Service and Maintenance Manual
E Compressor

Serial Number: _____

00							
Rev	Date	Description	Prepared by	Checked by	Discipline Approval	Project Approval	Client Approval

E Innovation AS

Client:		*Contract No.:*	
Procedure Title:	Service and Maintenance Manual E Compressor	Project No.:	
Document No.:	**63KZ-SMM**	Rev: *00*	Page: 1 of 54

WARNINGS COMPRESSED AIR AND ELECTRICITY ARE DANGEROUS. BEFORE DOING ANY WORK ON THIS UNIT, BE SURE THE ELECTRICAL SUPPLY HAS BEEN SHUT OFF (LOCKED AND TAGGED) AND THE ENTIRE E COMPRESSOR SYSTEM HAS BEEN VENTED OF ALL PRESSURE.

1. Do not remove the cover, loosen or remove any fittings, connections or devices when this unit is operating or in operation. Compressed air within this unit can cause severe injury.

2. The E Compressor has high and dangerous voltage in the motor, the starter and control box. All installations must be in accordance with recognized electrical procedure. Before working on the electrical system, ensure that the system's power has been shut off by use of a manual disconnect switch. A circuit breaker or fuse switch must be provided in the electrical supply line to be connected to the compressor. The preparation work for installation of this unit must be done on suitable ground, maintenance clearance and lightning arrestors for all electrical components.

3. Do not operate the E Compressor at a higher discharge pressure than those specified on the compressor nameplate. If so an overload will occur. This condition will result in electric motor shutdown.

4. Use only safety solvent for cleaning the E Compressor and auxiliary equipment and components.

5. Secure that the E Compressor is suitably located for service work.

6. Whenever pressure is released through the safety valve during operation, it is due to excessive pressure in the system. The cause of excessive pressure should be checked and immediately corrected.

7. Before doing any mechanical work on the E Compressor,
a) Shut down the unit.
b) Electrically isolate the compressor by disconnecting the power supply cable.

8. Before starting the E Compressor, the maintenance instructions should be thoroughly read and understood.

9. After maintenance work is completed, covers must be securely closed.

10. For questions contact your team leader or other personnel trained to carry out service work on the E Compressor.

The company reserves the right to make changes without prior notice.

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1. **Purpose**

The purpose of this Service and Maintenance Manual is to provide detailed instructions for the safe service and maintenance of the E Compressor Breathing air Compressor model no 63KZXXXX. The E Compressor will be serviced and maintained by trained personnel from E Innovation AS or other specialized personnel. There are a few service and maintenance and service tasks that needs to be done by the operator of the E Compressor. This is some filter changes, controlling drain silencers and keeping the unit in a clean condition. These operations are covered by the User manual.

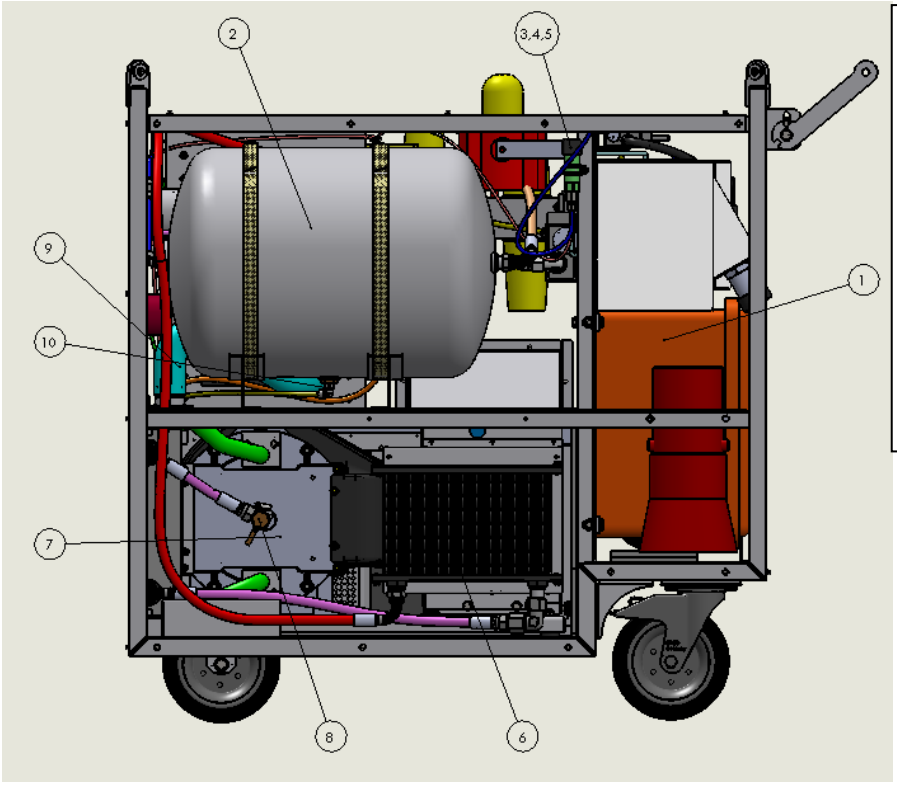
2. **System description.**

The E Compressor is designed to deliver safe breathing air for two users in ATEX zone 1. The system is mobile allowing the user to move the E Compressor by hand from location to location. The air quality is continuously monitored and is displaying the values for CO, CO2, O2 and Dew point. In the case of emergency shutdown as a result of gas detection, 10%LEL, values of CO, CO2, O2 or dew point out of limits the system has a automatic High Pressure (HP) back up system. The same display at the operator panel that shows the air quality does also display a variety of codes indicating status of the E Compressor.

The description and also the foundation to understand, operate, service and maintain the E Compressor is the User manual. This manual gives basic information on mobilization, installation the use and operation of the E Compressor. The User manual will form essential parts of the understanding of the operation of the E Compressor and it is essential for the worker that is trained to perform service on the E Compressor. It shall also be mentioned that only light field service will be performed by personnel that is not trained to service the system. The company has decided to allow service and maintenance only to trained personnel.

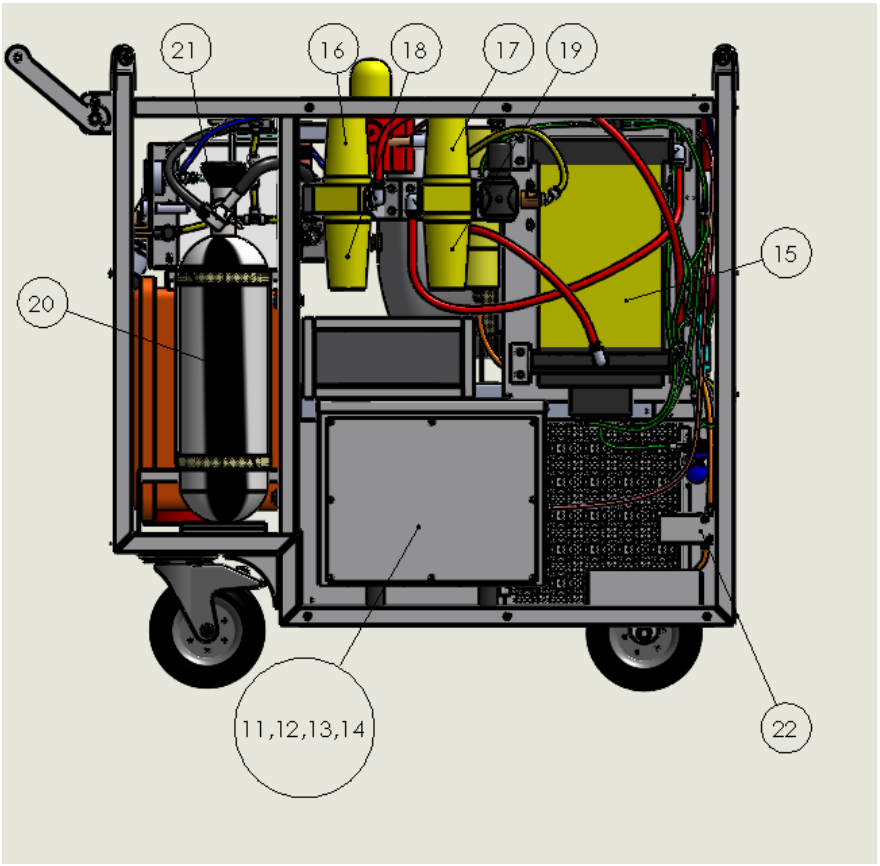
This manual describes the service and maintenance of the E Compressor where the system is separated into systematically sub systems such as: The filtration system, motor and compressor, mechanical parts etc. Each section has its own description and a checklist that describe all the steps of the service and maintenance necessary to this section. These checklists are summarized as an attachment.

Following is a visual description of the E Compressor and its components:



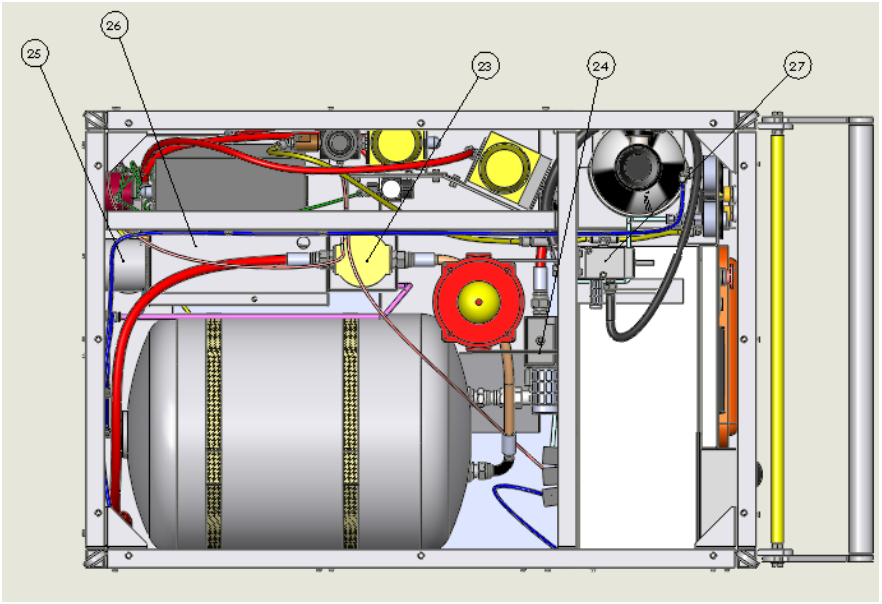
Item	Description Figure. 1
1	ATEX Control unit
2	Air vessel
3	10 Bar pressure transmitter
4	10 Bar pressure transmitter
5	400 Bar pressure transmitter
6	Air cooling stage 2
7	Oil less compressor
8	Safety valve
9	Air inlet hose
10	Tank water drain

Figure 1



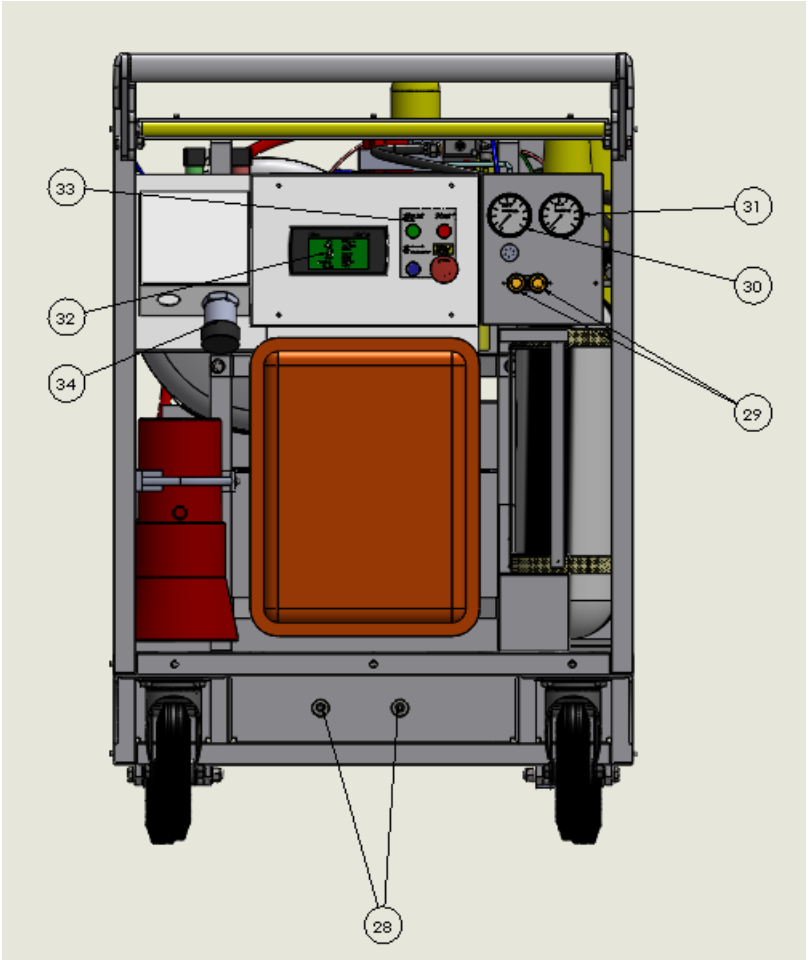
Item	Description Figure 2
11	CO Detector
12	CO2 Detector
13	O2 Detector
14	Dew Point sencor
15	Air drying unit
16	AC Filter
17	HC Filter
18	Particle filter
19	Particle filter
20	HP rescue bottle
21	HP Regulator assey
22	Magnetic drain valves

Figure 2



Item	Description Figure 3
23	Syclone water vapourer
24	1/2" Magnetic valve
25	Air inlet filter housing
26	H2S and Methane gas detectors
27	1/4" Rescue air valve

Figure 3



Item	Description Figure 4
28	Pulley adjustment bolts
29	2 x Compressed air outlet
30	High Pressure gauge
31	Low Pressure Gauge
32	Display
33	Operating buttons
34	Rig signal connector

Figure 4

3. Service and maintenance intervals

The E Compressor will need to be service on a regular basis. Some of the service work will be performed by the operator renting the E Compressor. E Innovation will give training to assure that the service is carried out in a safe and responsible manner to maintain the best possible quality of the E Compressor. On a yearly basis the E Compressor will automatically be replaced at the customer by a “new” recertified and calibrated unit. If the E Compressor is returned from a job at a shorter interval than 12 months a full service is performed but some of the calibration and recertification may be left out depending on the duration of the next job.

