8. Place the Control panel in the right position and fix it.
9. Connect the connectors of controller.
10. Close the maintenance cover.
11. Switch on the power supply.



*Figure 5.109 Replace controller*

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

#### 5.5.68 Replace electrical parts of cab HVAC unit

The controller is hardcore component of HVAC unit control system. It receives and analyses various data and information from sensors then sends orders to measure the unit running. The controller is in the HVAC unit system.

<b>Title: Electrical parts - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the HVAC Controller.		
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.		
<b>Special Tools and Facilities:</b> Mona-service and Maintenance Software Mona. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> electrical parts. <b>Parts number:</b> 12.0301.0016.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> FPC08		
<b>SAFETY PRECAUTIONS:</b> Remove <b>750 VDC Power From Car, Isolate HVAC System from all electrical supplies. Wear Required Safety Equipment, All Safety Rules and Regulations Must Be Observed.</b>		

# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

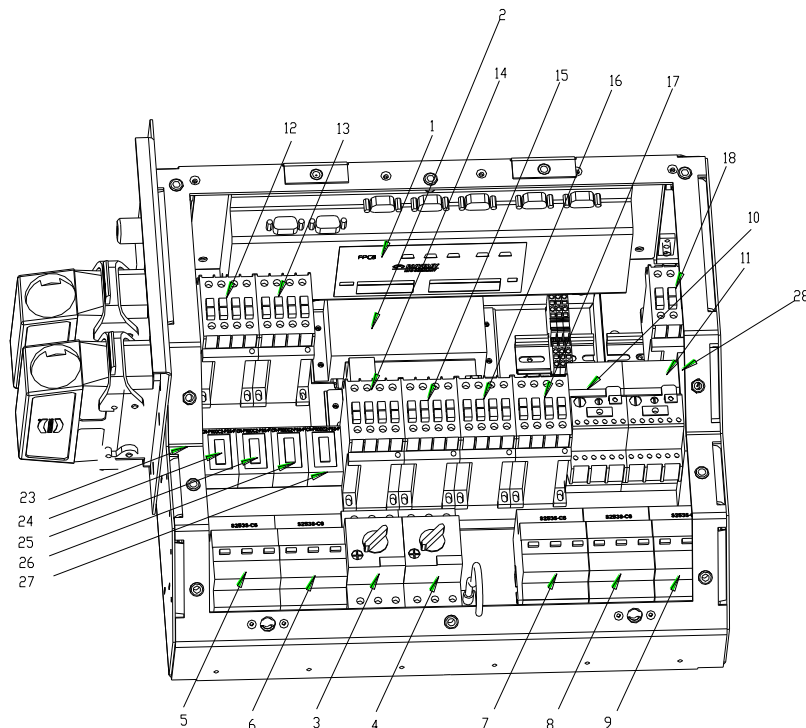
### 5 Maintenance and Overhaul Procedures

**Down Time:** 0.15 hours

**Team Size:** 2 person

**Procedure:**

1. Cut off the power supply.
2. Open the maintenance cover, see 5.4.4.
3. Loose the bolts fixing the control panel to the HVAC unit.
4. Take out the Control panel from the HVAC unit.
5. Open the cover of the Control panel, find the position of the electrical parts which need to be replaced. For detail, please see the following figure and table.
6. Loose the fixing bolts.
7. Replace the electrical parts which need to be replaced.
8. Tighten the fixing bolts, close the cover.
9. Place the Control panel in the right position and fix it.
10. Connect the connectors of controller.
11. Close the maintenance cover.
12. Switch on the power supply.



# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

### 5 Maintenance and Overhaul Procedures

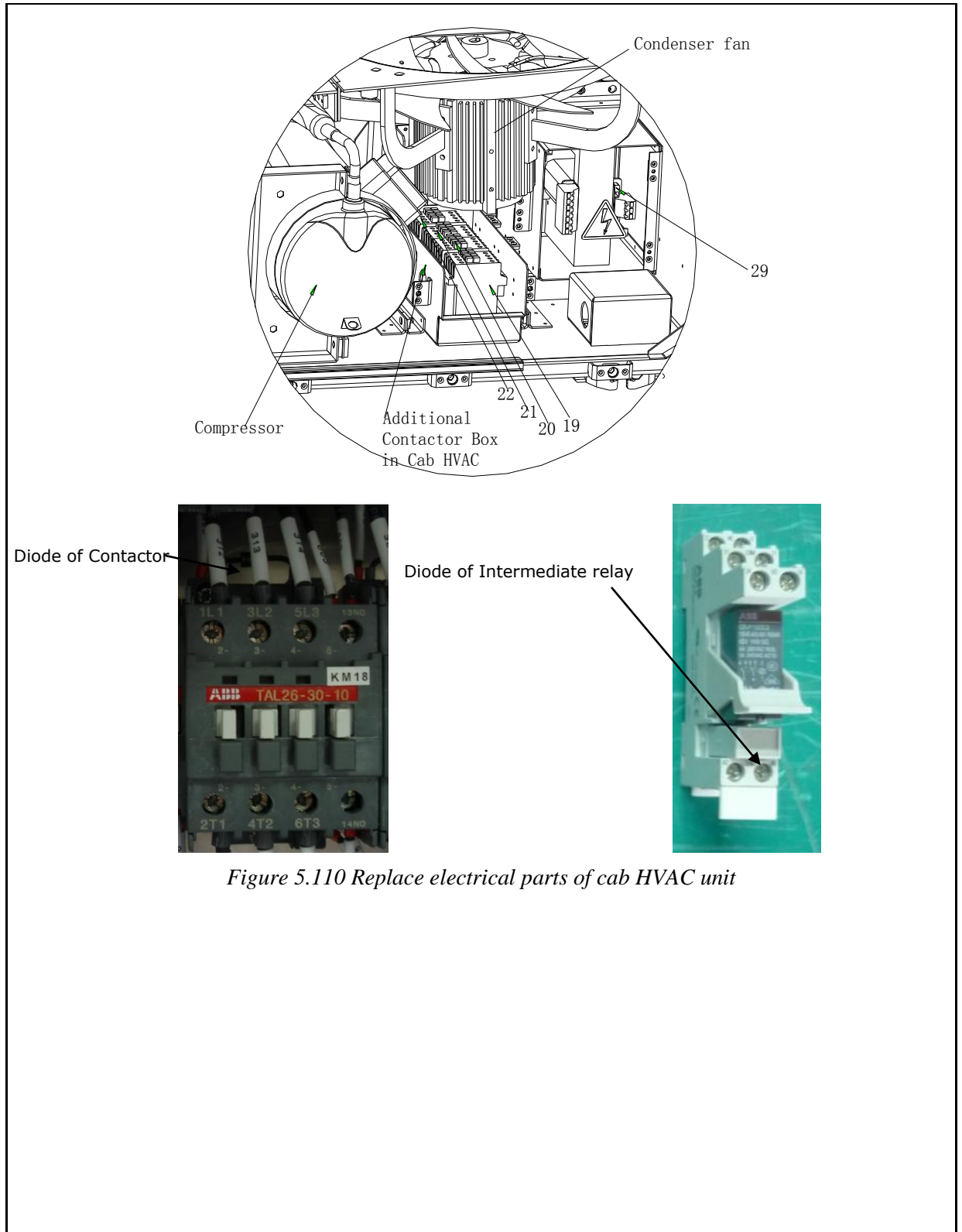


Figure 5.110 Replace electrical parts of cab HVAC unit

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

<b>N o.</b>	<b>Part name</b>	<b>Description</b>	<b>Diode</b>
1	Programmed logical controller	FPC08	No
2	Frequency detector	BTDT-01	No
3	Manual motor starter	QF1	No
4	Manual motor starter	QF2	No
5	Circuit breaker	QF3	No
6	Circuit breaker	QF4	No
7	Circuit breaker	QF5	No
8	Circuit breaker	QF6	No
9	Circuit breaker	QF7	No
10	Thermostat relay	FR1	No
11		FR2	No
12	Contactor	KM1	With
13		KM2	With

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

14		KM3	With
15		KM4	With
16		KM5	With
17		KM6	With
18		KM9	With
19		KM7	With
20		KM8	With
21		KM10	With
22		KM11	With
23	Intermediate relay	KA1	With
24		KA2	With
25		KA3	With
26		KA4	With
27		KA5	With
28	Time relay	KT1	No
29	Single phase transformer	MEHT-8 00-400/8 0-230	No

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.69 Replace controller of saloon HVAC unit

<b>Title: HVAC Controller - Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		X	
<b>Reason for Task:</b> To replace the HVAC Controller. (every 15 years or failure)			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> Stepladder, hexagon wrench, wrench. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Controller. <b>Parts number:</b> 12.0301.0016.			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> FPC08 DC110V.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

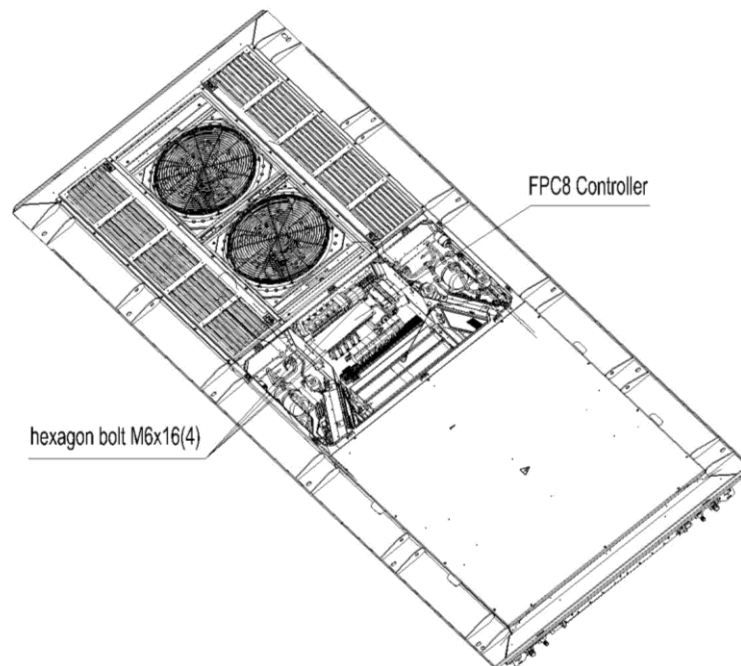
5 Maintenance and Overhaul Procedures

**Down Time:** 0.25 hours

**Team Size:** 2 person

**Procedure:**

1. Cut off the power supply.
2. Open the cover of the HVAC unit, see 5.4.2.
3. Loose the bolts which fix the top cover of the control panel
4. Open the top cover, turn it up.
5. Use the clamp inside the control panel to support the top cover.
6. Disconnect the connectors of controller.
7. Replace the controller (bolt: M6X16).
8. Connect the connectors of controller.
9. Close the cover of the control panel and screw down the bolts.
10. Close the cover.
11. Switch on the power supply.



*Figure 5.111 Replace controller*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.70 Replace DIO8 of saloon HVAC unit

<b>Title: DIO8 - Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		X	
<b>Reason for Task:</b> To replace the DIO8. (every 15 years or failure)			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> Stepladder, hexagon wrench, wrench. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> DIO8. <b>Parts number:</b> 12.0301.0021			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> DIO8			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

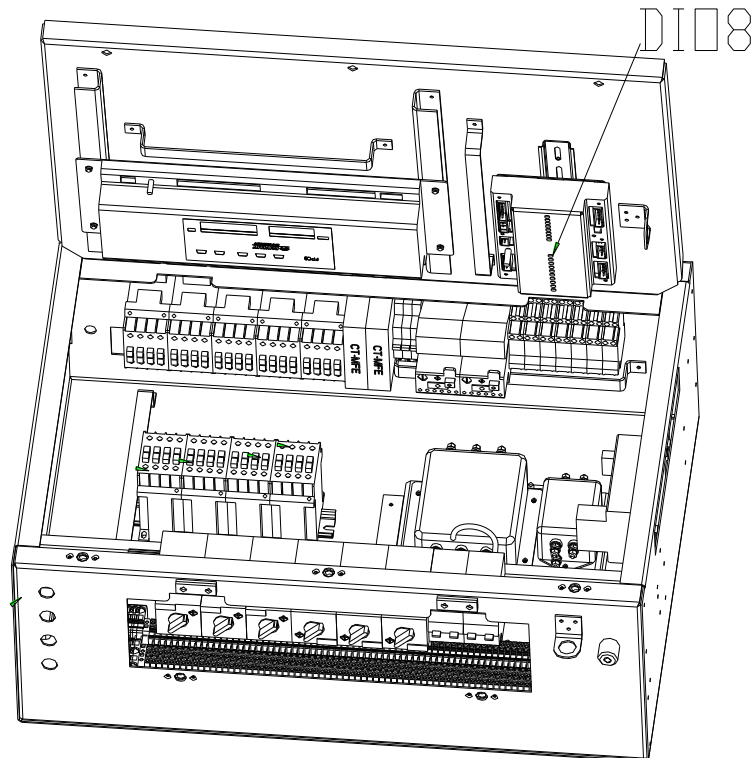
5 Maintenance and Overhaul Procedures

**Down Time:** 0.20 hours

**Team Size:** 2 person

**Procedure:**

1. Cut off the power supply.
2. Open the cover of the HVAC unit, see 5.4.1.
3. Loose the bolts which fix the top cover of the control panel
4. Open the top cover, turn it up.
5. Use the clamp inside the control panel to support the top cover.
6. Disconnect the connectors of DIO8.
7. Replace the DIO8.
8. Connect the connectors of DIO8.
9. Close the cover of the control panel and screw down the bolts.
10. Close the cover.
11. Switch on the power supply.



