Medical Air Supply System

Instruction Book

Medical Air Supply System

Version 01

BeaconMedæs®

Medical Air Supply System

TMA7, TMA11

From following serial No. onwards: WUX

Instruction book

Original instructions

This instruction book is valid for CE as well as non-CE labelled machines. It meets the requirements for instructions specified by the applicable European directives as identified in the Declaration of Conformity.

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1. Safety precautions

1.1 Safety icons

Explanation

	Danger to life
	Warning
	Important note

1.2 General safety precautions

1. The operator must employ safe working practices and observe all related work safety requirements and regulations.
2. If any of the following statements does not comply with the applicable legislation, the stricter of the two shall apply.
3. Installation, operation, maintenance and repair work must only be performed by authorized, trained, specialized personnel. The personnel should apply safe working practices by use of personal protection equipment, appropriate tools and defined procedures.
4. Before any maintenance, repair work, adjustment or any other non-routine checks:
    - Stop the machine
    - Press the emergency stop button
    - Switch off the voltage
    - Depressurize the machine
    - Lock Out - Tag Out (LOTO):
        - Open the power isolating switch and lock it with a personal lock
        - Tag the power isolating switch with the name of the service technician.
    - On units powered by a frequency converter, wait 10 minutes before starting any electrical repair.
    - Never rely on indicator lamps or electrical door locks before maintenance work, always disconnect and check with measuring device.

	If the machine is equipped with an automatic restart after voltage failure function and ifthis function is active, be aware that the machine will restart automatically when the power is restored if it was running when the power was interrupted!

5. Never play with compressed air. Do not apply the air to your skin or direct an air stream at people. Never use the air to clean dirt from your clothes. When using the air to clean equipment, do so with extreme caution and wear eye protection.
6. The owner is responsible for maintaining the unit in safe operating condition. Parts and accessories shall be replaced if unsuitable for safe operation.
7. It is prohibited to walk or stand on the unit or on its components.

1.3 Safety precautions during installation

	All responsibility for any damage or injury resulting from neglecting these precautions, or non observance of the normal caution and care required for installation, operation, maintenance and repair, even if not expressly stated, will be disclaimed by the manufacturer.

Precautions during installation

1. The machine must only be lifted using suitable equipment in accordance with the applicable safety regulations. Loose or pivoting parts must be securely fastened before lifting. It is strictly forbidden to dwell or stay in the risk zone under a lifted load. Lifting acceleration and deceleration must be kept within safe limits. Wear a safety helmet when working in the area of overhead or lifting equipment.
2. The unit is designed for indoor use. If the unit is installed outdoors, special precautions must be taken; consult your supplier.
3. In case the device is a compressor, place the machine where the ambient air is as cool and clean as possible. If necessary, install a suction duct. Never obstruct the air inlet. Care must be taken to minimize the entry of moisture at the inlet air.
4. Any blanking flanges, plugs, caps and desiccant bags must be removed before connecting the pipes.
5. Air hoses must be of correct size and suitable for the working pressure. Never use frayed, damaged or worn hoses. Distribution pipes and connections must be of the correct size and suitable for the working pressure.
6. In case the device is a compressor, the aspirated air must be free of flammable fumes, vapors and particles, e.g. paint solvents, that can lead to internal fire or explosion.
7. In case the device is a compressor, arrange the air intake so that loose clothing worn by people cannotbe drawn in.
8. Ensure that the discharge pipe from the compressor to the aftercooler or air net is free to expand underheat and that it is not in contact with or close to flammable materials.
9. No external force may be exerted on the air outlet valve; the connected pipe must be free of strain.
10. If remote control is installed, the machine must bear a clear sign stating: DANGER: This machine is remotely controlled and may start without warning.
    The operator has to make sure that the machine is stopped and depressurized and that the electrical isolating switch is open, locked and labelled with a temporary warning before any maintenance or repair. As a further safeguard, persons switching on or off remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the start equipment.
11. Air-cooled machines must be installed in such a way that an adequate flow of cooling air is available and that the exhausted air does not recirculate to the compressor air inlet or cooling air inlet.
12. The electrical connections must correspond to the applicable codes. The machines must be earthed and protected against short circuits by fuses in all phases. A lockable power isolating switch must be installed near the compressor.
13. On machines with automatic start/stop system or if the automatic restart function after voltage failureis activated, a sign stating "This machine may start without warning" must be affixed near the instrument panel.
14. In multiple compressor systems, manual valves must be installed to isolate each compressor. Non-return valves (check valves) must not be relied upon for isolating pressure systems.
15. Never remove or tamper with the safety devices, guards or insulation fitted on the machine. Every pressure vessel or auxiliary installed outside the machine to contain air above atmospheric pressure must be protected by a pressure relieving device or devices as required.
16. Piping or other parts with a temperature in excess of 70˚C (158˚F) and which may be accidentally touched by personnel in normal operation must be guarded or insulated. Other high temperature piping must be clearly marked.
17. If the ground is not level or can be subject to variable inclination, consult the manufacturer.
18. If the device is a dryer and no free extinguishing system is present in the air net close to the dryer, safety valves must be installed in the vessels of the dryer.

	Also consult following safety precautions: Safety precautions during operation andSafety precautions during maintenance. These precautions apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to theapplication which are not included herein. Some precautions are general and cover several machine types and equipment; hencesome statements may not apply to your machine.

1.4 Safety precautions during operation

	All responsibility for any damage or injury resulting from neglecting these precautions, ornon observance of the normal caution and care required for installation, operation, maintenance and repair, even if not expressly stated, will be disclaimed by the manufacturer.

Precautions during operation

1. Never touch any piping or components of the machine during operation.
2. Use only the correct type and size of hose end fittings and connections. When blowing through a hose or air line, ensure that the open end is held securely. A free end will whip and may cause injury. Make sure that a hose is fully depressurized before disconnecting it.
3. Persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the remote start equipment.
4. Never operate the machine when there is a possibility of taking in flammable or toxic fumes, vapors or particles.
5. Never operate the machine below or in excess of its limit ratings.
6. Keep all bodywork doors shut during operation. The doors may be opened for short periods only, e.g. to carry out routine checks. Wear ear protectors when opening a door.
7. On machines without bodywork, wear ear protection in the vicinity of the machine.
8. People staying in environments or rooms where the sound pressure level reaches or exceeds 80 dB(A) shall wear ear protectors.
9. Periodically check that:
   - All guards are in place and securely fastened
   - All hoses and/or pipes inside the machine are in good condition, secure and not rubbing
   - No leaks occur
   - All fasteners are tight
   - All electrical leads are secure and in good order
   - Safety valves and other pressure relief devices are not obstructed by dirt or paint
   - Air outlet valve and air net, i.e. pipes, couplings, manifolds, valves, hoses, etc. are in good repair, free of wear or abuse
   - Air cooling filters of the electrical cabinet are not clogged
10. If warm cooling air from compressors is used in air heating systems, e.g. to warm up a workroom, take precautions against air pollution and possible contamination of the breathing air.
11. On water-cooled compressors using open circuit cooling towers, protective measures must be taken to avoid the growth of harmful bacteria such as Legionella pneumophila bacteria.
12. Do not remove any of, or tamper with, the sound-damping material.
13. Never remove or tamper with the safety devices, guards or insulations fitted on the machine. Every pressure vessel or auxiliary installed outside the machine to contain air above atmospheric pressure shall be protected by a pressure relieving device or devices as required.
14. Yearly inspect the air receiver. Minimum wall thickness as specified in the instruction book must be respected. Local regulations remain applicable if they are more strict.

	Also consult following safety precautions: Safety precautions during installation and Safety precautions during maintenance. These precautions apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to the application which are not included herein. Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your machine.

1.5 Safety precautions during maintenance or repair

	All responsibility for any damage or injury resulting from neglecting these precautions, or non observance of the normal caution and care required for installation, operation, maintenance and repair, even if not expressly stated, will be disclaimed by the manufacturer.

Precautions during maintenance or repair

1. Always use the correct safety equipment (such as safety glasses, gloves, safety shoes, etc.).
2. Use only the correct tools for maintenance and repair work.
3. Use only genuine spare parts for maintenance or repair. The manufacturer will disclaim all damage or injuries caused by the use of non-genuine spare parts.
4. All maintenance work shall only be undertaken when the machine has cooled down.
5. A warning sign bearing a legend such as "Work in progress; do not start" shall be attached to the starting equipment.
6. Persons switching on remotely controlled machines shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the remote start equipment.
7. Close the compressor air outlet valve and depressurize the compressor before connecting or disconnecting a pipe.
8. Before removing any pressurized component, effectively isolate the machine from all sources of pressure and relieve the entire system of pressure.
9. Never use flammable solvents or carbon tetrachloride for cleaning parts. Take safety precautions against toxic vapors of cleaning liquids.
10. Scrupulously observe cleanliness during maintenance and repair. Keep dirt away by covering the parts and exposed openings with a clean cloth, paper or tape.
11. Never weld or perform any operation involving heat near the oil system. Oil tanks must be completely purged, e.g. by steam cleaning, before carrying out such operations. Never weld on, or in any way modify, pressure vessels.
12. Whenever there is an indication or any suspicion that an internal part of a machine is overheated, the machine shall be stopped but no inspection covers shall be opened before sufficient cooling time has elapsed; this to avoid the risk of spontaneous ignition of the oil vapor when air is admitted.
13. Never use a light source with open flame for inspecting the interior of a machine, pressure vessel, etc.
14. Make sure that no tools, loose parts or rags are left in or on the machine.
15. All regulating and safety devices shall be maintained with due care to ensure that they function properly. They may not be put out of action.
16. Before clearing the machine for use after maintenance or overhaul, check that operating pressures, temperatures and time settings are correct. Check that all control and shut-down devices are fitted and that they function correctly. If removed, check that the coupling guard of the compressor drive shaft has been reinstalled.
17. Protect the motor, air filter, electrical and regulating components, etc. to prevent moisture from entering them, e.g. when steam cleaning.

18. Make sure that all sound-damping material and vibration dampers, e.g. damping material on the bodywork and in the air inlet and outlet systems of the compressor, is in good condition. If damaged, replace it by genuine material from the manufacturer to prevent the sound pressure level from increasing.
19. Never use caustic solvents which can damage materials of the air net, e.g. polycarbonate bowls.

	Also consult following safety precautions: Safety precautions during installation andSafety precautions during operation. These precautions apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to theapplication which are not included herein. Some precautions are general and cover several machine types and equipment; hencesome statements may not apply to your machine.

2. General description

2.1 Introduction

Introduction

TMA Medical Air Supply System is used for the centralized supply of medical air, which is compressed and purified for the medical air piping system to the operating room, rescue room and ward terminal for medical use. Medical Air Supply System is not intended to be used directly with patients and medical staff, and it is just used by appropriately qualified and trained personnel only who have undergone relevant training regarding the safe use of medical gas supply systems.

TMA Medical Air Supply System provides a reliable source of supply that delivers the designed flow rate of medical and surgical air. These devices are intended for use as plant within the hospital environment for the supply of medical and/or surgical air. They are not intended for direct use with any patients or groups but supply a utility to medical devices that use medical or surgical quality air. Air is fed via compressors to air receiver vessels. Here the air is stored to compensate for variable consumption and to allow a longer running period to increase energy efficiency and reduce the number of ‘motor starts. The air is then fed through a 3-stage filtration system where dust particles and oil/water aerosols are separated, oil vapours and odours are absorbed, and fine particles are removed. The air delivered by the Medical Air Supply System is purified by utilizing multiple filters that combine to ensure the relevant impurities are removed from the compressed air following pressurization through the systems’ compressor(s). The filters are assembled within the dryer/purification module which ultimately establishes the desired output from the Medical Air Supply System. Without the dryer module the air delivered from the compressors would contain levels of impurity meaning it would be unsuitable for medicinal purposes.

TMA7 and TMA11 are Medical Air Supply System which has one set of two compressors and desiccant dryers. It has three controllers, one central controller, two sub controllers for two compressors. The compressors are air-cooled, single-stage, oil-injected screw compressors, driven by an electric motor. The motor runs at fixed speed and drives the compressor by means of V belts.

The compressors are enclosed in sound-insulating bodywork.

The compressors are controlled by an electronic controller (ER), mounted on the panel of the control cabinet (1). The panel also includes an emergency stop button (S3).

The central controller is MK5s touch controller.

The two compressors have a separate Elektronikon® Graphic controller with graphic display as sub controllers.

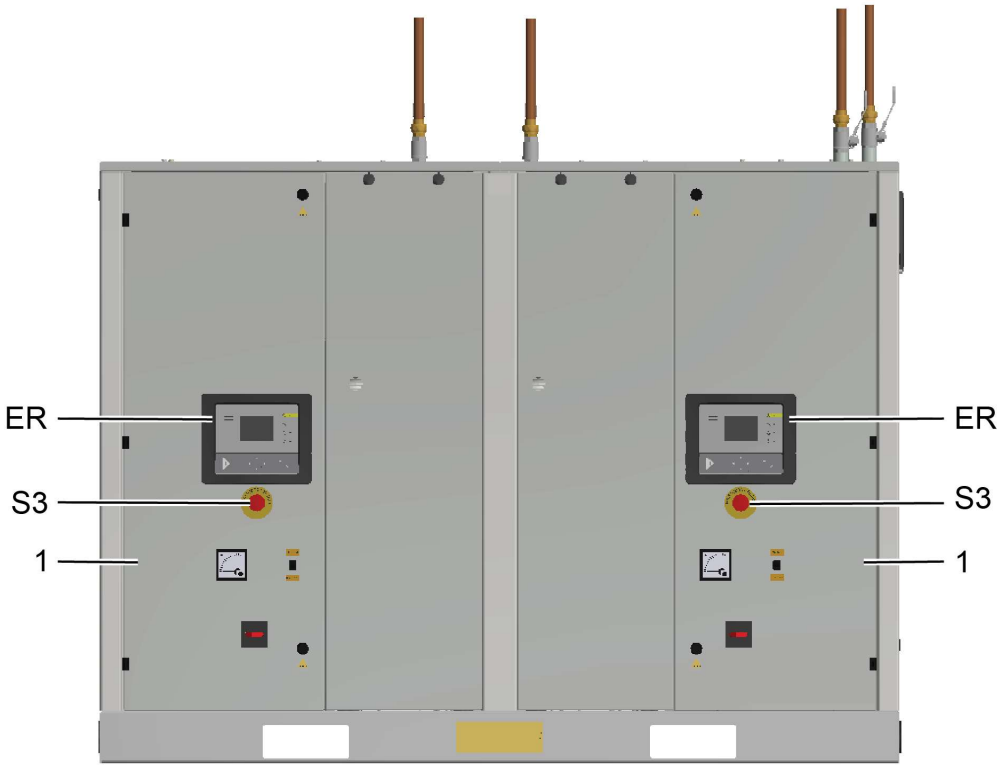


Figure 1 TMA 7-11 side view

Figure 2 TMA 7-11 front view

TMA is made up of the following modules:

- Air compressor.
- Reservoir as option (pressure vessel).
- Conditioning unit (Purifier).

The purifier module controls the specification and any related hazards of the air to the medical gas pipeline requirements. There is always a separate medical device (not within the scope of this device) between the medical gas pipeline and the patient that controls any mechanical hazards related to flow or pressure. This device therefore only protects the pipeline from any mechanical hazards, and only protects the patient from contamination hazards. The compressors and pressure vessels only influence mechanical hazards to the purification system, they neither influence hazards to the pipeline or patient.

Modular Design

TMA Medical Air Supply Systems are specifically designed for ease of installation, designed as a modular system and supplied as principle components, enabling a degree of flexibility in the installation layout.

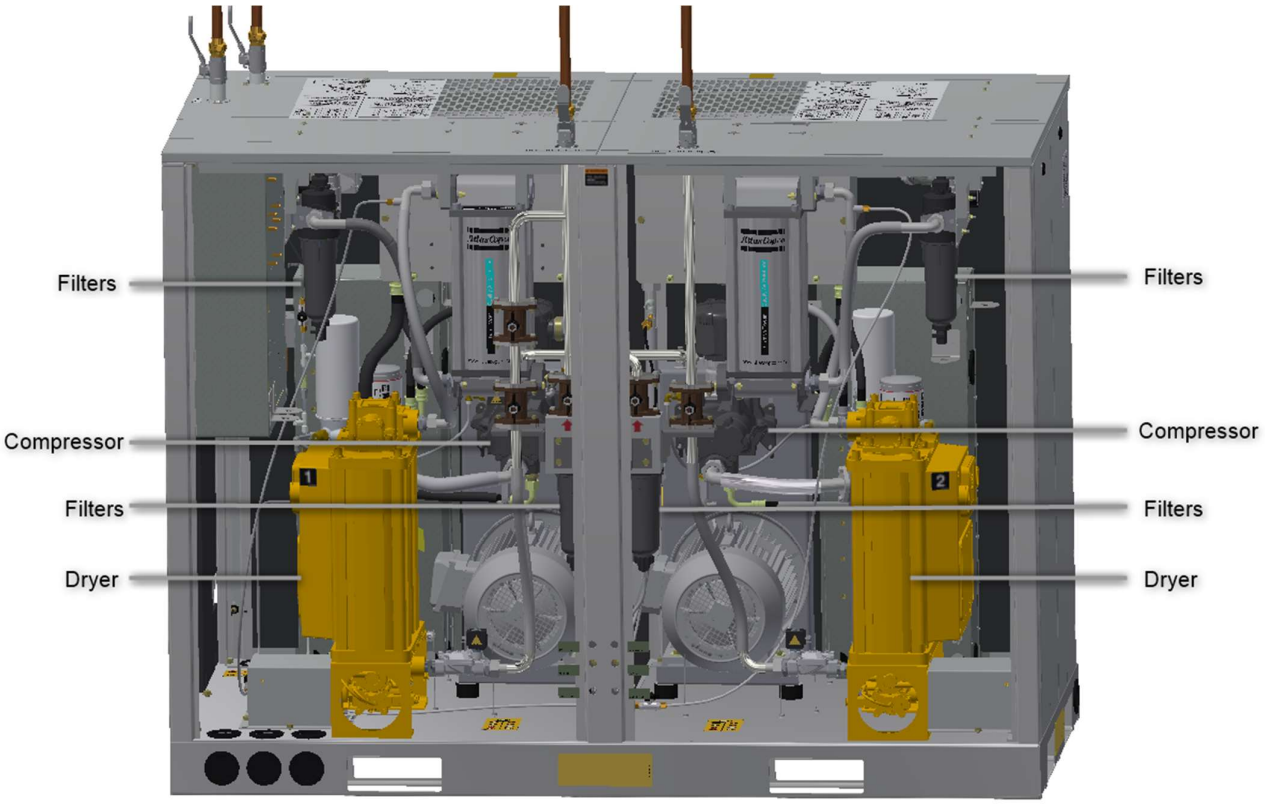


Figure 3 Medical Air Supply System Components

The Medical Air Supply System shall conform to EN ISO 7396-1 and NHS Health Technical Memorandum HTM02-01 or HTM2022. Medical quality air to the European Pharmacopoeia monograph shall be delivered at pressures of 400 kPa (4 bar) or 700kPa (7 bar) gauge for supply of the hospital medical or surgical air systems.

Medical Air Supply Systems shall be duplexed such that any single functional component failure will not affect the integrity of the medical compressed air supply.

Surgical Air Systems shall have a duplex air purification module and a simplex compressor. Additional compressors shall be available to duplex the compressors, such that any single compressor failure will not affect the integrity of the air supply.

Combined Medical and Surgical air plant provides a single connection point at 11 bar or 7 bar pressure for connecting to the surgical air pipeline system. A teed connection from the surgical air pipeline is connected to a duplex pressure reducing set (available separately) and is installed within the plant room in order to provide a 4 bar line pressure connection suitable for the medical air pipeline system. The design flow is the sum of the medical air and surgical air requirement.

Each installation is designed and valved to provide a Lead and Standby for all major components and enables the compressor, filter/dryer, regulator and/or the air receiver(s) to be isolated with the plant remaining operational.

Sources of Supply

HTM02-01 and ISO7396-1

The Medical Air Supply System will produce the primary supply with two compressors on standby (unless an automatic manifold is used as secondary (HTM02-01) or third (ISO7396-1) supply). For duplex plant, the secondary (HTM02-01) or third (ISO7396-1) supply shall be an automatic manifold. For triplex plant, each compressor can supply the total hospital flow. If more than three compressors are installed, the total hospital flow will be split over multiple compressors.

HTM2022

The Medical Air Supply System will produce the primary supply with one compressor on standby. For duplex plant, each compressor can supply the total hospital flow. If more than two compressors are installed, the total hospital flow will be split over multiple compressors. The back-up compressor will form the secondary supply. A third supply shall be from an automatic manifold capable of supplying the average hospital demand for 4 hours.

The medical air delivered by the BeaconMedaes devices is governed by European Pharmacopeia requirements in terms of purity, however what is considered variable among numerous plants is how this purification level is achieved. Within the BeaconMedaes Medical Air Supply System there are numerous ways of obtaining medical quality air dependant on a few variables, mainly the method of obtaining pressure (the compressor technology involved).

Compressor technology is developed by Atlas Copco and utilised within medical air plants. Essentially removing the oil from the compressor eliminates the need to incorporate a specific filtration element from the purifier. Conventional compressors developed by Atlas Copco incorporate oil as a lubricant ultimately to ensure longevity of the device。

Key Functional components

- **Air compressor**

The compressors are air-cooled, single-stage, oil-injected screw compressors, driven by an electric motor.

The motor runs at fixed speed and drives the compressor by means of V belts.

Compressors are provided with Mk5 Elektronikon® controllers as sub controller and CAN connections. All models are designed for ease of installation and pre-configured to communicate with the central controller. The modular approach enables the availability of Medical Air Supply Systems at the required pressure and flow for each healthcare application.

Figure 4 TMA 7-11 front view

The compressors are single-stage oil injected rotary screw compressors are suitable for both continuous and frequent start/stop operation at a nominal outlet pressure of 1000 kPa (10 bar) or 1300 kPa (13 bar) gauge. The compressors shall be supplied with a block and fin style after cooler with a dedicated quiet running fan to maximize cooling and efficiency. A multistage oil separator capable of achieving 2ppm oil carry-over is incorporated to minimize contamination and maintenance. Minimum EFF1 (CEMEP) rated, IP55 class F electric motors are specified integrating maintenance-free bearings. The compressor is supplied with a high-definition colour display controller. The compressor provides the following features as required by HTM02-01/HTM2022: Ammeter, Main switch, Temperature sensor downstream the aftercooler, Failed-to-go-on-load feedback pressure switch and Automatic restart after voltage failure.

- **Air Purification Module – Dryer and Filter System**

High quality air is of vital importance to many industries, but nowhere as literally as in the medical sector. The purity of the compressed air for hospital applications is crucial. The air drawn from our environment however, especially in cities or industrial areas, is rarely of a sufficient quality for medical purposes. For this application, BeaconMedaes has designed the dual medical air purifier module. The purifier takes air from any regular compressor and treats it to become ultra clean. It consists of a number of components, which together, after the commissioning certification, produce air with a quality matching the Pharmacopoeia legislation. The purifier module is primarily aimed at the healthcare sector where applications like breathing air in operating theatres and surgical air to drive surgical tools demand high quality air.

Purifier module consists of two independent air treatment units, each consisting of following stages of cleaning:

- A water separator (WSD) to eliminate free water from the compressed air, thus ensuring good operation of the desiccant dryer.
- A coalescing filter (UD+ filter) to remove contaminating particles and oil droplets.
- A desiccant dryer to lower the atmospheric dew point to -46 ˚C, eliminating the risk of condensation and strongly reducing water-related problems like bacteria growth.
- A QD+ filter to reduce hydrocarbons like oil vapour and smells to harmless levels, QDT filter converts excessive concentrations of CO into CO2 where the hopcalite catalyst filter is fitted.
- A particle filter (PDp+ filter) to eliminate particles that may have migrated out of the desiccant dryer. This central controller activates one unit and will switch to the other one after a certain amount of time has elapsed. This guarantees a constant delivery of purified air and also ensures service can be performed on one unit whilst the system is still operating. At all times an indication of dew point and pressure can be retrieved from the display.

- **Dryer operation principle**

The operation cycle of the dryer is repetitive and is controlled by a factory-set timer, programmed in the controller. While the desiccant in one tower dries the compressed air, the desiccant in the second tower is being regenerated. Regeneration of the desiccant is achieved by means of purge air from the drying tower. The compressed air entering the dryer is led to one of the towers by means of the inlet selector valve. The position of the selector valve depends on the condition (activated or not) of the solenoid valves. While the air flows upwards through the tower, the desiccant adsorbs the water vapour, and the compressed air is dried. The dried air leaves the dryer via the outlet selector valve. A small portion of the dried air passes a nozzle, expands to atmospheric pressure and flows downwards through the other tower, regenerating (drying) the desiccant. The regeneration air is released via the solenoid valve and the silencer of the regenerating tower. The solenoid valves are controlled by the controller. After a pre-set period, the function of the towers is reversed. The fully regenerated tower will now dry the air, while the desiccant in the other tower will be regenerated. By default, the regeneration timer will restart from the beginning of the cycle in case of a power failure during operation.

- **Dryer Purge control**

The dryer is equipped with a dew point sensor, extending the drying time and saving compressed air. The regeneration time remains timer controlled. Operation principle: The sensor constantly measures the atmospheric dew point of the air leaving the drying tower. While the dew point is measured below the purge saver set point the dryer will continue to supply dry air, but the purging of the regenerating tower will be de-active. Once the dew point rises above the set point the purge cycling function will become active

- **Dew Point Monitoring**

The dryer incorporates a dew point hygrometer with an accuracy of ±2°C in the range -80 to 20°C atmospheric dew point and 4-20mA analogue output. An alarm condition is triggered on the dryer control panel if the dew point exceeds a -46°C atmospheric set point. The plant control unit displays the dewpoint of the delivered air to enable monitoring of the air quality by the healthcare facility. Voltage-free contacts enable the dew point alarm signal to be connected to the central medical gas alarm system and/or building management system (BMS). To enable periodic calibration of the dew point sensor element, the hygrometer is remotely connected downstream of the dryer via a micro-bore tube.