Each E Compressor has a unique documentation folder that provides all certification necessary for this particular compressor to enter a worksite. It is equivalent important to update this documentation folder at each service and maintenance point. All certificates of calibration need update, the service log shall be maintained and the correct declarations of conformities shall always be available for the operator of the equipment. All certificates are copied and the original is kept by the owner of the E Compressor if the document folder should be lost at the worksite.

3.1 Field service and regular maintenance.

During its time at a work site the E Compressor requires a minimum of service and maintenance. Nevertheless, a certain looking after is required to maintain the high quality performance of the system. This “field service” includes some filter change and looking after the system for optimal operation. Field service is also covered in the User manual.

Field maintenance checkpoints and service				
Filter/replacement	**Part no**	**monthly**	**3 months**	**6 months**
Stage 1 Air inlet filter filter no 1622 0658 00	1622 0658 00	x		
Stage 3 Adsorption filter element	K013AC		x	
Stage 6 Adsorption filter element	K013HC		x	
Drain valve silencers x 2	1/4" Festo		Check	check/replace
General cleaness/visual inspection		Weekly	-	-
Reading and reporting runningtime	Display	x		

Table 1 Field service carried out by dedicated personnel

3.2 Standard 12 months service program or when returned from project

When the E Compressor return from a job the whole system is controlled according to the 12 months service and maintenance plan as described in this manual. Depending on the duration of the previous job and the new contract, certificates and calibration will be performed on a job to job basis. If the certification is good for another 5 months and the upcoming contract is for 3 months, all certificates stay the same.

The following chapters 4 trough chapter 14 will in closer details describe the complete E Compressor service and maintenance plan step by step. The system is divided into the following sections.

Chapter	Description of secttion of the E Compressor
4	Panels, frame, wheels, lifting points, lifting sling
5	Hoses, tubing, pipes, fittings, air outlets
6	Air vessel and Air cooling radiators 1 and 2
7	Air purification system and cyclone water separator
8	Magnetic valves and silencers
9	Methane, H2S, CO, O2, Co2 and Dew Point detectors
10	High Pressure rescue system
11	Electrical motor and transmission
12	Scroll Compressor unit
13	Safety valve
14	Internal structural parts
15	Electro

Table 2

4. Service and maintenance, panels, frame, wheels, lifting points and lifting aid.

-When an E Compressor comes in for service al outer panels are removed, checked for damage, cleaned and repainted if necessary. If old and worn décor is replaced

-Each panel shall be controlled for numbering (same serial number as the unit) If the condition of a panel is to bad to be repaired it shall be replaced.

-All POP nuts shall be inspected and replaced if worn. Before reattaching the panels, the M5 popnuts shall be lubricated with white Vaseline to prevent corrosion attacking and impede reopening after being exposed to a harsh environment at the worksite.

-Inspection on all quarter turn locks shall be carried out and replaced if worn / damaged.

-Control that all marking is correct / not damaged and replace if necessary.

-All wheels shall be examined and replaced if rubber is worn or damaged. After cleaning/replacement, the steel parts shall be coated with a fine layer of Techtyl.
-The frame and lifting points shall together with the lifting sling be inspected by a 3rd party every 12 months. (Otic perform this services in Norway) the color of the year shall be applied and the service tag updated together with the control card in the documentation folder.

-Lifting aid shall be recertified and marked with the correct color of the year. Certificates/control cards in the Documentation folder shall be updated / replaced.

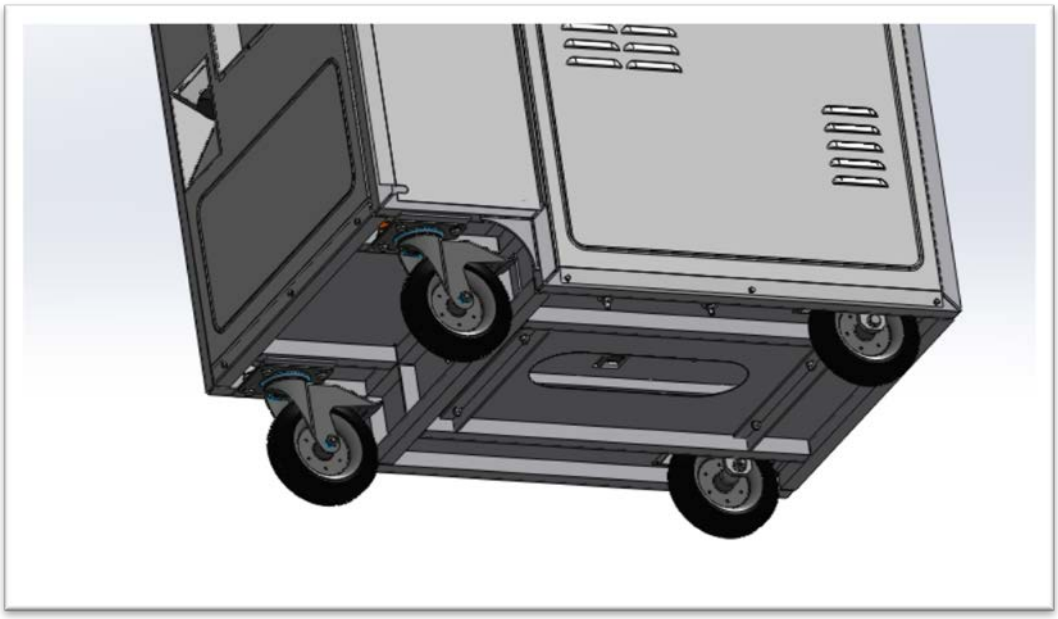


Figure 5 Detailing the E Compressor panel, wheels, framework

5. **Service and maintenance, Hoses, tubing, pipes, fittings**
   All hoses, tubing, pipes and fittings are inspected and replaced if any sign of wear. A leak detection test is always carried out to identify any possible leakage points. All Dowty seals and o-rings on M22/1/2” aluminum fittings shall be inspected and re lubricated with Molycote

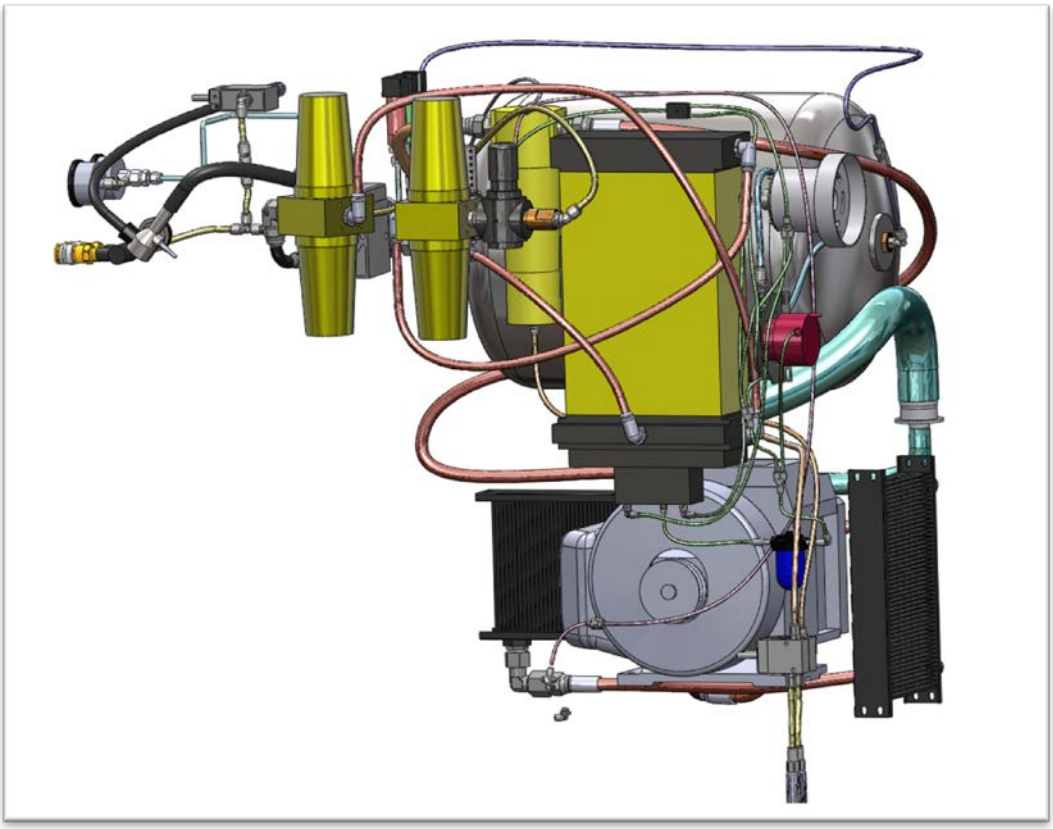


Figure 6 The complete air flow trough all filters, hoses, valves and drains

6. **Service and maintenance, Air vessel and Air Cooling radiators 1 and 2**
Before entering the 60 liter air vessel (part no 100168) the compressed air will flow trough 2 air cooling radiators that bring down the air temperature from 130°C to 20°C. The two Setrab aluminum radiators (part no 100045)

6.1 Air vessel

Air vessel 60 liter is cleaned and inspected at each service. The tank will be replaced if corrosion or other damage is present. The tank will be replaced every 5 year.
(Tank with fittings assembly manual no 100326)
-Dismantle the M22 fittings on the tank.
-Clean with mild cleaning detergent and rinse thoroughly with hot water.
-Let the tank dry in an upraised position.
-Use a flashlight to visually examine the inside of the tank.
-Re install the fittings, check seals and threads on fittings

6.2 Air cooling radiators 1 and 2

The radiators are subject to the following service and maintenance.
-Dismantle the ½” tubing connecting the Radiators
-Remove the M6 bolts, washers and nuts holding the radiator in place
-With the radiator dismantled from the E Compressor, remove the 2 x M22 -1/2” fittings (part no. 100314)

-Inspect the radiator for any damage, corrosion both externally and internally. Also check threads for fittings.
-Rinse the radiator with a mild detergent and thoroughly rinse with water making sure all traces of detergent is removed.
-Use low pressure compressed air to remove water and leave to dry.
-Inspect the aluminum M22-1/2” fittings with O-rings and reinstall if no damage is present.
-Re install the radiator.

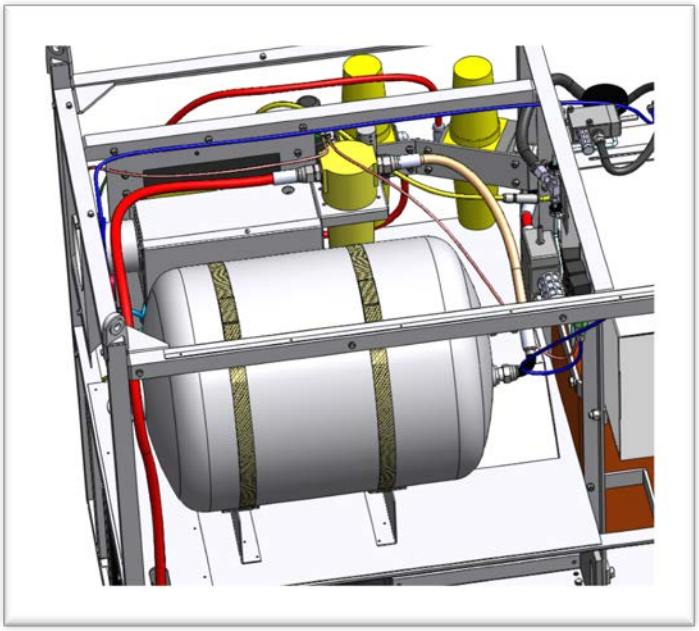


Figure 7 The 60 liter Air vessel Part no 100168

7. **Air purification system and cyclone water separator, service and maintenance.**
The filtration of air and compressed air consists of 7 stages. Each stage is important to the final result and quality of the breathing air. For all stages to operate correct a service schedule is important.

Short description of the seven purification stages from air inlet to ready produced breathing air.

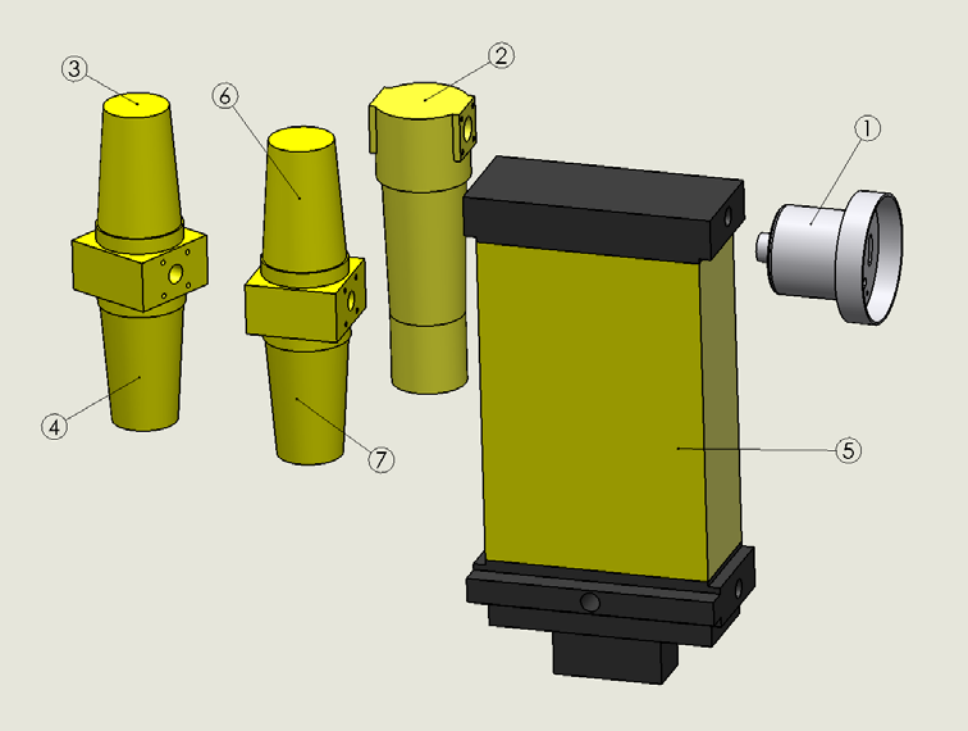


Figure 8 The seven stages of air purification

1. **Air inlet dust filter** – 30 micron filter removing particulars from the air before it is drawn into the compressor.