*Figure 5.112 Replace DIO8*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.71 Replace electrical parts of saloon HVAC unit

<b>Title:</b> Electrical parts - Replace	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>Cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
		X	
<b>Reason for Task:</b> To replace the electrical parts.			
<b>System/Equipment Title:</b> Saloon HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> Stepladder, hexagon wrench, wrench. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Replace electrical parts of saloon HVAC unit. <b>Parts number:</b> -			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> -			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

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**Down Time:** 0.15 hours

**Team Size:** 2 person

**Procedure:**

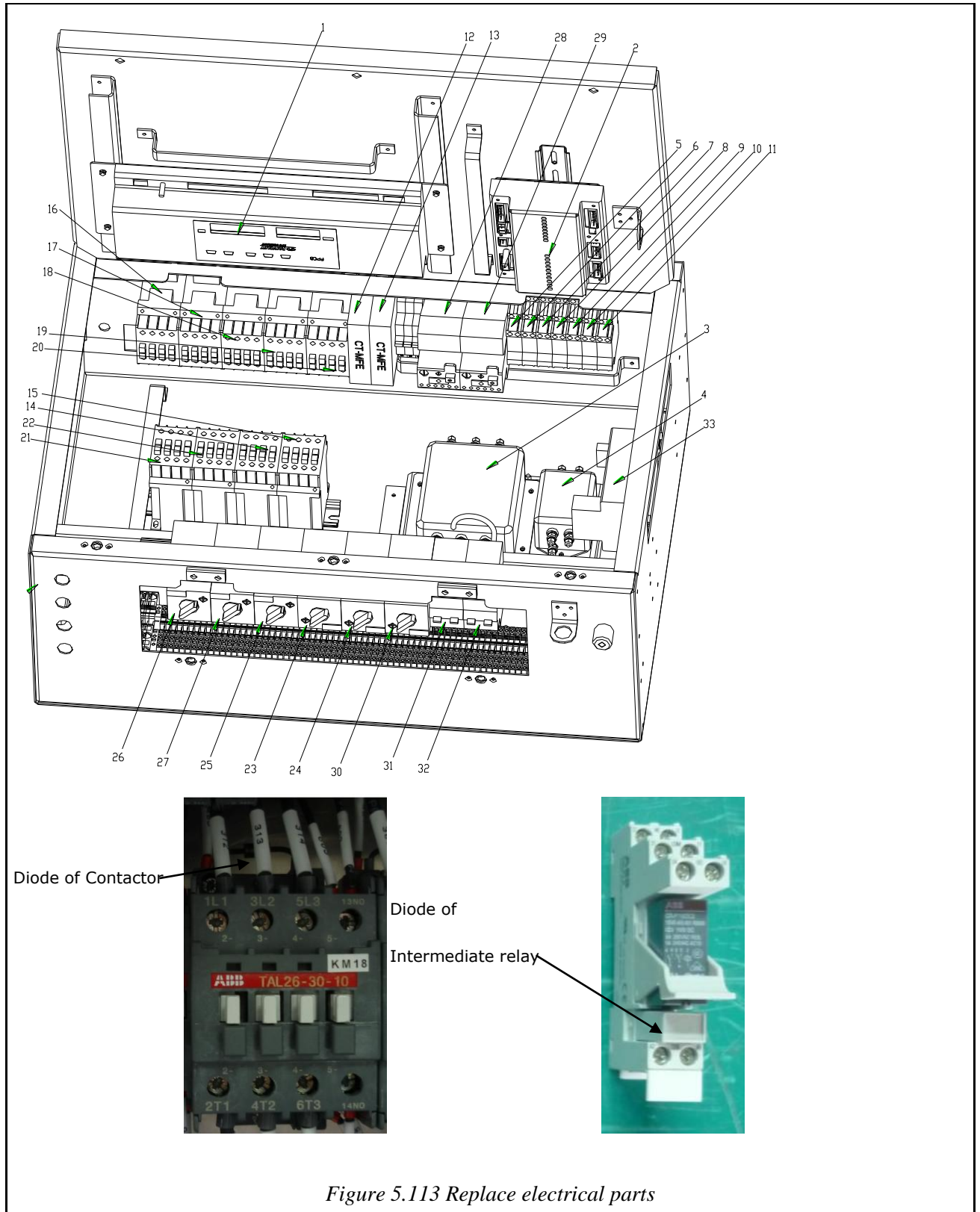
1. Cut off the power supply.
2. Open the cover of the HVAC unit, see 5.4.2.
3. Loosen the bolts which fix the top cover of the control panel.
4. Open the top cover, turn it up.
5. Use the clamp inside the control panel to support the top cover.
6. Disconnect the connectors of controller.
7. Replace the electrical parts which need to be replaced. For the detail, please see the following figure and table.
8. Connect the connectors of controller.
9. Close the cover of the control panel and screw down the bolts.
10. Close the cover
11. Switch on the power supply.

# AMSTERDAM (Alstom)

## Rolling Stock

### HVAC System

### 5 Maintenance and Overhaul Procedures



## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

No.	Part name	Description	Diode
1	Programmed logical controller	FPC08	No
2	Module for controller	DI08	No
3	EMC filter BTF004	NF1	No
4	EMC filter BTF002	NF2	No
5	Intermediate relay	KA1	With
6		KA2	With
7		KA3	With
8		KA4	With
9		KA5	With
10		KA6	With
11		KA7	With
12	Time relay	KT1	No
13		KT2	No
14	Contactor TAL26-30-10	KM18	With
15		KM19	With
16	Contactor TAL9-30-10	KM13	With
17		KM14	With
18		KM15	With
19		KM16	With

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

20		KM17	With
21	Contactor TAL16-30-10	KM11	With
22		KM12	With
23	Manual motor starter MS116-2.5(1.6-2.5)	QF3	No
24		QF4	No
25	Manual motor starter MS116-4.0(2.5-4.0)	QF8	No
26	Manual motor starter MS116-16(10-16)	QF1	No
27		QF2	No
28	Thermostat relay FR02	FR1	No
29	Thermostat relay FR01	FR2	No
30	Circuit breaker QF05	QF5	No
31	Circuit breaker QF06	QF6	No
32	Circuit breaker QF07	QF7	No
33	H/L frequency Detector	BTDT-0 1	NO