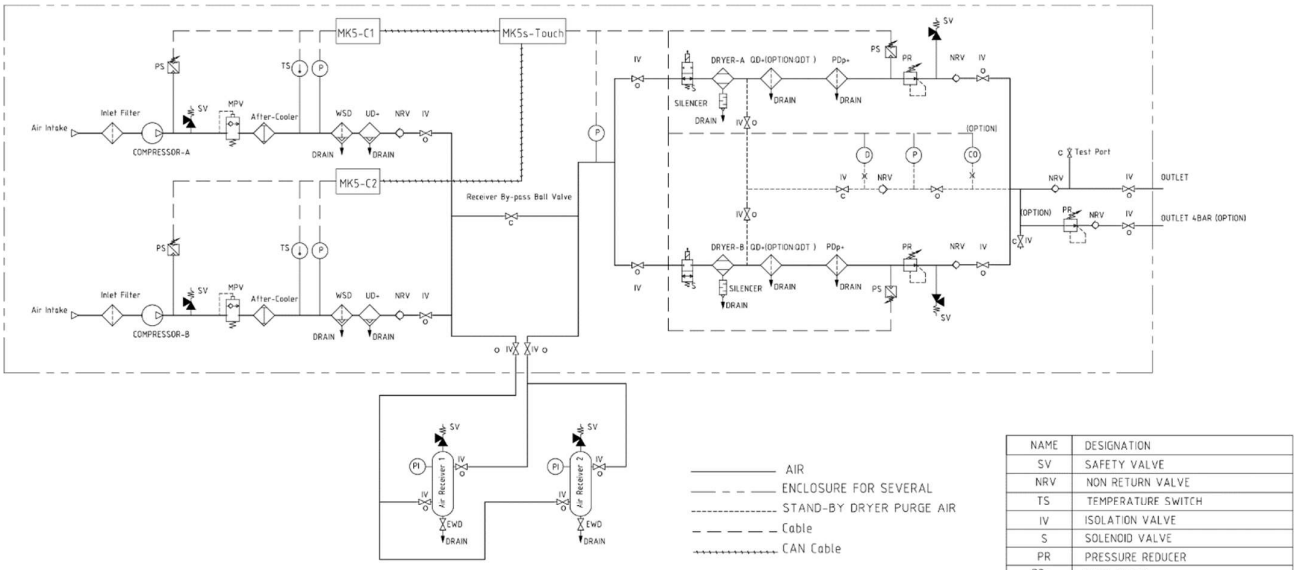
- **Central controller**

The central control system provides an intelligent human machine interface incorporating on board flash memory and real-time clock for recording operational parameters in the in-built event log. The central control system operates at low voltage and include Building Management System (BMS) connection for plant fault, plant emergency, reserve fault and pressure fault. Visualisation of plant inputs, outputs, and status is provided through a web browser, using an Ethernet connection. The central control unit incorporates a user friendly 5.7” high-definition colour display with clear pictograms and LED indicators, providing easy access to system operational information. The central control system employs automatic rotation of the lead compressor & dryer to maximize life and ensure even wear. The compressors & dryers are designed with their own individual controller, providing a back-up in case of a central controller malfunction, ensuring continued operation

- **Receiver Assembly**

Air receivers supplied with relevant test certificates. Air receiver material specifications are steel construction with powder coating for protection (CE standard). The receiver assembly is fitted with a pressure safety valve capable of passing the maximum flow output of the compressor at 10% receiver overpressure. The receiver is further protected by a safety pressure relief valve and include a pressure gauge for indication of vessel content

2.2 Flow diagram



NAME	DESIGNATION
SV	SAFETY VALVE
NRV	NON RETURN VALVE
TS	TEMPERATURE SWITCH
IV	ISOLATION VALVE
S	SOLENOID VALVE
PR	PRESSURE REDUCER
PDp+	DUST FILTER
QDT	Activated Carbon Tower
QD+	ACTIVATED CARBON FILTER
PS	PRESSURE SWITCH
UD+	OIL FILTER
WSD	WATER SEPARATOR
D	PRESSURE DEW POINT SENSOR
P	PRESSURE SENSOR
CO	CARBON MONOXIDE SENSOR
MPV	Minimum Pressure Valve

NAME	DESIGNATION
EWD	ELECTRICAL WATER DRAIN
MK5s-Touch	MK5s-Touch FOR CENTRAL CONTROL SYSTEM
MK5-C1	MK5-Graphic CONTROL SYSTEM FOR COMPRESSOR 1
MK5-C2	MK5-Graphic CONTROL SYSTEM FOR COMPRESSOR 2
PI	PRESSURE INDICATOR

Figure 5 Medical air supply system flow diagram

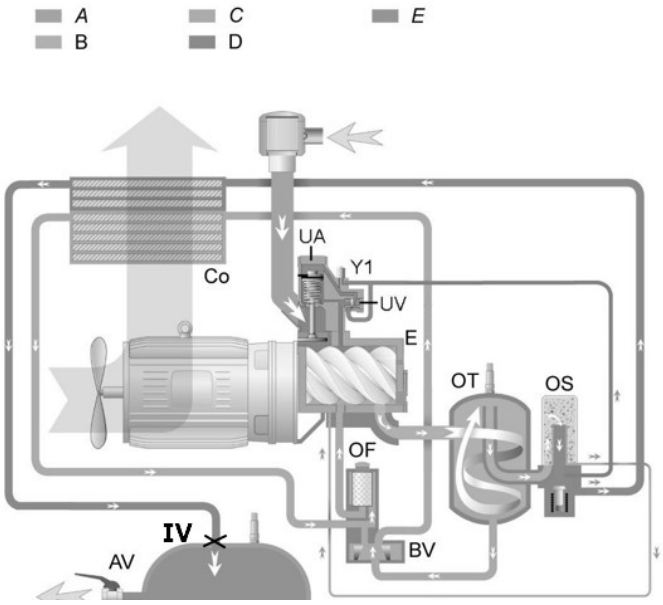


Figure 6 Compressor 's flow diagram

Compressor's Air flow

Air, drawn in through the air filter, passes the open inlet valve of the unloading valve assembly (UA) and is compressed by the compressor element (E), where it mixes with the injected oil (see Oil circuit).

The mixture of compressed air and oil flows via the oil separator tank (OT) to the oil separator element (OS), where the oil is separated from the compressed air.

Next, the compressed air passes the minimum pressure valve and flows via the aftercooler (if fitted) into the air receiver (AR) then to the desiccant dryer.

The minimum pressure valve gets its name from the fact that it only opens from the moment a certain minimal pressure is reached in the oil separator tank (OT). This pressure is required for injecting the oil into the compressor element during loaded operation.

Compressor's Oil circuit

In the oil separator tank (OT), most of the oil is separated from the mixture of compressed air and oil by centrifugal action. The oil collects at the bottom of the tank. The remaining oil is removed from the compressed air by the oil separator element (OS) and is returned to the oil circuit via a separate line. The pressure in the oil separator tank (OT) forces the oil from the tank through oil cooler (Co) and oil filter (OF) to the compressor element (E).

A thermostatic bypass valve bypasses the oil cooler when the oil is cold, thus decreasing the risk foraccumulation of condense in the lubricating oil.

Cooling

The compressors are air cooled.

Cooling air, generated by the fan on the motor shaft is blown over the cooler(s) (Co).

Every compressor has an oil cooler. An air cooler is standard on the Full-Feature Tank mounted modelsand available as standard option on the Pack versions.

Condensate system

Compressors with an air cooler and WSD (water separator) have a manual/auto drain valve.

The air receiver serves also as water separator. The air receiver is equipped witha manual drain valve.

Compressor's Regulating system

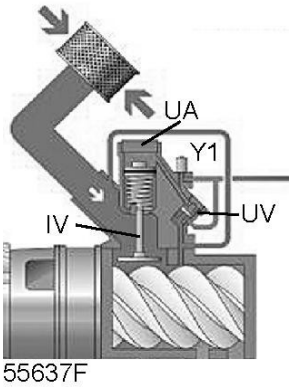


Figure 7 Regulating system principle

The compressors are equipped with an unloading valve assembly (UA) to prevent too frequent starting and stopping in periods of fluctuating compressed air demand. When there is no demand for compressed air, the compressor will run unloaded with reduced energy consumption.

Compressor's Loaded operation

With the compressor running loaded and as long as the working pressure is below the programmed maximum pressure, solenoid valve (Y1) is energised, allowing control air from the oil separator tank (OT) to the unloading valve (UV). The inlet valve opens completely against spring force and the compressor runs loaded (100 % output).

Compressor's Unloaded operation

When the pressure reaches the programmed maximum (unloading) pressure, solenoid valve (Y1) is de- energised and the control air is vented to atmosphere. The inlet valve closes by spring force and the compressor runs unloaded (0 % output).

The electronic controller will stop the compressor after a predefined period of unloaded operation, unless the pressure in the air net decreases within this time interval. The compressor will automatically restart as soon as the pressure drops below the programmed minimum (loading) pressure.

3. Central controller (MK5s Touch)

Elektronikon™ MK5s Touch controller

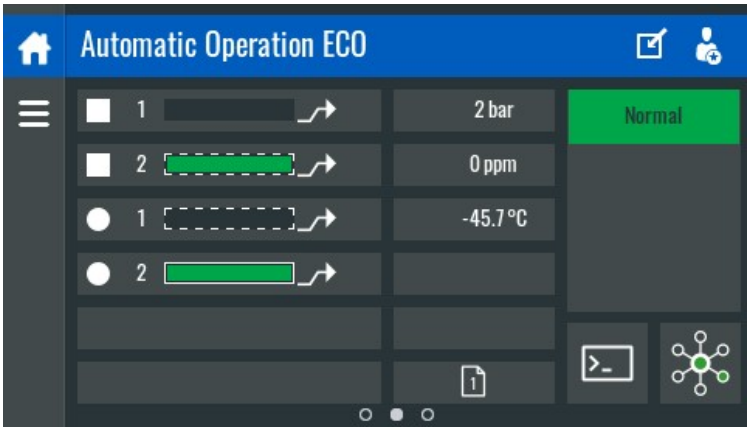


Figure 8

Figure 9

Reference	Designation	Description
(1)	Data menu	The data menu contains the Compressor status, information about the Inputs, Outputs and Counters. The Auxiliary equipment can also be viewed through this menu.
(2)	Service menu	The service menu contains the Service information. The 'Clean screen' function can be used to clean the touchscreen.
(3)	Week timer menu	Multiple Week timers and a Remaining running time can be set through this menu.
(4)	Event history menu	In case of an alarm, the compressor Status information is saved and can be viewed through this menu.
(5)	Machine settings menu	Alarms settings, Regulation settings and Control parameters can be changed through this menu. Auxiliary equipment parameters can also be changed.
(6)	Controller settings menu	Network settings, Localisation settings and a User password can be set through this menu. There is also a Help page available and the Controller information can be shown.

Data menu

Function

This screen is used to display the following submenus:

- Status
- Inputs
- Outputs
- Counters
- Aux.Equipment

These submenus can be entered by tapping the icons.

Procedure

To enter the Data menu screen:

- Tap the Menu button
- Tap the Data icon

Description

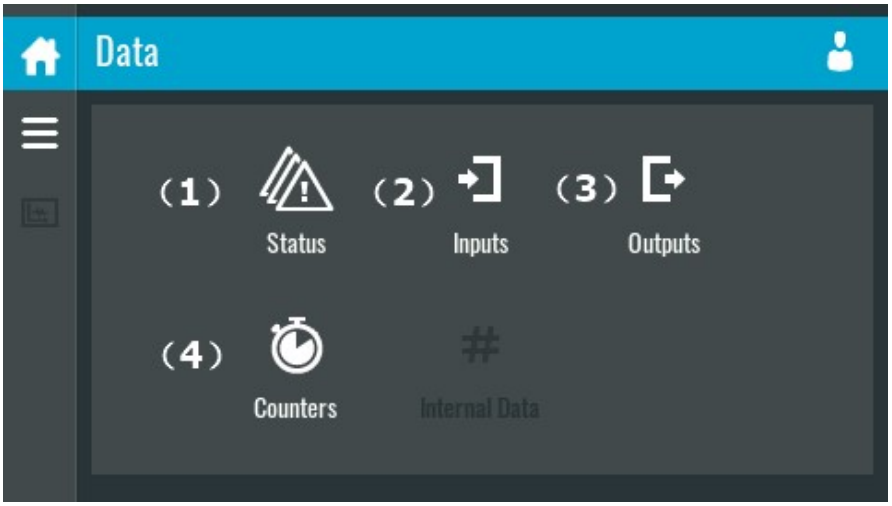


Figure 10

Reference	Designation
(1)	Status menu
(2)	Inputs menu
(3)	Outputs menu
(4)	Counters menu

Status menu

Tap the Status icon to enter the status menu. This menu shows the current compressor status.

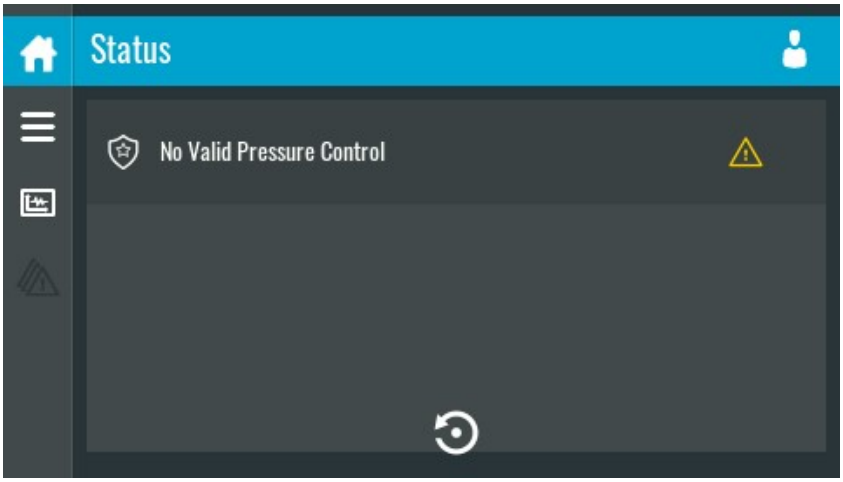


Figure 11

Inputs menu

Tap the Inputs icon to enter the inputs menu. This menu shows information about all the inputs.

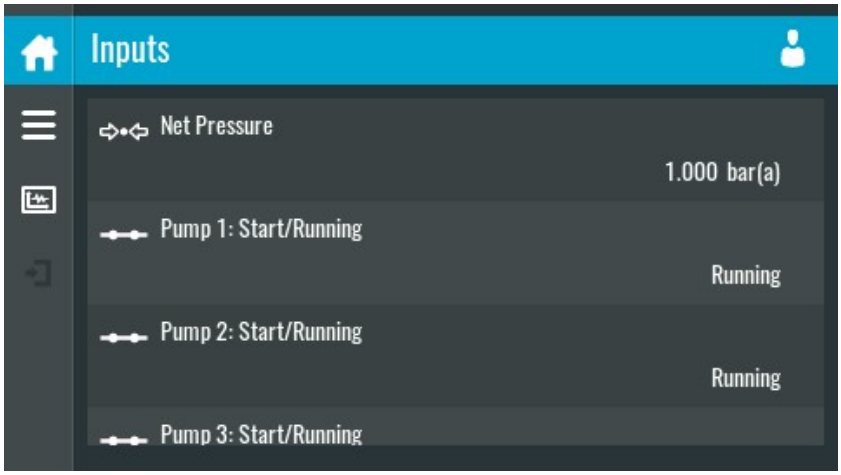


Figure 12

Outputs menu

Tap the Outputs icon to enter the outputs menu. This menu shows information about all the outputs.

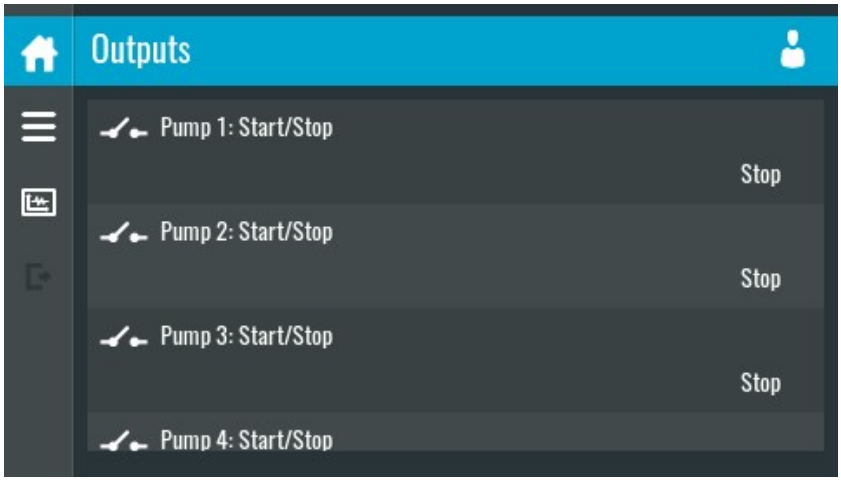


Figure 13

⚠	Voltage-free outputs may only be used to control or monitor functional systems. They should NOT be used to control, switch or interrupt safety related circuits. Check the maximum allowed load on the label.
⚠	Stop the compressor and switch off the supply before connecting external equipment. Check the Safety precautions.

Counters menu

Tap the Counters icon to enter the counters menu.

This menu shows an overview of all actual hours and counters of the compressor and controller.

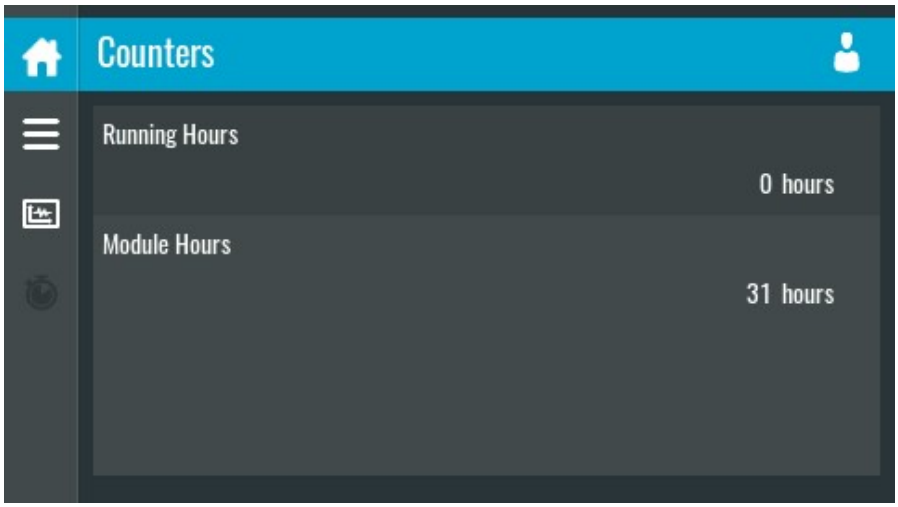


Figure 14

Saved data

Tap the Saved data icon to enter the saved data menu. :

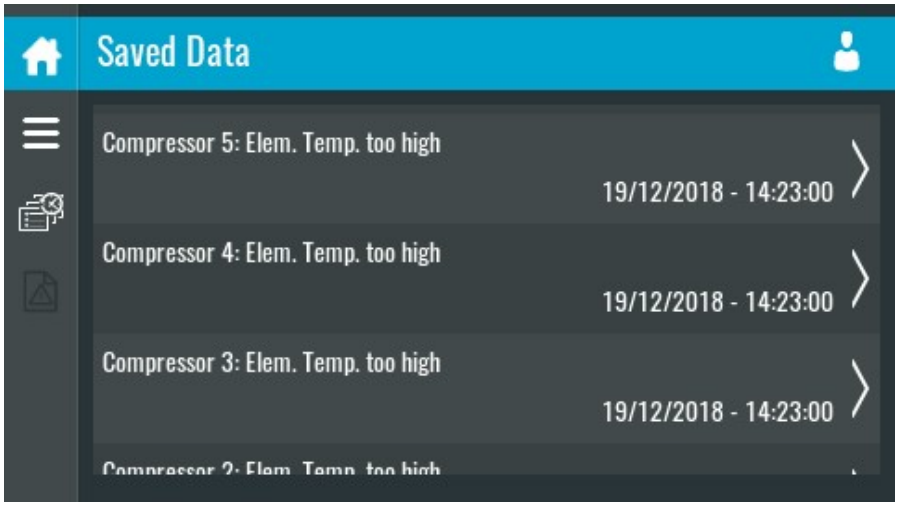


Figure 15

Machine settings menu

Function

This screen is used to display the following submenus:

• Alarms

• Regulation

• Control Parameters

Only visible if the machine has adaptable parameters.

These submenus can be entered by tapping the icons.

Procedure

To enter the Machine settings menu screen:

• Tap the Menu button

• Tap the Machine Settings icon

Description

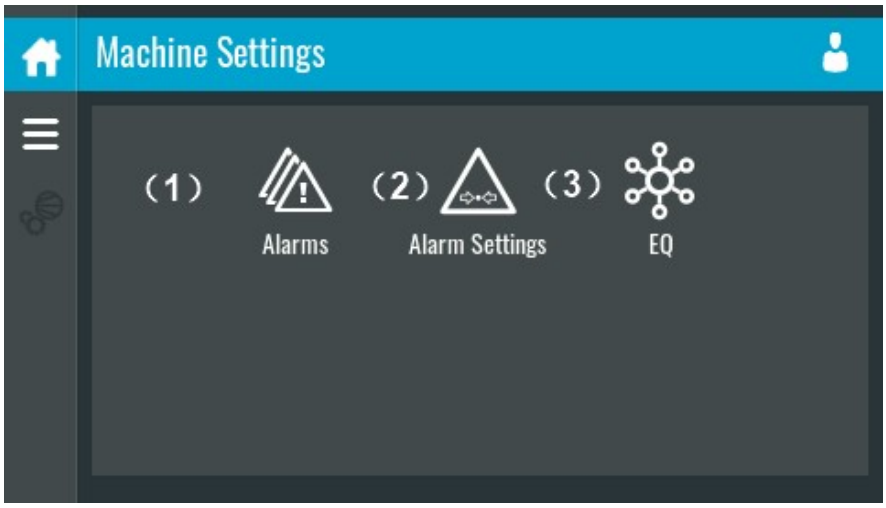


Figure 16

Reference	Designation
(1)	Alarms menu
(2)	Regulation menu
(3)	Control Parameters menu

Alarms menu

Tap the Alarms icon to enter the alarms menu.

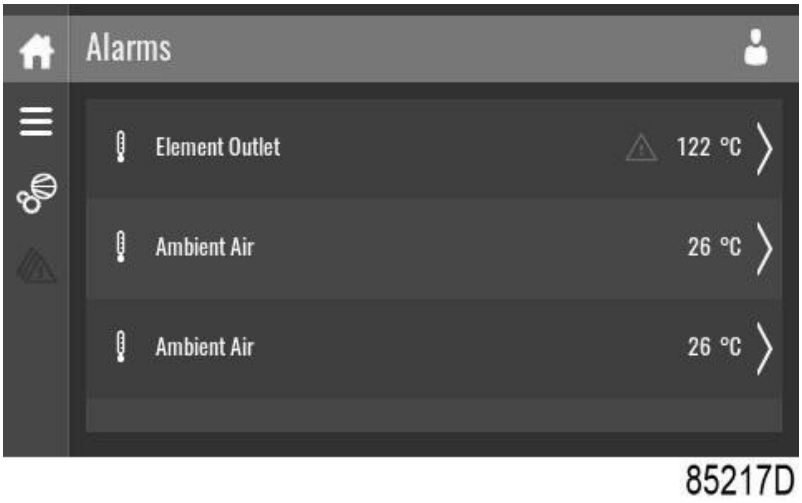


Figure 17

The central control system provides an intelligent human machine interface incorporating on board flash memory and real-time clock for recording operational parameters in the in-built event log. The central control system operates at low voltage and include Building Management System (BMS) connection for plant fault, plant emergency, reserve fault and pressure fault. Visualisation of plant inputs, outputs, and status is provided through a web browser, using an Ethernet connection. The central control unit incorporates a user friendly 5.7” high definition colour display with clear pictograms and LED indicators, providing easy access to system operational information. The central control system employs automatic rotation of the lead compressor & dryer to maximize life and ensure even wear. The compressors & dryers are designed with their own individual controller, providing a back-up in case of a central controller malfunction, ensuring continued operation.

On the main screen the status of the air plant is shown. This means the most important measurements of the compressed air at the outlet (pressure level and atmospheric dew point) and any possible alarms are shown. On the figures below the different statuses/alarms can be seen from left to right: normal operation, operating alarm triggered and emergency operating triggered.

Figure 18

Figure 19

Figure 20

The alarm indications are described accordingly:

Plant fault:

This alarm indicates something in the system is not right and should be looked at (Warning – action required but not immediate). A Plant Fault is caused by the following:

- Failing transducer (dew point or pressure)
- Failed dryer
- Failed compressor
- Compressor communication error
- Inlet pressure too high or too low
- All compressors in load (LAG alarm)

Plant emergency:

This alarm indicates an unwanted situation which should be rectified as quickly as possible. It is caused by the dew point, which is measured at the outlet, being too high.

Reserve fault:

This alarm indicates that the back-up cylinder supply pressure is too low. Pressure fault: This alarm indicates a problem with the medical outlet pressure being too high or too low.

Views screen:

In the views screen the most important inputs of the sensors are visible on the screen. How this is displayed can be chosen by the user.

In the screen the status of the compressors is visible. You can see each compressor and whether it is stand-by, in load or in unload. A compressor in load has a full bar, in unload a partially filled bar and when in stand-by an empty bar. It is also visible which compressor is the next to be called or stopped by the controller.

Figure 21

In the screen the status of the 2 dryers is visible. You can see which dryer is active and if there is a fault on the dryer(s).

Compressor

Dryer

Figure 22

4. Sub controller-Elektronikon® Graphic controller (for compressor)

4.1 Elektronikon® Graphic controller

Control panel

Figure 23 Display of the Elektronikon® Graphic controller

Introduction

The Elektronikon® Graphic controller has following functions:

- Controlling the compressor
- Protecting the compressor
- Monitoring components subject to service
- Automatic restart after voltage failure (made inactive)

Automatic control of the compressor operation

The controller maintains the net pressure between programmable limits by automatically loading and unloading the compressor (on compressors running at a fixed speed). A number of programmable settings, e.g. the unloading and loading pressures (for fixed speed compressors), the setpoint (for compressors with frequency converter), the minimum stop time and the maximum number of motor starts and several other parameters are hereby taken into account.

The controller stops the compressor whenever possible to reduce the power consumption and restarts it automatically when the net pressure decreases. In case the expected unloading period is too short, the compressor is kept running to prevent too short standstill periods.

	A number of time based automatic start/stop commands may be programmed. Take into account that a start command will be executed (if programmed and activated), even after manually stopping the compressor.

Protecting the compressor

Compressor Shutdown

Several sensors are provided on the compressor. If one of the measured signals exceeds the programmed shut-down level, the compressor will be stopped. This will be indicated on display (1) and general alarm LED (2) will blink.

Remedy the trouble and reset the message. See also the Inputs menu.

	Before remedying, consult the applicable safety precautions.

Compressor Shut-down warning

A shut-down warning level is a programmable level below the shut-down level.

If one of the measured signals exceeds the programmed shut-down warning level, a message will appear on display (1) and general alarm LED (2) will light up to warn the operator that the shut-down warning level is exceeded.

The message disappears as soon as the warning condition disappears.

Warning

A warning message will appear.

Compressor Service warning

A number of service operations are grouped (called Service Plans). Each Service Plan has a programmed time interval. If a time interval is exceeded, a message will appear on display (1) to warn the operator to carry out the service actions belonging to that Service Plan.

Automatic restart after voltage failure

The controller has a built-in function to automatically restart the compressor when the voltage is restored after voltage failure.

	If the function is activated and provided the regulator was in the automatic operation mode, the compressor will automatically restart if the supply voltage to the module is restored.

4.2 Control panel (for compressor)

Elektronikon Graphic regulator

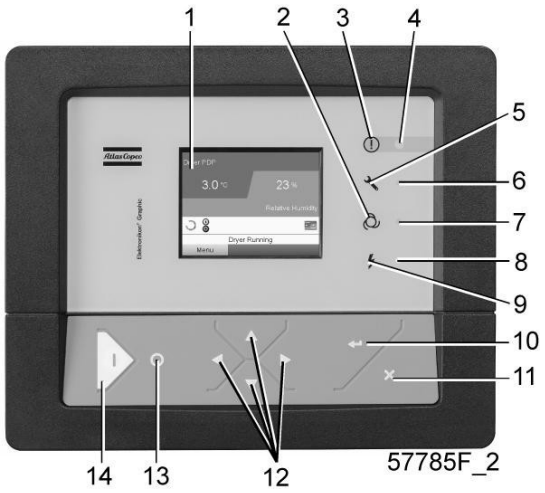


Figure 24 Control panel

Parts and functions

Reference	Designation	Function
1	Display	Shows the compressor operating condition and a number of icons to navigate through the menu.
2	Pictograph	Automatic operation
3	Pictograph	General alarm
4	Alarm LED	Flashes in case of a shut-down, is lit in case of a warning condition.
5	Pictograph	Service
6	Service LED	Lights up if service is needed
7	Automatic operation LED	Indicates that the regulator is automatically controlling the compressor.
8	Voltage on LED	Indicates that the voltage is switched on.
9	Pictograph	Voltage
10	Enter key	Use this button to confirm the last action.
11	Escape key	Use this button to go to previous screen or to end the current action.
12	Scroll keys	Keys to scroll through the menu.
13	Stop button	Button to stop the compressor. LED (7) goes out.
14	Start button	Button to start the compressor. LED (7) lights up indicating that the Elektronikon regulator is operative.

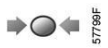
4.3 Icons used

Status icons

Name	Icon	Description
Stopped / Running	 57786F	When the compressor is stopped, the icon stands still.When the compressor is running, the icon is rotating.
Compressor status	 57787F	Motor stopped
	 57788F	Running unloaded
	 57789F	Running loaded
Machine control mode	 57790F or  59161F	Local start / stop
	 57791F	Remote start / stop
	 57792F	Network control
Automatic restart after voltage failure	 57793F	Automatic restart after voltage failure is active
Week timer	 57794F	Week timer is active

Active protection functions	 57795F	Emergency stop
	 57796F	Shutdown
	 57797F	Warning
Service	 57798F	Service required
Main screen display	 59162F	Value line's display icon
	 82196F	Chart display icon
General icons	 81105D	No communication / network problem
	 82418D	Not valid
	 57812F	General alarm

Input icons

Icon	Description
 57799F	Pressure
 57800F	Temperature
 57801F	Digital input
 57802F	Special protection

System icons

Icon	Description
 57803F	Compressor element
 57805F	Fan
 57807F	Drain
 57808F	Filter
 57809F	Motor
 57810F	Failure expansion module

Menu icons

Icon	Description
 57813F	Inputs
 57814F	Outputs
 57812F	Alarms (Warnings, shutdowns)
 57815F	Counters
 57816F	Test
 57817F	Settings
 57798F	Service
 57818F	Event history (saved data)

 57819F	Access key / User password
 57792F	Network
 57820F	Setpoint
 57867F	Info

Navigation arrows

Icon	Description
 57821F	Up
 57822F	Down

	This chapter gives a general survey of available icons. Not all icons mentioned in this chapter are applicable to every machine.