2. **A cyclone water separator** - removes most of the condensed water from the compressed air. Remaining condensed air is automatically drained from Cyclone filter and tank by a 8 second interval automatic drain with a 0,5 second opening.

3. **Grade AA** – High efficiency coalescing filter – for removal of oil/water aerosols and dirt particulate down to 0.01 micrometer, giving a maximum remaining oil content of 0.01 mg/m3

4. **Grade AC** – Adsorption bed of activated carbon – for removal of oil vapors and odors. The downstream air after this stage now has a maximum remaining oil content of 0.003 mg/m3 at a filtration temperature of 20°C.

5. **Adsorption Purifier** – regenerative adsorption bed of desiccant for removing water vapor and also reducing the CO2 content prior to the catalyst stage. The desiccant purifier maintains a low dew point by utilizing the heatless pressure swing adsorption principle. Cycle time is controlled by 2 solenoid valves.

6. **Grade HC** – Catalytic element – for removal of carbon monoxide by oxidation to carbon dioxide through chemisorptions and catalysis. The catalyst is kept active by maintaining a low dew point prior to the catalytic bed. This is achieved by the integral adsorption purifier.

7. **Grade AAR** – Dust removal – for removal of particulate matter and dust carry-over down to 0.01 micrometer.

These 7 stages of purification need to be maintained on a regular basis. The remaining part of chapter 7 will in detail describe the operation and service of each single purification stage.

7.1 Routine maintenance of air purification system; Stage 1 Air inlet filter

The 30 micron air inlet filter situated at the E Compressor air inlet manifold should be changed every 1 months when in regular operation. **Spare filter no. 1622 0658 00**

Twist the filter housing counterclockwise to open, remove and replace filter and reattach the filter housing. Clean the filter housing using a mild detergent and a Scotch Brite cleaning scrub. Dry off all water and protect the filter holder with a very thin layer of white Vaseline to prevent corrosion.

7.2 Routine maintenance Air Purification System Stage 2 Cyclone Water Separator.

The Käeser water separator is a mechanical devise that requires no maintenance. Nevertheless, the separator is inspected and cleaned on every service. If broken or corroded the separator is replaced.

-Dethatch the Water separator 8mm drain tubing

-release the two ½” hoses using a 32mm and a 27mm wrench

-cut the two strips that hold the separator in place

-split the water separator head from the bowl and clean and inspect

-use Molycote Vaseline to re grease the o-ring and assemble the unit

-re install in reverse order. **Note air direction on the top of separator.**

-make sure that a leak detection test is carried out.

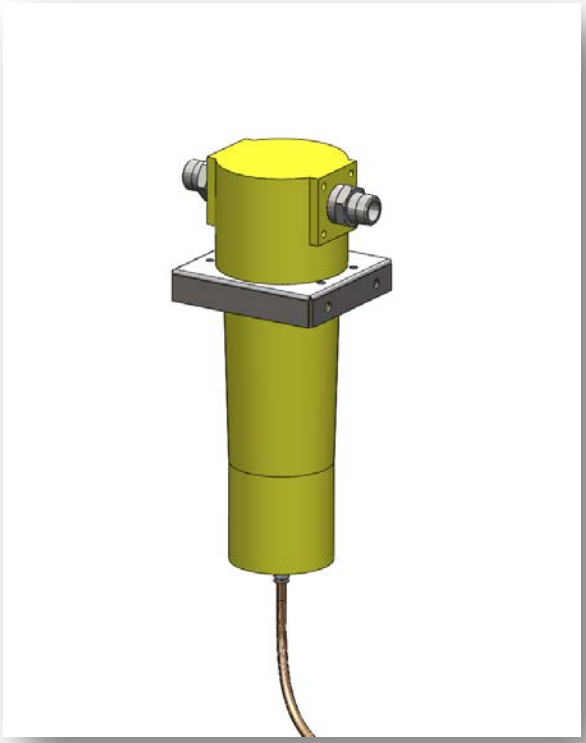


Figure 9 The water separator with ¾” stainless steel fittings and 8mm drain tubing

7.3 Routine maintenance Air Purification System Stages 3, 4, 5 ,6 and 7

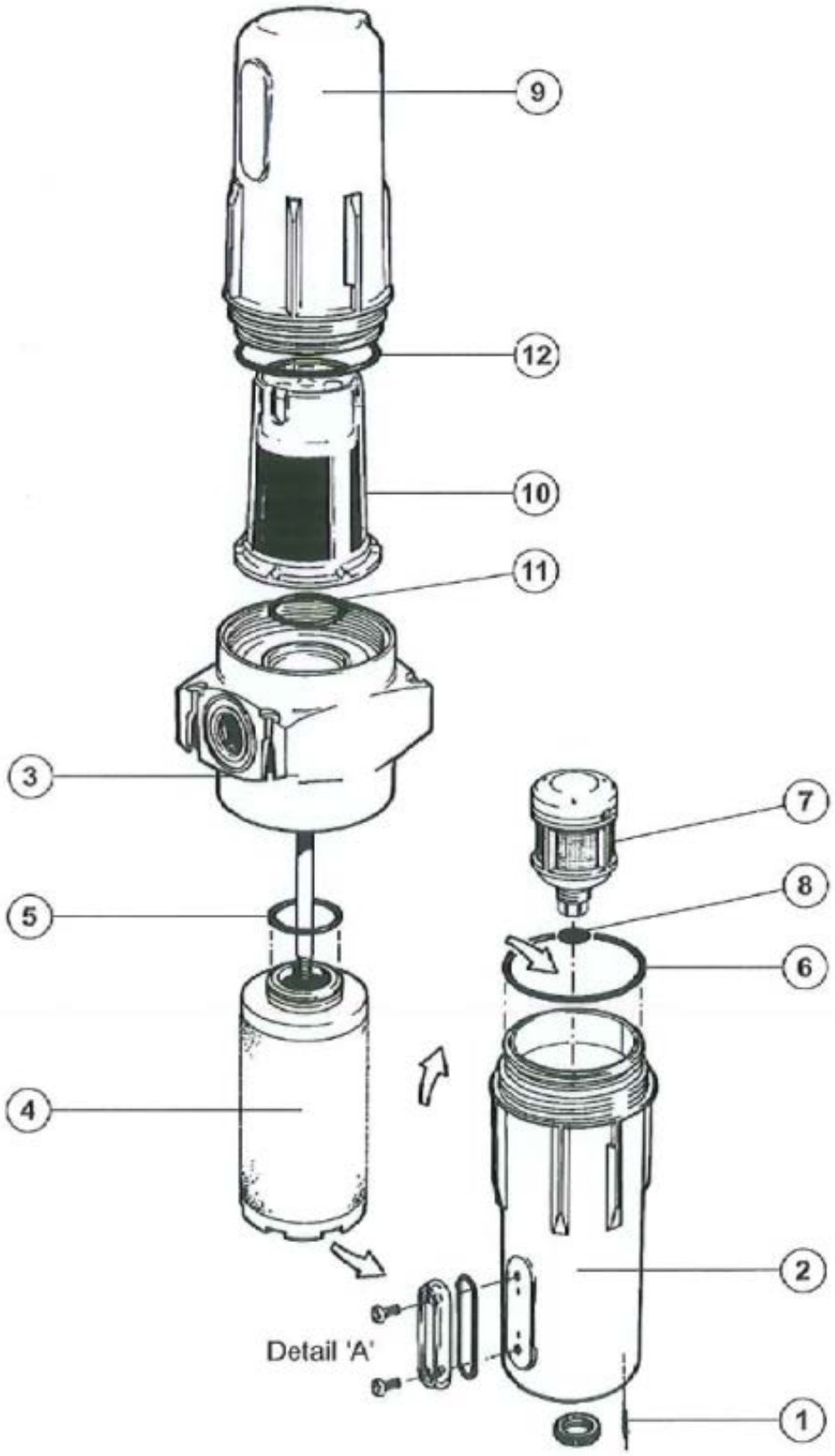


Figure 10 Exploded Drawing of 3rd and 4th Filtration Stages

7.3.1 Routine Maintenance Instructions for 3rd and 4rt Filtration Stages

3rd Stage Grade AA Filter Element Replacement (K017AA)

Operating Description:
The Grade AA filter element will operate indefinitely when only removing liquids. However, the pressure drop across the element will increase due to the build up of solid contaminants being trapped. It is recommended that this element is changed before the pressure loss becomes prohibitive for the application or after 6000 hours of use, whichever is the earlier.

Instruction:
1. Disconnect the power supply, make sure to shut off the HP valve and depressurize the E Compressor.

2. Fully depressurize filter housing using bleed valve in the Rectus 96 air outlet

3. Unscrew lower bowl (2) counter clockwise and remove. If pressure has not been completely released from the filter, air will escape from the warning hole (3) giving an audible alarm. Screw bowl back and repeat instruction 2 before attempting again. Should resistance to unscrewing be experienced, provision is made for a ‘C’ spanner to fit on to the ribs of the bowl.

4. Unscrew filter element (4) and replace with a new unit, using new ‘O’ ring supplied (5). (Replacement filter element number K017AA).

5. Check condition of bowl seal (6) and replace if necessary. Clean screw threads. Inspect interior of bowl and report any signs of corrosion or other damage to a competent person.

6. The autodrain assembly (7) is not serviceable and must be replaced if faulty.

7. Check the autodrain seal (8) and replace if worn.

8. Replace vent valve (1) if faulty or leaking.

9. Refit bowl (2).

10. Pressurise and check for leaks. If leaks do occur they will most probably be from the bowl ‘O’ ring (6). Depressurize housing and remove ‘O’ ring as stated above and inspect and clean. Ensure that mating surfaces are clean and then refit ‘O’ ring, re-locate bowl and repressurise.

NOTE:
WHEN CHANGING FILTER ELEMENTS OR REPLACING THE AUTOMATIC DRAIN, TAKE THE OPPORTUNITY TO GENERALLY CLEAN THE INSIDE OF THE BOWL AND CLEAN SCREW THREADS

11. A sight glass (detail ‘A’) monitors the function of the autodrain and in adverse conditions can become contaminated. Dismantle as per detail ‘A’ and clean (a replacement kit is available, part no. SGK 1).

7.3.2 4th Stage Grade AC Filter Element Replacement

Operating Description:
The Grade AC adsorption element has a recommended useful life of 2000 hours or 90 days when used at a filtration temperature of 30°C (86°F) and whilst the pressure differential may not increase during this period, the replacement of this element must be carried out regularly by planned maintenance or when the user detects the first signs of oil vapour or odour.

Instruction:

1. Disconnect the power supply, make sure to shut off the HP valve and depressurize the E Compressor.

2. Fully depressurize filter housing using bleed valve in the Rectus 96 air outlet

3. Unscrew upper bowl (9) anticlockwise and remove. If the pressure has not been completely released from the housing, air will escape from the warning hole (3) giving an audible alarm. Screw back bowl and repeat instruction 13 before attempting again.Should resistance to unscrewing be experienced, provision is made for a ‘C’ spanner to fit on to the ribs of the bowl.

4. Remove AC filter element (10) which is a plug in type and insert a new unit, using the new ‘O’ ring (11) supplied (replacement filter element number K013AC).

5. Check condition of bowl seal (12) and replace if necessary. Clean screw threads. Inspect interior of bowl and report any signs of corrosion or other damage to a competent person.

6. Refit bowl (9).

7. Repressurise and check for leaks. If leaks do occur they will most probably be from the bowl ‘O’ ring (12). Depressurise housing and remove ‘O’ ring as stated above and inspect and clean. Ensure that mating surfaces are clean and then refit ‘O’ ring, re-locate bowl and repressurise.