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.72 Replace supply air fan of cab Aerotherm unit

<b>Title: supply air fan - Replace</b>	<b>Work Instruction No.</b>	
<b>Unit applicability</b>	<b>Cab Aerotherm unit</b>	<b>Saloon HVAC unit</b>
	X	
<b>Reason for Task:</b> To replace the supply air fan of cab Aerotherm unit. (every 5 years or failure)		
<b>System/Equipment Title:</b> Cab Aerotherm unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.		
<b>Special Tools and Facilities:</b> Stepladder, hexagon wrench, wrench. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> supply air fan. <b>Parts number:</b> 12.0301.0016.		
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> supply air fan.		
<b>SAFETY PRECAUTIONS:</b> <div style="text-align: center;"> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES. WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b></div>		

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

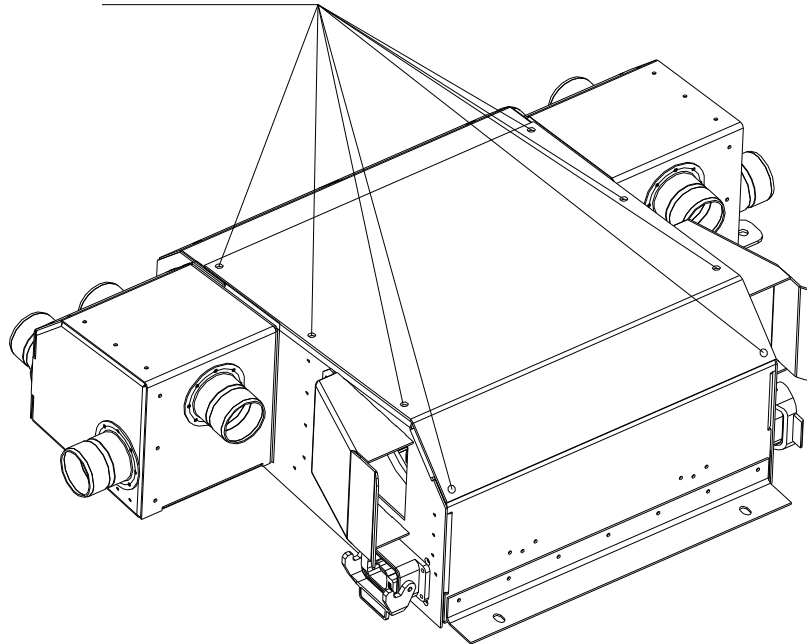
**Down Time:** 0.20 hours

**Team Size:** 2 person

**Procedure:**

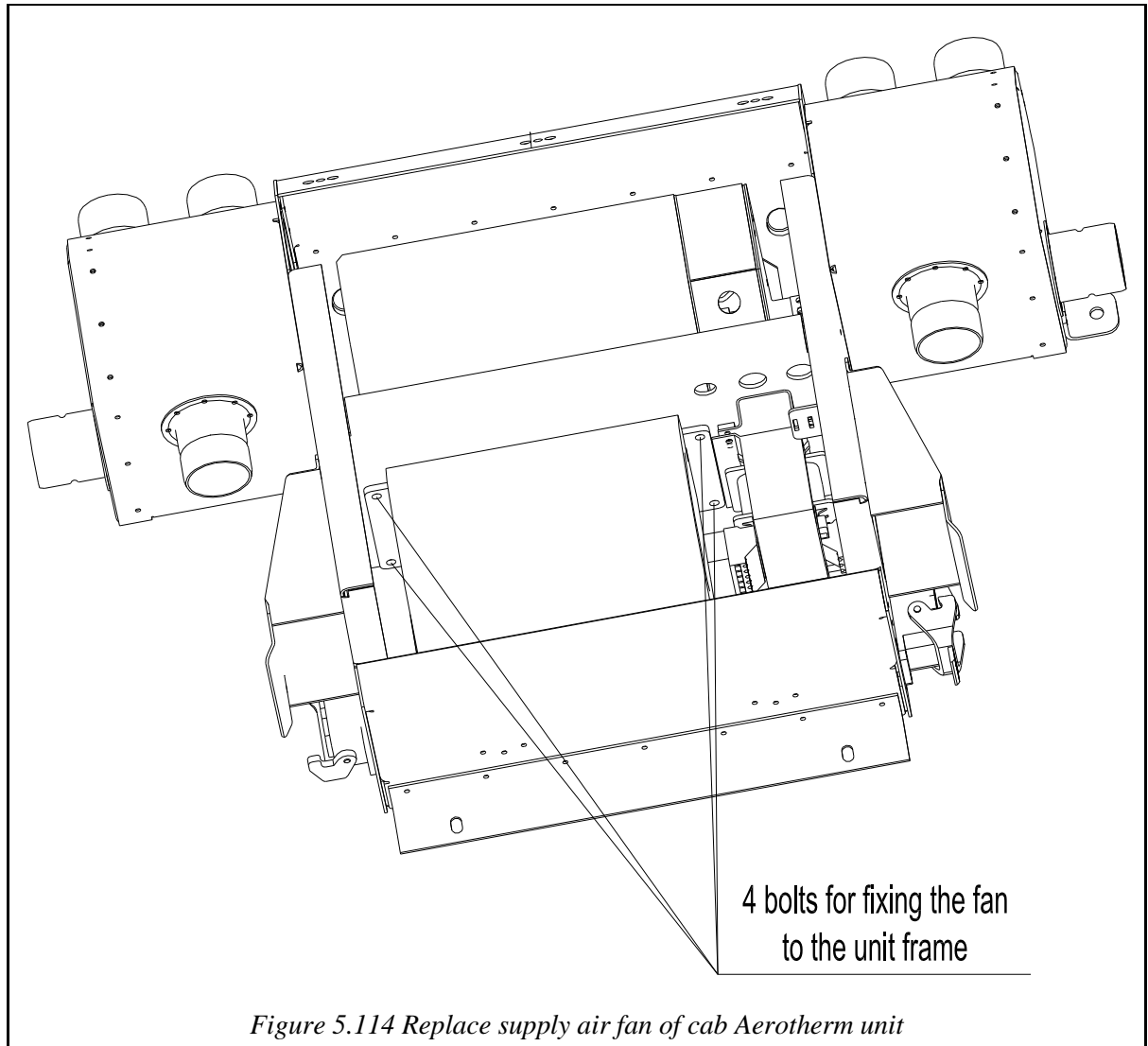
1. Cut off the power supply.
2. Loose the 8 bolts which fix the top cover of the Aerotherm unit.
3. Open the top cover.
4. Find the location of the supply air fan.
5. Loosen the 4 bolts(M6×20) which fix the supply air fan to the unit frame.
6. Remove the supply air fan.
7. Place a new supply air fan in the right place.
8. Tighten the 4 bolts(M6×20) fixing the supply air fan.
9. Close the cover of the Aerotherm unit and screw down the bolts.
10. Switch on the power supply.