4.4 Elektronikon® Graphic Main screen

Control panel

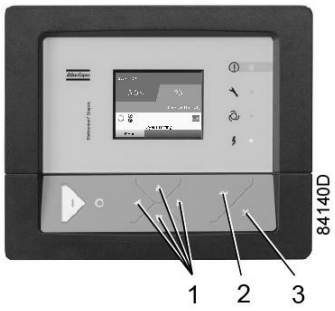


Figure 25

(1)	Scroll keys
(2)	Enter key
(3)	Escape key

Function

The Main screen is the screen that is shown automatically when the voltage is switched on and one of thekeys is pushed. It is switched off automatically after a few minutes when no keys are pushed.

Typically, 5 different main screen views can be chosen:

1. Two value lines
2. Four value lines
3. Chart (High resolution)
4. Chart (Medium resolution)
5. Chart (Low resolution)

Two and four value line's screens

This type of Main screen shows the value of 2 or 4 parameters (see section Inputs menu).

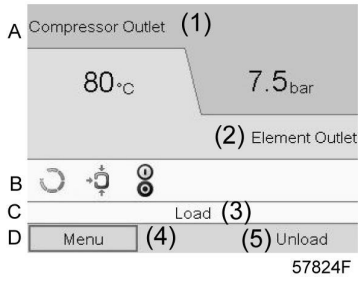


Figure 26 Typical Main screen (2 value lines), fixed speed compressors

Text on image

(1)	Compressor Outlet
(2)	Element Outlet
(3)	Load , shutdown ,.. (text varies upon the compressors actual condition).
(4)	Menu
(5)	Unload ,ES, ... (text varies upon the compressors actual condition

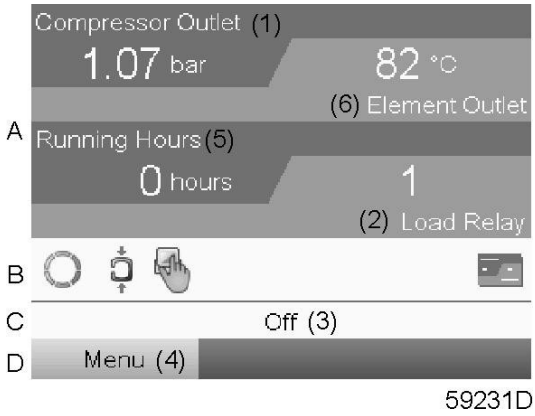


Figure 27 Typical Main screen (4 value lines), fixed speed compressors

Text on image

(1)	Compressor Outlet
(2)	Load Relay (one of the input signals of fixed speed compressors)
(3)	Off , Shutdown , ... (text varies upon the compressors actual condition)
(4)	Menu

(5)	Running Hours
(6)	Element Outlet

- **Section A** shows information regarding the compressor operation (e.g. the outlet pressure or thetemperature at the compressor outlet).
- **Section B** shows Status icons. Following icon types are shown in this field:
  - Fixed icons
    These icons are always shown in the main screen and cannot be selected by the cursor (e.g. compressor stopped or running, compressor status (running, running unloaded or motor stopped)).
  - Optional icons
    These icons are only shown if their corresponding function is activated (e.g. week timer, automatic restart after voltage failure , etc.)
  - Pop up icons
    These icons pop up if an abnormal condition occurs (warnings, shutdowns, service, ...)

  To call up more information about the icons shown, select the icon concerned using the scroll keys and press the enter key.
- **Section C** is called the Status bar
  This bar shows the text that corresponds to the selected icon.
- **Section D** shows the Action buttons. These buttons are used:
  - To call up or program settings
  - To reset a motor overload, service message or emergency stop
  - To have access to all data collected by the regulator

  The function of the buttons depends on the displayed menu. The most common functions are:

Designation	Function
Menu	To go to the menu
Modify	To modify programmable settings
Reset	To reset a timer or message

To activate an action button, highlight the button by using the Scroll keys and press the Enter key.
To go back to the previous menu, press the Escape key.

Chart views

Instead of viewing values, it is also possible to view a graph of one of the input signals (see section Inputs menu) in function of the time.

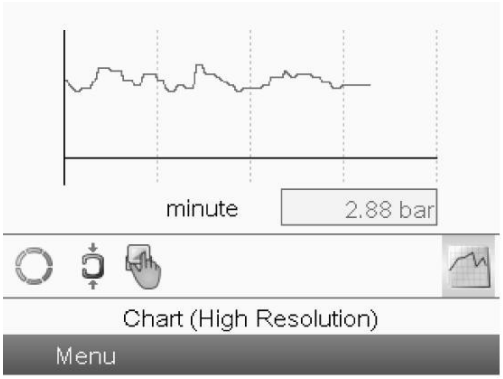


Figure 28

When Chart (High Resolution) is selected, the chart shows the variation of the selected input (in this case the pressure) per minute. Also the instantaneous value is displayed. The screen shows the last 4 minutes.

The switch button (icon) for selecting other screens is changed into a small Chart and is highlighted (active).

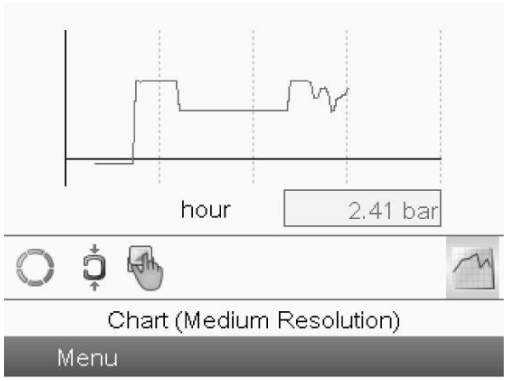


Figure 29

When the Chart (Medium Resolution) is selected, the chart shows the variation of the selected input perhour. The screen shows the last 4 hours.

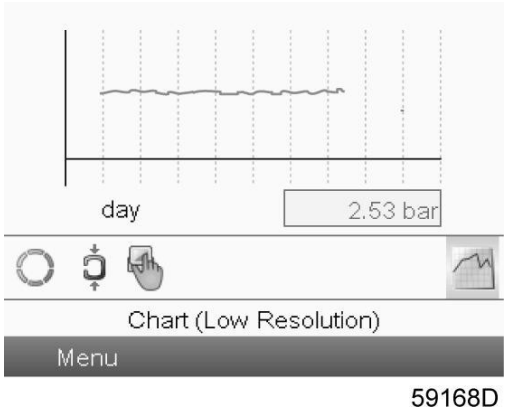


Figure 30

When the Chart (Low Resolution) is selected, the chart shows the variation of the selected input per day.The screen shows the evolution over the last 10 days.

Selection of a main screen view

To change between the different screen layouts, select the far right icon in the control icons line (see value lines display icon or chart display icon in section Icons used) and press the Enter key. A screen similar to the one below opens:

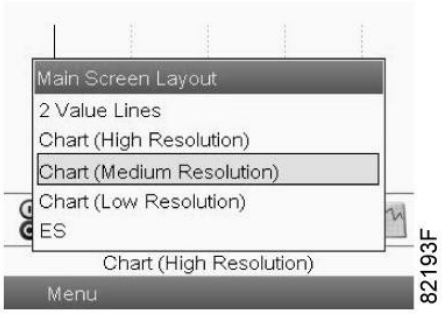


Figure 31

Select the layout required and press the Enter key. See also section Inputs menu.

4.5 Elektronikon® Graphic Calling up menus

Control panel

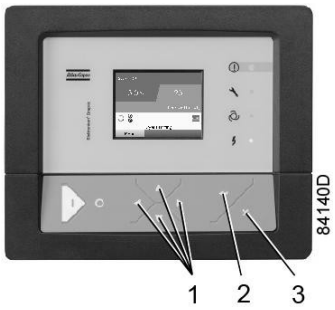


Figure 32 Control panel

(1)	Scroll keys
(2)	Enter key
(3)	Escape key

Description

When the voltage is switched on, the main screen is shown automatically (see section Main screen):

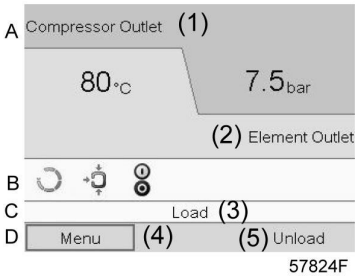


Figure 33 Typical Main screen (2 value lines), fixed speed compressors

Text on image

(1)	Compressor Outlet
(2)	Element Outlet
(3)	Load , shutdown ,.. (text varies upon the compressors actual condition).
(4)	Menu
(5)	Unload ,ES, ... (text varies upon the compressors actual condition

To go to the Menu screen, highlight Menu, using the Scroll keys.

- Press the Enter key to select the menu. Following screen appears:

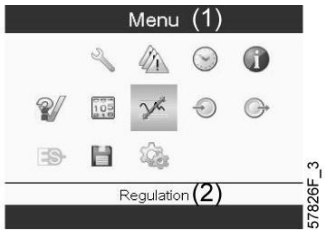


Figure 34 Typical menu screen

- The screen shows a number of icons. Each icon indicates a menu item. By default, the Pressure Settings (Regulation) icon is selected. The status bar shows the name of the menu that correspondswith the selected icon.
- Use the Scroll keys to select an icon.
- Press the Escape key to return to the Main screen.

4.6 Elektronikon® Graphic Inputs menu

Menu icon, Inputs

Function

- To display the actual value of the measured data (analog inputs) and the status of the digital inputs(e.g. emergency stop contact, motor overload relay, etc.).
- To select the digital input to be shown on the chart in the main screen.

Procedure

Starting from the main screen,

- Move the cursor to the action button Menu and press the Enter key. Following screen appears:

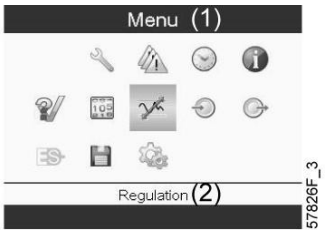


Figure 35

Text on image

(1)	Menu
(2)	Regulation

- Using the Scroll keys, move the cursor to the Inputs icon (see above, section Menu icon).
- Press the Enter key. A screen similar to the one below appears:

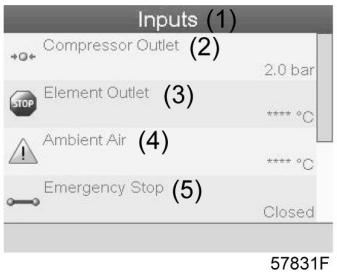


Figure 36

Text on image

(1)	Inputs
(2)	Compressor Outlet
(3)	Element Outlet
(4)	Ambient Air
(5)	Emergency Stop

- The screen shows a list of all inputs with their corresponding icons and readings.
- If an input is in warning or shutdown, the original icon is replaced by the warning or shutdown icon respectively (i.c. the Stop icon and the Warning icon in the screen shown above).

A small chart icon, shown below an item in the list means this input signal is shown on the chart at the main screen. Any analog input can be selected.

Selecting another input signal as main chart signal

With the Modify button active (light grey background in above screen), press the Enter button on the controller. A screen similar to the one below appears:

Figure 37

The first item in the list is highlighted. In this example, the Net Pressure is selected (chart icon).

To change, press the Enter button again: a pop-up window opens:

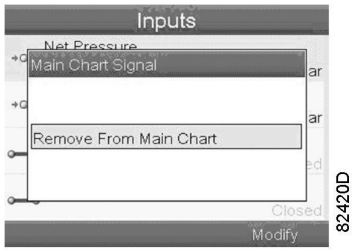


Figure 38

Press Enter again to remove this input from the chart. Another confirmation pop-up opens:

Figure 39

Select Yes to remove or No to quit the current action.

In a similar way, another input signal can be highlighted and selected as Main Chart signal:

Figure 40

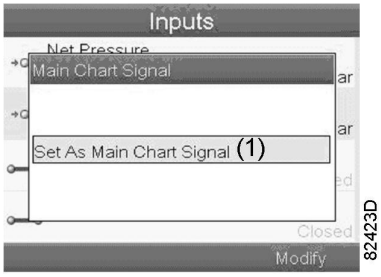


Figure 41

Text on image

(1)	Set as main chart signal

4.7 Elektronikon® Graphic Outputs menu

Menu icon, Outputs

Function

To call up information regarding the actual status of some outputs such as the condition of the Fan overloadcontact (on air cooled compressors), the Emergency stop contact, etc.

Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key. Following screen appears:

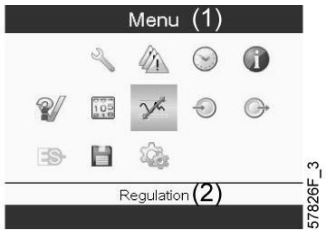


Figure 42

Text on image

(1)	Menu
(2)	Regulation

- Move the cursor to the Outputs icon (see above, section Menu icon, using the Scroll keys.
- Press the Enter key. A screen similar to the one below appears:

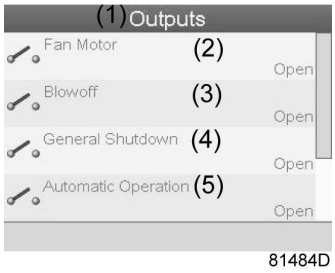


Figure 43 Outputs screen (typical)

Text on image

(1)	Outputs
(2)	Fan motor
(3)	Blowoff
(4)	General shutdown
(5)	Automatic operation

- The screen shows a list of all outputs with their corresponding icons and readings.
  If an output is in warning or shutdown, the original icon is replaced by the warning or shutdown icon respectively.

4.8 Elektronikon® Graphic Counters

Menu icon, Counters

Function

To call up:

- The running hours
- The loaded hours
- The number of motor starts
- The number of hours that the regulator has been powered
- The number of load cycles

Procedure

Starting from the Main screen (see Main screen),

- Move the cursor to the action button Menu and press the Enter key. Following screen appears:

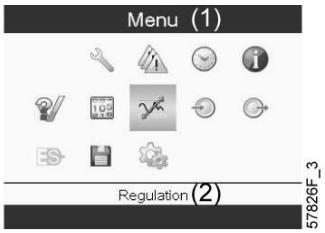


Figure 44

Text on image

(1)	Menu
(2)	Regulation

- Using the Scroll keys, move the cursor to the Counters icon (see above, section Menu icon)
- Press the Enter key. Following screen appears:

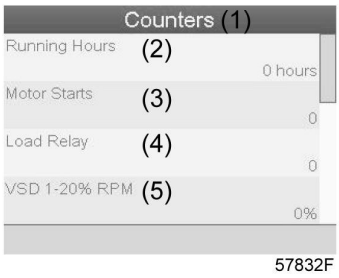


Figure 45

Text on image

(1)	Counters
(2)	Running Hours
(3)	Motor Starts
(4)	Load Relay
(5)	VSD 1-20 % RPM (the percentage of the time during which the motor speed wasbetween 1 and 20 %) (compressors with frequency converter)

The screen shows a list of all counters with their actual readings.

Note: the example above is for a frequency converter driven compressor. For a fixed speed compressor, theactual screen will be somewhat different.

4.9 Elektronikon® Graphic Control mode selection

Control panel

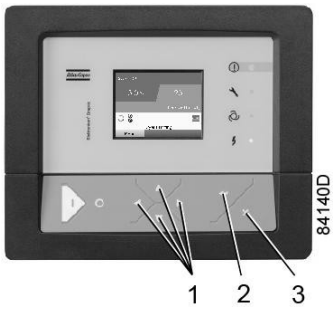


Figure 46

Text on image

(1)	Scroll keys
(2)	Enter key
(3)	Escape key

Function

To select the control mode, i.e. whether the compressor is in local control, remote control or controlled via a local area network (LAN).

Procedure

Starting from the main screen, make sure the button Menu (1) is selected:

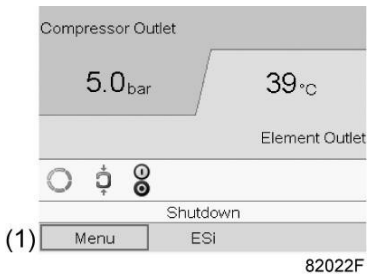


Figure 47

Next, use the scroll buttons to go to the regulation icon (2) and press the Enter button:

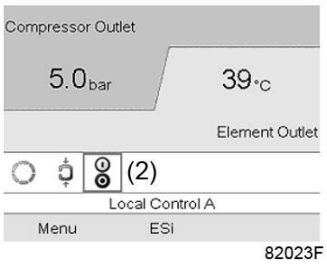


Figure 48

There are 3 possibilities, of which you can select 2 by default:

- Local control
- Remote control (not selectable)
- LAN control (network)

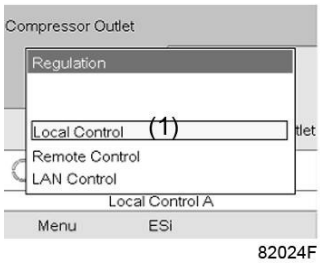


Figure 49

After selecting the required regulation mode, press the enter button on the controller to confirm your selection. The new setting is now visible on the main screen. See section Icons used for the meaning of theicons.

Contact BeaconMedaes to activate remote control.

4.10 Elektronikon® Graphic Service menu

Menu icon, Service

Function

- To reset the service plans which are carried out.
- To check when the next service plans are to be carried out.
- To find out which service plans were carried out in the past.
- To modify the programmed service intervals.

Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key. Following screen appears:

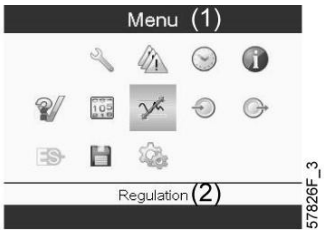


Figure 50

Text on image

(1)	Menu
(2)	Regulation

- Using the Scroll keys, move the cursor to the Service icon (see above, section Menu icon).
- Press the Enter key. Following screen appears:

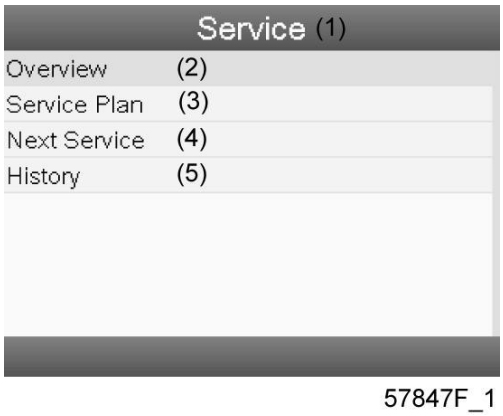


Figure 51

Text on image

(1)	Service
(2)	Overview
(3)	Service Plan
(4)	Next Service
(5)	History

- Scroll through the items to select the desired item and press the Enter key to see the details asexplained below.

Overview

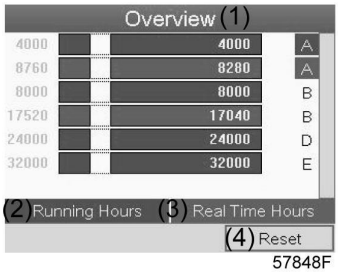


Figure 52

Text on image

(1)	Overview
(2)	Running Hours
(3)	Real Time Hours
(4)	Reset

Example for service level (A):

The figures at the left are the programmed service intervals. For Service interval A, the programmed number of running hours is 4000 hours (upper row) and the programmed number of real time hours is 8760 hours, which corresponds to one year (second row). This means that the controller will launch a service warning when either 4000 running hours or 8760 real hours are reached, whichever comes first. Note that the real time hours counter keeps counting, also when the controller is not powered.

The figures within the bars are the number of hours to go till the next service intervention. In the example above, the compressor was just started up, which means it still has 4000 running hours or 8280 hours to gobefore the next Service intervention.

Service plans

A number of service operations are grouped (called Level A, Level B, etc...). Each level stands for a number of service actions to be carried out at the time intervals programmed in the Elektronikon® controller.

When a service plan interval is reached, a message will appear on the screen.

After carrying out the service actions related to the indicated levels, the timers must be reset. From the Service menu above, select Service plan (3) and press Enter. Following screen appears:

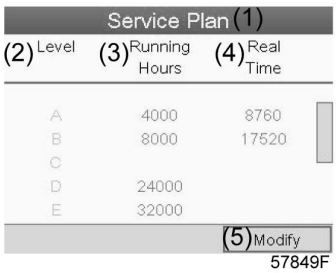


Figure 53

Text on image

(1)	Service Plan
(2)	Level
(3)	Running hours
(4)	Real Time (hours)
(5)	Modify

Modifying a service plan

Dependent on the operating conditions, it can be necessary to modify the service intervals. To do so, usethe Scroll keys to select the value to be modified. A screen similar to the one below appears:

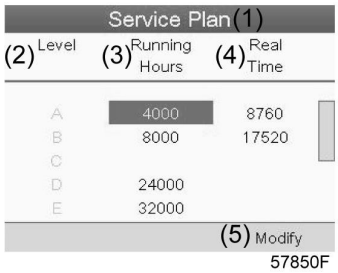


Figure 54

Press the Enter key. Following screen appears:

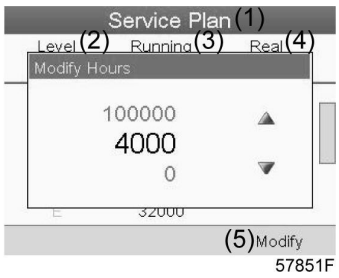


Figure 55

Modify the value as required using the ↑ or ↓ scroll key and press the Enter key to confirm.

Note: Running hours and real time hours can be modified in steps of 100 hours.

Next Service

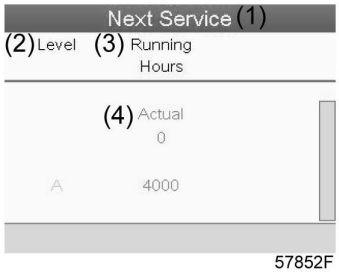


Figure 56

Text on image

(1)	Next service
(2)	Level
(3)	Running Hours
(4)	Actual

In the example above, the A Service level is programmed at 4000 running hours, of which 0 hours have passed.

History

The History screen shows a list of all service actions done in the past, sorted by date. The date at the top is the most recent service action. To see the details of a completed service action (e.g. Service level, Running hours or Real time hours), use the Scroll keys to select the desired action and press the Enter key.

4.11 Elektronikon® Graphic Setpoint menu

Control panel

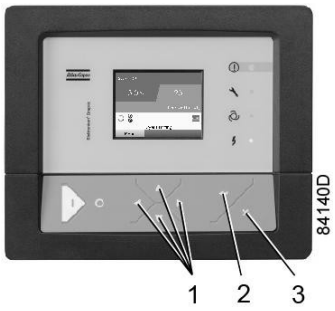


Figure 57

Text on image

(1)	Scroll keys
(2)	Enter key
(3)	Escape key

Menu icon, Setpoint

Function

On fixed speed compressors , the operator can program two different pressure bands. This menu is alsoused to select the active pressure band.

Procedure

Starting from the Main screen (see Main screen),

- Move the cursor to the action button Menu and press the Enter key. Following screen appears:

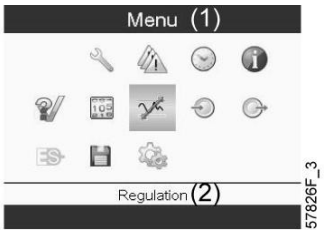


Figure 58

Text on image

(1)	Menu
(2)	Regulation

- Move the cursor to the Setpoint icon (see above, section menu icon) using the Scroll keys.
- Press the Enter key. Following screen appears:

Figure 59

Text on image

(1)	Regulation
(2)	Unloading Pressure 1
(3)	Loading Pressure 1
(4)	Unloading Pressure 2
(5)	Loading Pressure 2
(6)	Modify

- The screen shows the actual unloading and loading pressure settings for both pressure bands. To modify the settings, move the cursor to the action button Modify and press the Enter key.Following screen appears:

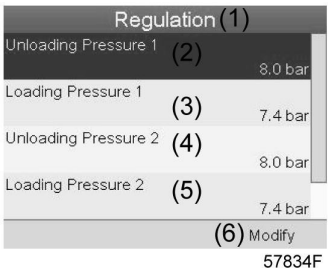


Figure 60

- The first line of the screen is highlighted in red. Use the Scroll keys to highlight the setting to be modified and press the Enter key. Following screen appears:

Figure 61

Text on image

(1)	Regulation
(2)	Unloading Pressure 1
(3)	Modify

- The upper and lower limit of the setting is shown in grey, the actual setting is shown in black. Use the ↑ or ↓ key of the Scroll keys to modify the settings as required and press the Enter key to accept.
  If necessary, change the other settings as required in the same way as described above.

4.12 Elektronikon® Graphic Event history menu

Menu icon, Event History

Function

To call up the last shutdown and last emergency stop data.

Procedure

Starting from the Main screen,

- move the cursor to the action button Menu and press the Enter key. Following screen appears:

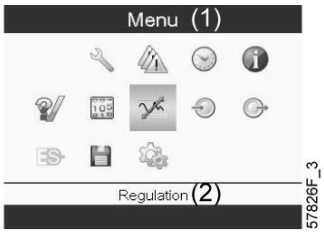


Figure 62

Text on image

(1)	Menu
(2)	Regulation

- Using the Scroll keys, move the cursor to the Event History icon (see above, section Menu icon)
- The list of last shutdown and emergency stop cases is shown.

Figure 63 Example of Event History screen

- Scroll through the items to select the desired shutdown or emergency stop event.
- Press the Enter key to find the date, time and other data reflecting the status of the compressor whenthat shutdown or emergency stop occurred.

4.13 Elektronikon® Graphic Modifying general settings

Menu icon, Settings

Function

To display and modify a number of settings.

Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key. Following screen appears:

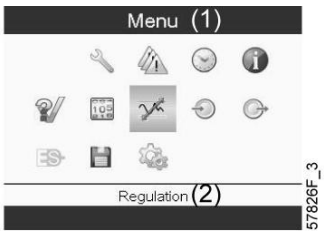


Figure 64

Text on image

(1)	Menu
(2)	Regulation

- Next, move the cursor to the Settings icon (see above, section menu icon), using the Scroll keys.
- Press the Enter key. Following screen appears:

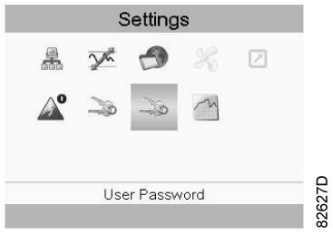


Figure 65

This screen shows again a number of icons. By default, the User Password icon is selected. The status bar shows the description that corresponds with the selected icon. Each icon covers one or more items , such as

- Access key
- User password
- Main chart
- General
- Automatic restart after voltage failure (ARAVF)
- Network
- Regulation

For adapting certain parameters, a password may be necessary.

Example: Selecting the General Settings icon gives the possibility to change e.g. the language, thedate, the date format, etc.:

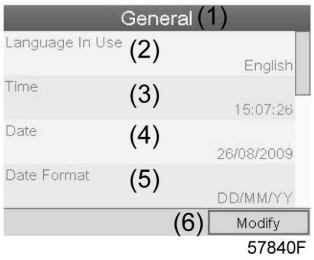


Figure 66

Text on image

(1)	General
(2)	Language in Use
(3)	Time
(4)	Date
(5)	Date Format
(6)	Modify

- To modify, select the Modify button using the Scroll keys and press the Enter key.
- A screen similar to the one above is shown, the first item (Language) is highlighted. Use the ↓ key of the Scroll keys to select the setting to be modified and press the Enter key.
- A pop-up screen appears. Use the ↑ or ↓ key to select the required value and press the Enter key toconfirm.

4.14 Elektronikon® Graphic Info menu

Menu icon, Info

Function

To show the BeaconMedaes internet address.

Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key. Following screen appears:

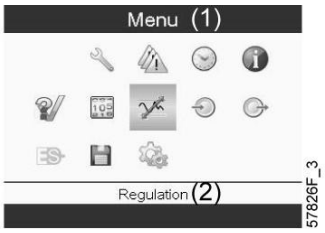


Figure 67

Text on image

(1)	Menu
(2)	Regulation

- Using the Scroll keys, move the cursor to the Info icon (see above, section Menu icon).
- Press the Enter key. The BeaconMedaes internet address appears on the screen.

4.15 Elektronikon® Graphic Week timer menu

Menu icon, Week timer

Function

- To program time based start/stop commands for the compressor
- To program time based changeover commands for the net pressure band
- Four different week schemes can be programmed.
- A week cycle can be programmed, a week cycle is a sequence of 10 weeks. For each week in thecycle, one of the four programmed week schemes can be chosen.

	Important remark: In the Elektronikon you can select different timers on one day (up to 8 actions). It is however not possible to program 2 actions at the same time. The solution: leave at least 1 minute in between 2 actions. Example: Start Compressor: 5.00 AM, Pressure Setpoint 2: 5.01 AM (or later).

Procedure

Starting from the Main screen (see Main screen),

- Move the cursor to the action button Menu and press the Enter key. Use the Scroll buttons to selectthe Timer icon

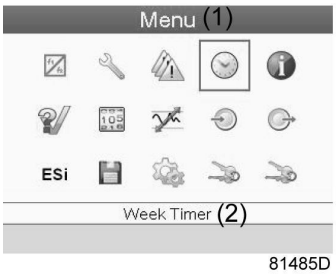


Figure 68

Text on image

(1)	Menu
(2)	Week Timer

- Press the Enter key on the controller. Following screen appears:

Figure 69

Text on image

(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Week Timer Inactive
(6)	Remaining Running Time

The first item in this list is highlighted. Select the item requested and press the Enter key on the controller to modify.