7.3.4 Routine Maintenance Instructions for 5th Stage Purifier

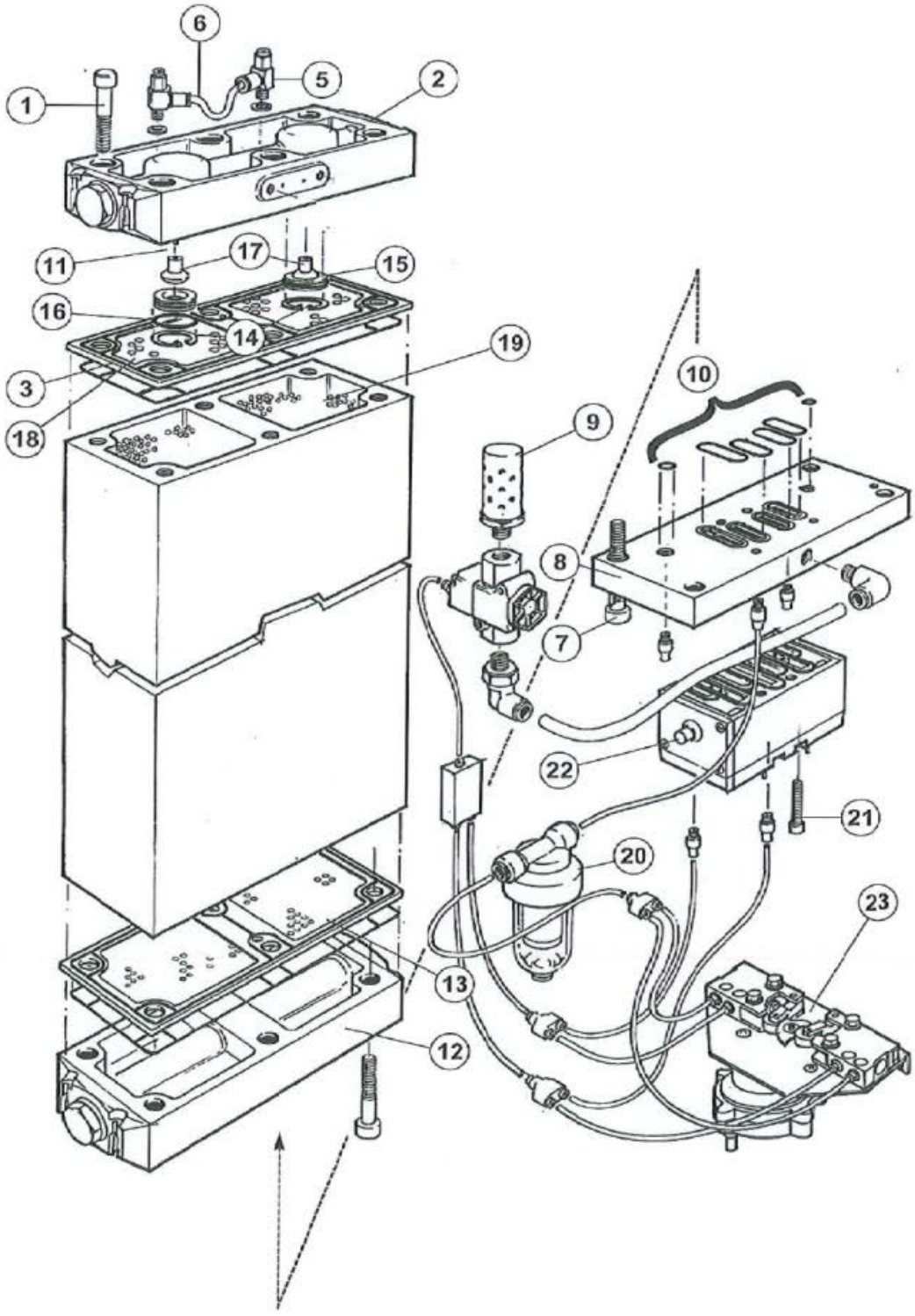


Figure 11 Exploded Drawing of 5th Purification Stage

Operating Description:

Compressed air is fed to the inlet port at the bottom of the purifier via the 1st and 2nd filtration stages (see previous sections), which protects the 5th stage from contamination. Principally, the 5th stage purifier contains two chambers of desiccant material. Whilst one is drying and reducing the level of carbon dioxide in the compressed air (adsorption), the other is simultaneously undergoing regeneration (desorption). The adsorption and desorption chambers are automatically reversed in function by the cam timer mechanism. At changeover, the purged air in the desorption column is vented to atmosphere, characterised by a small hissing noise.

7.3.5 Removal of the Adsorption Purifier from the E Compressor

Disconnect nylon tubing from push in elbow connectors, **Figure 12 (1,2,3,4,5,and 6)**, first marking the tube and connection (see details of Dryer drawing). This will allow the 5th stage purifier to be removed. Remove 8 M6 bolts, washers and nuts from brackets (7) detaching the purifier from the base plate. Caution, hold purifier when removing the last bolt to avoid the assembly falling out and causing injury. Carefully maneuver dryer until it is clear of cabinet (the 5th stage purifier weighs 21.2 Kg.

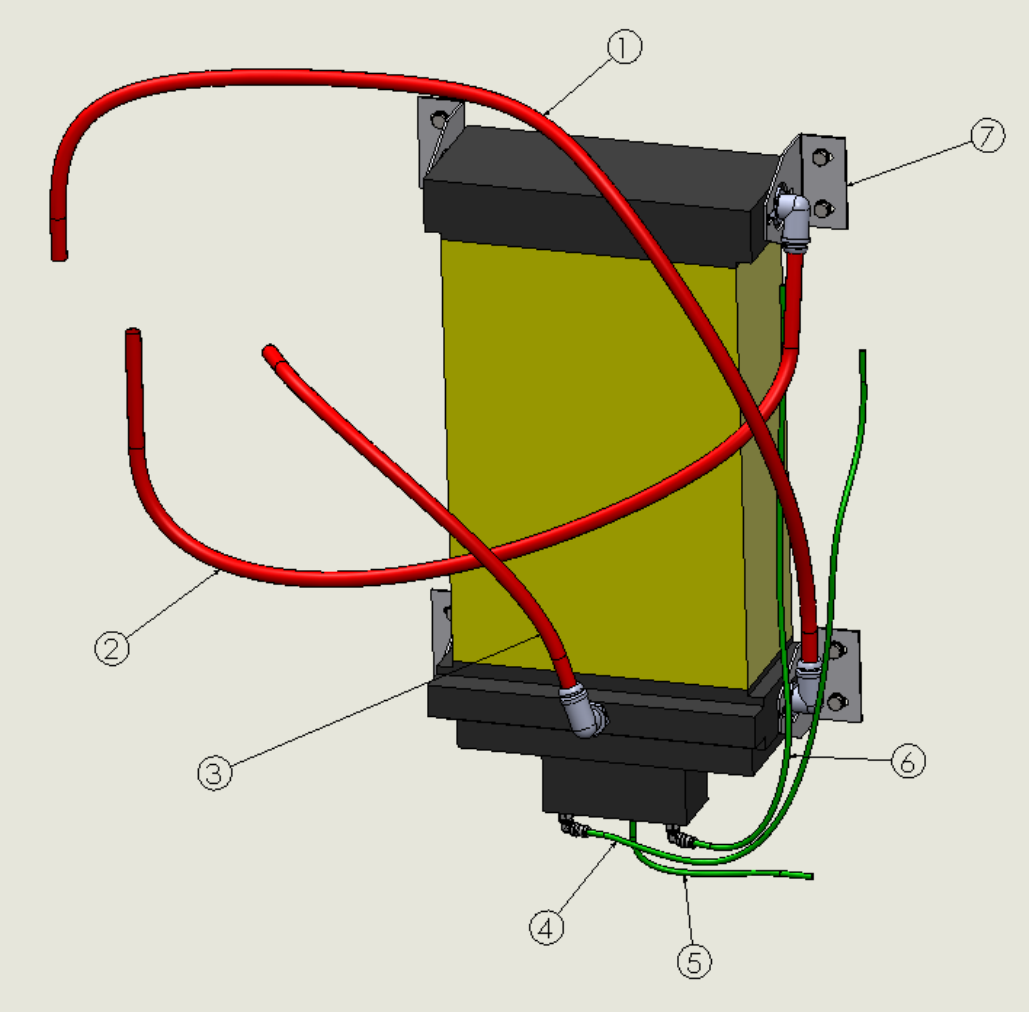


Figure 12 Hoses to disconnect when removing the dryer unit from the E Compressor

7.3.6 Upper Gasket Replacement
For the following instructions see **Fig. 11 - Exploded Drawing of 5th Purification Stage**
Disconnect outlet of purifier. Remove six cap head screws (1) from outlet head (2). Remove outlet head assembly (2), taking care not to disturb the column pads (18). Remove gasket (3). Fit new gasket and reassemble in reverse order. Torque six cap head screws (1) to 75 Nm (55 Ibf ft).

7.3.7 Lower Gasket Replacement
Invert purifier, paying particular attention not to apply pressure to the purge valves (5). Remove sub plate (8) complete with control valve (22), silencer (9), support screens and 'O' rings and moulded gaskets (10). Remove two cap head screws from inlet head (12). Remove inlet head (12) complete with gasket (13). Fit new gasket and re-assemble in reverse order. Torque two cap head screws and four cap head screws (7) to 75 Nm (55 Ibf ft).

7.3.8 Check Valve & Seat Replacement
Remove outlet head assembly (2) as described in 7.3.2. Remove circlip (14) and valve seat (15) with 'O' ring (16). Remove check valve (17). Re-assemble in reverse order fitting new parts where necessary.

7.3.9 Check Valve Guide Replacement
Remove outlet head assembly (2) as described on 7.3.2. Remove check valve seat and valve as described in 7.2.4. Remove check valve guide (11) by unscrewing in an anticlockwise direction. Re-assemble in reverse order fitting new parts where necessary.

7.3.10 Desiccant Replacement
Remove outlet head assembly (2) and upper gasket (3) as described in 7.3.2. Remove column pads (18) and remove desiccant (19) by either inverting the purifier or transferring desiccant into a suitable container by means of an industrial vacuum cleaner. Remove column pads (18) and replace with new. Fill each chamber with new desiccant (19) paying particular attention to notes regarding desiccant recharging. Fit new upper column, pads (18). Reassemble as described in 7.3.2 using new gasket (3).

NOTE :
IN ORDER TO MANTAIN PERFORMANCE, IT IS ESSENTIAL TO USE ONLY domnick hunter DRYFIL* FOR RECHARGING PURPOSES AND MAXIMUM PACKING DENSITY MUST BE ACHIEVED, WHICH IS ONLY POSSIBLE USING A domnick hunter SNOW STORM FILLING DEVICE. THIS DEVICE IS PLACED IN THE TOP OF EACH CHAMBER IN TURN FOR RECHARGING WITH domnick hunter DRYFIL*.

*Dryfil is a Registered Trademark of domnick hunter limited.
Store desiccant in a dry condition and do not leave open to atmosphere.

7.3.11 Control Valve Replacement
Remove four cap head screws (21) and control valve. Fit new control valve (22) with cap head screws.

7.3.12 Cam Timer Pre-Filter Element Replacement
Unlock cabinet door. Un-screw clear bowl from prefilter head (20). Remove filter element and replace with new (K003AA).

7.3.13 Cam Timer Replacement
Unlock cabinet door. Remove two cap head screws and nuts. Identify tube connections to the cam timer before disconnecting. Remove cam timer (23). Replace with new cam timer in reverse order and reassemble.

7.3.14 Exhaust Silencer Pad Replacement
Remove four cap head screws (7) and sub plate (8) as in 3.2.3. Remove exhaust silencer pad (9) and reassemble in reverse order, fitting new exhaust silencer pad.

7.3.15 Adjustment of Variable Purge
The variable purge needle valves (5) are situated in the top of the inlet head (2) of the Dryer.

7.3.16 Adjustment of the Purge for other working pressures (4 - 10.5 bar g)

Instruction:

1. Turn both valve adjusting screws clockwise (5) until they are fully closed. **DO NOT OVER TIGHTEN THESE SCREWS.**

2. The 6mm dia plastic pipe (6) which connects both valves together should be removed from the push in connections on the valves by pressing on the face of the connection to release the collet.

3. A flow meter (FESTO) which is capable of measuring the amount of purge air required should be fitted to either one of the purge needle valves (5).

4. Allow the column to pressurise, on which the purge needle valve functions. Turn the adjusting screw in an anticlockwise direction until the desired purge flow setting* is obtained (see - Purge Notes). If the flow meter does not register after THREE TURNS, the adjacent column is pressurising, wait for the desired column to pressurise and continue.

5. The operating pressure must be maintained throughout in order for the purge flow setting to be correctly set.

6. When the above operation is complete and the correct purge flow is obtained, wait until the adjacent column pressurises. Remove the flow meter from the previously adjusted valve and attach to the unadjusted valve. Turn the adjusting screw anticlockwise until the desired purge flow setting is obtained.

7. After adjustment has been carried out, remove the flow meter from the previously adjusted valve. Replace the 6mm plastic pipe (6). A proportionate amount of purge air will exhaust when this pipe is being fitted, relative to the capacity of the dryer.

8. The correctly adjusted unit is now ready for use.

Purge rate (L/min) for Alternative Working Pressure (bar g)

The E Compressor shall be set for operation to 5 bar the correct flowrate shall than be 106 liter per minute.