8 bolts for fixing the  
cover to the unit frame



# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.114 Replace supply air fan of cab Aerotherm unit*

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.73 Replace heating rods of cab Aerotherm unit

<b>Title: heating rods - Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>cab Aerotherm</b>	<b>Saloon HVAC unit</b>	
	X		
<b>Reason for Task:</b> To replace the heating rods of cab Aerotherm unit.			
<b>System/Equipment Title:</b> Cab Aerotherm unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle / on the ground.			
<b>Special Tools and Facilities:</b> Stepladder, hexagon wrench, wrench. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> heating rods. <b>Parts number:</b> 12.0301.0016.			
<b>Illustrations:</b> TBD. <b>Reference Drawings:</b> heating rods.			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td><b>▲CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲CAUTION</b>
<b>▲CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

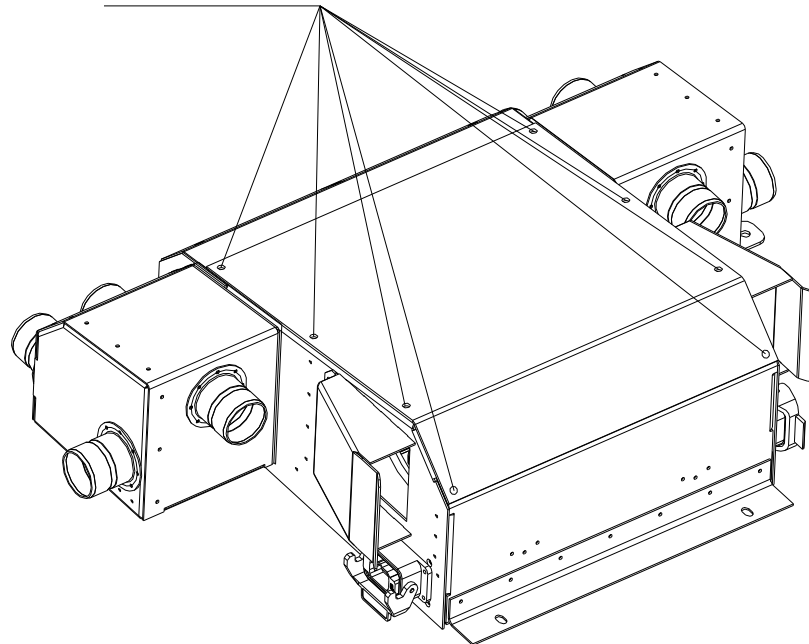
**Down Time:** 0.30 hours

**Team Size:** 2 person

**Procedure:**

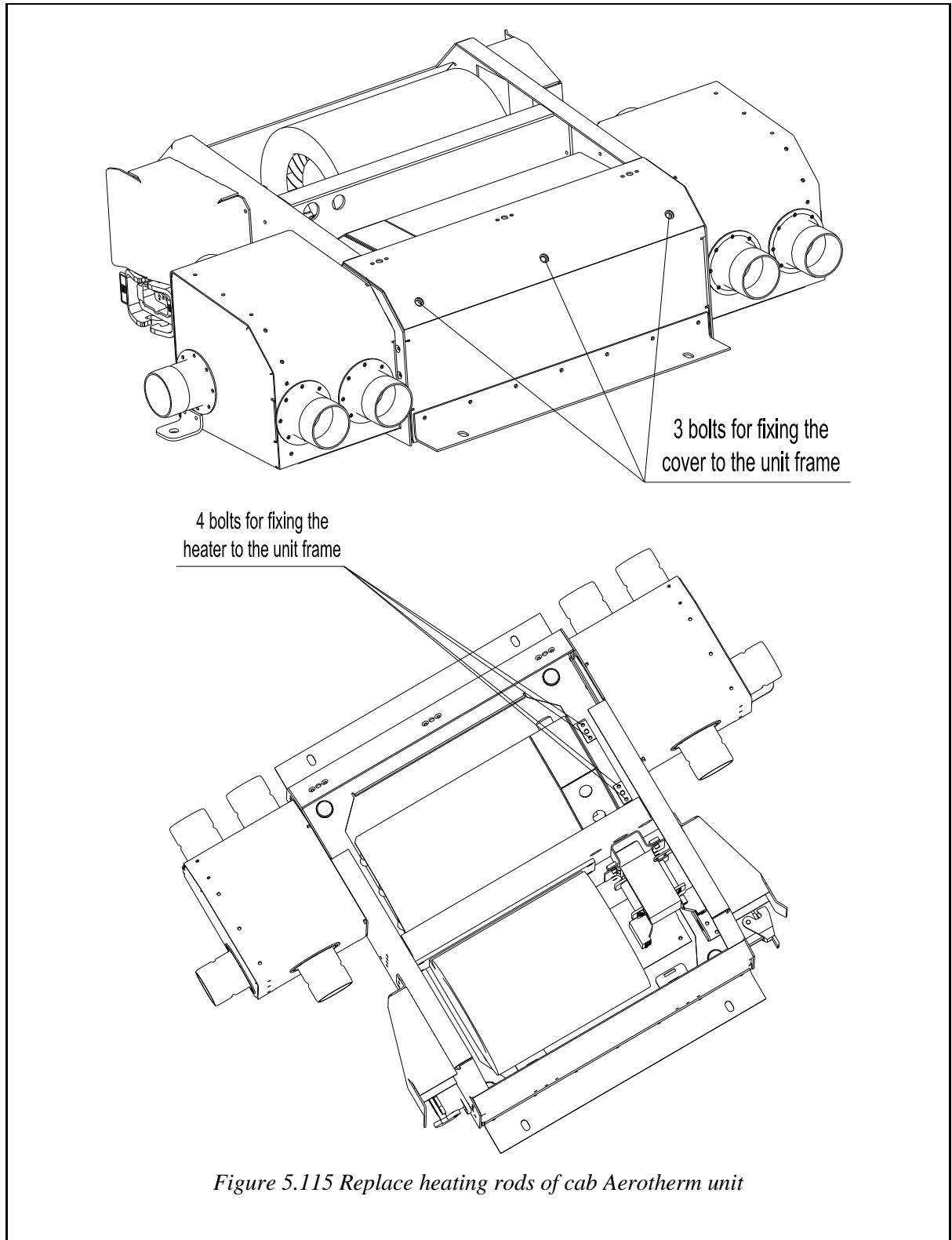
1. Cut off the power supply.
2. Loose the 8 bolts which fix the top cover of the Aerotherm unit.
3. Open the top cover.
4. Find the other top cover, please see the following figure.
5. Loosen the 3 bolts which fix the cover to the unit frame.
6. Then loosen the 4 bolts which fix the heater to the unit frame.
7. Remove the heater.
8. Replace heater rods.
9. Place the heater in the right place.
10. Tighten the 3 bolts fixing the heater.
11. Close the cover of the Aerotherm unit and screw down the bolts.
12. Switch on the power supply.