Programming week schemes

- Select Week action schemes and press Enter. A new window opens. The first item in the list ishighlighted. Press the Enter key on the controller to modify Week Action Scheme 1.

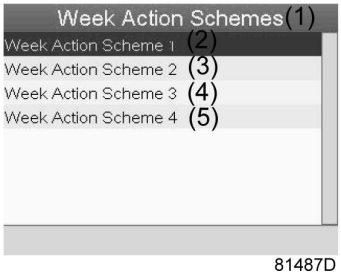


Figure 70

Text on image

(1)	Week Action Schemes
(2)	Week Action Scheme 1
(3)	Week Action Scheme 2
(4)	Week Action Scheme 3
(5)	Week Action Scheme 4

- A weekly list is shown. Monday is automatically selected and highlighted. Press the Enter key on the controller to set an action for this day.

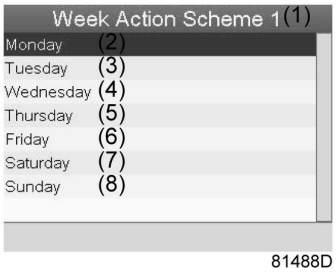


Figure 71

Text on image

(1)	Week Action Scheme 1
(2)	Monday
(3)	Tuesday
(4)	Wednesday
(5)	Thursday
(6)	Friday
(7)	Saturday
(8)	Sunday

- A new window opens. The Modify action button is selected. Press the enter button on the controller to create an action.

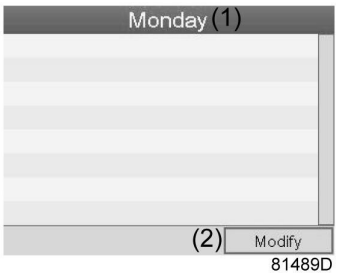


Figure 72

Text on image

(1)	Monday
(2)	Modify

- A new pop-up window opens. Select an action from this list by using the Scroll keys on the controller. When ready press the Enter key to confirm.

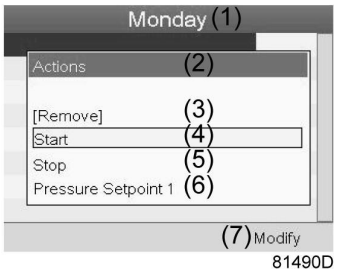


Figure 73

Text on image

(1)	Monday
(2)	Actions
(3)	Remove
(4)	Start
(5)	Stop
(6)	Pressure Setpoint 1
(7)	Modify

- A new window opens. The action is now visible in the first day of the week.

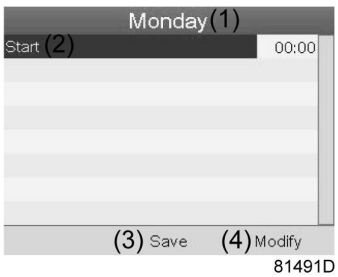


Figure 74

Text on image

(1)	Monday
(2)	Start
(3)	Save
(4)	Modify

- To adjust the time, use the Scroll keys on the controller and press the Enter key to confirm.

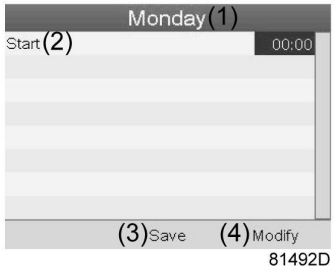


Figure 75

- A pop-up window opens. Use the ↑ or ↓ key of Scroll keys to modify the values of the hours. Use the ← or → Scroll keys to go to the minutes.

Figure 76

- Press the Escape key on the controller. The action button Modify is selected. Use the Scroll keys toselect the action Save.

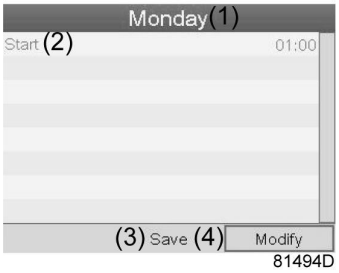


Figure 77

- A new pop-up window opens. Use the Scroll keys on the controller to select the correct actions. Pressthe Enter key to confirm.

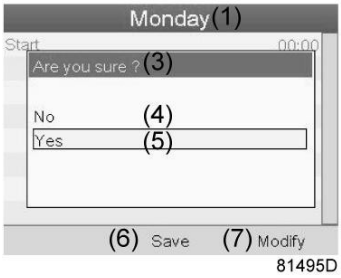


Figure 78

Text on image

(1)	Monday
(3)	Are you sure?
(4)	No
(5)	Yes
(6)	Save
(7)	Modify

- Press the Escape key to leave this window.
- The action is shown below the day the action is planned.

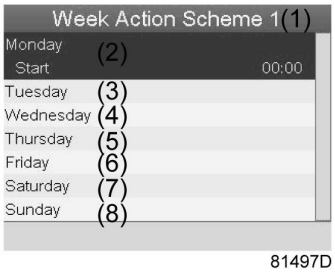


Figure 79

Text on image

(1)	Week Action Scheme 1
(2)	Monday
(3)	Tuesday
(4)	Wednesday
(5)	Thursday
(6)	Friday
(7)	Saturday
(8)	Sunday

Press the Escape key on the controller to leave this screen.

Programming the week cycle

A week cycle is a sequence of 10 weeks. For each week in the cycle, one of the four programmed week schemes can be chosen.

- Select Week Cycle from the main Week Timer menu list.

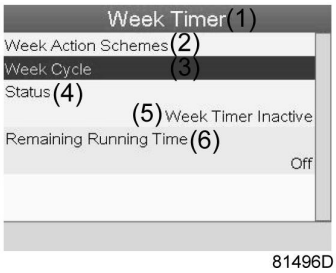


Figure 80

Text on image

(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Week Timer Inactive
(6)	Remaining Running Time

- A list of 10 weeks is shown.

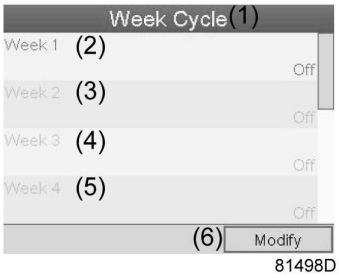


Figure 81

Text on image

(1)	Week Cycle
(2)	Week 1
(3)	Week 2
(4)	Week 3
(5)	Week 4
(6)	Modify

- Press twice the Enter key on the controller to modify the first week.
- A new window opens. Select the action, example: Week Action Scheme 1

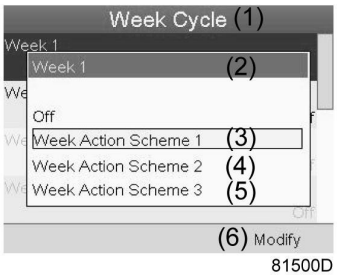


Figure 82

Text on image

(1)	Week Cycle
(2)	Week 1
(3)	Week Action Scheme 1
(4)	Week Action Scheme 2
(5)	Week Action Scheme 3
(6)	Modify

- Check the status of the Week Timer
  Use the Escape key on the controller to go back to the main Week Timer menu. Select the status ofthe Week Timer.

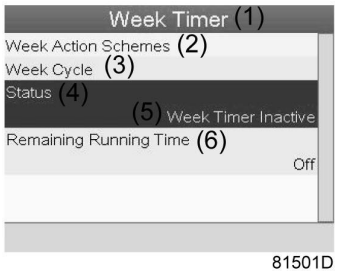


Figure 83

Text on image

(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Week Timer Inactive
(6)	Remaining Running Time

- A new window opens. Select Week 1 to set the Week Timer active.

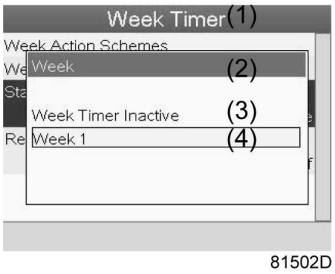


Figure 84

Text on image

(1)	Week Timer
(2)	Week
(3)	Week Timer Inactive
(4)	Week 1

- Press the Escape key on the controller to leave this window. The status shows that week 1 is active.

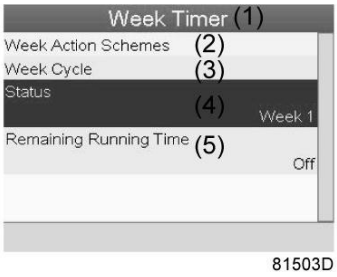


Figure 85

Text on image

(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Remaining Running Time

- Press the Escape key on the controller to go to the main Week Timer menu. Select Remaining Running Time from the list and press the Enter key on the controller to Modify.

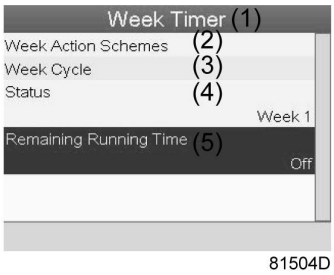


Figure 86

Text on image

(1)	Week Timer
(2)	Week Action Schemes
(3)	Week Cycle
(4)	Status
(5)	Remaining Running Time

- This timer is used when the week timer is set and for certain reasons the compressor must continue working, for example, 1 hour, it can be set in this screen. This timer is prior to the Week Timer action.

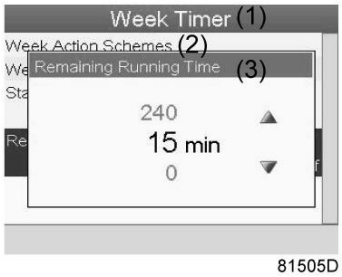


Figure 87

Text on image

(1)	Week Timer
(2)	Week Action Schemes
(3)	Remaining Running Time

4.16 Elektronikon® Graphic Test menu

Menu icon, Test

or

Function

- To carry out a display test, i.e. to check whether the display and LED's are still intact.

Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the enter key (2), following screen appears:

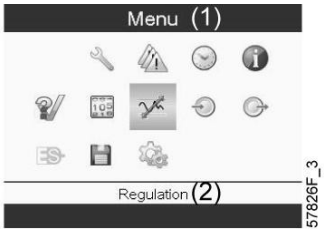


Figure 88

- Using the scroll keys (1), move the cursor to the test icon (see above, section Menu icon)
- Press the enter key (2), following screen appears:

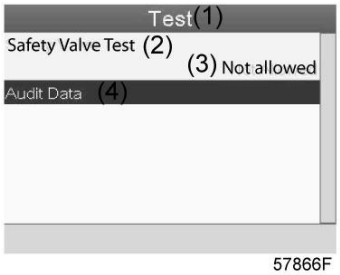


Figure 89

Text on image

(1)	Test
(2)	Safety Valve Test
(3)	Not allowed
(4)	Audit Data

- The safety valve test can only be performed by authorized personnel and is protected by a securitycode.
- Select the item display test and press the enter key. A screen is shown to inspect the display, at thesame time all LED's are lit.

4.17 Elektronikon® Graphic User password menu

Control panel

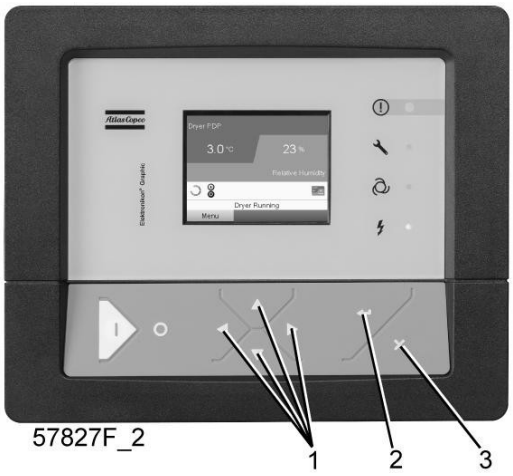


Figure 90

Text on image

(1)	Scroll keys
(2)	Enter key
(3)	Escape key

Menu icon, Password

Function

If the password option is activated, it is impossible for not authorized persons to modify any setting.

Procedure

Starting from the Main screen (see Main screen),

- Move the cursor to <Menu> and press the Enter key (2). Following screen appears:

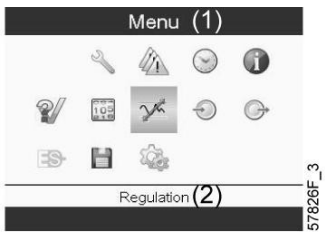


Figure 91

- Using the Scroll keys, select the <Settings> icon (see section Modifying general settings)
- Press the Enter key. Following screen appears:

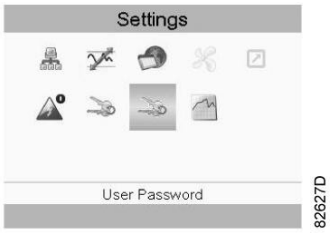


Figure 92

- Move the cursor to the Password icon (see above, section Menu icon)
- Select <Modify> using the Scroll keys and press the Enter key. Next, modify the password as required.

4.18 Elektronikon® Graphic Web server

All controllers have a built-in web server that allows direct connection to the company network or to a dedicated PC via a local area network (LAN). This allows to consult certain data and settings via a PC instead of the display of the controller.

Getting started

Make sure you are logged in as administrator.

- Use the internal network card from your computer or a USB to LAN adapter.
- Use a UTP cable (CAT 5e) to connect to the controller (see picture below).

Configuration of the network card

- Go to Network and Sharing Center (1).

Figure 93

- Click on Change adapter settings (1).

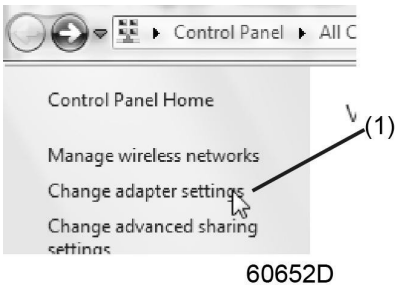


Figure 94

- Select the Local Area Connection, which is connected to the controller.

Figure 95

- Click with the right button and select Properties (1).

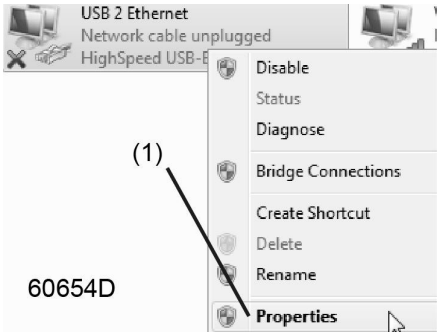


Figure 96

- Use the check box Internet Protocol version +4 (TCP/IPv4) (1) (see picture). To avoid conflicts, uncheck other properties if they are checked. After selecting TCP/IPv4, click on the Properties button (1) to change the settings.

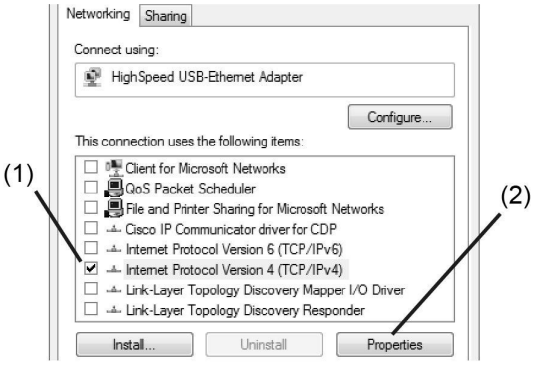


Figure 97

- Use the following settings:
  - IP Address 192.168.100.200 (1)
  - Subnetmask 255.255.255.0 (2)

  Click OK (3) and close network connections.

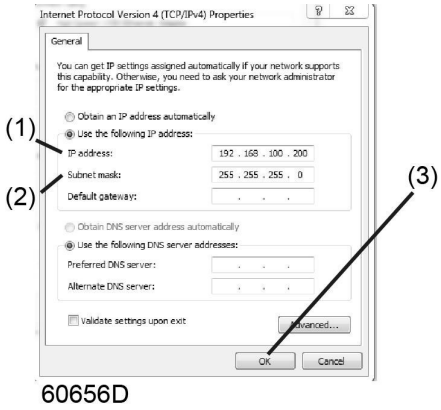


Figure 98

Configure a company network (LAN) connection

- Ask your IT department to generate a fixed IP address in your company's network.
- That IP address will be excluded from the DNS server, so it will be reserved for the Elektronikon Mk5.
- Also get the correct Gateway and Subnet mask settings. For example:
  - IP = 10.25.43.200
  - Gateway = 10.25.42.250
  - Subnet mask = 255.255.254.0
- Connect your Elektronikon Mk5 to the company's network (LAN) by using a UTP cable (min. CAT 5e).

- Adapt the network settings in the Elektronikon Mk5:
  - Go to Main Menu

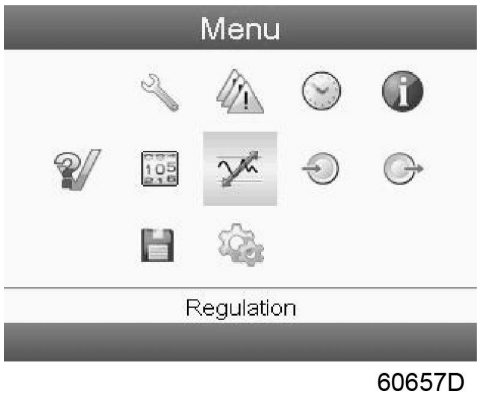


Figure 99

  - Go to Settings (1)

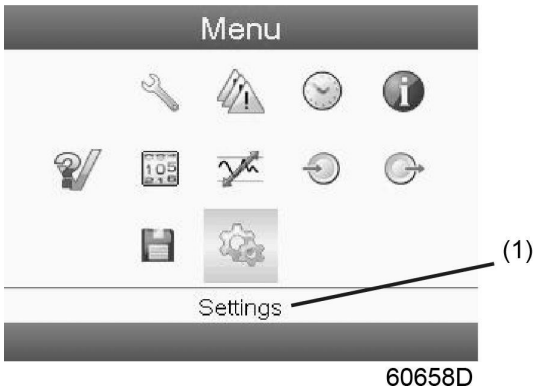


Figure 100

- Go to Network (1)

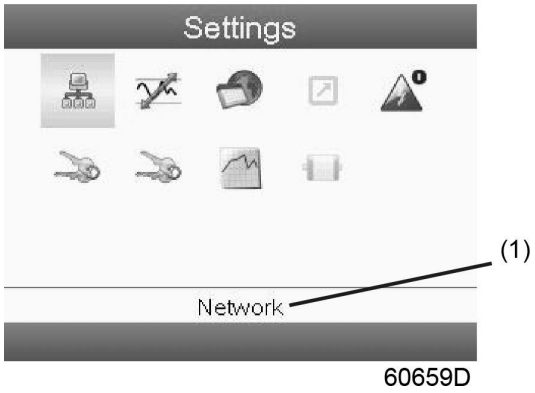


Figure 101

- Go to Ethernet (1)

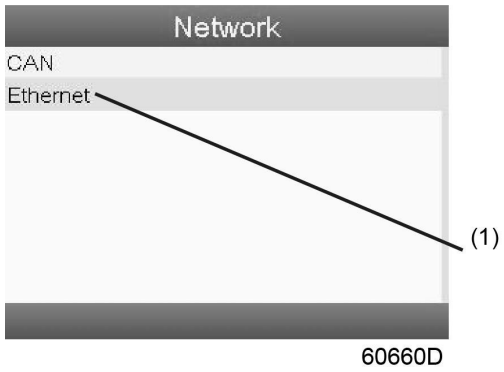


Figure 102

- Switch Off (1) the Ethernet communication to allow editing the settings

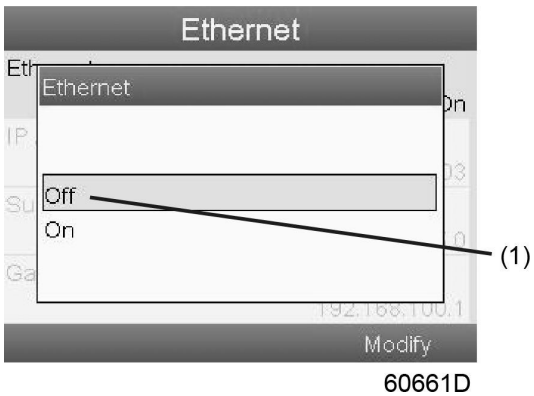


Figure 103

- Adapt IP Address (1)
- Adapt Gateway IP (2)
- Adapt Subnet Mask (3)
- Switch On (4) the Ethernet communication

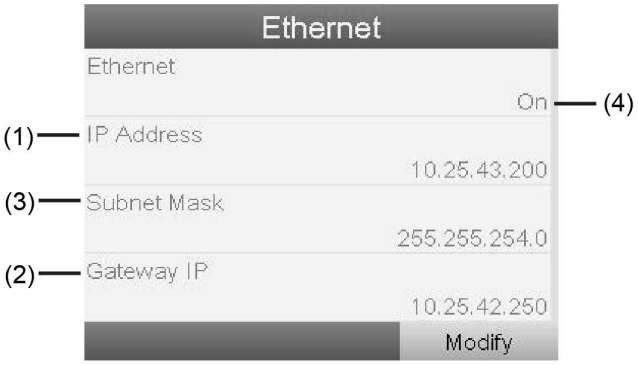


Figure 104

- Wait a few minutes so the LAN network can connect to the Elektronikon Mk5

Configuration of the web server

The internal web server is designed and tested for Microsoft® Internet Explorer.Also **"Opera", "Mozilla Firefox", "Safari"**and **"Chrome"** should work.

Viewing the controller data

	All screen shots are indicative. The number of displayed fields depends on the selected options.

- Open your browser and type the IP address of the controller you want to view in your browser (in this example http://192.168.100.100). The interface opens:

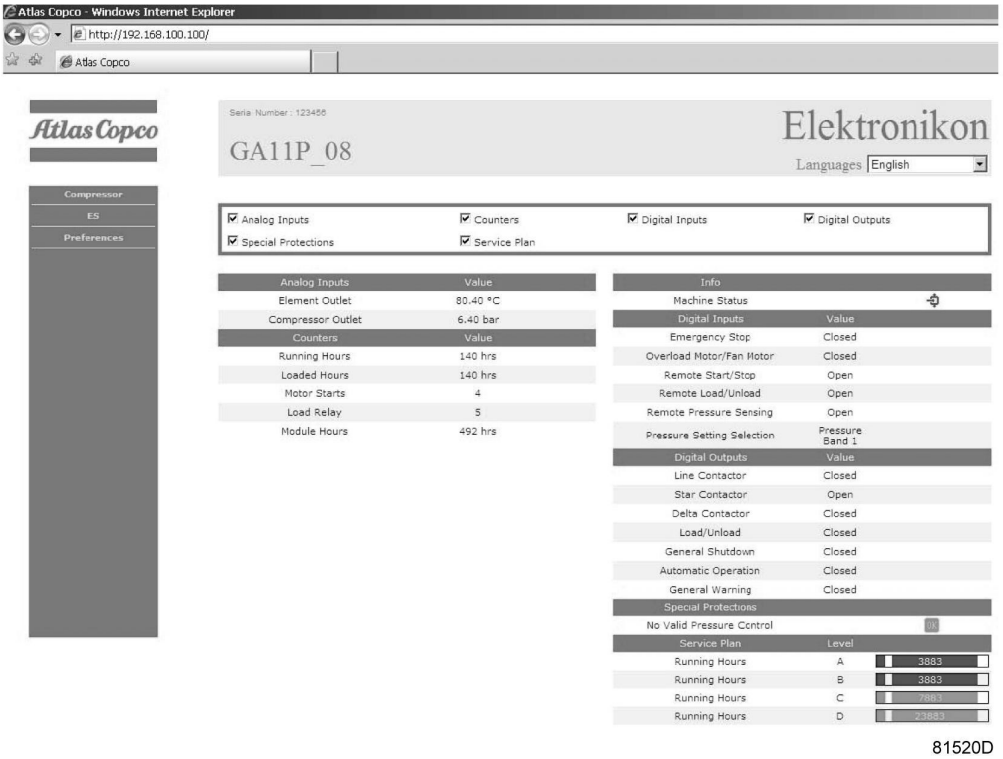


Figure 105 Screen shot (example)

Navigation and options

- The banner shows the unit type and the language selector. In this example, three languages areavailable on the controller.

Figure 106

- On the left side of the interface, you can find the navigation menu.
  If a license for ESi is foreseen, the menu contains 3 buttons.
  - Machine: shows all generator settings.
  - ES: shows the ESi status (if a license is provided).
  - Preferences: allows to change temperature and pressure unit.

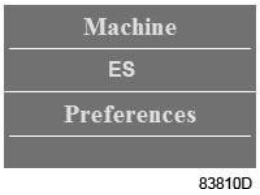


Figure 107

Unit settings

All unit settings can be displayed or hidden. Put a check mark in front of each point of interest and it will be displayed. Only the machine status is fixed and can not be removed from the main screen.

Analog inputs

Lists all current analog input values. The measurement units can be changed in the preference button fromthe navigation menu.

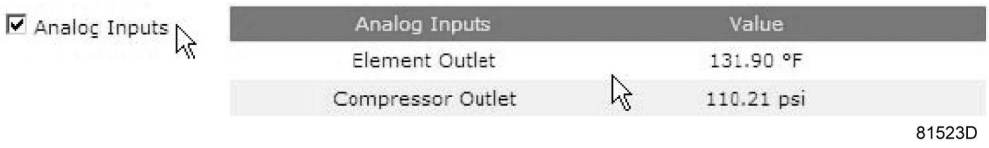


Figure 108

Counters

Lists all current counter values from controller and unit.

Figure 109

Info status

Machine status is always shown on the web interface.

Figure 110

Digital inputs

Lists all digital inputs and their status.

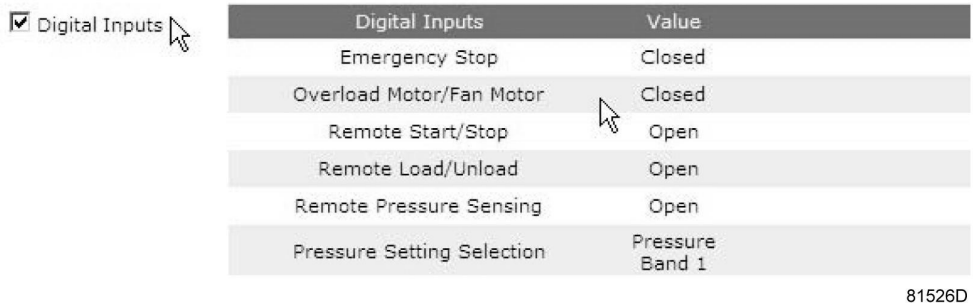


Figure 111

Digital outputs

Lists all digital outputs and their status.

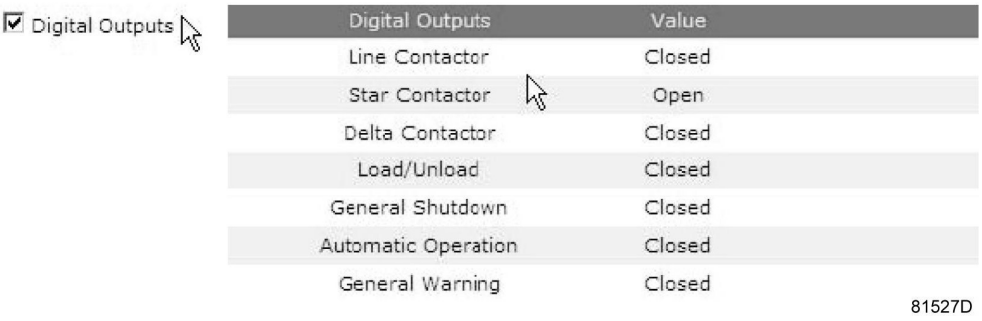


Figure 112

Special protections

Lists all special protections of the unit.

Figure 113

Service plan

Displays all levels of the service plan and their status. This screen shot underneath only shows the runninghours. It is also possible to show the current status of the service interval.

Figure 114

4.19 Compressor Programmable settings

Parameters: unloading/loading pressures for compressors

		Minimum setting	Factory setting	Maximum setting
Unloading pressures				
Unloading pressure (10 bar compressors)	bar(e)	4.1	9.5	10
Unloading pressure (10 bar compressors)	psig	59.5	137.8	145.0
Unloading pressure (13 bar compressors)	bar(e)	4.1	12.5	13
Unloading pressure (13 bar compressors)	psig	59.5	181.3	188.6
Loading pressures				
Loading pressure (10 bar compressors)	bar(e)	4	8.9	9.9
Loading pressure (10 bar compressors)	psig	58	129.1	143.6
Loading pressure (13 bar compressors)	bar(e)	4	11.9	12.9
Loading pressure (13 bar compressors)	psig	58	172.6	187.1

Parameters

		Minimum setting	Factory setting	Maximum setting
Motor running time in star	sec	5	10	10
Load delay time (star-delta)	sec	0	0	10
Number of motor starts	starts/day	0	240	240
Minimum stop time	sec	0	20	30
Programmed stop time	sec	0	3	20
Power recovery time (ARAVF)	sec	20	20	3600
Restart delay	sec	0	0	1200
Communication time-out	sec	10	30	60

Protections

		Minimum setting	Factory setting	Maximum setting
Compressor element outlet temperature (Shutdown warning level)	˚C	50	110	119
Compressor element outlet temperature (Shutdown warning level)	˚F	122	230	246
Compressor element outlet temperature (Shutdown level)	˚C	111	120	120
Compressor element outlet temperature (Shutdown level)	˚F	232	248	248

Service plan

The built-in service timers will give a Service warning message after their respective preprogrammed time interval has elapsed.