Figure 13 - Exploded Drawing of 6th and 7th Filtration Stages

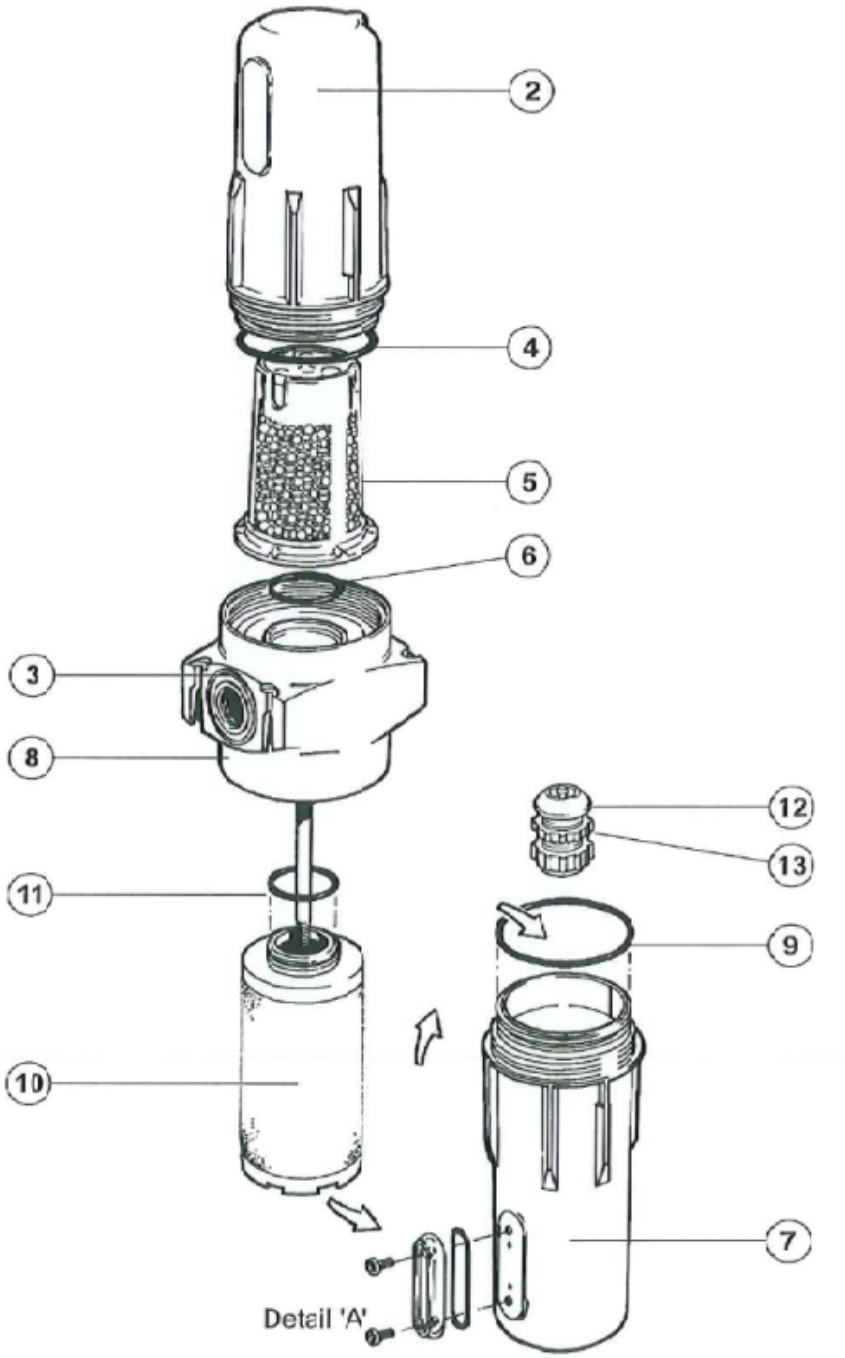


Figure 13 Exploded Drawing of 6th and 7th Filtration Stages

7.4 Routine Maintenance Instructions for 6th and 7th Filtration Stages

7.4.1 6th Stage Grade HC Filter Element Replacement

Operating Description:

Grade HC filter elements must only be used in dry compressed air systems where the dew point has been reduced to -40°C (-40°F) pressure dew point. The user should also check the system to ensure CO removal is within international standards when used for breathing air purposes. It is the responsibility of the user to ensure that the system is safe to operate. The Grade HC filter element removes carbon monoxide (CO) gas by oxidation to carbon dioxide (CO2) through chemisorptions and catalysis. The catalyst will remain active providing the upstream compressed air is maintained at a pressure dew point of -40°C . The maximum inlet concentration of CO allowable is 50 ppmv (volumetric parts per million). If higher concentrations are encountered, then the system must be diagnosed to determine the cause. The Grade HC filter element has an estimated useful life of 2000 hours or 90 days and the replacement of this filter element must be carried out regularly by planned maintenance, or when pressure dew point failure has occurred [e.g. > -20°C PDP (-4°F PDP)]. Instruction:

1. Disconnect the power supply, make sure to shut off the HP valve and depressurize the E Compressor.

2. Unscrew upper bowl (2) anticlockwise and remove. If pressure has not been completely released from the filter, air will escape from the warning hole (3) giving an audible alarm. Screw back bowl and repeat instruction 2 before attempting again. Should resistance to unscrewing be experienced, provision is made for a ‘C’ spanner to fit on to the ribs of the bowl.

3. Remove HC element (5) which is a plug in type and insert a new unit using the new ‘O’ ring (6) supplied (replacement filter element no. K013HC).

4. Check condition of bowl seal (4) and replace if necessary. Clean screw threads. Inspect interior of bowl and report any signs of damage to a competent person.

5. Refit bowl (2). Do not over tighten as this may result in breaking of the flange on the filter.

6. Repressurise and check for leaks. If leaks do occur they will most probably be from the bowl ‘O’ ring (4). Depressurise housing and remove ‘O’ ring as stated above and inspect and clean. Ensure that mating surfaces are clean and then refit ‘O’ ring re-locate bowl and repressurise.

7.4.2 7th Stage Grade AA Dust Filter Element Replacement

Operating Description:
The Grade AA filter element is installed as a safeguard against dust/particle carry-over from the 3rd and 4th stages. Pressure drop across the Grade AA filter element will increase due to the build up of solid contaminants being trapped. It is recommended that this element is changed before the pressure loss becomes prohibitive for the application or after 6000 hours of use, whichever is earlier.

Instruction:
1. Disconnect the power supply, make sure to shut off the HP valve and depressurize the E Compressor.

2. Fully depressurise filter housing by using the bleed valve in the Rectus 96 air outlet connection.

3. Unscrew bottom bowl (7) counter clockwise and remove. If pressure has not been completely released from the filter, air will escape from the warning hole (8) giving an audible alarm.

4. Unscrew filter element (10) and replace with a new unit using new 'O' ring (11) supplied (replacement filter element no. K017AA).

5. Check condition of bowl seal (9) and replace if necessary. Clean screw threads. Inspect interior of bowl and report any signs of damage or corrosion to a competent person.

6. The manual drain assembly (12) is not serviceable and must be replaced if faulty.

7. Check the manual drain seal (13) and replace if worn.

8. Replace vent valve (1) if faulty or leaking.

9. Refit bowl (7).

10. Repressurise and check for leaks. If leaks do occur they will most probably be from the bowl 'O' ring (9). Depressurise housing and remove 'O' ring as stated above and inspect and clean. Ensure that mating surfaces are clean and then refit 'O' ring, re-locate bowl and repressurise.

7.5 Pressure Regulator

Although the pressure regulator (item 10, Fig. 1.0) does not require routine maintenance, a service kit (part no.60 500 2060) is available. Disassembly, repair and reassembly should be carried out in accordance with the service kit instructions.

7.6 Recommended Maintenance Tooling List

Description
Torque Wrench (Capacity 30) - 150 Nm
Hex. Drive - 10mm A/F
Combination Spanners (Range 8mm - 24mm)
Metric Allen Keys
Tube Pliers
Tube Cutters
Soft Faced Hammer
Strap Wrench
Screwdrivers - 6" Plain Slot- 6" Pozidrive

7.7 Recommended 1000 Hours Spares Kit

Description	Part No.	Qty
Stage 3 Replacement Adsorption -	K013AC	1 off Filter Element
Stage 5 Replacement Adsorption -	K013HC	1 off Filter Element

7.8 Recommended 6000 Hours Spares Kit

Description	Part No.	Qty
Stage 3 Replacement Filter Element -	K017AA	1 off
Stage 2 Replacement Adsorption -	K013AC	6 off Filter Element
Stage 3 Dryfil* Desiccant (4 Kg)	60 820 0194	1 off
Stage 4 Replacement Adsorption -	K013HC	6 off Filter Element
Stage 5 Replacement Filter Element -	K017AA	1 off
(5th Stage Purifier Spares):-		
Gasket Pack	60 820 0315	2 off
Moulded Gasket Pack	60 820 0318	2 off
Control Valve Pack	60 820 0320	1 off
Purge Kit	60 820 0321	1 off
Check Valve - Complete	60 820 0323	2 off
Exhaust Silencer	60 820 0324	2 off
Snowstorm Filler (D)	60 820 0411	1 off

*‘Dryfil’ is a Registered Trade Mark of domnick hunter limited.

7.9 Recommended 12000 Hours Spares Kit

Description	Part No.	Qty.
Stage 1 Replacement Filter Element -	K017AA	2 off
Stage 2 Replacement Adsorption -	K013AC	12 off Filter Element
Stage 3 Dryfil* Desiccant (4 Kg)	60 820 0194	2 off
Stage 4 Replacement Adsorption -	K013HC	12 off Filter Element
Stage 5 Replacement Filter Element -	K017AA	2 off
(5th Stage Purifier Spares):-		
Gasket Pack	60 823 0315	4 off
Bolt Pack	60 820 0316	1 off
Moulded Gasket Pack	60 820 0318	4 off
Sub-Plate Pack	60 820 0319	1 off
Control Valve Pack	60 820 0320	2 off
Purge Kit 60 820 0321 2 off		
Check Valve Kit - Complete	60 820 0323	4 off
Exhaust Silencer	60 820 0324	4 off
Push-in fitting Pack	60 820 0325	1 off
Snowstorm Filler (D)	60 820 0414	1 off
Cam Timer	60 820 0287	1 off
Cam Timer Pre Filter Element	50 403 0490	1 off

*‘Dryfil’ is a Registered Trademark of domnick hunter

8. **Service and maintenance, Magnetic valves, silencers**

The 2 x 1/8” Festo valves used for drainage shall be coated with white Vaseline when installed to protect against corrosion. At each service these valves shall be replaced.

-release the 6 and 8mm tubing on the top of each magnetic valve
-release the two 6mm tubing below the magnetic valve
-open the M6 nuts holding the cover shield protecting the coils and valves
-when shield is removed, open the two serrated circular nuts and spring washer from the coils. Use a tie wrap to prevent loosing the nut and washer. Replace if worn
-reuse the hexagonal blind plug and fittings from the old valves.
-coat the new valves with white Vaseline to prevent corrosion and replace fittings and blind plug.
-reinstall the valve and make sure the 8 and 6 mm drain tubes are reinstalled at correct coil.

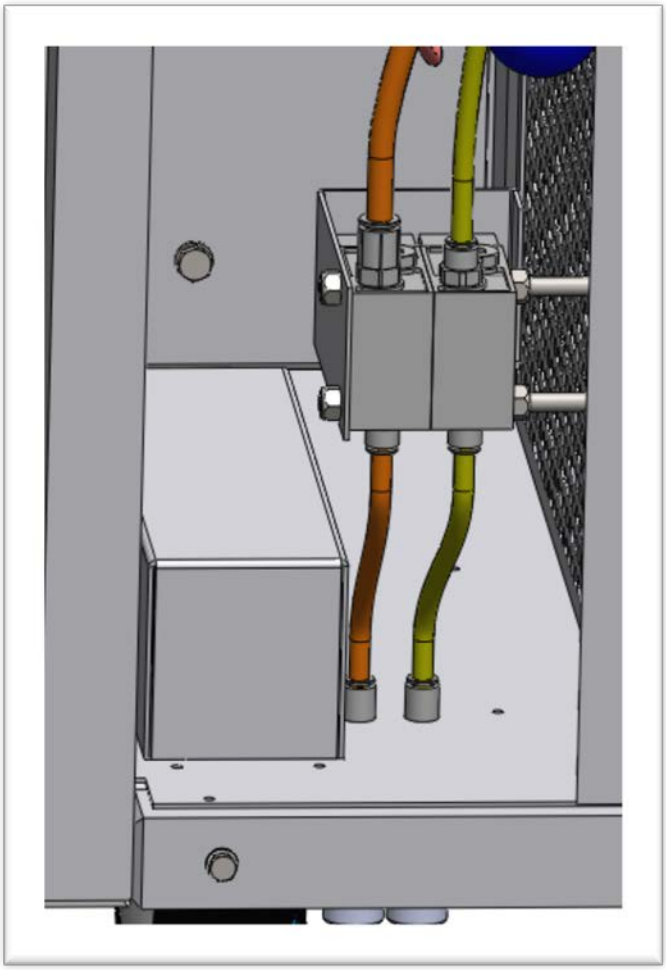


Figure 14 Displaying magnetic drain valves with silencers and tubing connections

The larger ½” and ¼” valves used for HP rescue air and closure between tank and filter shall be inspected and replaced if signs of wear and corrosion. Function tests shall always be carried out to see that the valves is I proper working order.

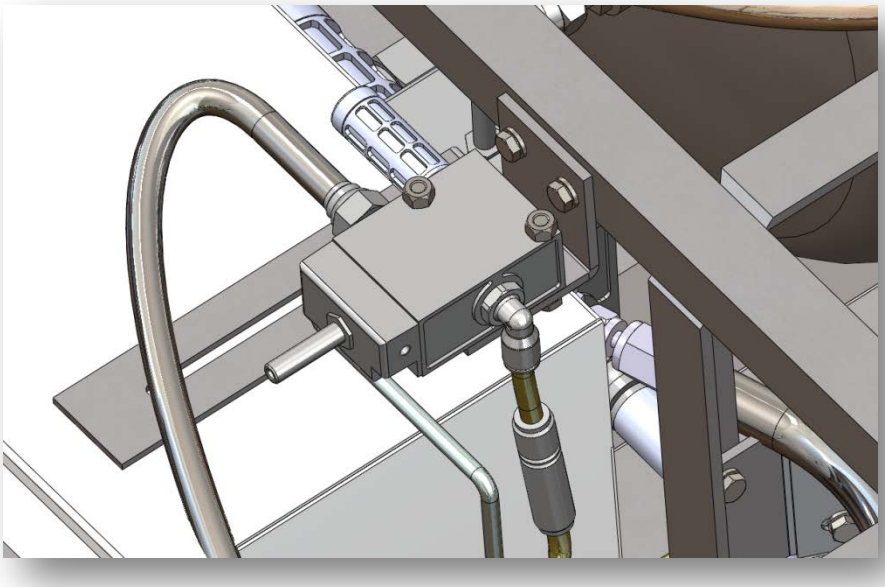


Figure 15 The Rescue air release valve connected to HP regulator valve and the air outlet hose on the right hand