8 bolts for fixing the  
cover to the unit frame



# AMSTERDAM (Alstom)

## Rolling Stock



# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.74 Replace transformer of cab Aerotherm unit

<b>Title: Transformer -Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>cab Aerotherm unit</b>	<b>Saloon HVAC unit</b>	
	<b>X</b>		
<b>Reason for Task:</b> To replace transformer.			
<b>System/Equipment Title:</b> cab Aerotherm Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Transformer. <b>Parts number:</b> 12.0511.0015			
<b>Illustrations:</b> . <b>Reference Drawings:</b> SOG-2-0.4/0.14-0.35			
<b>SAFETY PRECAUTIONS:</b>  <table border="1" data-bbox="352 1653 564 1704"><tr><td><b>▲ CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			<b>▲ CAUTION</b>
<b>▲ CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.30 hours

**Team Size:** 1 person

**Procedure:**

**Disassembly:**

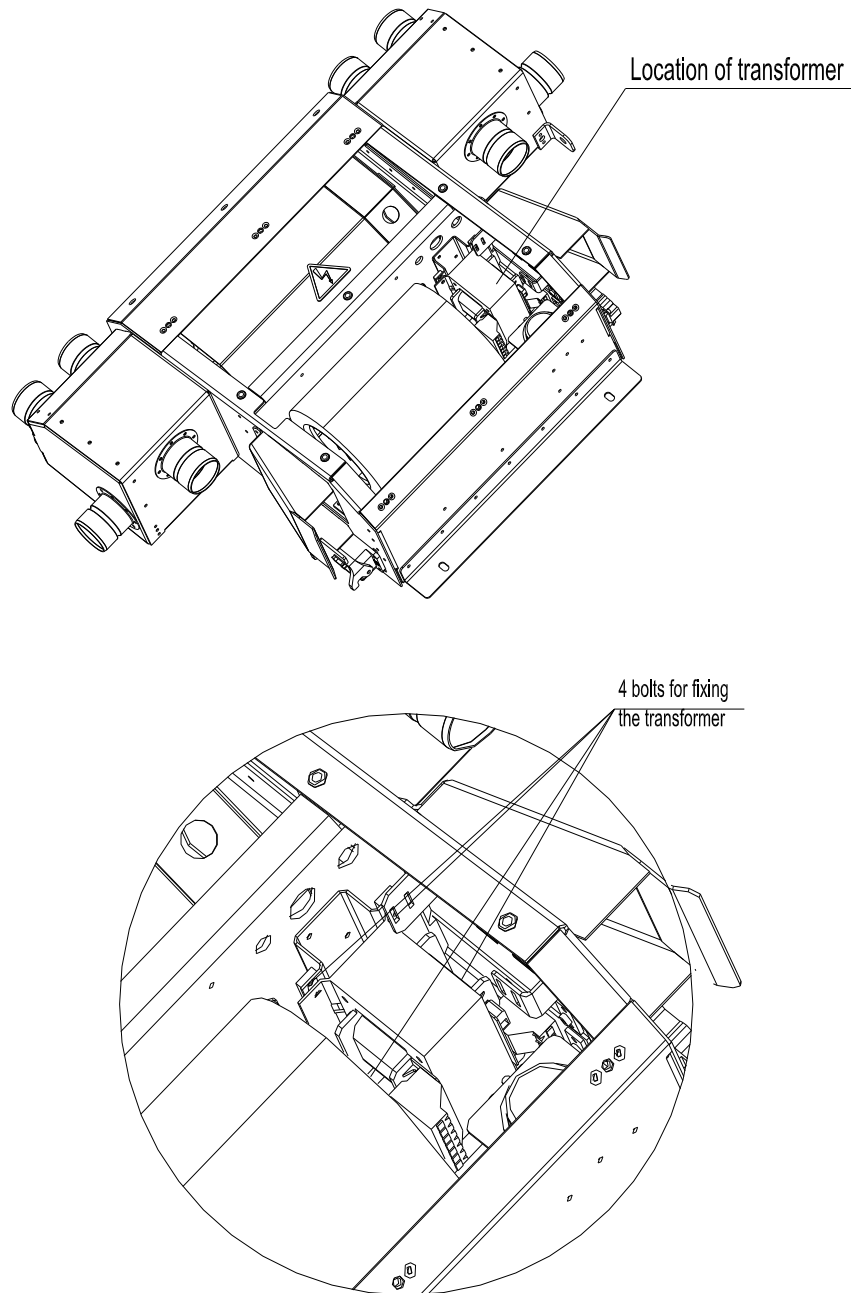
1. Cut off the power supply.
2. Open the cover and remove it.
3. Find the location of the transformer, Use a wrench to loosen the 4 bolts for fixing the plate and remove the plate.
4. Use a wrench to loosen the 3 bolts for fixing the transformer. Then take out the clamp.
5. Remove the transformer out of HVAC Unit.

**Assembly:**

1. Place a new transformer in the right location.
2. Replace the clamp, then replace the 3 bolts for fixing the transformer and tighten them.
3. Replace the plate and then replace the 3 bolts for fixing the transformer and tighten them.
4. Replace the cover.
5. Tighten the screws which fix the cover to the frame.

# AMSTERDAM (Alstom)

## Rolling Stock



*Figure 5.116 Replace transformer of cab aerotherm unit*




# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

### 5.5.75 Replace transformer of cab HVAC unit

<b>Title: Transformer -Replace</b>	<b>Work Instruction No.</b>		
<b>Unit applicability</b>	<b>cab HVAC unit</b>	<b>Saloon HVAC unit</b>	
	<b>X</b>		
<b>Reason for Task:</b> To replace transformer.			
<b>System/Equipment Title:</b> Cab HVAC Unit <b>Manufacturer:</b> SFRT <b>Type/Model No:</b> KS97 <b>Location of unit to be maintained:</b> on the roof of vehicle.			
<b>Special Tools and Facilities:</b> N.A. <b>Materials and Consumables:</b> N.A. <b>Essential Replacement Parts:</b> Transformer. <b>Parts number:</b> 12.0511.0016			
<b>Illustrations:</b> . <b>Reference Drawings:</b> MEHT-800-400/80-230			
<b>SAFETY PRECAUTIONS:</b>  <table border="1"><tr><td> <b>CAUTION</b></td></tr></table> <b>SECURE CAR WHEELS WITH HANDBRAKE AND CHAINS</b> <b>REMOVE 750 VDC POWER FROM CAR, ISOLATE HVAC SYSTEM FROM ALL ELECTRICAL SUPPLIES.</b> <b>WEAR REQUIRED SAFETY EQUIPMENT, ALL SAFETY RULES AND REGULATIONS MUST BE OBSERVED.</b>			 <b>CAUTION</b>
 <b>CAUTION</b>			

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

**Down Time:** 0.30 hours

**Team Size:** 1 person

**Procedure:**

**Disassembly:**

6. Cut off the power supply.
7. Open the cover and remove it, see 5.4.4.
8. Find the location of the transformer, Use a wrench to loosen the 4 bolts for fixing the plate and remove the plate.
9. Use a wrench to loosen the 3 bolts for fixing the transformer. Then take out the clamp.
10. Remove the transformer out of HVAC Unit.