Also see section Preventive maintenance schedule.

Consult BeaconMedaes if a timer setting has to be changed. The intervals must not exceed the nominalintervals and must coincide logically. See section Modifying general settings.

Terminology

Term	Explanation
ARAVF	Automatic Restart After Voltage Failure. See section Elektronikon regulator.
Power recovery time	Is the period within which the voltage must be restored to have an automatic restart. Is accessible if the automatic restart is activated.
Restart delay	This parameter allows to programme that not all compressors are restarted at the same time after a power failure (ARAVF active).
Compressor element outlet	The recommended minimum setting is 70 ˚C (158 ˚F). For testing the temperature sensor the setting can be decreased to 50 ˚C (122 ˚F). Reset the value after testing. The regulator does not accept illogical settings, e.g. if the warning level is programmed at 95 ˚C (203 ˚F), the minimum limit for the shut-down level changes to 96 ˚C (204 ˚F). The recommended difference between the warning level and shut-down level is 10 ˚C (18 ˚F).
Delay at shut-down signal	Is the time for which the signal must exist before the compressor is shut down. If it is required to program this setting to another value, consult BeaconMedaes.
Oil separator	Use only Atlas Copco oil separators. The recommended maximum pressure drop over the oil separator element is 1 bar (15 psi).
Minimum stop time	Once the compressor has automatically stopped, it will remain stopped for the minimumstop time, whatever happens with the net air pressure. Consult BeaconMedaes if a setting lower than 20 seconds is required.
Unloading/ Loading pressure	The regulator does not accept inconsistent settings, e.g. if the unloading pressure is programmed at 7.0 bar(e) (101 psi(g)), the maximum limit for the loading pressure changes to 6.9 bar(e) (100 psi(g)). The recommended minimum pressure difference between loading and unloading is 0.6 bar (9 psi(g)).

5. Installation

5.1 Dimension drawings

The dimension drawings are available in pdf format.

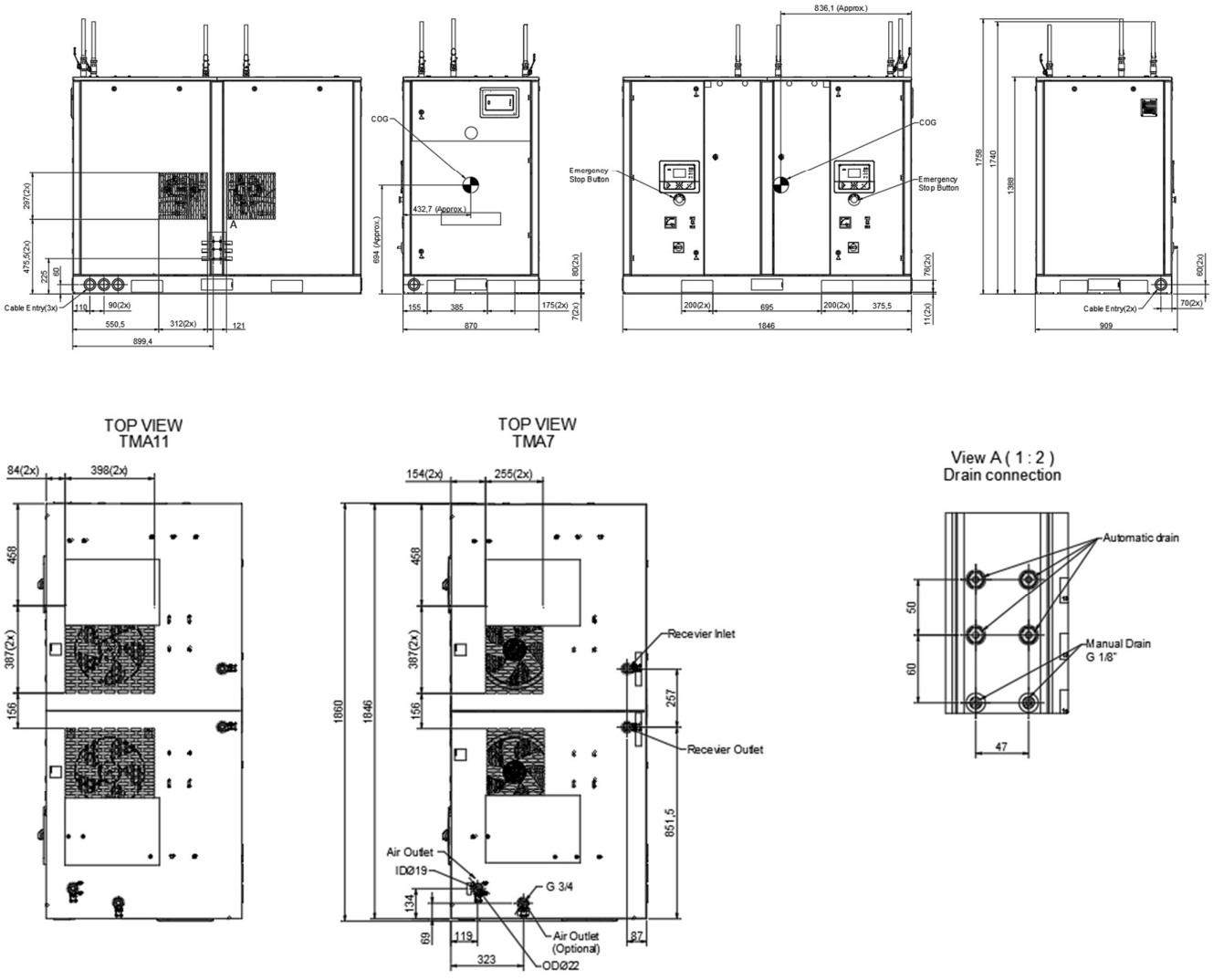


Figure 115

5.2 Installation proposal

Moving/lifting

The Medical Air Supply System can be moved by a lift truck using the slots in the frame. Make sure that the forks protrudefrom the other side of the frame. The Medical Air Supply System can also be lifted after inserting beams in the slot. Make sure that the beams cannot slide and that they protrude from the frame equally. The chains must be held parallel to the bodywork by chain spreaders in order not to damage the compressor. The lifting equipment must be placed in such way that the Medical Air Supply system is lifted perpendicularly. Lift gently and avoid twisting.

General instructions

Installation of Medical Air Supply System must be carried out by suitably qualified and competent personnel who fully understand the standards required when working on a piped medical gas distribution system and are conversant with the information contained in this instruction book and the instruction books of the separate components. Installation must be carried out strictly in accordance with the specific installation proposal and service diagram issued with the plant.

The Medical Air Supply System must be installed within a plant room which provides adequate ventilation for the cooling of electric motors, bearing in mind that approximately 75% of all energy consumed is dissipated into the plant room as heat energy. At least 609 mm must be allowed between the plant and any walls or other obstructions and additional headroom is required to enable installation. Specific plant dimensions must be taken into account especially where access is limited. Install the units in an area where the noise levels do not cause an inconvenience.

The intake of the air of the plant for the compressors should be taken from sources free of possible contamination such as combustion engines exhausts, chimneys, garbage belts or containers, loading/unloading docks of trucks, areas where trucks or cars frequently stand still, air conditioning or refrigerating equipment using HCFC (chlorinated hydrocarbons, freon, ...), air conditioning air outlet or e.g. surgery room air extraction equipment, etc.

- Consult section Safety precautions during installation.
- The compressor is designed for indoor installation. Avoid installation outdoor (rain).
- Install the compressor where the air is as cool and clean as possible. Avoid ambient temperatures above 40°C. Consult section Reference conditions and limitations.
- Allow sufficient space around the compressor for maintenance (see below).
- If the compressor is installed in an enclosed room, ventilation is to be provided (see below for details).
- **All piping must be connected stress free to the compressor.** Provide adequate support to the pipes.
- When more than 2 compressors are connected to one pipe, please install a check valvefor each compressor downstream of pipe. The valve should be active when compressorstops. The pipe should have a slope towards the direction of the air flow to prevent condensation remains in the pipe.
- Floor mounted compressors must be connected to an air receiver to prevent too frequent loading and unloading of the compressor. If a dryer is installed, the dryer should be installed downstream of the receiver.

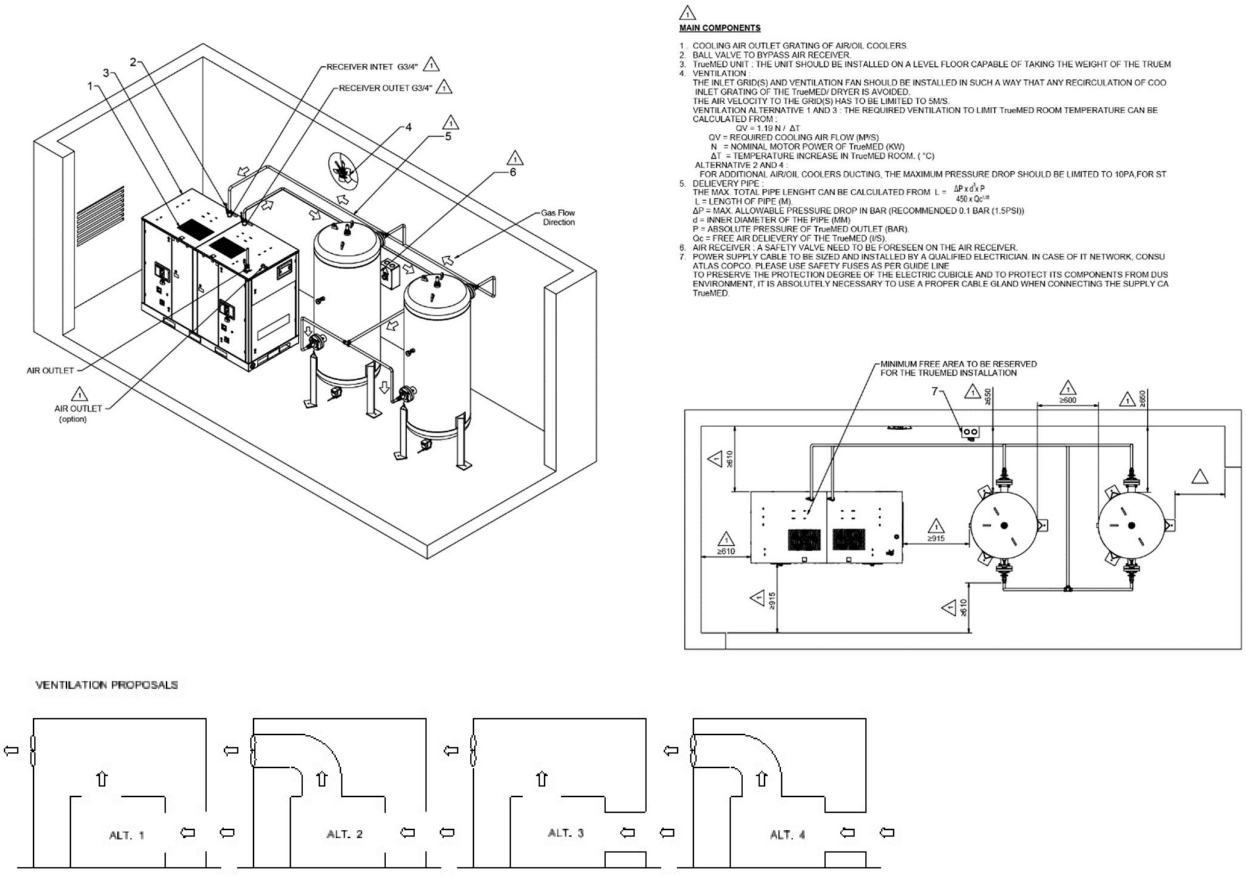


Figure 116 Installation proposal

1. Cooling air outlet grating of air/oil coolers
2. Ball valve to bypass air receiver delivery pipe
3. TMA compressor unit:

   Install the unit on a level floor, capable of taking the weight of the compressor.
   The recommended minimum distance between top of unit and ceiling is 900 mm. Stated distances between units and walls are minimum. A distance of 609 mm between the compressor and the wall is the minimum. 800 mm is recommended for easy access.

4. Ventilation:

   The inlet grids and ventilation fan should be installed in such a way that any recirculation of cooling air to the compressor is avoided. The maximum air velocity through the grids is 5 m/s (16.5 ft/s). The maximum air temperature at the compressor intake is 46 °C (115 °F), (minimum 0 °C / 32 °F).
   Ventilation alternative 1:
   The required ventilation to limit compressor can be calculated from:
   Q_v = 1.06 N / ΔT for Pack units
   Q_v = (1.06 N + 1.2)/ ΔT for Full Feature units
   Q_v = required cooling air flow in m^3/s
   N = Nominal motor power of the compressor in kW
   ΔT = Temperature increases in the compressor room in °C
   Ventilation alternative 2:
   The fan capacity should match the compressor fan capacity at a pressure head equal to the pressure drop caused by cooling air ducts. The ducting for the cooling air outlet of the dryer (4b) also shouldbe separated from the ducting for the cooling air outlet of compressor (4a).
   The maximum allowable pressure drops in ducting before or after the compressor is 30 Pa.

5. Delivery pipe:

   The pressure drop over the air pipes can be calculated from:
   $\Delta p = (L \times 450 \times Q_c^{1.85}) / (d^5 \times P)$, with d
   = Inner diameter of the pipe in mm
   Δp = Pressure drops in bar (recommended maximum: 0.1 bar (1.5 psi))
   L = Length of the pipe in m
   P = Absolute pressure at the compressor outlet in barQc = air flow in l/s

6. Air receiver: A safety valve and drain need to be foreseen on the air receiver.
7. Main cable entry:

   To preserve the protection degree of the electric cubicle and to protect its components from dust from the environment, it is absolutely necessary to use a proper cable gland when connecting the power supply cable to the compressor.

5.3 Mechanical Installation

1. Please take into account the recommendations as explained in the instruction books of the components, e.g. regarding removing of transport protections, placement and ventilation ducting.
2. Remove any transportation protection caps from pipes. Check that no ingress has occurred, if necessary clean the pipes.
3. Mount each connection kit, supplied in a box with every Medical Air Supply system to the Medical Air Supply system outlet pipe.
4. Mount the air receiver connection kits if fitted, supplied in a separate box, to each air receiver.
5. Connect piping between the units according to the installation proposal. Clean the piping network before brazing. All pipes must be secured to give added stability.

5.4 Electrical connections

⚠	Always disconnect the power supply before working on the electrical circuit! Use the hole for the supply cable (section Dimension drawings, item 5). Use a suitablecable gland to protect the cable against mechanical damage and to prevent dust entering the electric cubicle.

Instructions

Consult the service diagrams (inside the cubicles) and verify the motor data plates. Ensure that the power supply is off and correctly isolated before connecting to the cubicles. All wiring must be in accordance with IEE regulations. Cable sizes and fuses given in the respective chapters of the instruction books are recommendations, all cable sizes and protective devices must be sized by a qualified electrician. The Medical Air Supply system requires a separate power supply for each compressor, preferably from an essential circuit, and requires a 400V AC supply to the central controller cubicle. Check that the central controller power LED is lit, and the controller screen is operational when the supply voltage is connected.

Step	Action
1	Ensure that the supply voltage matches the voltage on the data plate.
2	Install an isolating switch near the compressor and provide fuses in the supply line.
3	Connect the power supply cables to L1, L2 and L3 and connect the Neutral conductor (ifapplicable) to the appropriate connector (N). Connect the earth connector to bolt (PE). More details can be found on the Service diagram, included in the electric cubicle.

5.5 Pictographs

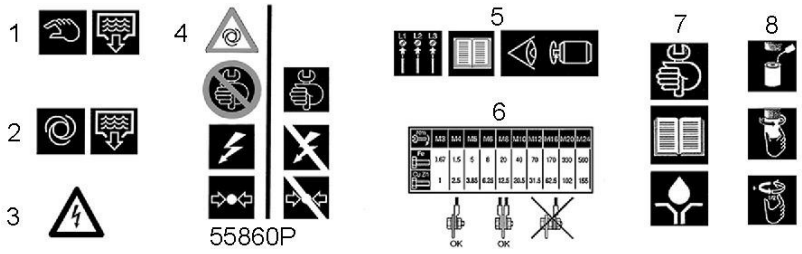


Figure 117 Pictographs

Reference	Designation
1	Manual condensate drain
2	Automatic condensate drain
3	Warning: voltage
4	Warning: switch off the voltage and depressurize compressor before repairing
5	Warning: before connecting compressor electrically, consult Instruction book for motorrotation direction
6	Torques for steel (Fe) or brass (CuZn) bolts
7	Consult instruction book before replacing the oil
8	Lightly oil gasket of oil filter, screw it on and tighten by hand (approx. half a turn)

6. Operating instructions

Introduction

Commissioning of a Medical Air Supply System must be carried out strictly in accordance with the following procedures, which are designed to ensure that the installation is correct and ensure that the Medical Air Supply System operates correctly. The full commissioning procedure must be carried out after the installation before the system is brought into use. The relevant sections of the commissioning procedure must be repeated after major component replacement or whenever the plant operation or performance is suspect. Commissioning must only be undertaken by suitably qualified and competent personnel who are fully conversant with the information contained in this manual. It is recommended that for a full commissioning procedure, the following paragraphs are carried out in strict sequence. This ensures that at each step the plant is correctly set for the next procedure.

Where applicable, a work permit must be obtained before commencing any work on the Medical Air Supply System.
These procedures are designed in accordance with EN ISO 7396-1 (e.g. integrity of the pipeline installation, check system design performance and functionally test all components).

6.1 Starting and stopping

Safety

	The operator must apply all relevant Safety precautions.

Initial start-up

- Consult the installation instructions (see section Installation proposal).
  Remove red spacer and bolt(s) "A" (transport fixture).

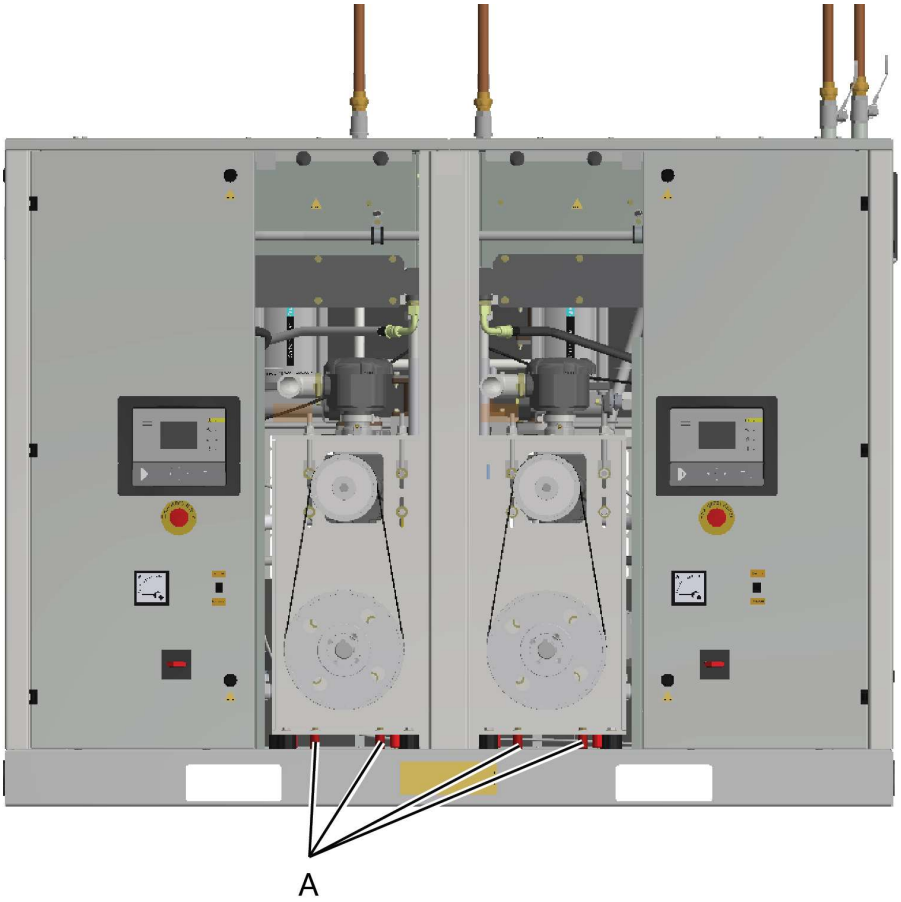


Figure 118

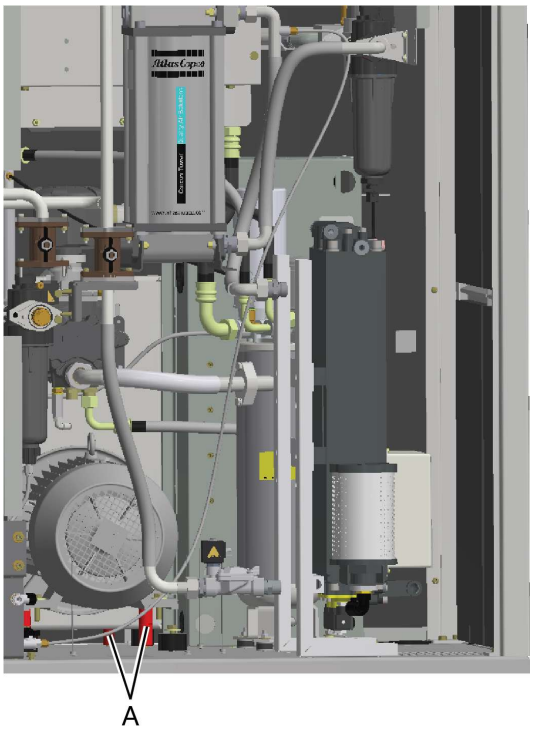


Figure 119

- Before starting, check the oil level.

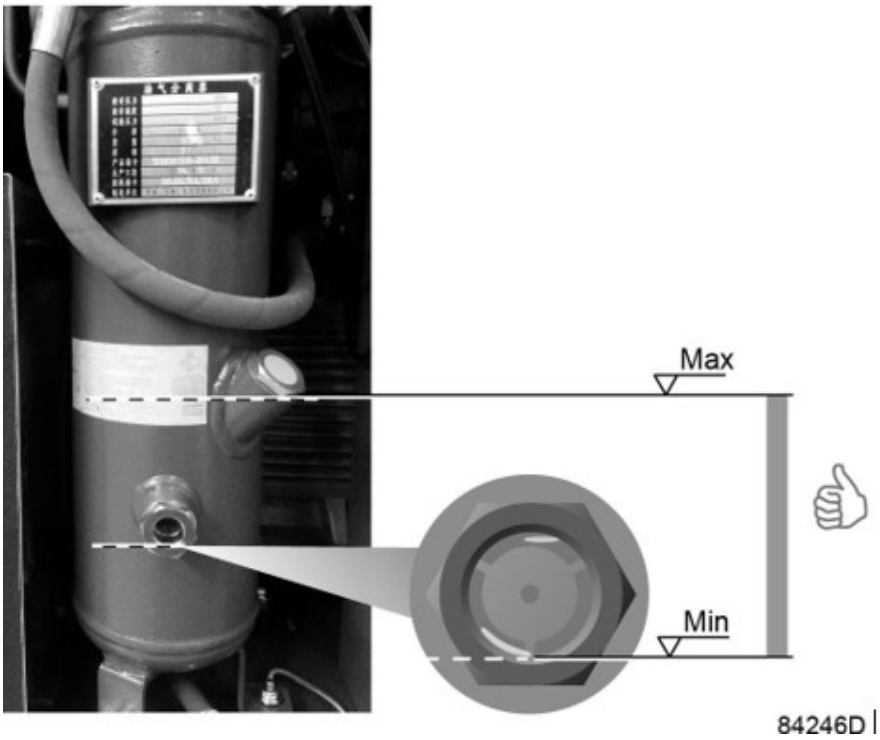


Figure 120

- Check the receiver ball valve

Figure 121

With receiver

Ball valve type	State
Main outlet ball valve	Open
Receiver ball valve	Open

Without receiver

Ball valve type	State
Main outlet ball valve	Open
Receiver ball valve	Close

- Check the block ball valve

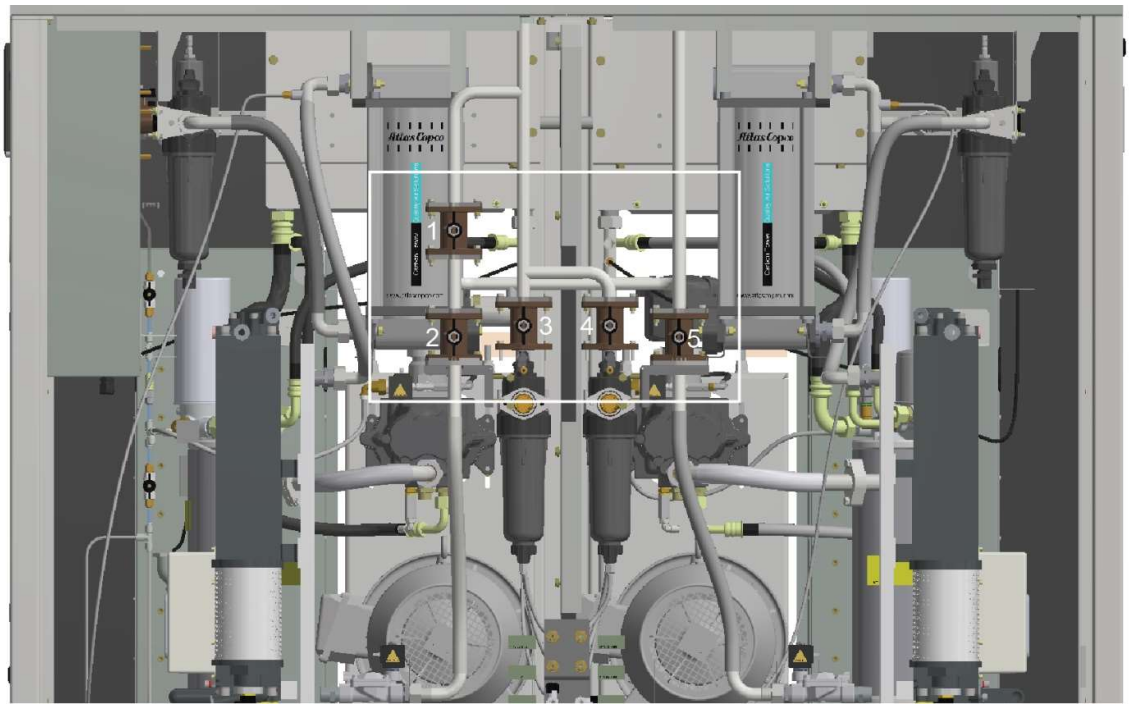


Figure 122

With receiver

Ball valve No	State
(1)	Close
(2)	Open
(3)	Open
(4)	Open
(5)	Open

Without receiver

Ball valve No	State
(1)	Open
(2)	Open
(3)	Open
(4)	Open
(5)	Open

- Connect the 400V/50Hz power to the central control's cubicle's terminal L1, L2, L3, PE; and to the two sub control cubicle's S10 T1/T2/T3 terminals and PE bolts.

  Switch on the voltage.

Figure 123

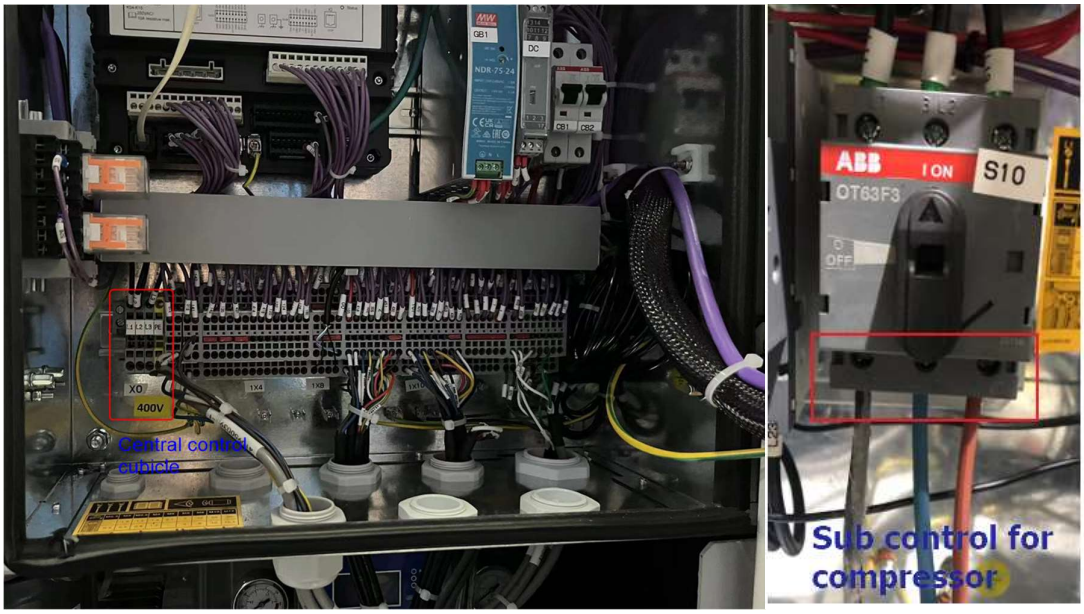


Figure 124

- Wait for initialization. Check the data displayed on the main interface of central controller.
  The screen is on and displays normally. The main interface shows that the analog signals is normal.