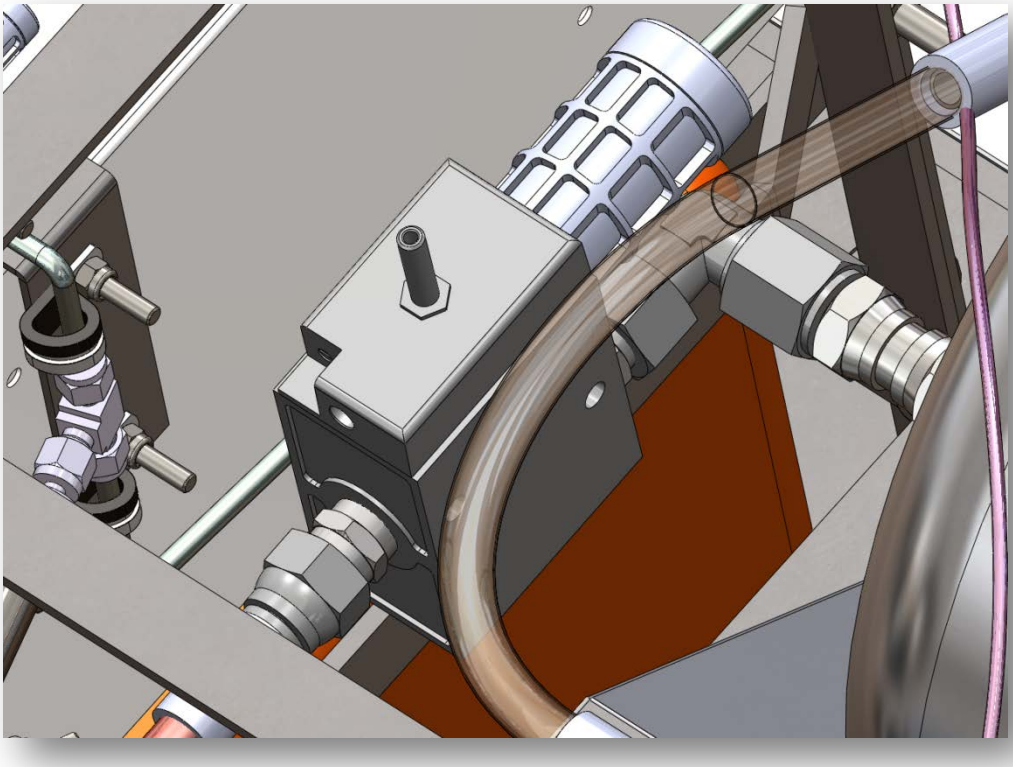


Figure 16 ½" Magnetic valve between Tank and Filter package

Scilencers ¼" for water drain valves shall be changed at every service. The scilencer shall also have two cross drilled holes with a 1mm drill bit.

9. **Service and maintenance, detectors, Methane, H2S, CO, O2, Co2 and Dew Point**

The detectors for Methane, H2S (located in air inlet) shall be maintained and recertified according to manufacturer's specification. Function tests shall be carried out between recertification at all services.

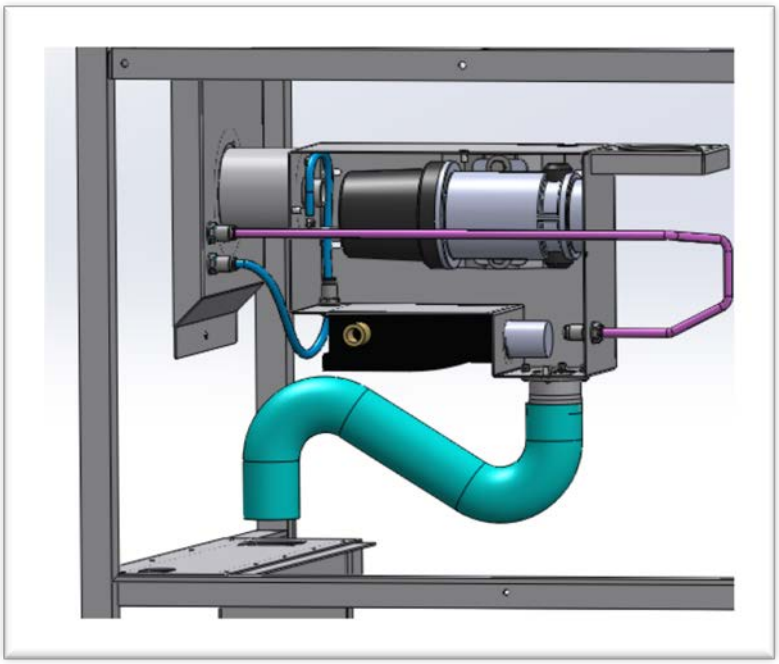


Figure 17 Methane and H2S detectors placed prior to the Compressor air inlet

Detectors located in the "online measurement cabinet" CO, O2, Co2 and Dew Point sensors shall be tested at each service and recertified and serviced according to manufacturer specifications. (See table 3)

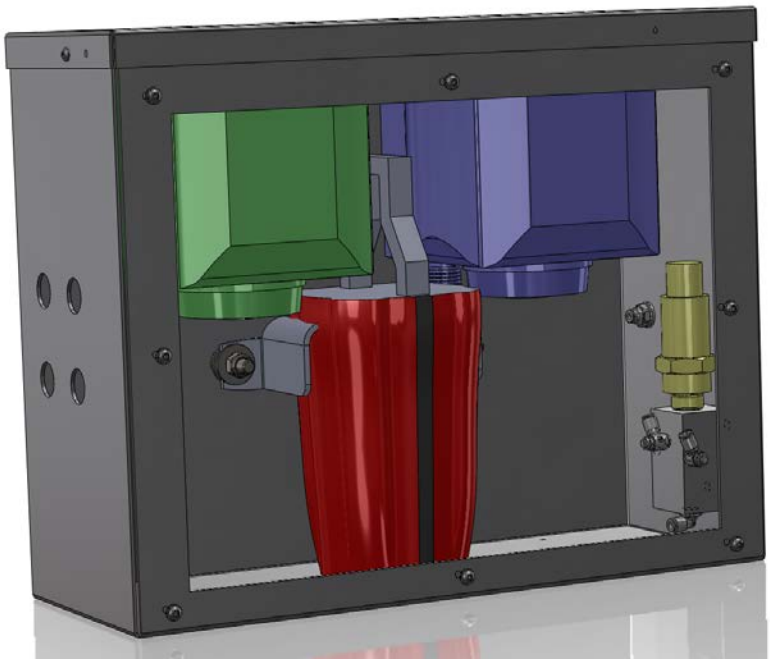


Figure 18 Air Quality Monitoring Cabinet

Common for all detectors: General cleaning and control of cables and connections tagging to be carried out on all services.

Sensor / Transmitter air quality	E I Part No	12 months calibration required
Simtronic GD10 methane gas detector	100264	service acording to manufacturer
H2S Sensor - EC28D(i) transmitter	100406	service acording to manufacturer
Xentaur -HTD-100 dewpoint transmitter	100395	service acording to manufacturer
Polytron 7000 CO sensor	100415	service acording to manufacturer
Polytron 7000 O2 sensor	100229	service acording to manufacturer
Pir 7200 CO2 sensor IR	100232	service acording to manufacturer

Table 3

10. **Service and maintenance, High Pressure rescue system**

Supplied within the compressor a high pressure, 6.8 liter composite bottle, pressurized with 300bar of breathing air, will always be available to supply the user as long as the connection hoses from the unit to the user is not cut. Note: The E Compressor will not refill the HP bottle.

The High Pressure bottle has a safety precaution against breaking the bottle neck and will in the event of damage only leak maximum 600 liters a minute. The bottle is tagged with E Compressor serial number and return address and shall be returned with the equipment.

Caution has to be taken by the user before and after using the system. By neglecting the start and stop procedures; complete loss of HP air can be the result.

- A stop, and removal of the power supply can appear as a power out, hence the Intermediate and Permanent stop Procedure in chapter 3.3
- Overflow masks will empty HP rescue air bottle faster than a mask with a lung demand valve.

The High Pressure rescue system consists of the following parts:

- HP composite bottle
- HP to low pressure regulator and hoses
- HP 0-400 bar manometer situated on the front of the E Compressor
- HP pressure transmitter (Teksal scope of delivery and service)
- HP stainless steel tubing ¼” Svageloc system

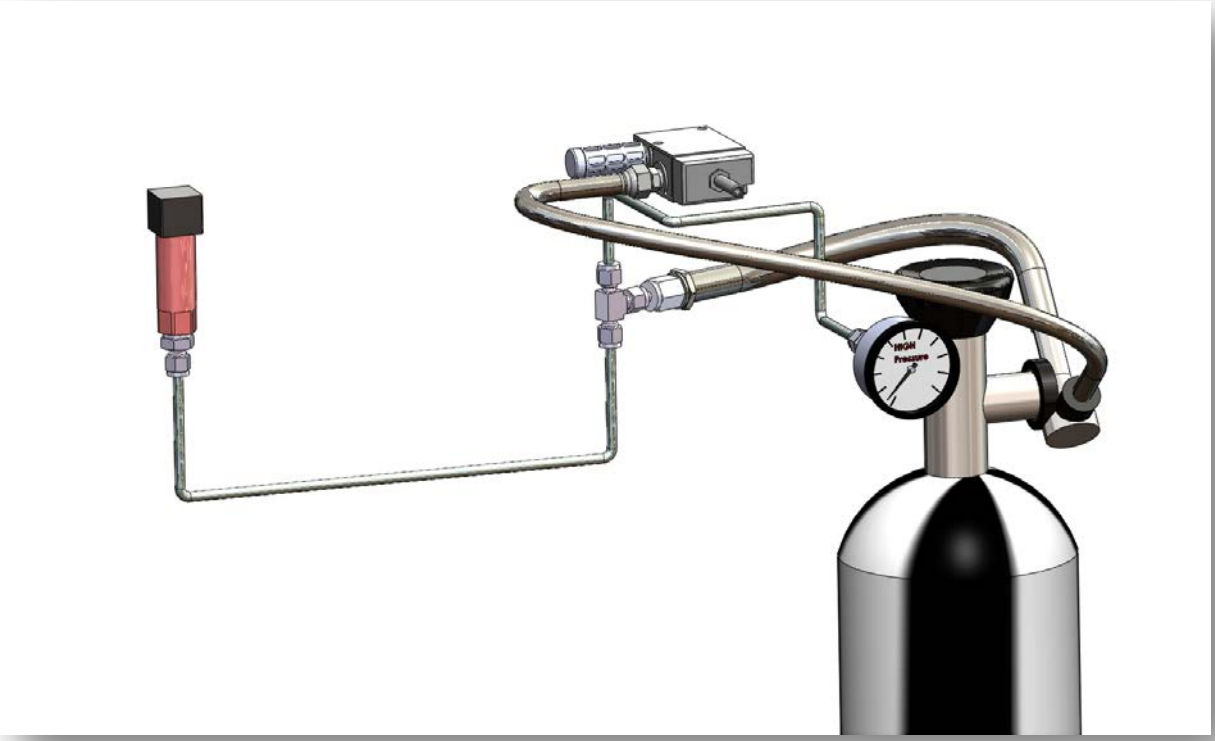


Figure 19 HP (High Pressure) Rescue system

10.1 HP Composite bottle:
The Composite bottle is a 6,8liter, 300 bar dive air bottle. The bottle is the emergency rescue air if the E Compressor shut down. The bottle is fitted with a emergency air reducer in the bottle neck in the event of a user drop the bottle and break of the top only 600 liters of air will escape pr minute. If an E Compressor is returned from a customer fitted with an old type air bottle, the bottle should be replaced with new bottle. The new type of bottle has a grey opening valve and some also have a small pressure indicator.

The bottle has a 20 years lifetime and shall be recertified every 5 years according to the label on the bottle.

10.2 HP to low pressure regulator and hoses:
The Draeger PAS Micro air regulator that is connected to the HP bottle will secure emergency air to the user during emergency evacuation in the event of E Compressor shutdown.
The regulator and hoses follow the Draeger service and recertification plan.

10.3 HP 0-400 bar manometer situated on the front of the E Compressor
The manometer indicating 0-400 bar shall be visually inspected and tested to reveal any signs of wrong readings. Faulty/damaged manometer is replaced. **Part no: Dunlop Hiflex 1210162**

10.4 HP stainless steel tubing ¼" Svageloc system

The connection tubing between the HP regulator hoses, the manometer and the Pressure transmitter is a stainless ¼" Svageloc tubing system. This system shall be cleaned and pressure tested to verify that no leak is present.

10.5 Leak detection testing procedure

The leak detection is carried out when the E Compressor is connected to power source and the Festo ¼" valve is shut. Open the HP bottle fully until system is pressurized and then close the valve. Note the digital and manual readings and leave for 3 hours. During this period the pressure may vary one or two bar depending on temperature but there shall be no drop in pressure during these 3 hours. If a leakage is discovered, using leack detector fluid, depressurize the system and tighten the leaking point. Redo the pressurizing and try again.

11. Service and maintenance, Electrical motor, drive belts, pulleys and assembly mounts

The E Compressor is powered by a 4,5Kw electrical engine. The power is transmitted to the Oil less Scroll compressor unit by means of pulleys and belts. The motor and scroll compressor is mounted on a frame allowing drive belt replacement and adjusting without dismantling the motor.

To perform any work related to transmission the following parts and guards need to be removed.