**Assembly:**

6. Place a new transformer in the right location.
7. Replace the clamp, then replace the 4 bolts for fixing the transformer and tighten them.
8. Replace the plate and then replace the 4 bolts for fixing the transformer and tighten them.
9. Replace the cover.
10. Tighten the screws which fix the cover to the frame.

# AMSTERDAM (Alstom)

## Rolling Stock

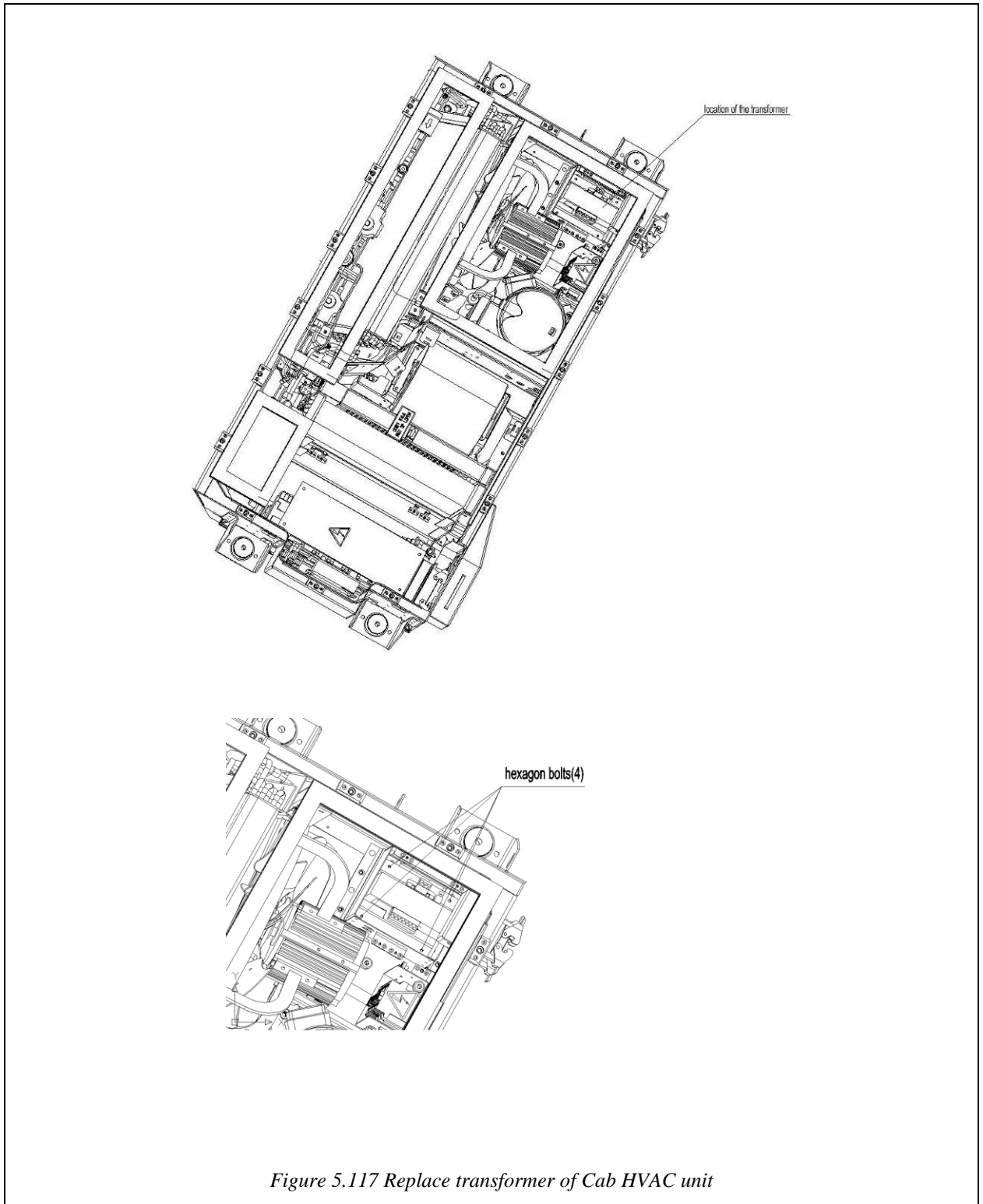


Figure 5.117 Replace transformer of Cab HVAC unit

# AMSTERDAM (Alstom)

## Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

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Appendix 1 fastener reference table

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

No.1	Type	Size	Standard	pcs	Fixing
1	Hexagon bolt	M6×16	ISO 4017	4	Supply air fan of Cab HVAC unit
	locking washer	Φ6-14-1.3	NF E25-511	4	
	plain washer	Φ6	ISO 7089	4	
2	Hexagon bolt	M8×50	ISO 4017	6	Supply air fan of Saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	6	
	plain washer	Φ8	ISO 7089	6	
3	Hexagon bolt	M8×20	ISO 4017	8	supply air fan bumper of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	8	
	plain washer	Φ8	ISO 7089	8	
4	Hexagon bolt	M8×16	ISO 4017	12	condenser fan of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	12	
	plain washer	Φ8	ISO 7089	12	
5	Hexagon bolt	M8×20	ISO 4017	4	cab HVAC condenser fan
	locking washer	Φ8-18-14	NF E25-11	4	
	plain washer	Φ8	ISO7089	4	
6	Hexagon bolt	M8×20	ISO 4017	2	compressor of cab HVAC unit
		M8×40		4	
	locking washer	Φ8-18-1.4	NF E25-511	8	
	plain washer	Φ8	ISO 7089	12	