Figure 125

- Click the icon as below;

Figure 126

- Click “ECO”, and enter password

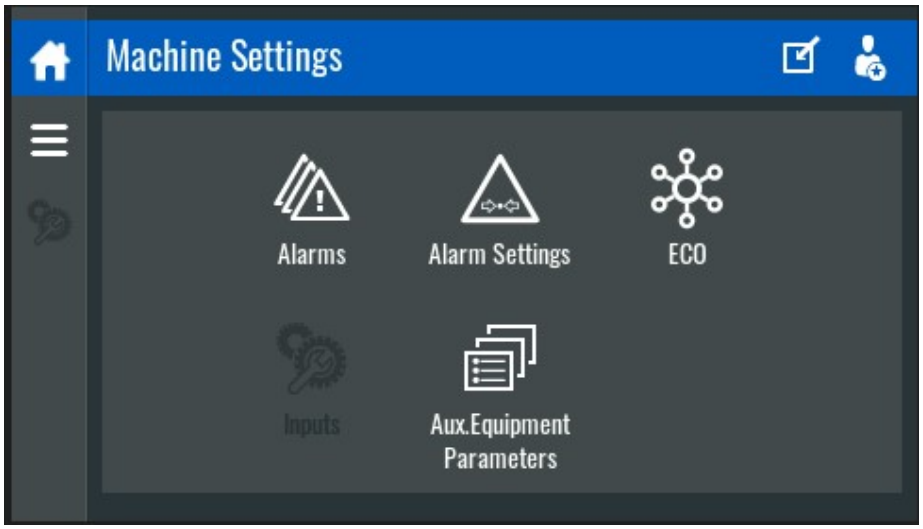


Figure 127

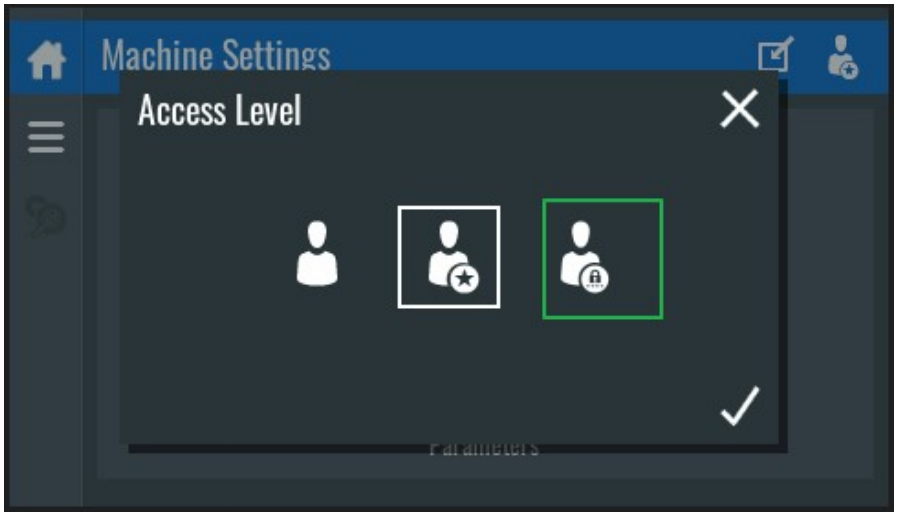


Figure 128

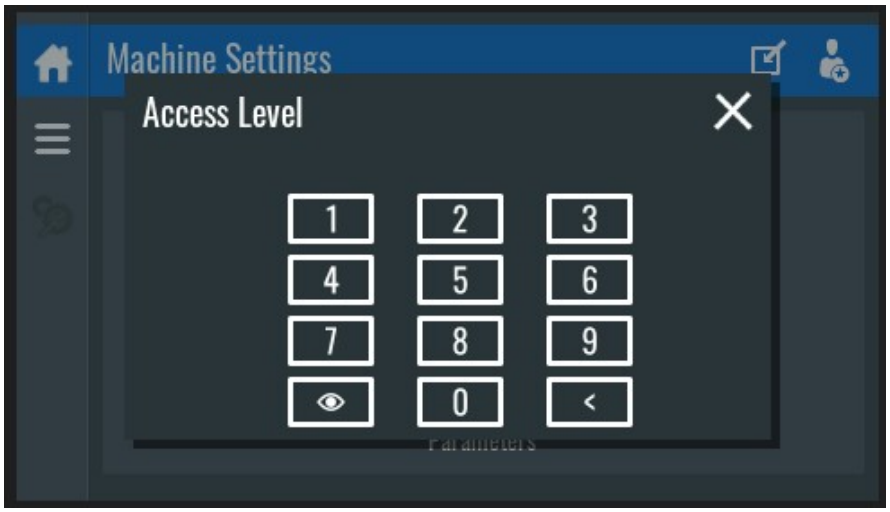


Figure 129

- Click “Status”, and open ”ECO”

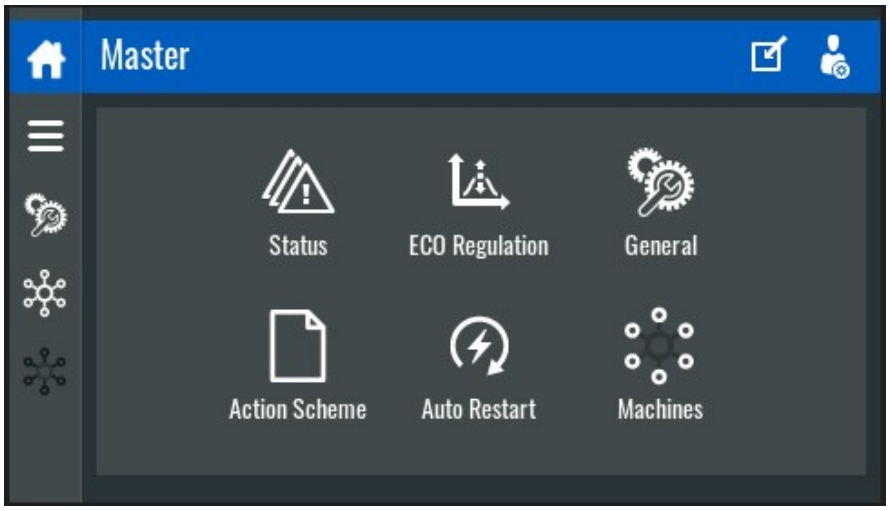


Figure 130

Figure 131

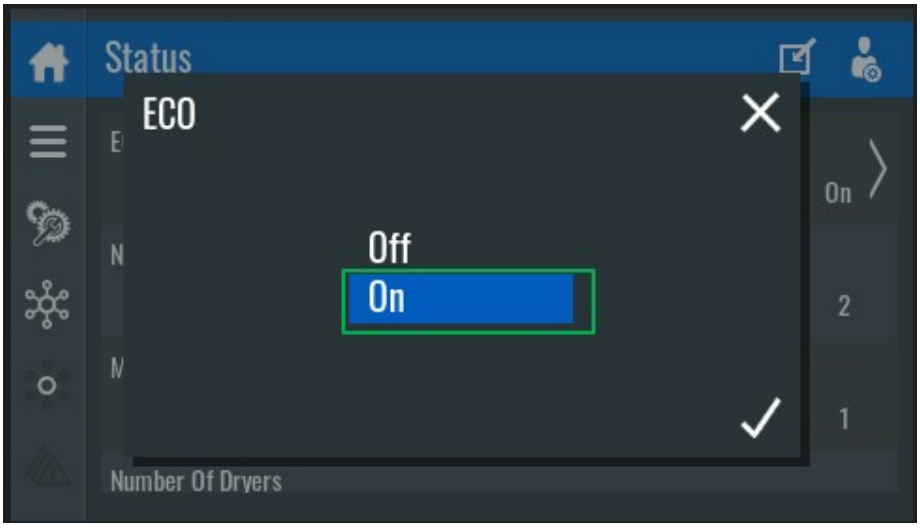


Figure 132

- Click on the bottom right corner of the screen of central controller and select "ECO Stop" in the pop-up window.

Figure 133

- The compressor and dryer are into local mode with yellow status bars

Figure 134

- Sub controllers choose “Local”, and press button on panel to “local”;

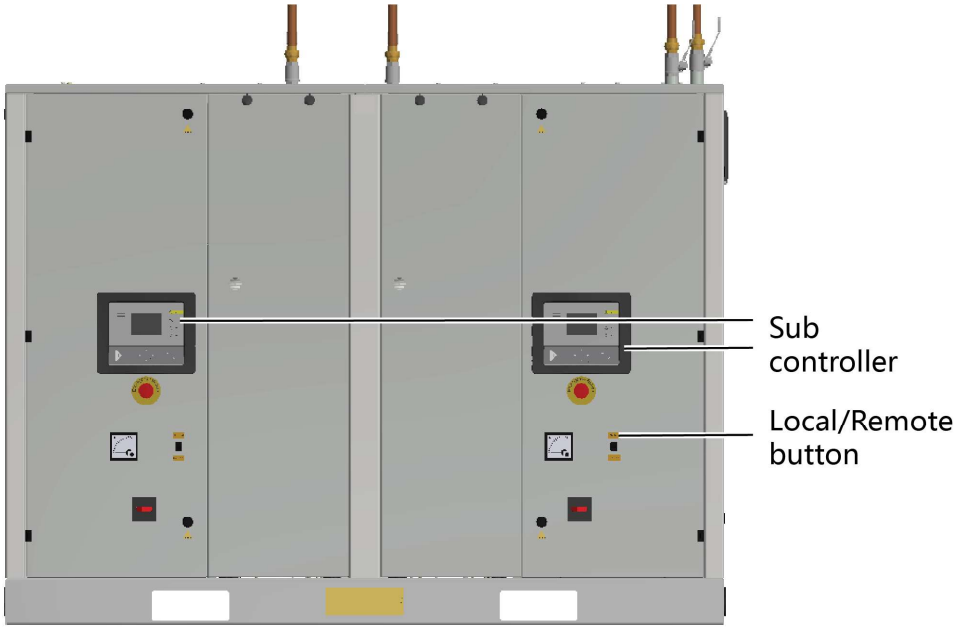


Figure 135

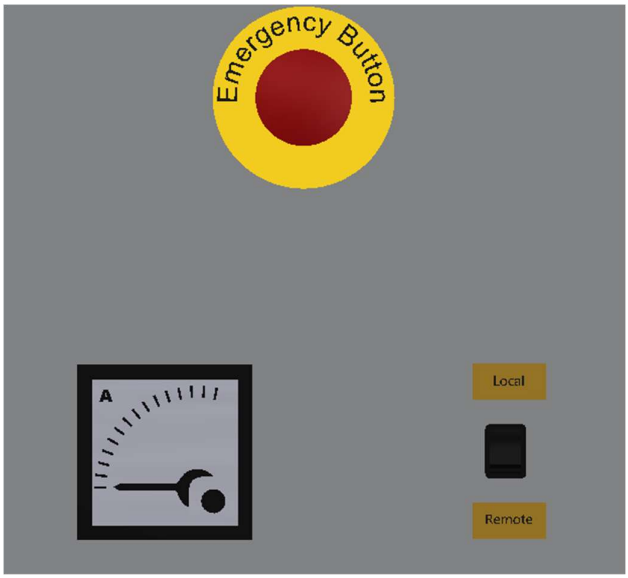


Figure 136

- Push the start button (5) on the sub controller panel.

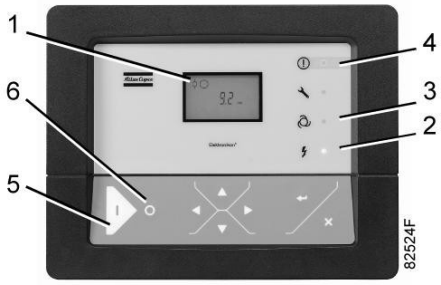


Figure 137

If the supply phases are connected correctly, the compressor will start. If the compressor does not start, the built-in protection against rotation in the wrong direction.

Set the compressor controller to local control, check the rotation direction of each compressor by clicking "on" and "off" on the compressor controller, and observe whether the rotation direction is correct.

Figure 138

Figure 139

Switch off the voltage and switch two of the supply cables. The rotation direction arrow is marked on the fan cover of the motor. Replace the power supply wire and correct the rotation direction as needed. The wind label on the fan cover of the unit blows upward, and when it shows OK, the fan is in normal operation

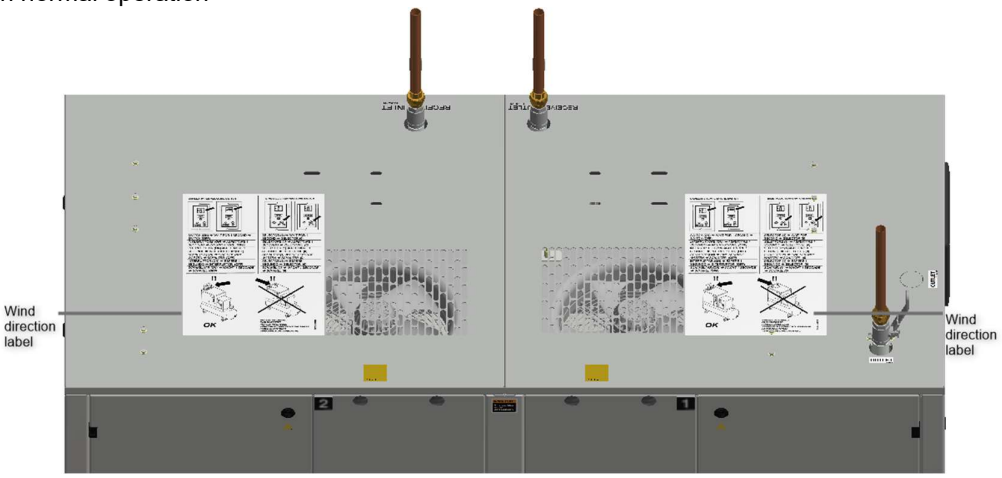


Figure 140

- Run the compressor for a few minutes. Check that the compressor operates normally.
- Push the sub controller stop button (6) to stop the compressor.
- Click on the bottom right corner of the screen of central controller and select " Switch dryers " in the pop-up window.

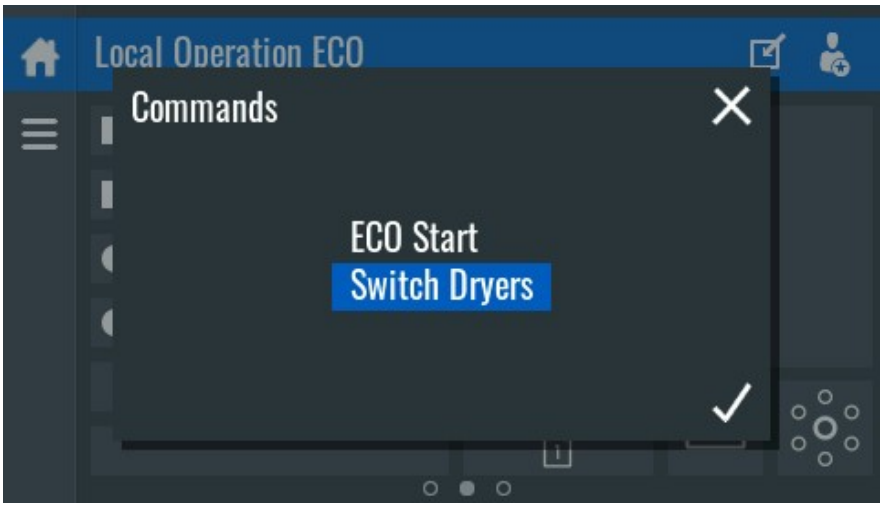


Figure 141

- Switch to the second dryer operating to check the dryer and solenoid valves' function.

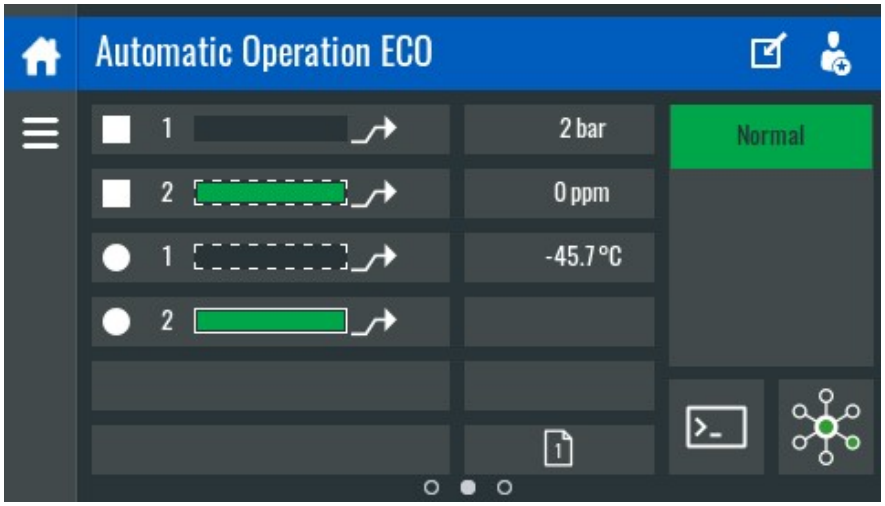


Figure 142

Local Starting Compressor

- Check the oil level.
- Push the start button (5) on the sub controller panel. Automatic Operation LED (3) lights up. The compressor starts. The controller will now load and unload, start and stop and protect the compressor automatically, until the stop button (6) or the alarm button (S3) is pushed.

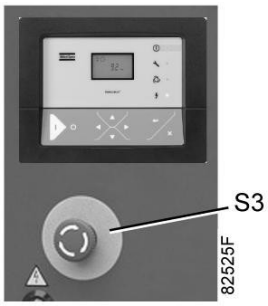


Figure 143

	• In order to ensure optimal cooling, the doors must be closed during operation andmay be opened for short periods only to carry out checks. • Compressors with an air cooler have a water separator with a manual drain valve.Regularly release condensate during operation.
	When the motor is stopped but the Automatic Operation LED (3) is enlightened, the motor maystart automatically! For trouble free operation, the compressor should run loaded during at least 40 % of the running time. If this is not the case, the oil temperature risks to remain under the condensation limit and the oil will start collecting condensate. In such case, a tropical thermostat should be installed to minimize the risk.

Local Stopping Compressor

- Push the stop button (6) on the sub controller panel. Automatic Operation LED (3) goes out. The compressor stops.

- Switch off the voltage.

	To stop the compressor in case of emergency, press the emergency stop button (S3).Alarm LED (4) blinks. After remedying the problem cause, unlock the button by pulling it out again.
	Do not use emergency stop button (S3) for normal stopping of the compressor!

ECO stat

- Sub controllers choose “LAN” for CAN communication, and press button on panel to “Remote”;

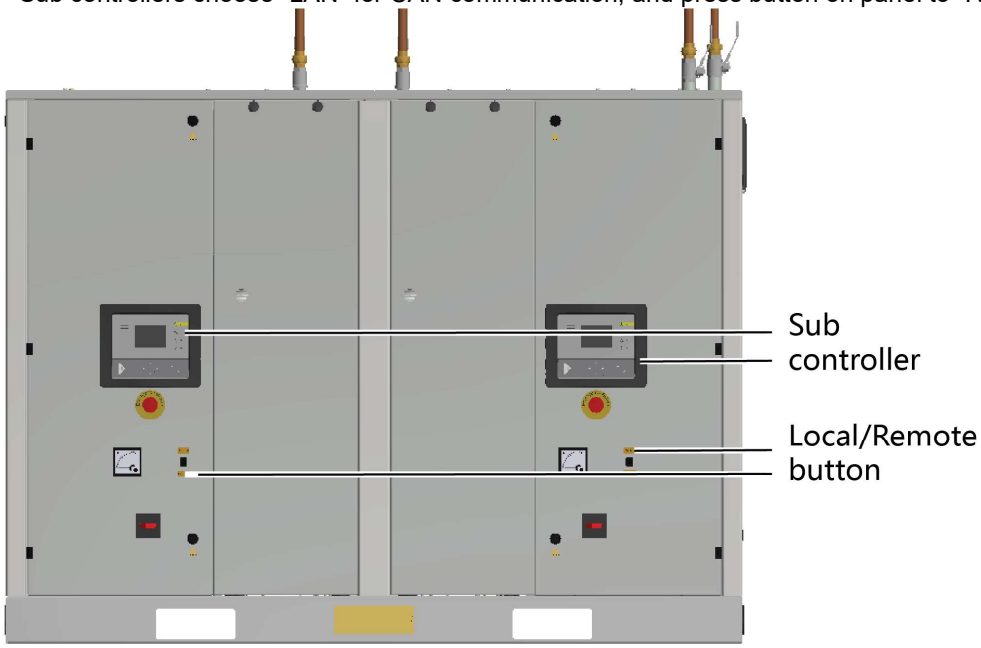


Figure 144

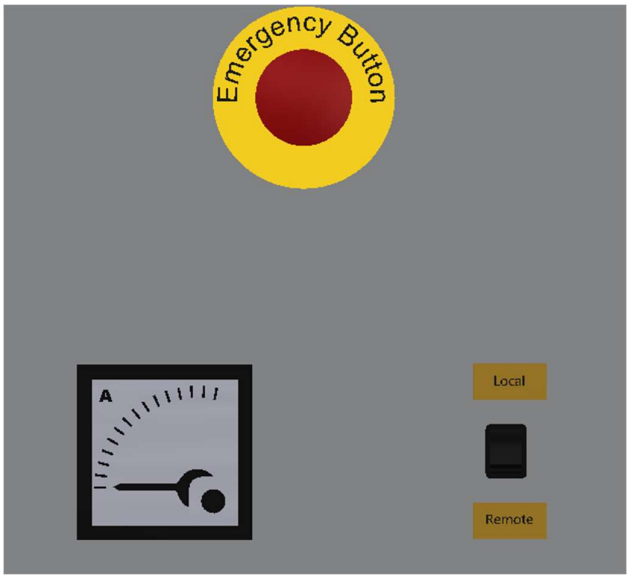


Figure 145

- Click on the bottom right corner of the screen of central controller and select "ECO Start" in the pop-up window.

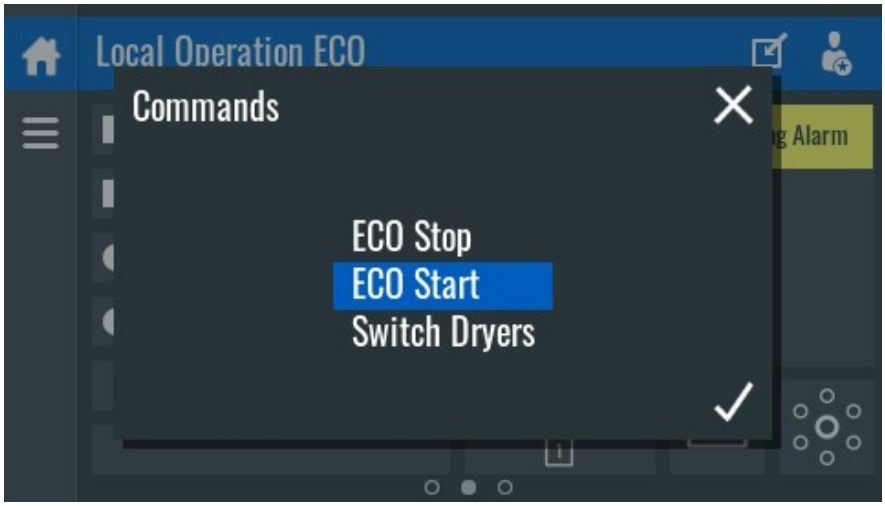


Figure 146

- The compressor and dryer are into remote mode with green status bars.

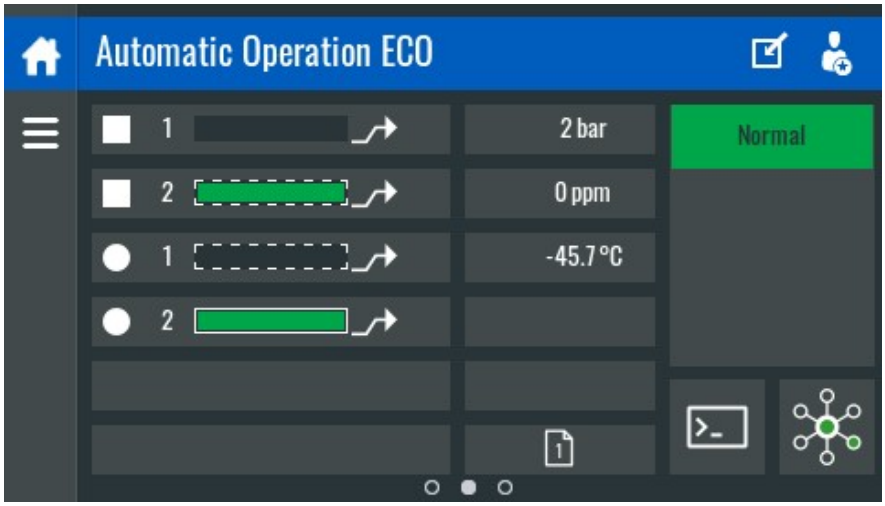


Figure 147

6.2 Taking out of operation

Warning

⚠	The operator must apply all relevant Safety precautions.

Procedure

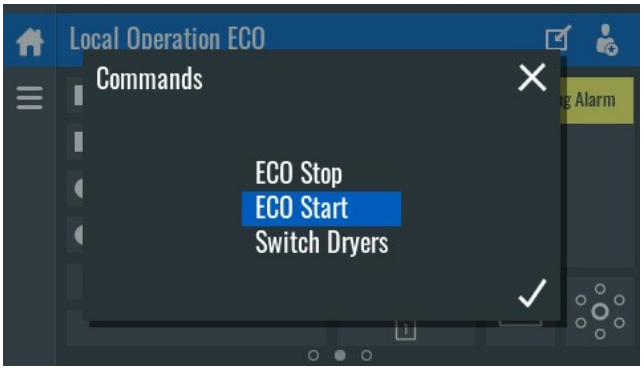


Figure 148

(1)	Click on the bottom right corner of the screen of central controller and select "ECO Stop" in the pop-up window.
(2)	Switch off the voltage and disconnect the unit from the mains.
(3)	Open the manual drain valve(s) and wait until the medical air supply system has depressurized.
(4)	Shut off and depressurize the part of the air net which is connected to the outlet valve.Disconnect the medical air supply system air outlet pipe from the air net.
(5)	Drain the oil.
(6)	Disconnect the condensate piping from the condensate net.

7. Maintenance

7.1 Preventive maintenance schedule

Warning

	**Before carrying out any maintenance, repair work or adjustments of compressor, proceed asfollows:** • Stop the compressor. • Switch off the voltage and open the isolating switch. • Close the air outlet valve and open the manual condensate drain valves. • Depressurise the compressor. For detailed instructions, see the next sections. The operator must apply all relevant Safety precautions.

Warranty-Product Liability

Use only authorised parts. Any damage or malfunction caused by the use of unauthorised parts is notcovered by Warranty or Product Liability.

General

When servicing, replace all removed gaskets, O-rings and washers.

Intervals

Carry out maintenance at the interval which comes first. The local BeaconMedaes Customer Centre may overrule the maintenance schedule, especially the service intervals, depending on the environmental andworking conditions of the compressor.

The "longer interval" checks must also include the "shorter interval" checks.