-remove both side panels/ cover panels from the E Compressor

-unbolt and remove the online monitoring cabinet (Figure 20)

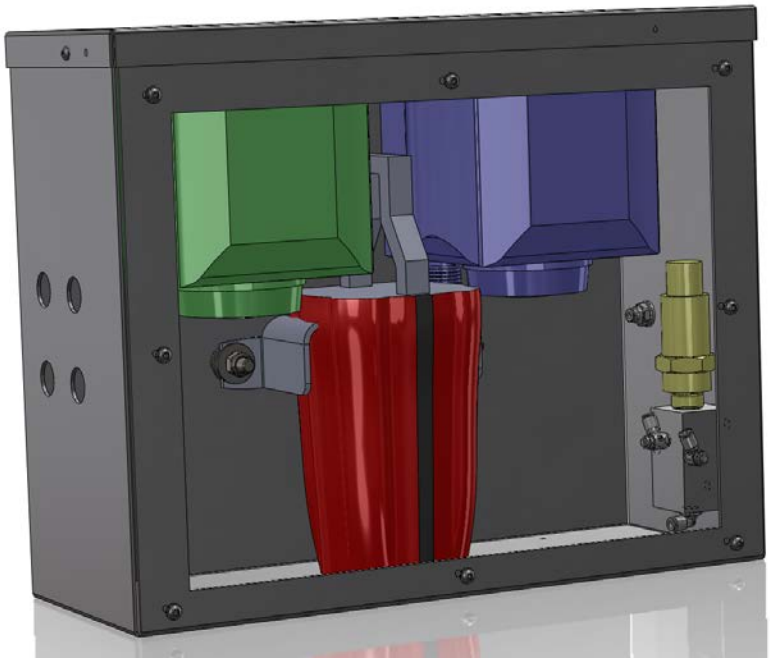


Figure 20 Online Air Monitoring Cabinet

-Place cabinet on a stand secure from falling down

-unbolt M4 button head screws from guard panel and remove these

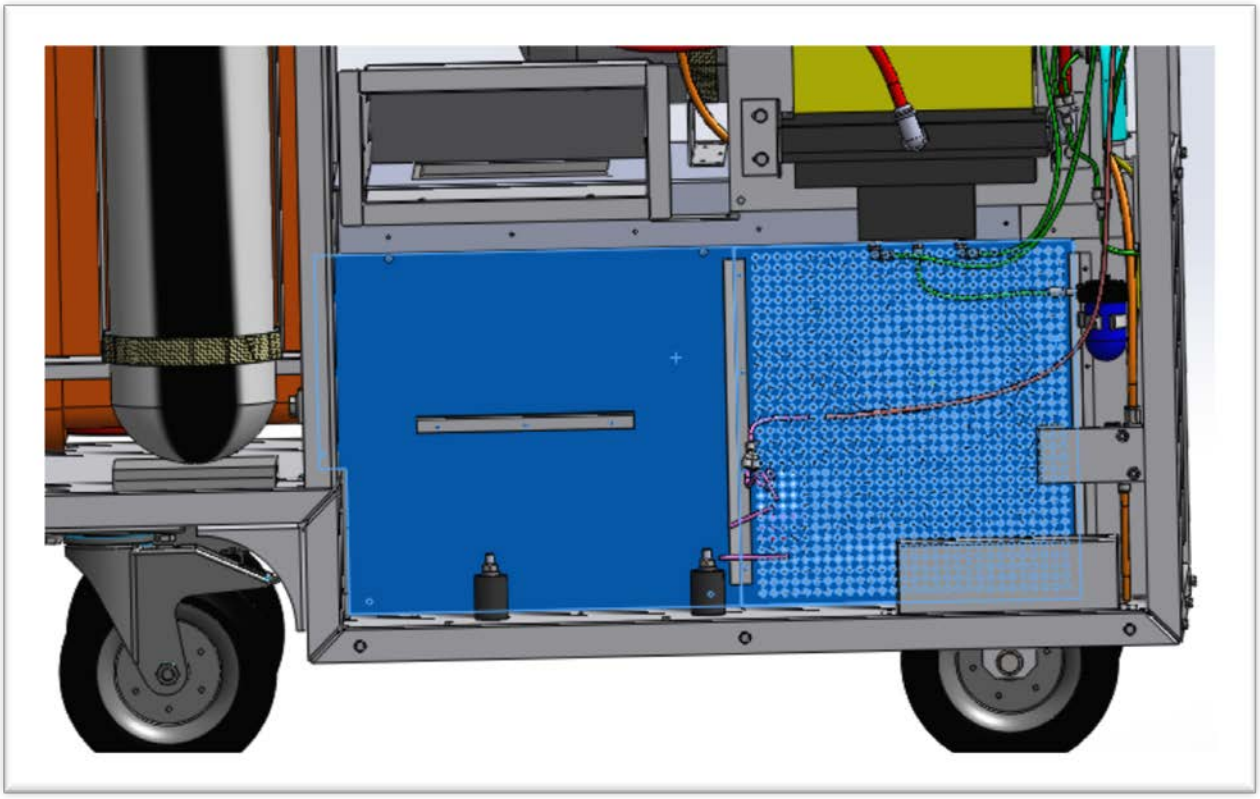


Figure 21 The blue guard doors covering the motor, transmission and scroll compressor element

- use 13mm wrench to release the 4 M8 bolts holding the motor sub plate
(it is recommended to detach the ½" air tubing from the radiator on the motor opposite side to reach the M8 bolt)

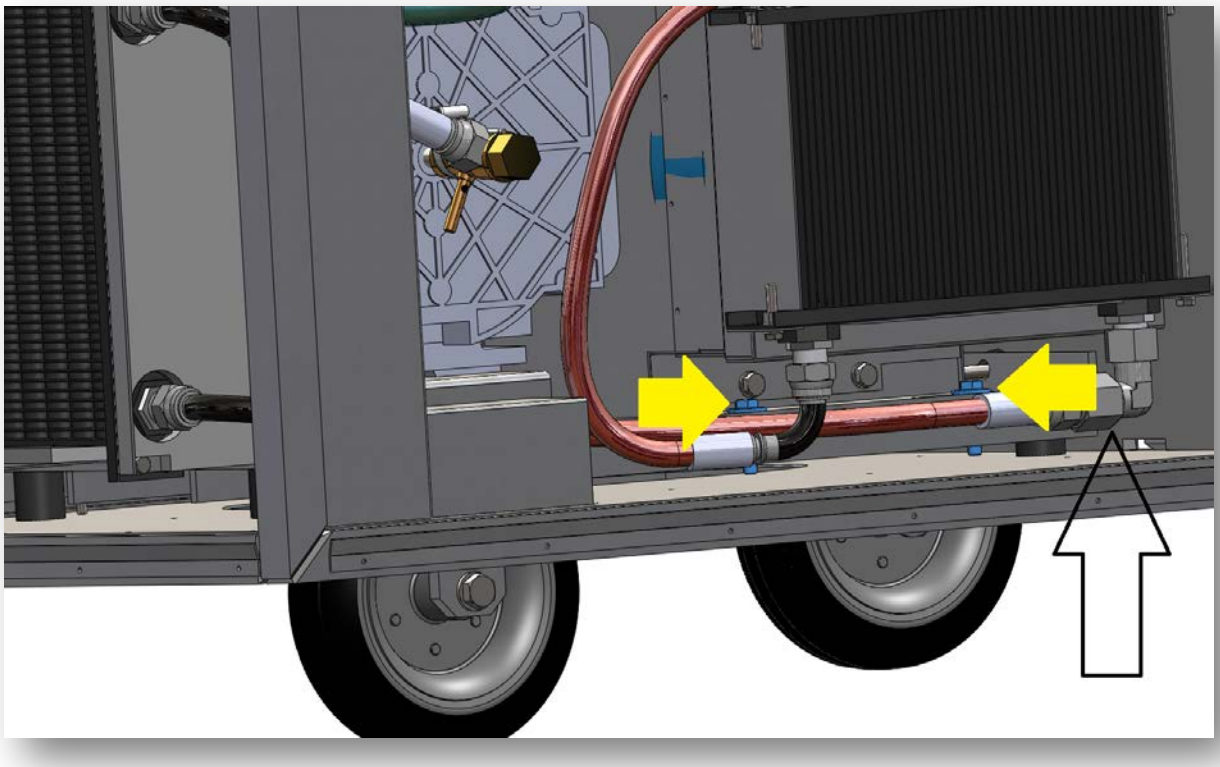


Figure 22 Arrows indicating tubing and M8 Motor bolts

11.1 Electrical motor

The electrical motor is serviced and maintained according to manufacturer specifications.

11.2 Drive belts.

It is essential to the efficiency and durability of the 2 x pulley belts that the motor and Compressor unit is adjusted properly. Failure to adjust the belts will result in wear and tear of the belts and shortened life expectancy and underperformance of the compressor if belts are loose.

At service, pulley belts are always replaced, adjusted with run test, left to run for 2-3 hours and controlled for stability and directional accuracy.

To replace the drive belt:
-Release the motor sub plate M8 nuts
-By turning counter clock wise the two bolts tightening the drive belt
- As the motor slides against the scroll compressor the drive belts can be taken off and replaced

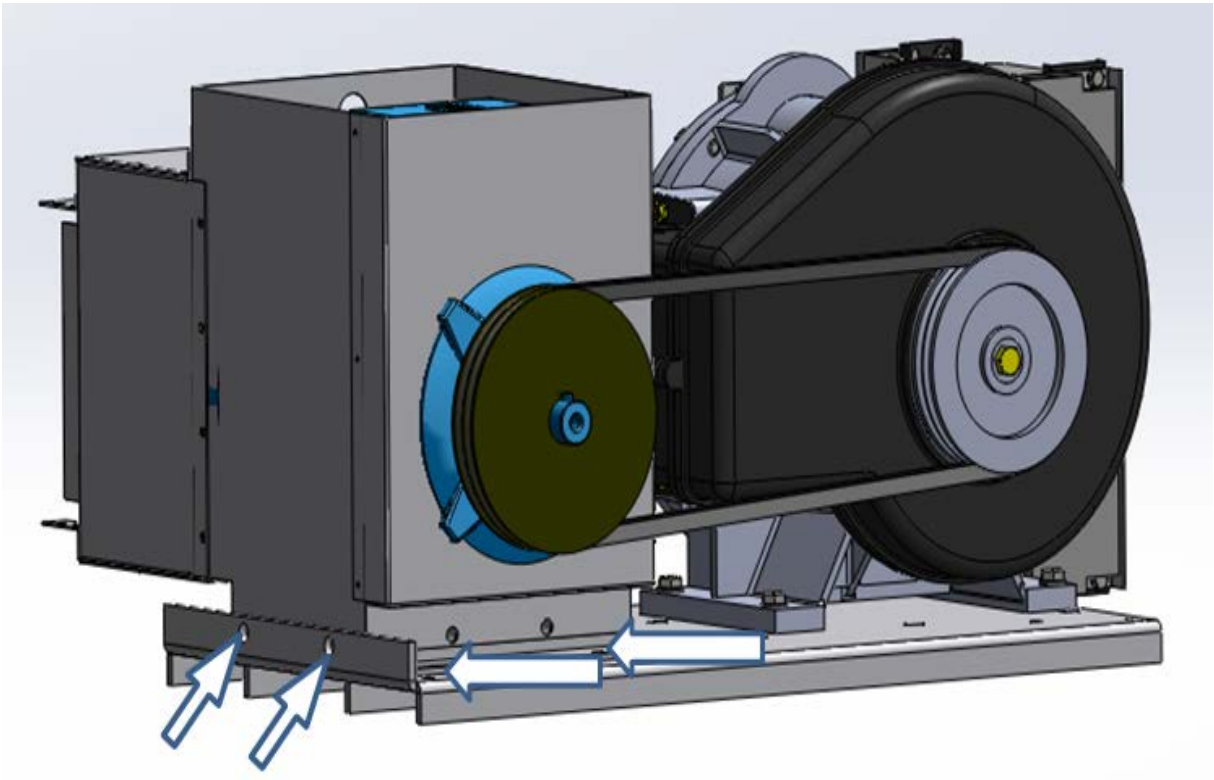


Figure 23 Motor, Transmission and compressor. Arrows indicating belt tensioning bolts (left) M8 motor bolts (right) Everything assembled on the subplate.

The E Compressor cannot compensate automatically for a change between 50 and 60 Hz power selection. When the customers use 60Hz power, the E Compressor must be geared accordingly to compensate for the change in motor speed. Se table for correct selection of motor pulley and pulley belt lengths.

Pulley and belt selection at 50Hz and 60Hz operation		
Pulley diameter / Taperlock base	**50 or 60 Hz**	**Belt length**
SPZ x 2 - 140mm pulley /1610 taper loc	50Hz	2 x 1000 mm SPZ belts
SPZ x 2 - 132mm pulley /1210 taper loc	60Hz	2 x 950 mm SPZ belts

Table 4

11.3 Replacing Pulley, reinstalling and adjusting pulley and drive belts.

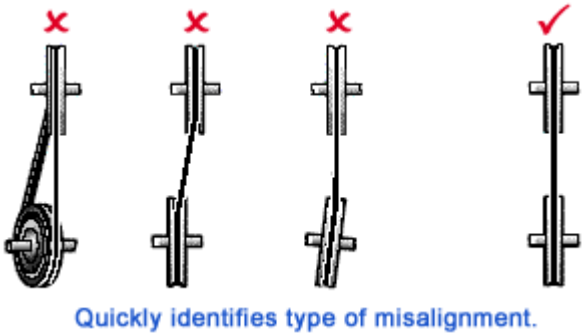
-If the pulley on the motor is being replaced, unlock the taper loc by unscrewing the two unbraco bolts and insert one at the middle entry hole and tighten. The taper lock will now open and release.

-fit the new pulley and taper lock base.

-To ensure correct setting of the pulley, an aligning process needs to be followed.

NOTE:

belt



Failure to set the pulley correctly may result in drive fatigue and rupture.

Figure 24 Display different types of misalignment of the pulleys and the transmission belt

Aligning the motor pulley is essential to achieve a problem free transmission.

-Use equipment such as laser or other pulley alignment tools to achieve straight and correct installed drive belts.