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

7	Hexagon bolt	M10×60	ISO 4017	6	compressor of saloon HVAC unit
	locking washer	Φ10-22-1.6	NF E25-511	6	
	plain washer	Φ10	ISO 7089	6	
8	Hexagon bolt	M8×16	ISO 4017	4	condenser of cab HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	4	
	plain washer	Φ8	ISO 7089	4	
9	Hexagon bolt	M8×16	ISO 4017	16	condenser of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	16	
	plain washer	Φ8	ISO 7089	16	
10	Hexagon bolt	M8×20	ISO 4017	4	evaporator of cab HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	4	
	plain washer	Φ8	ISO 7089	4	
11	Hexagon bolt	M8×12	ISO 4017	4	evaporator of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	4	
	plain washer	Φ8	ISO 7089	4	
12	Hexagon bolt	M8×20	ISO 4017	4	electrical heater of cab HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	4	
	plain washer	Φ8	ISO 7089	4	
13	Hexagon bolt	M8×16	ISO 4017	4	electrical heater of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	4	

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

	plain washer	Φ8	ISO 7089	4	
14	Hexagon bolt	M6×16	ISO 4017	8	gas liquid separator of saloon HVAC unit
	plain washer	Φ6	ISO 7089	8	
15	Hexagon bolt	M6×16	ISO 4017	3	transformer of saloon HVAC unit
	locking washer	Φ6-14-1.3	NF E25-511	3	
	plain washer	Φ6	ISO 7089	3	
16	Hexagon bolt	M8×45	ISO 4017	8	bumper for condenser fan of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	8	
	plain washer	Φ8	ISO 7089	8	
17	Hexagon bolt	M6×16	ISO 4017	4	controller of cab HVAC unit
	locking washer	Φ6-14-1.3	NF E25-511	4	
	plain washer	Φ6	ISO 7089	8	
18	Hexagon bolt	M6×16	ISO 4017	4	controller of saloon HVAC unit
	locking washer	Φ6-14-1.3	NF E25-511	4	
	plain washer	Φ6	ISO 7089	4	
19	Hexagon bolt	M6×20	ISO 4017	4	supply air fan of cab Aerotherm unit
	locking washer	Φ6-14-1.3	NF E25-511	4	
	plain washer	Φ6	ISO 7089	4	
20	Hexagon bolt	M6×16	ISO 4017	4	transformer of cab Aerotherm unit
	locking washer	Φ6-14-1.3	NF E25-511	4	

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

	plain washer	Φ6	ISO 7089	4	
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## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

No.1	Type	Size	Standard	pcs	Fixing
1	Hexagon bolt	M6×16	ISO 4017	4	Supply air fan of Cab HVAC unit
	locking washer	Φ6-14-1.3	NF E25-511	4	
	plain washer	Φ6	ISO 7089	4	
2	Hexagon bolt	M8×50	ISO 4017	6	Supply air fan of Saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	6	
	plain washer	Φ8	ISO 7089	6	
3	Hexagon bolt	M8×20	ISO 4017	8	supply air fan bumper of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	8	
	plain washer	Φ8	ISO 7089	8	
4	Hexagon bolt	M8×16	ISO 4017	12	condenser fan of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	12	
	plain washer	Φ8	ISO 7089	12	
5	Hexagon bolt	M8×20	ISO 4017	4	cab HVAC condenser fan
	locking washer	Φ8-18-1.4	NF E25-511	4	
	plain washer	Φ8	ISO 7089	4	
6	Hexagon bolt	M8×20	ISO 4017	2	compressor of cab HVAC unit
		M8×40		4	
	locking washer	Φ8-18-1.4	NF E25-511	8	
	plain washer	Φ8	ISO 7089	12	

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

7	Hexagon bolt	M10×60	ISO 4017	6	compressor of saloon HVAC unit
	locking washer	Φ10-22-1.6	NF E25-511	6	
	plain washer	Φ10	ISO 7089	6	
8	Hexagon bolt	M8×16	ISO 4017	4	condenser of cab HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	4	
	plain washer	Φ8	ISO 7089	4	
9	Hexagon bolt	M8×16	ISO 4017	16	condenser of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	16	
	plain washer	Φ8	ISO 7089	16	
10	Hexagon bolt	M8×20	ISO 4017	4	evaporator of cab HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	4	
	plain washer	Φ8	ISO 7089	4	
11	Hexagon bolt	M8×12	ISO 4017	4	evaporator of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	4	
	plain washer	Φ8		4	
12	Hexagon bolt	M8×20	ISO 4017	4	electrical heater of cab HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	4	
	plain washer	Φ8		4	
13	Hexagon bolt	M8×16	ISO 4017	4	electrical heater of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	4	

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

	plain washer	Φ8	ISO 7089	4	
14	Hexagon bolt	M6×16	ISO 4017	8	gas liquid separator of saloon HVAC unit
	locking washer	None	NF E25-511		
	plain washer	Φ6	ISO 7089	8	
15	Hexagon bolt	M6×16	ISO 4017	3	transformer of saloon HVAC unit
	locking washer	Φ6-14-1.3	NF E25-511	3	
	plain washer	Φ6	ISO 7089	3	
16	Hexagon bolt	M8×45	ISO 4017	8	bumper for condenser fan of saloon HVAC unit
	locking washer	Φ8-18-1.4	NF E25-511	8	
	plain washer	Φ8	ISO 7089	8	
17	Hexagon bolt	M6×16	ISO 4017	4	controller of cab HVAC unit
	locking washer	Φ6-14-1.3	NF E25-511	4	
	plain washer	Φ6	ISO 7089	8	
18	Hexagon bolt	M6×16	ISO 4017	4	controller of saloon HVAC unit
	locking washer	Φ6-14-1.3	NF E25-511	4	
	plain washer	Φ6	ISO 7089	4	
19	Hexagon bolt	M6×20	ISO 4017	4	supply air fan of cab Aerotherm unit
	locking washer	Φ6-14-1.3	NF E25-511	4	
	plain washer	Φ6	ISO 7089	4	
20	Hexagon bolt	M6×16	ISO 4017	4	transformer of cab

## AMSTERDAM (Alstom)

### Rolling Stock

HVAC System

5 Maintenance and Overhaul Procedures

	locking washer	Φ6-14-1.3	NF E25-511	4	Aerotherm unit
	plain washer	Φ6	ISO 7089	4	
21	Hexagon bolt	M8(BOSSARD)		14	AHU cover of Saloon HVAC
	locking washerΦ8	Φ8-18-1.4	NF E25-511	24	
	large washer Φ8	Φ8	GB/T96.1-2002	24	
	M8 nylon washer	Φ8(BOSSARD)		24	
22	Hexagon bolt	M8(BOSSARD)		17	Top cover of cab HVAC
	locking washerΦ8	Φ8-18-1.4	NF E25-511	17	
	large washer Φ8	Φ8	GB/T96.1-2002	17	
	M8 nylon washer	Φ8(BOSSARD)		17	