Number	Content	Frequency
1	Check the oil level before starting; drain the condensate after stopping.	Daily
2	Inspect the cooler, clean if necessary	Weekly
3	Inspect the compressor air filter. Clean or replace as necessary	Weekly
4	Inspect the condensate trap, clean the float valve if necessary	Weekly
5	Check the service indicator of UD+ filter,PDP+ filter,replace the filter if necessary	Weekly
6	Checked dryer filter condition	Weekly
7	Plant room compliance check performed	Monthly
8	Checked flexible pipe work	Monthly
9	Check for possible leaks	Monthly
10	Dates of filters, and desiccant recorded	Monthly
11	Pressure gauges and differential gauges check and found satisfactory	Monthly
12	Checked cooling air flow	Monthly
13	Clean cooling air inlet	Monthly
14	Check the tension and the condition of the belts. Adjust, if necessary	Monthly
15	Drainage traps checked for correct operation. Replaced / repaired as necessary	Monthly
16	Visible electrical connections checked for damage and overheating	Monthly
17	Oil / water separator checked. (Recommended if not fitted.)	Monthly
18	Checked bleed to dew point sensor	Monthly
19	Recorded dryer dew point where available	Monthly

Number	Content	Frequency
20	Checked filter auto-drains	Monthly
21	Tested dryer operation	Monthly
22	Recorded dryer run hours if available	Monthly
23	Tested dryer dew point sensor and 'Dew Point Fault' alarm by simulating fault.	Monthly
24	Recorded set point if able (for dyplex dryer)	Monthly
25	Checked dryer selected 'Standby' when faults simulated (for dyplex dryer)	Monthly
26	Checked all electrical connections for security and visually inspect cables	Monthly
27	Checked dryer inlet solenoid operation if fitted (see note 1)	Monthly
28	Have the safety valve tested	Yearly
29	Have the operation of sensors, electrical interlocks and components checked.	Yearly
30	Checked calibration of dryer dew point readout if fitted	Yearly
31	Checked calibration of CO sensor	Yearly
32	Replace QD+ filter element (2901 2080 32)	4000h
33	Replace QDT+ filter element (catalyst if fitted) (3001 5009 01)	4000h
34	Replace Air-Oil Filter (3002 6006 40)	4000h
35	Replace Oil Separation (2202 9294 50)	4000h
36	Replace Dryer Kit filter and silencer (3002 6250 49)	4000h
37	Replace UD+ filter element (2901 2079 52)	8000h
38	Replace PDp+ filter element (2901 2080 12)	8000h
39	Replace VMC Unloader (2200 9009 61)	8000h
40	Replace Minimum pressure & thermostatic valve (83degc) (2901 1872 00)	8000h
41	Replace Minimum pressure & thermostatic valve kit (71degc)	8000h
42	Replace WSD element (2904 5000 69)	8000h
43	Replace Dewpoint sensor (4109 5026 43)	8000h
44	Replace CO sensor(catalyst if fitted) (1092 9062 98)	16000h
45	Replace Dryer Kit solenoids,inlet ,outlet and exhaust valve (3002 6250 52)	16000h
46	Replace Dryer Kit desiccant,seal (3002 6250 58)	24000h
47	Replace Element Shaft Seal (2901 3500 00)	24000h
48	Replace Element mounting kit (2901 3501 00)	24000h

(1): Whichever comes first.

(2): More frequently in a dusty environment

(3): The indicated exchange intervals are programmed in the controller and are valid for standard operating conditions (see section Reference conditions and limitations) and nominal operating pressure (see section Compressor data). Exposure of the compressor to external pollutants or operation at high humidity combined with low duty cycles may require a shorter oil exchange interval. Contact BeaconMedaes if in doubt.

- Always consult BeaconMedaes if a service timer setting has to be changed.
- For the change interval of oil and oil filter in extreme conditions, consult your BeaconMedaes Customer Centre.
- Any leakage should be attended to immediately. Damaged hoses or flexible jointsmust be replaced.

7.2 Oil specifications

	Never mix oils of different brands or types as they may not be compatible and the oil mix will have inferior properties. A label, indicating the type of oil filled ex-factory, is stuck onthe air receiver/oil tank.

It is strongly recommended to use BeaconMedaes lubricants. See section Preventive maintenance schedule forrecommended oil change intervals.

For part numbers, consult the Spare Parts List.

Roto-Synthetic Fluid Ultra

BeaconMedaes's ROTO-SYNTHETIC FLUID ULTRA is a specially developed lubricant for use in single stage oil-injected screw compressors. Its specific composition keeps the compressor in excellent condition. ROTO-SYNTHETIC FLUID ULTRA can be used for compressors operating at ambient temperatures between 0 ˚C (32 ˚F) and 40 ˚C (104 ˚F). If the compressor is regularly operating in ambient temperatures between 40 °C and 46 °C (115 °F), oil lifetime is reduced significantly. In such case it is recommended to use Roto-Xtend Duty Fluid.

Roto-Xtend Duty Fluid

BeaconMedaes's Roto-Xtend Duty Fluid is a high-quality synthetic lubricant for oil-injected screw compressors which keeps the compressor in excellent condition. Because of its excellent oxidation stability, Roto-Xtend Duty Fluid can be used for compressors operating at ambient temperatures between 0 ˚C (32 ˚F) and 46 ˚C (115 ˚F).

7.3 Storage after installation

If the Medical air supply system is stored without running from time to time, consult BeaconMedaes as protective measures may be necessary.

7.4 Service kits

Service kits

For overhauling and for preventive maintenance, a wide range of service kits is available. Service kits comprise all parts required for servicing the component and offer the benefits of genuine BeaconMedaes partswhile keeping the maintenance budget low.

Also a full range of extensively tested lubricants, suitable for your specific needs is available to keep the compressor in excellent condition.

Consult the Spare Parts List for part numbers.

7.5 Disposal of used material

Used filters or any other used material (e.g. desiccant, lubricants, cleaning rags, machine parts, etc.) must be disposed of in an environmentally friendly and safe manner, and in line with the local recommendations and environmental legislation.

Electronic components are subject to the EU Directive 2012/19/EC for Waste Electrical and Electronic Equipment (WEEE). As such, these parts must not be disposed of at a municipal waste collection point. Refer to local regulations for directions on how to dispose of this product in an environmentally friendly manner.

8. Adjustments and servicing procedures

8.1 Service No.1 Compressor

8.1.1 Service No.1 Compressor general process

1. Set No. 1 compressor controller to local control, click the compressor controller shutdown button to turn off No. 1 compressor, close No. 1 compressor's circuit breaker, and then compressor is power off. Close the ball valve 3 at the valve block and keep the other ball valves in their original state.

Note: If No. 1 compressor is running at this time, No. 2 compressor will run automatically after cutting to the local area.

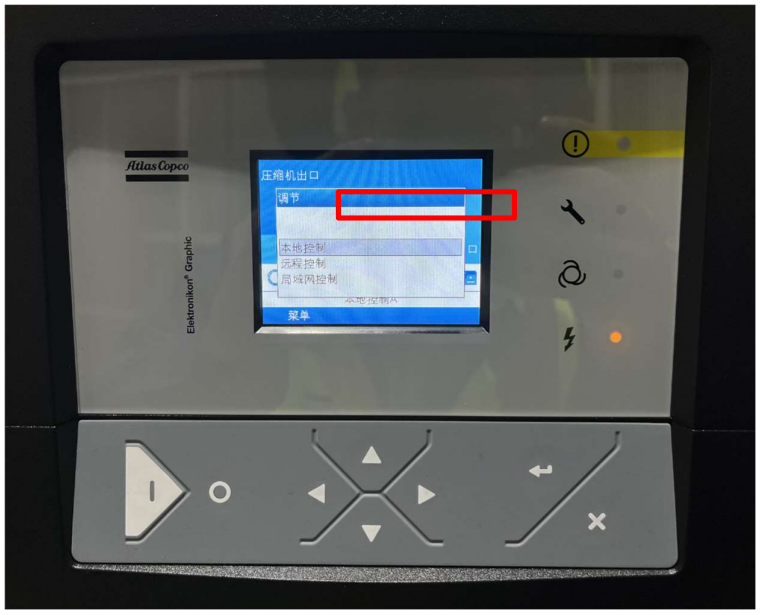


Figure 149

Figure 150

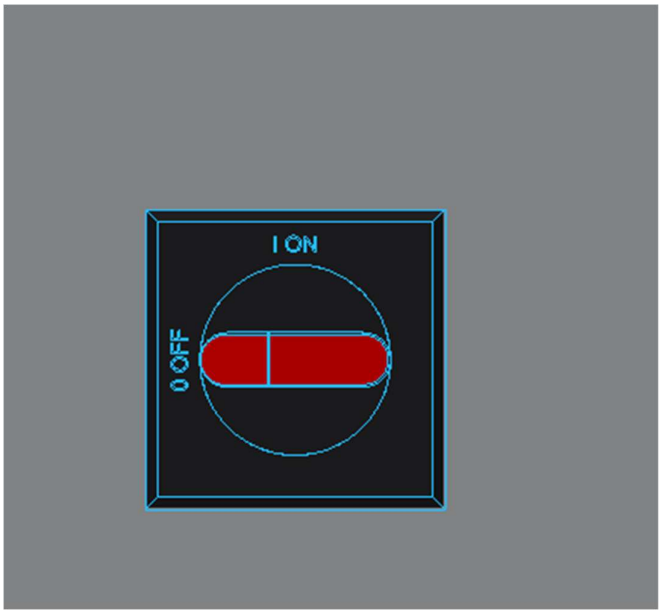


Figure 151

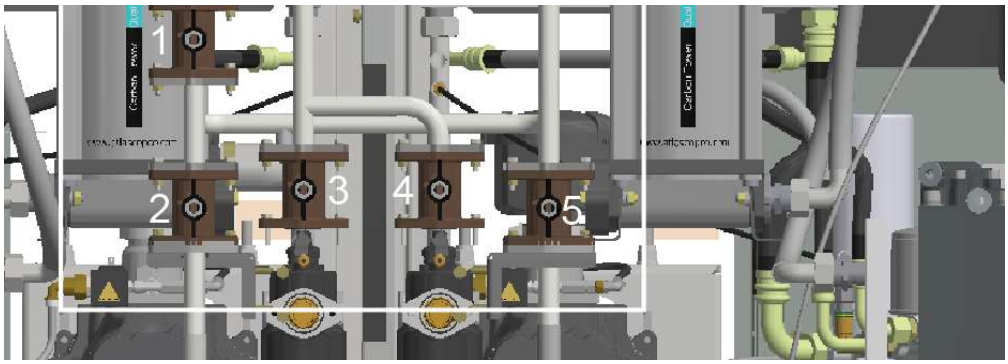


Figure 152

When finish servicing, open the No. 3 ball valve at the valve block and open the No. 1 compressor circuit breaker. At this time, the No. 1 compressor is controlled locally. Manually start No. 1 compressor to confirm that No. 1 compressor can run normally after the maintenance is completed, then shut down the compressor, switch to remote control on the compressor controller, and No. 1 compressor comes online.

8.1.2 Service No.1 Compressor Air filter

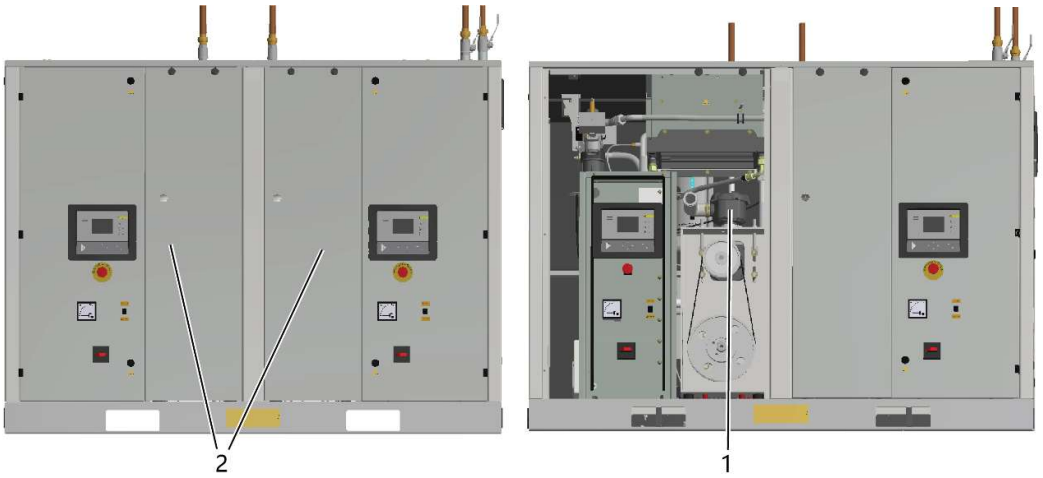


Figure 153

Step	Action
1	Stop the one compressor, close the air outlet valve, and switch off the voltage, refer to 8.1.1.
2	Remove one compressor's front panel (2).
3	Unscrew the filter cover (1) and remove the filter element. Discard the air filter element.
4	Fit the new element and screw on the filter cover.
5	Refit the front panel.

8.1.3 Service No.1 Compressor Oil, oil filter and oil separator change

Important

	Never mix oils of different brands or types. A label, indicating the type of oil filled ex-factory, is stuck on the air receiver/oil tank. Always drain the compressor oil at all drain points. Used oil left in the compressor can shorten the lifetime of the new oil. If the compressor is exposed to external pollutants, is being used at high temperatures (oil temperature above 90˚C / 194˚F) or is being used under severe conditions, it is advisable to change the oil more frequently. Consult BeaconMedaes.

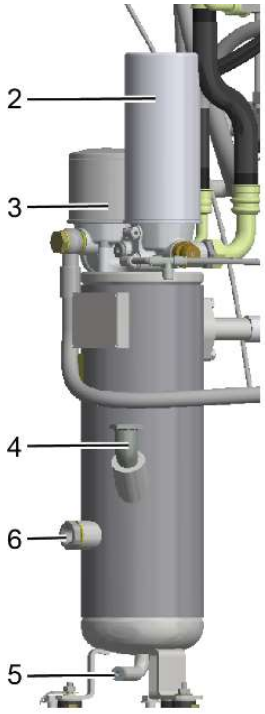


Figure 154

Step	Action
1	Run the compressor until warm. Stop the compressor, close the air outlet valve and switch off the voltage, refer to 8.1.1.
2	Remove the front panel.
3	Depressurise the compressor by unscrewing filler plug (4) one turn to permit any pressure in the system to escape.
4	Depressurise the air receiver by opening the drain valve (tank mounted units).
5	Drain the oil by opening drain valve (5). Close the valve after draining. Deliver the spent oil to the local oil collection service.
6	Remove oil filter (3) and oil separator (2). Clean the seats on the manifold.
7	Oil the gaskets of the new filter and separator and screw them into place. Tighten firmly by hand.
8	Remove filler plug (4) and fill oil tank with oil until the level reaches the middle of sight-glass (6). Ensure no dirt gets into the system. Refit and tighten filler plug (8)
9	Run the compressor for a few minutes. Check the oil level.
10	Refit the body panel and the cover (1).

8.1.4 Service No.1 Compressor drive motor

General

Keep the outside of the electric motor clean for efficient cooling. If necessary, remove dust with a brush and/or compressed air jet.

8.1.5 Service No.1 Compressor Cooler maintenance

Instructions

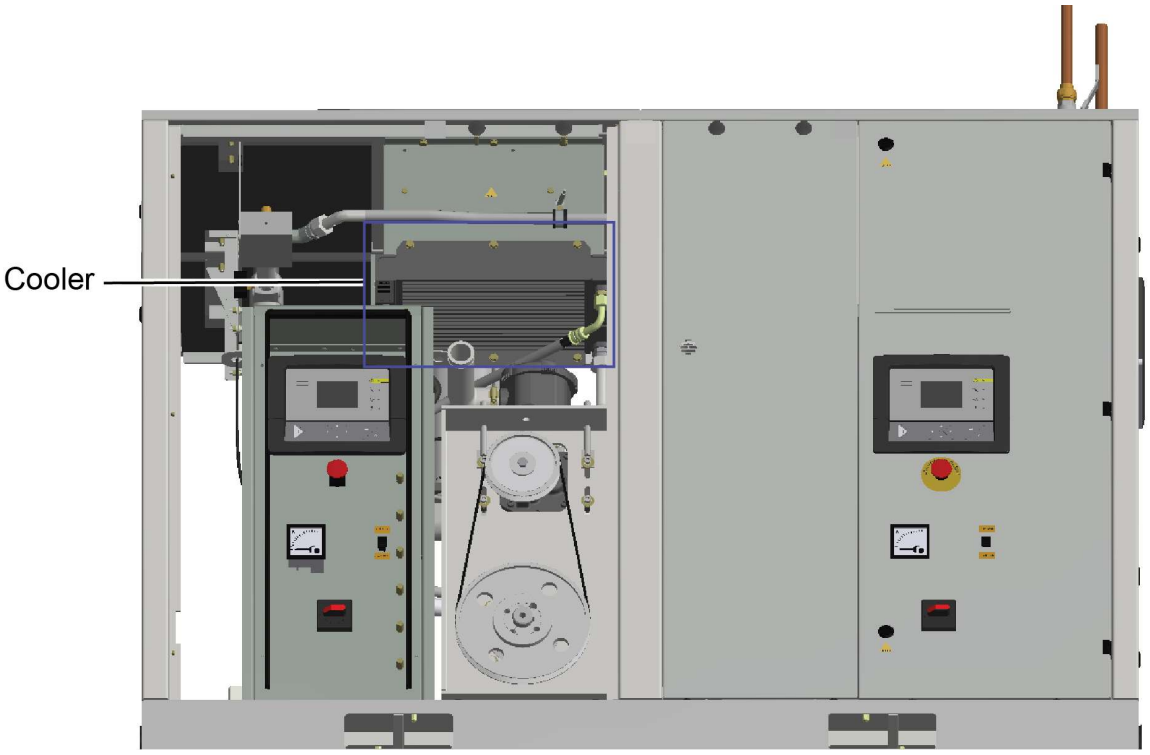


Figure 155

Step	Action
1	Stop the compressor, close the air outlet valve and switch off the voltage,refer to 8.1.1.
2	Remove the front panel.
3	Remove any dirt from the cooler with a fibre brush. Never use a wire brush or metal objects. Then clean using an air jet.
4	Refit the body panel.

8.1.6 Service No.1 Compressor Belt exchange and tensioning

⚠	Read the warning in the Preventive maintenance schedule section.

Tensioning

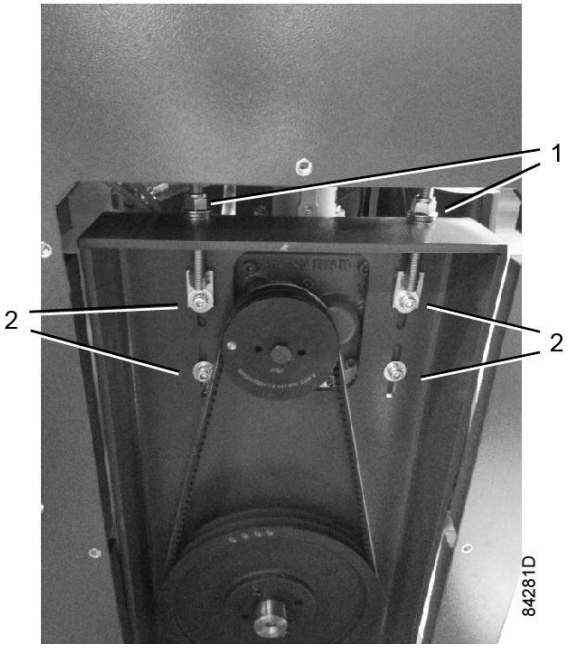


Figure 156

Step	Action
1	Stop the compressor, close the air outlet valve and switch off the voltage, refer to 8.1.1.
2	Remove the front panel and the right panel.
4	Loosen locking nuts (1) and bolts (2) by one turn.
5	Adjust the belt tension by turning tensioning nut (1). The tension is correct when a force of between 18 N and 22 N, applied at the midpointof the belt causes a deflection of 5 mm.
6	Retighten locking nuts (1) and bolts (2).
7	Refit the bodywork panels.

Belt replacement

	The belts must always be replaced as a set, even if only one of the belts is worn. Onlyuse genuine BeaconMedaes belts.

Step	Action
1	Stop the compressor, close the air outlet valve and switch off the voltage, refer to 8.1.1.
2	Remove the front panel and the right panel.
3	Loosen locking nuts (1) and bolts (2) by one turn. Release the belt tension by loosening tensioning nut (1).
4	Replace the belts and then tension them as described above.
5	Rotate the belts a few times by hand to equalise the belt tension.
6	Refit the bodywork panel.
7	Check the belt tension after 50 running hours.

Alternative tensioning method:

Instead of measuring the deflection, it is also possible to tension the belts based on the frequency:

Compressor type	Normal tension (Hz)	Initial tension (Hz)
TMA 7	84	100
TMA 11	93	110

8.2 Service No.2 Compressor

8.2.1 Service No.2 Compressor general process

1. Set No. 2 compressor controller to local control, click the compressor controller shutdown button to turn off No. 2 compressor, close No. 2 compressor's circuit breaker, and then compressor is power off. Close the ball valve 4 at the valve block and keep the other ball valves in their original state.

Note: If No. 2 compressor is running at this time, No. 1 compressor will run automatically after cutting to the local area.

Figure 157

Figure 158

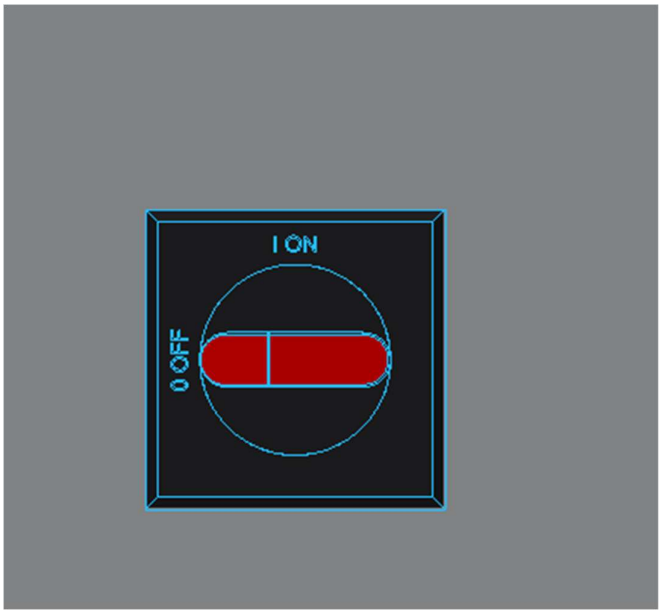


Figure 159

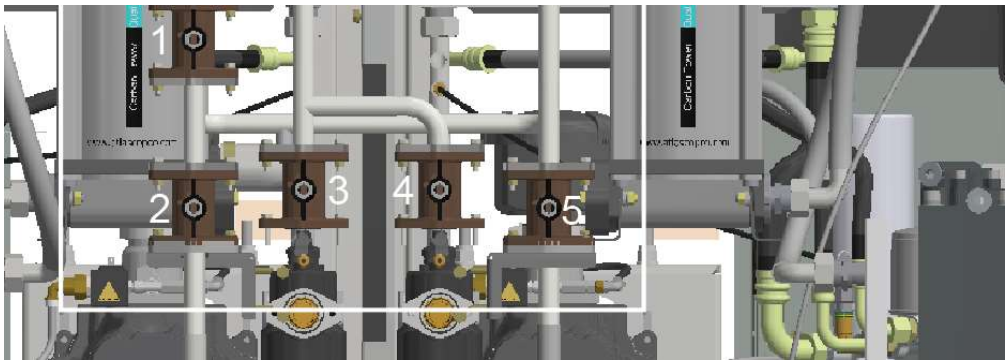


Figure 160

When finish servicing, open the No. 4 ball valve at the valve block and open the No. 2 compressor circuit breaker. At this time, the No. 2 compressor is controlled locally. Manually start No.2 compressor to confirm that No. 2 compressor can run normally after the maintenance is completed, then shut down the compressor, switch to remote control on the compressor controller, and No. 2 compressor comes online.

8.2.2 Service No.2 Compressor Air filter

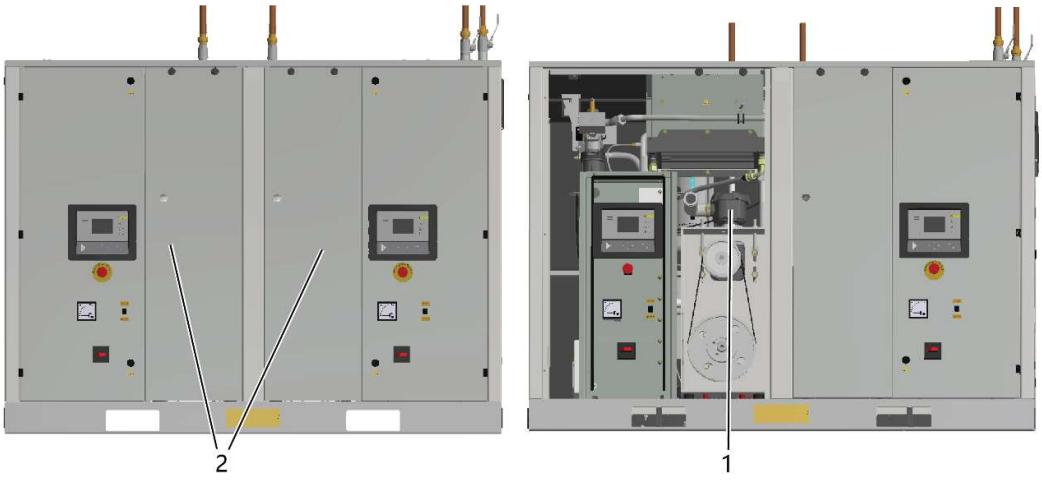


Figure 161

Step	Action
1	Stop the one compressor, close the air outlet valve and switch off the voltage, refer to 8.2.1.
2	Remove one compressor's front panel (2).
3	Unscrew the filter cover (1) and remove the filter element. Discard the air filter element.
4	Fit the new element and screw on the filter cover.
5	Refit the front panel.

8.2.3 Service No.2 Compressor Oil, oil filter and oil separator change

Important

	Never mix oils of different brands or types. A label, indicating the type of oil filled ex-factory, is stuck on the air receiver/oil tank. Always drain the compressor oil at all drain points. Used oil left in the compressor can shorten the lifetime of the new oil. If the compressor is exposed to external pollutants, is being used at high temperatures (oil temperature above 90˚C / 194˚F) or is being used under severe conditions, it is advisable to change the oil more frequently. Consult BeaconMedaes.

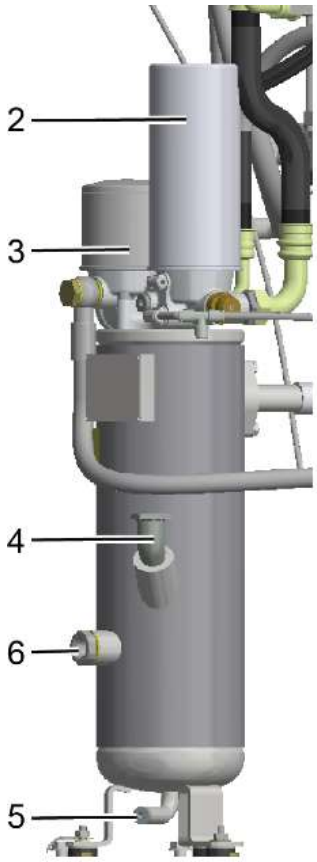


Figure 162

Step	Action
1	Run the compressor until warm. Stop the compressor, close the air outlet valve and switch off the voltage,, refer to 8.2.1.
2	Remove the front panel.
3	Depressurise the compressor by unscrewing filler plug (4) one turn to permit any pressure in the system to escape.
4	Depressurise the air receiver by opening the drain valve (tank mounted units).
5	Drain the oil by opening drain valve (5). Close the valve after draining. Deliver the spent oil to the local oil collection service.
6	Remove oil filter (3) and oil separator (2). Clean the seats on the manifold.
7	Oil the gaskets of the new filter and separator and screw them into place. Tighten firmly by hand.
8	Remove filler plug (4) and fill oil tank with oil until the level reaches the middle of sight-glass (6). Ensure no dirt gets into the system. Refit and tighten filler plug (8)
9	Run the compressor for a few minutes. Check the oil level.
10	Refit the body panel and the cover (1).

8.2.4 Service No.2 Compressor drive motor

General

Keep the outside of the electric motor clean for efficient cooling. If necessary, remove dust with a brush and/or compressed air jet.