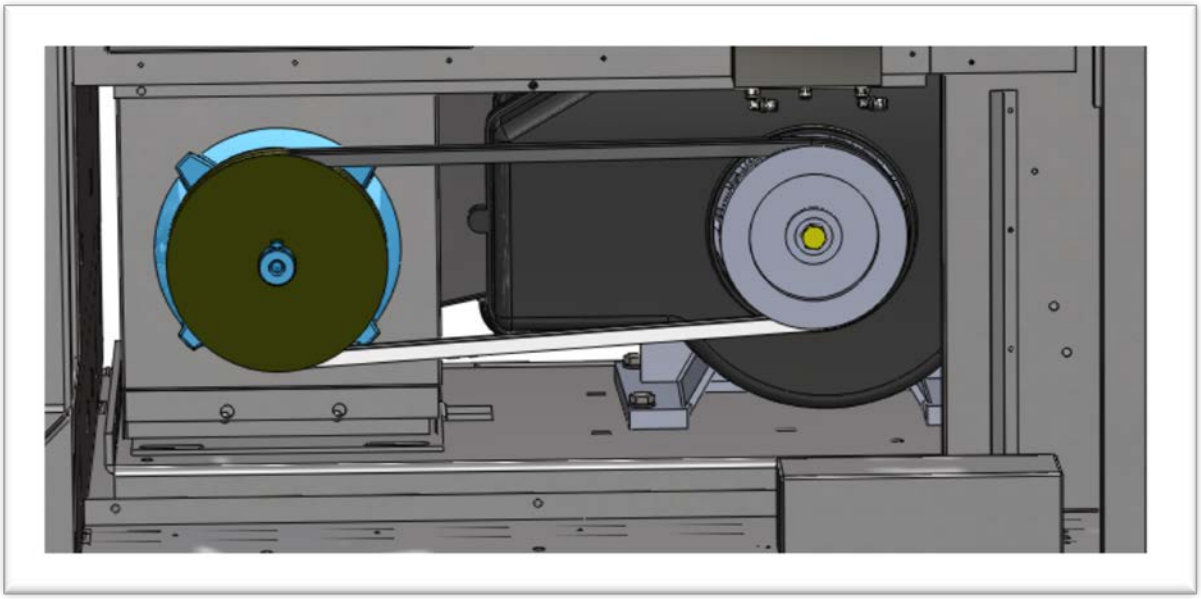


Figure 25 displaying the motor transmission and compressor assembly

12. Service and maintenance, Scroll Compressor

The Scroll compressor is the heart in the E Compressor. This is a high efficiency and oil less compressor element driven by a 5,5Kw electrical motor by means of pulleys and belt transmission.

Based on the experience with this kind of elements they are reasonable in cost to purchase but relatively expensive to overhaul and E Innovation has based on experience with more than 40 compressors in the North Sea and the harsh environment this reduced the lifetime of each compressor to 8-10.000 hours total lifetime. During this period regular service and maintenance will be carried out according to this manual.

12.1 BASIC MAINTENANCE TABLE

The Scroll unit shall be cleaned and inspected at each service and if the unit is returned from one project with more hours on the reading and it is likely to run out of hours on the next project based on the duration, the scroll will be replaced.

Item	Check	Runtime	
		Regular maintenance	Disassembling maintenance
		3000hr / 1 year	6000hrs / 2 year
Bearing Grease	Re-Grease	•	•
OS Center Bearing	check exchange	o	•
Pin Cranc bearing	check exchange	o	•
Bearing cover	check exchange	o	•
Crankshaft bearing	check exchange	o	•
Tip seal	exchange	•	•
Basic Pulley	check exchange	o	•
Sirocco fan	check exchange	o	•
OS FS fin	Cleaning		
Fan Duct Cover	Cleaning		
Sirocco	Cleaning		
Housing	Cleaning		

*) o : check, •: exchange or check

Table 5

12.2. **Regular maintenance**

CAUTION
Routine maintenance and disassembly maintenance, must be applied when the hourly or time schedule comes due, which ever comes first.

Regular maintenance, disassembly maintenance standard: is applied when the standard use condition and installation environment are satisfactory and when the surrounding environment or operation condition is severe, the period or time for regular maintenance and disassembly maintenance must be shortened.

The regular maintenance and disassembly maintenance are not part of the warranty.

Cleaning: When the surrounding environment or operation condition are service(high heat or dirty environment), the cleaning time or periodic maintenance intervals must be shortened. (3,51KL/H) per 2,500 hours)

12.2.1 Preparation
1) Tools

- screw driver (1 cross-tip)

- 17mm hand socket, extension, ratchet handle

- Holding Spanner
- Low pressure compressed air
- Torque wrench, in-lbs

12.2.2 Disassembly order and method

1) Fan duct

- Loosen the 3 upset type M6 bolts and separate the fan duct.

2) Fan cover (external)

- Loosen the 5 tapping screw M6 bolts and separate the fan cover.

3) Basic pulley

- Take off the hexagon socket head cap screws with a spanner in the balance weight of pulley rotation direction and remove the pulley/fan assembly.

4) Fan cover (internal)

- Separate the fan cover by loosening the 3 screws.

.

5) Fixed scroll set

- Separate the fixed scroll by removing six(6) self locking nuts.

12.2.3 Cleaning

1) Orbiting scroll cooling fin

- Remove dust and dirt attached to the cooling fin using compressed air gun.

- Do not clean the orbiting scroll set with organic solvent (thinner, solvent)

2) Fixed scroll cooling fin

- Remove dust and dirt attached to the cooling fin using compressed air gun.

- Do not clean the orbiting scroll set with organic solvent (thinner, solvent).

NOTE

Damage may occur to special protective coating.

3) Fan cover & duct

- Remove dust and dirt attached to the fan cover and duct using air gun.

4) Sirocco fan

- Remove dust and dirt attached to the sirocco fan using air gun.

12.2.4 Maintenance

NOTE

Conduct maintenance in a clean location to prevent pollution and damage to the scroll maintenance parts. Use only recommended high temperature grease. (Consult your distributor)

1) Injecting grease into orbiting scroll center bearing

- Remove the dust cap on the top rib or left of housing.

- The crank shaft key must be in 7 o'clock direction when seen from the front.

- Insert the nozzle connected to the grease gun into the housing dust cap hole and connect to the grease nipple attached to the crank.

NOTE

Move the crank shaft from left to right and check the connection of the grease nozzle and nipple. Bearing should rotate smoothly and quietly.

- Press the grease gun button and inject grease.

NOTE

Keep the nipple securely on the grease gun nozzle so that grease does not leak between the grease gun nozzle and nipple. Rotate the crank so the grease is applied evenly within the bearing, do not over grease.

- After injecting the grease fit the housing with the dust cap.

2) Injecting grease into pin crank bearing

- Use a flat screw driver to remove the 3 bearing grease caps behind the housing.

- Apply grease onto the pin crank orbiting scroll shaft bearing. Use a needle grease nozzle, apply grease evenly within the bearings, and do not over grease.

- Stick the grease gun nozzle closely into the pin crank bolt nipple and press the grease gun button about 3 to 4 times to supply grease to the housing bearing.

CAUTION

Watch closely so that grease does not leak between the grease gun and pin crank nipple when injecting the grease.

- Re-assemble the 3 bearing grease caps into its original position, do not force them, hand pressure is adequate.

3) Tip seal set exchange

- Separate the high pressure and low pressure tip seal from the top seal by using pick in the fixed scroll set.

- Using the same method, separate the dust seal and back up tube.

- Using the same method, separate tip seal from the orbiting scroll set.

- Lift about 2mm from the high pressure central tip seal and insert into the high pressure tip seal vertical hem and fix with finger tips.

CAUTION

LIP formed on the tip seal floor, insert for the front V groove to face the wrap center.

- Insert high pressure tip seal using the same method.
- Insert low pressure tip seal into the end of the high pressure tip seal and press down with finger tip and insert and cut according to tip seal groove with a knife.

- Insert low pressure tip seal using the same method.
- When fixing a backup tube to the fixed scroll set, the joint must face 6 o'clock direction.

- Fit the dust seal on top of the back up tube and make the joint face 3 o'clock direction.

CAUTION

The top and bottom are not distinguishable when assembling dust seal.

12.2.5 Assembling

1) Fixed scroll set

- Assemble the fixed scroll set according to the housing parallel pin location.

- Temporarily assemble 6 self-locking nuts then tighten with cross pattern sequence using a torque wrench.

[TORQUE]

OS5 : 260 lbf.inch(300㎏f.㎏)

OS5H : 260 lbf.inch(300㎏f.㎏)

2) Sirocco fan & fan cover, duct

- Fit 3 screws onto the fan cover (internal).

- Tighten the hexagon socket head cap screws with a spanner in the balance weight of pulley reverse-rotation direction to assemble the pulley sirocco fan assembly.

Torque : 174 lbf.inch(200㎏f.㎏)

- Close the fan cover (external) with self-tapping screw.

CAUTION

When tightening tapping screw, please be careful so that the screw thread does not get damaged.

13. **Service and maintenance, Safety valve**

1 BODY BRASS CZ121
2 SEAL PERFLUOROELASTOMER
3 PLUNGER BRASS CZ121
4 SPRING ST. STEEL 1.4310 (302)
5 ADJUSTER BRASS CZ121
6 NAMEPLATE ALUMINIUM ALLOY
Describe figure 25

The safety valve placed on the air outlet from the Oil less Scroll compressor is a spring loaded safety relief valve. Its purpose is to prevent overload in the event of failure to any of the monitoring systems controlling the pressure in the E Compressor. The valve will open at pressures above 9,3 bar.

The valve comes with a certificate with 12months duration. At yearly service this safety relief valve is replaced with a new valve with a new certificate for another 12 months. The valve is also tagged with a name plate with corresponding certificate number for easy identification.

14. **Service and maintenance, Internal structural parts**

The E Compressor also has several internal plates, brackets, safeguards, covers and mounting assemblies. In general cleaning and control of all bolts, screws, POP nuts, brackets, surfaces shall be done at every service opportunity to ensure that all components are safely assembled. Reference is made to the Assembly manual for details.

15. **Service and maintenance, electro**
    OneCo Teksal is the supplier of all electrical components, systems and installations of all electric components. OneCo Teksal is also the supplier of service and maintenance for the electric components supplied.
    As with the remaining of the system only trained personnel will be performing service on the E Compressor apart from easy performed field service and assisted tasks.
    -ATTACMENT OneCo Teksal checklists for service and maintenance

16. **Adjusting and running tests for complete E Compressor**
    Setting and adjust the E Compressor to run optimal after servicing the system. This is not the FAT but adjustment to ensure all system parts are working according to specification.

    16.1-Air drying unit adjustment
    See chapter 7. The air drying unit shall be adjusted to 5,5 - 6,5 turns from closed position.

    16.2 Cam timer for air dryer adjustment
    The cam timer shall use 4minutes and 50 seconds to complete one full turn while no airhoses is connected to the system (See item no 23 in Figure 11 Exploded Drawing of 5th Purification Stage)

    16.3 Dew Point transmitter air flow adjustment
    ca 5 l/min of air shall pass the transmitter. Use the FESTO flowmeter and adjust the needle valve to set the correct flow (air hose shall be connected)

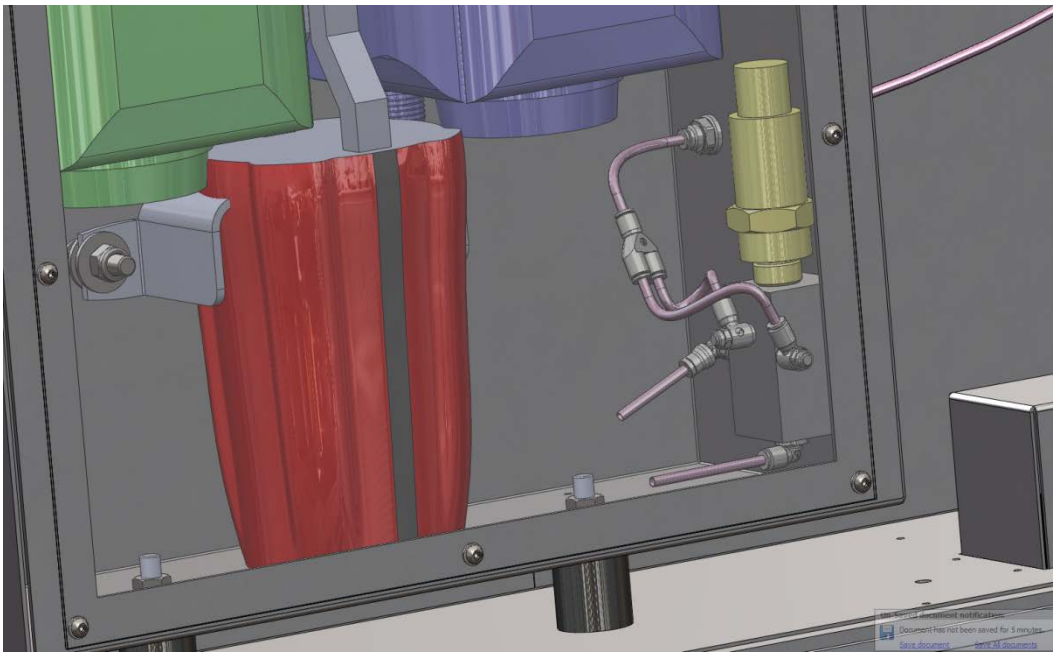


Figure 26 DP sensor (right) mounted in test sample block.

16.4 Airflow adjustment to the online air monitoring cabinet.
At the same time control that 3 l/min is flowing from the second valve in the online measurement cabinet.

16.5 Drain valves timer setting.
Control that the two drain valves are correctly set. 8mm drain tube from cyclone water evaporator shall have 8 seconds interval and 0,5 second opening. The 6mm drain valve from the tank shall open each 16 seconds with a 0,2seconds opening.

16.6 Air quality testing and sensor readings control.
-Air testing shall be performed using the Draeger Simultan test With Draeger test tubes. Under normal circumstances and in a workshop with safe working air quality the following parameters is tested to validate the readings given from the Online Monitoring Cabinet sensors.

CO
O2
CO2
Dew Point (water content in the air)

When performing these tests, the ambient temperature, relative humidity, CO, O2, CO2 levels in the workshop should be indicated on the test results.

16.7 Air flow control and adjustment
16.8 Air pressure control and setting

17. **Check lists**

18. **FAT**
When the E Compressor is ready serviced and all checklists have been completed both for mechanical and electrical service and maintenance. The Final testing can be completed according to the FAT procedure (63KZ-FAT)

19. **Packing, loading and transportation**
As a part of the service and maintenance procedure packing, loading and transportation procedure is applicable and shall be complied with during the service work. Reference is made to the Procedure **63KZ-PLT Packing, Lifting and Transportation Procedure**

20. List of appendices