8.2.5 Service No.2 Compressor Cooler maintenance

Instructions

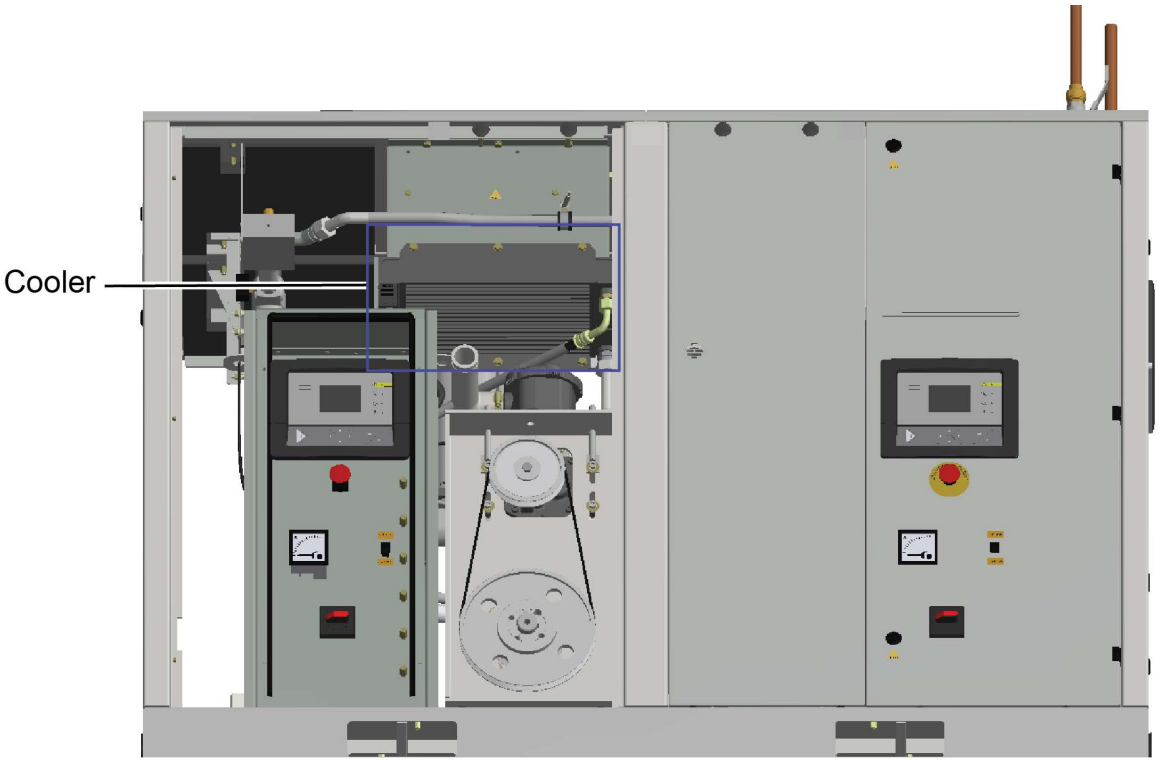


Figure 163

Step	Action
1	Stop the compressor, close the air outlet valve and switch off the voltage, refer to 8.2.1.
2	Remove the front panel.
3	Remove any dirt from the cooler with a fibre brush. Never use a wire brush or metal objects. Then clean using an air jet.
4	Refit the body panel.

8.2.6 Service No.2 Compressor Belt exchange and tensioning

⚠	Read the warning in the Preventive maintenance schedule section.

Tensioning

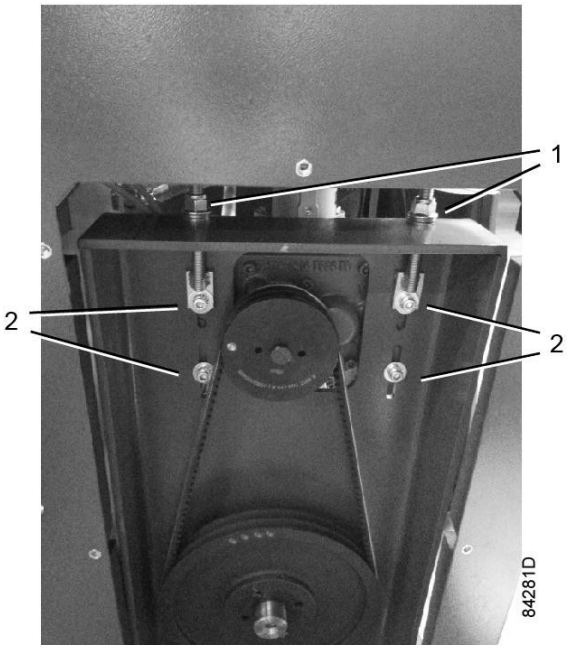


Figure 164

Step	Action
1	Stop the compressor, close the air outlet valve and switch off the voltage, refer to 8.2.1.
2	Remove the front panel and the right panel.
4	Loosen locking nuts (1) and bolts (2) by one turn.
5	Adjust the belt tension by turning tensioning nut (1). The tension is correct when a force of between 18 N and 22 N, applied at the midpointof the belt causes a deflection of 5 mm.
6	Retighten locking nuts (1) and bolts (2).
7	Refit the bodywork panels.

Belt replacement

	The belts must always be replaced as a set, even if only one of the belts is worn. Onlyuse genuine BeaconMedaes belts.

Step	Action
1	Stop the compressor, close the air outlet valve and switch off the voltage, refer to 8.1.1.
2	Remove the front panel and the right panel.
3	Loosen locking nuts (1) and bolts (2) by one turn. Release the belt tension by loosening tensioning nut (1).
4	Replace the belts and then tension them as described above.
5	Rotate the belts a few times by hand to equalise the belt tension.
6	Refit the bodywork panel.
7	Check the belt tension after 50 running hours.

Alternative tensioning method:

Instead of measuring the deflection, it is also possible to tension the belts based on the frequency:

Compressor type	Normal tension (Hz)	Initial tension (Hz)
TMA 7	84	100
TMA 11	93	110

8.3 Safety valve

General

The oil separator vessel is protected by a safety valve. A separate safety valve protects the air receiver ontank mounted units.

Operation

From time to time, operate the safety valve, depending on the type of valve:

- By unscrewing the cap one or two turns and retightening it
- By pulling the valve lifting lever

Testing

The safety valve can be tested on a separate compressed air line.

Before removing the valve, stop the compressor (see section Starting and stopping).

Close the air outlet valve, switch off the voltage, open drain valves (if applicable) and unscrew the oil filler plug one turn to permit any remaining pressure in the system to escape.

	If the valve does not open at the set pressure stamped on the valve, replace the valve.No adjustments are allowed. Never run the compressor without a safety valve.

8.4 UD+, QD+, PDP+ filters, service procedure

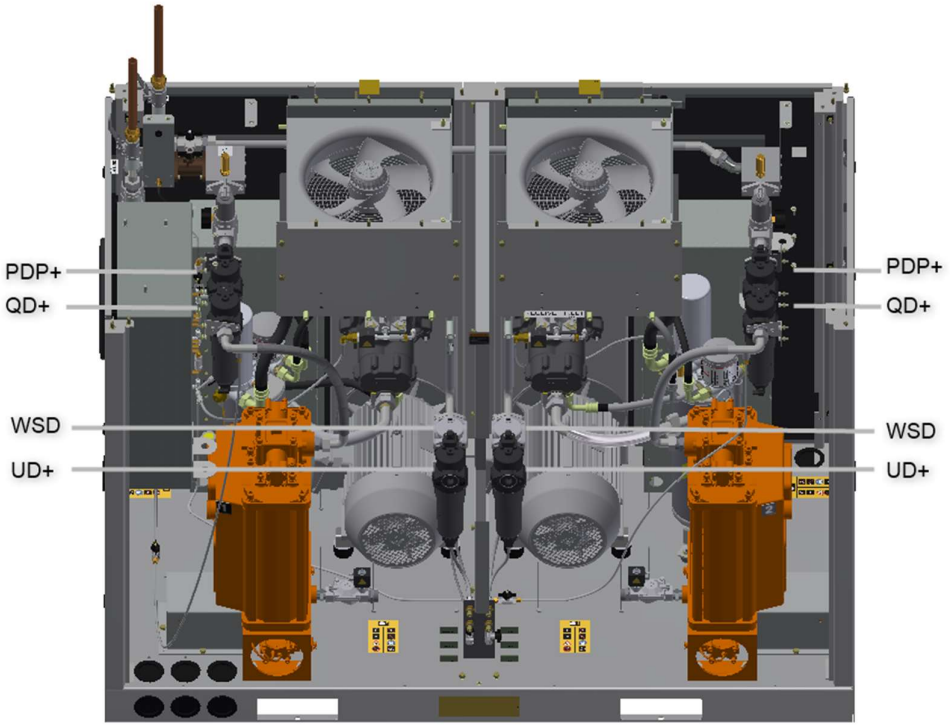


Figure 165

For the maintenance of the side filter of No.1 dryer, refer to 6.3.1 and start the maintenance after turning off No.1 dryer. After maintenance, refer to 6.3.1 to switch No.1 dryer for normal operation. For side filter maintenance of No.2 dryer, refer to 6.3.2 and start maintenance after shutting down No.2 dryer. After maintenance, refer to 6.3.2 to switch No.2 dryer for normal operation.

8.5 Dryer Service

Storage (standby) requirements

1. Positive pressure storage (p>1atm): under the condition that there is pressure inside the absorber, start the machine once every three months, and the running time is not less than 2 hours, and the pressure dew point reaches the design value;
2. Atmospheric storage (P=1atm): start the machine once a month, start the machine for no less than 2 hours, and the pressure dew point reaches the design value;
3. Stored (not installed)! It is forbidden for the adsorbent associated channel to be directly connected with the atmosphere! The air inlet and air outlet of the blotting machine need to be closed. When the storage period exceeds three months, activation operation is required for the first startup to activate the adsorption capacity.
4. Activation is operated in this way, that is, open the air compressor, run the blotting dryer, close the pipe at the back end of the blotting dryer ball valve, the last stage of the filter at the back end of the blotting dryer, the manual valve at the bottom is slightly open (blow on the skin of the hand, there is a slight feeling)

8.5.1 No.1 Compressor Service

1. When No. 1 dryer is maintained, switch to No. 2 dryer working on MK5 controller.

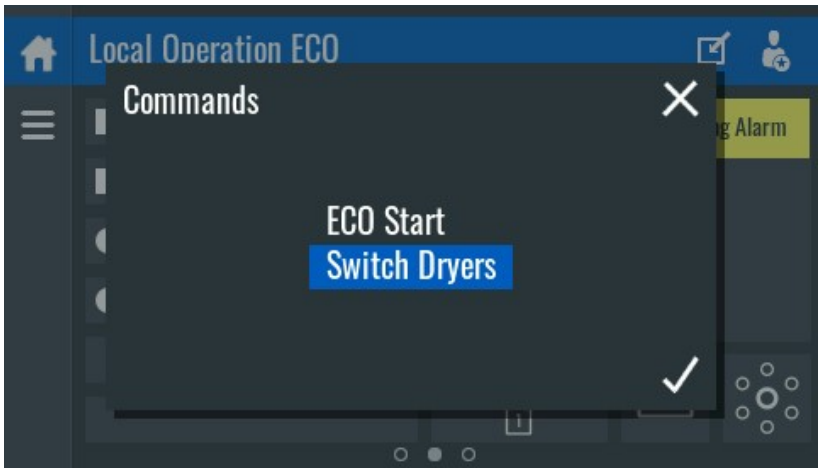


Figure 166

2. Close No. 2 ball valve at the valve block and keep the other ball valves as they are.

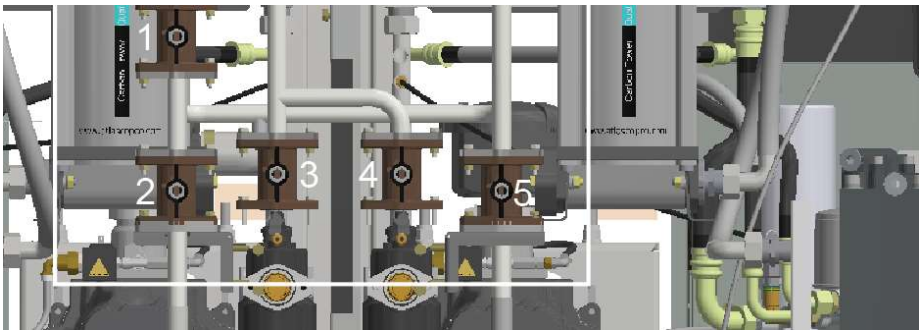


Figure 167

3. Close No. 1 compressor exhaust valve

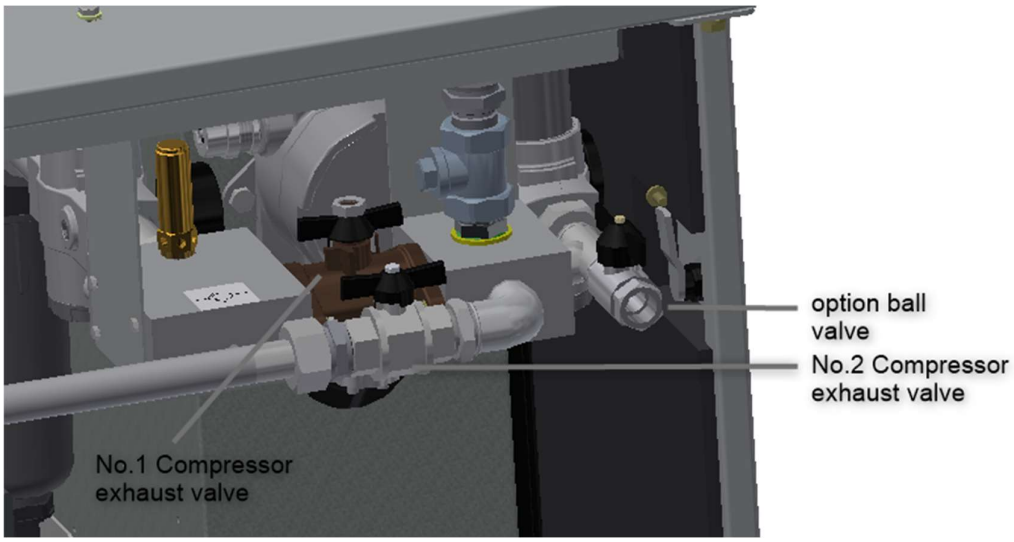


Figure 168

4. Close the air pipe ball valve A between the dryers

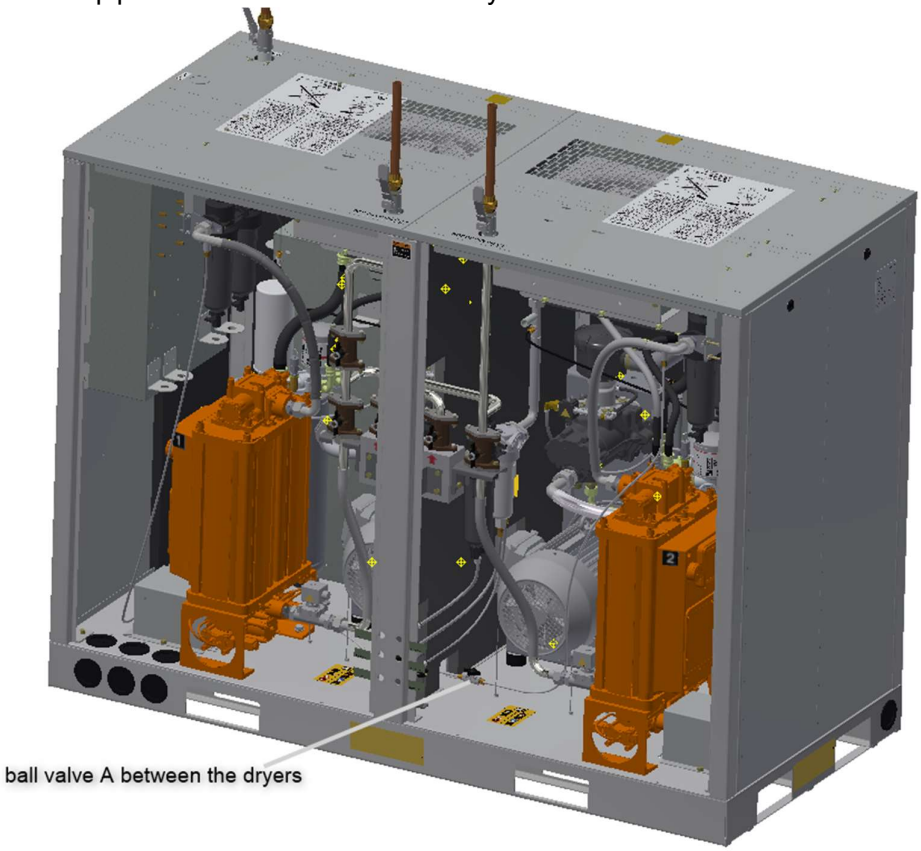


Figure 169

5. Turn off FU1,FU2 switch or CB1 switch in the main electrical control cabinet to power off No. 1 dryer. Dryer service can begin at this time.
6. After the service, open the ball valve at 2.3.4 of the above step closed, turn on the FU1, FU2 switch or CB1 switch, and power on the No.1 dryer.
7. Dryer switch, switch to No.1 dryer, confirm whether the operation is normal.

8.5.2 No.2 Compressor Service

1. When No. 2 dryer is maintained, switch to No. 1 dryer working on MK5 controller.

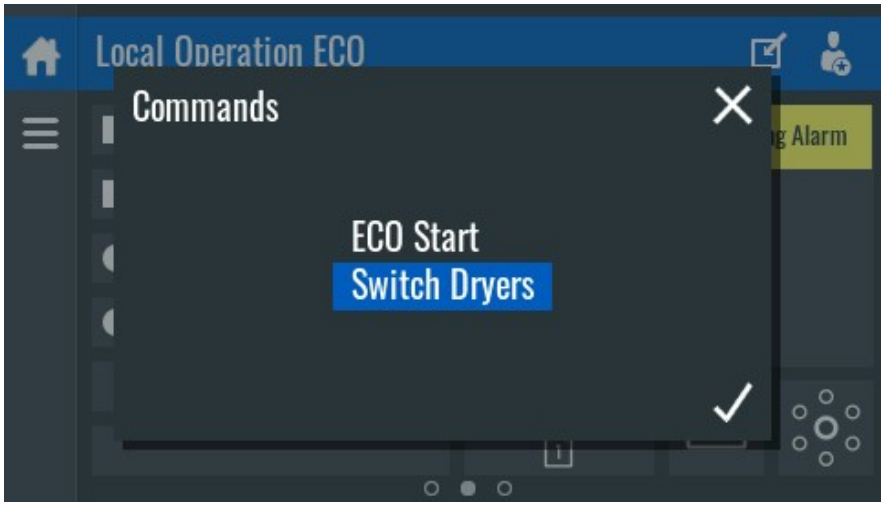


Figure 170

2. Close No. 5 ball valve at the valve block and keep the other ball valves as they are.

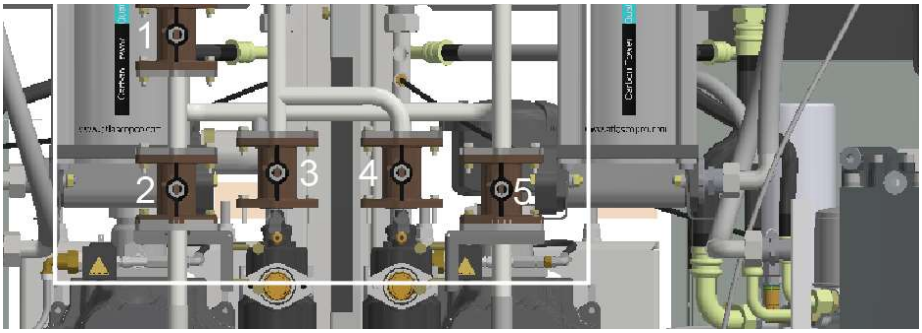


Figure 171

3. Close No. 2 compressor exhaust valve

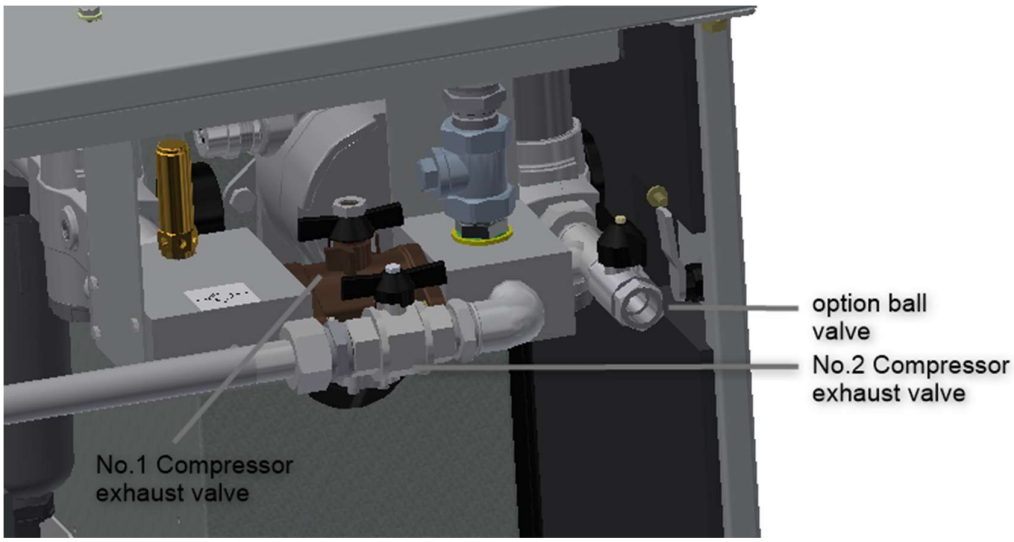


Figure 172

4. Close the air pipe ball valve B between the dryers

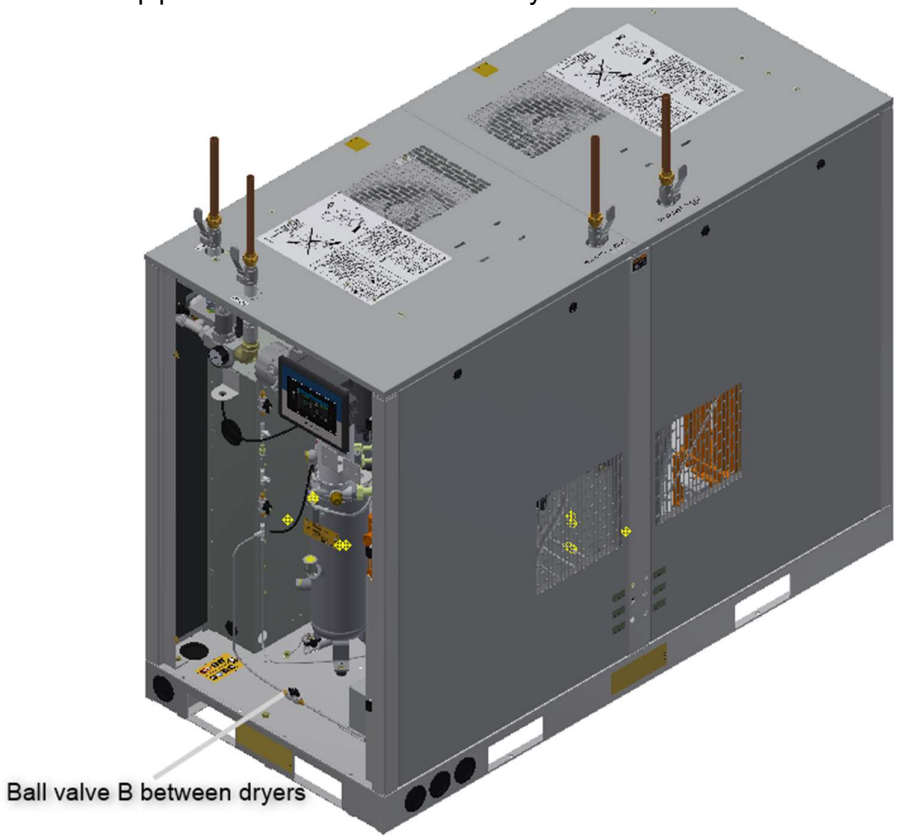


Figure 173

5. Turn off FU3,FU4 switch or CB2 switch in the main electrical control cabinet to power off No. 2 dryer. Dryer service can begin at this time.
6. After the service, open the ball valve at 2.3.4 of the above step closed, turn on the FU1, FU2 switch or CB1 switch, and power on the No.1 dryer.
7. Dryer switch, switch to No.1 dryer, confirm whether the operation is normal.

9. Problem solving

	Use only authorised parts. Any damage or malfunction caused by the use of unauthorised parts is not covered by Warranty or Product Liability. Apply all relevant Safety precautions during maintenance or repair.
	Stop the compressor and the dryer before carrying out any maintenance or repair workon the compressor. Open the isolating switch to prevent an accidental start. Close air outlet valve and depressurise the compressor by opening the oil filler plug oneturn. Open the manual condensate drain valves (if present).

Faults and remedies

Condition	Fault	Remedy
Compressor starts running, but does not load after a delay time	Loading solenoid valve (Y1) out of order	Replace valve
	Inlet valve (unloader) stuck in closed position	Have valve checked
	Leak in control air hoses	Replace leaking hose
	Minimum pressure valve (Vp) leaking (when net is depressurised)	Have valve checked
Compressor air output or pressure below normal	Air consumption exceeds air output of compressor	Check equipment connected
	Clogged air inlet filter element (AF)	Replace filter element
	Solenoid valve (Y1) malfunctioning	Replace valve
	Leak in control air flexibles	Replace leaking flexible
	Inlet valve (IV) does not fully open	Have valve checked
	Oil separator (OS) clogged	Replace separator element
	Safety valves leaking	Replace valves
Air outlet temperature above normal	Insufficient cooling air or cooling air temperature too high	Check for cooling air restriction or improve ventilation of compressor room. Avoid recirculation of coolingair. If installed, check capacity of compressor room fan
	Oil level too low	Check and correct as necessary
	Cooler clogged	Clean cooler
	Temperature switch malfunctioning	Have switch tested
	Compressor element (E) out of order	Consult BeaconMedaes

10. Technical data

10.1 Electric cable size

- The voltage on the compressor terminals must not deviate more than 10% of thenominal voltage.
  It is however highly recommended to keep the voltage drop over the supply cablesat nominal current below 5% of the nominal voltage (IEC 60204-1).
- If cables are grouped together with other power cables, it may be necessary to usecables of a larger size than those calculated for the standard operating conditions.
- Use the original cable entry. See section Dimension drawings.
  To preserve the protection degree of the electric cubicle and to protect its components from dust from the environment, it is mandatory to use a propercable gland when connecting the supply cable to the compressor.
- Local regulations remain applicable if they are stricter than the values proposedbelow.

Type	V	Hz	Approval	$I_{tot\ max}$ (A)	Fuse (A)	Cable
TMA 7	400	50	IEC	36	50	5 x 6 mm²
TMA 11	400	50	IEC	62	80	5 x 10 mm²

The suggested cable size is valid for PVC insulated cables with copper conductors (maximum conductor temperature 70 °C) and is calculated according to standard 60364-5-52 - electrical installations of buildings part 5 - selection and erection equipment and section 52 - current carrying capacities in wiring systems for installation method B2 and ambient temperatures up to 45 °C.

10.2 Overload settings and fuses

Frequency (Hz)	Voltage (V)	TMA 7 Overload relay (A)	TMA 7 Main fuses(A)	TMA 11 Overload relay (A)	TMA 11Main fuses(A)
50	400	10.5	50	18	80

Fuse calculations for IEC are done according to 60364-4-43 electrical installations of buildings, part 4: protection for safety- section 43: protection against overcurrent. Fuse sizes are calculated in order to protectthe cable against short circuit. Fuse type aM is recommended but gG/gL is also allowed.

10.3 Reference conditions and limitations

Reference conditions

Air inlet pressure (absolute)	bar	1
Air inlet pressure (absolute)	psi	14.5
Air inlet temperature	˚C	20
Air inlet temperature	˚F	68
Relative humidity	%	0
Working pressure	bar(e)	See Compressor data
Working pressure	psi	See Compressor data

Limitations

Maximum working pressure	bar(e)	See Compressor data
Maximum working pressure	psig	See Compressor data
Minimum working pressure	bar(e)	4
Minimum working pressure	psig	58
Maximum air inlet temperature	˚C	40
Maximum air inlet temperature	˚F	109
Minimum ambient temperature	˚C	0
Minimum ambient temperature	˚F	32

10.4 Compressor data

TMA7 Compressor data

	Unit	**10 bar**	**13 bar**
Frequency	Hz	50	50
Maximum (unloading) pressure	bar(e)	10	13
Nominal working pressure	bar(e)	9.5	12.5
Pressure drop over dryer	bar(e)	0.12	0.12
Motor shaft speed	r/min	2940	2940
Set point, thermostatic valve	˚C	83	83
Temperature of air leaving outlet valve(approx.)	˚C	25	25
Nominal motor rating	kW	7.5	7.5
Oil capacity	l	4.5	4.5
Sound pressure level, according to ISO2151 (2004)	dB(A)	73	73

TMA11 Compressor data

	Unit	10 bar	13 bar
Frequency	Hz	50	50
Maximum (unloading) pressure	bar(e)	10	13
Nominal working pressure	bar(e)	9.5	12.5
Pressure drop over dryer	bar(e)	0.12	0.12
Motor shaft speed	r/min	2940	2940
Set point, thermostatic valve	˚C	83	53
Temperature of air leaving outlet valve (approx.) with air cooler before air receiver	˚C	35	35
Temperature of air leaving outlet valve (approx.)	˚C	25	25
Nominal motor rating	kW	11	11
Oil capacity	l	4.5	4.5
Sound pressure level, according to ISO2151 (2004)	dB(A)	73	73

11. Instructions for use

Oil separator vessel

1	The vessel can contain pressurised air. This can be potentially dangerous if the equipment is misused.
2	This vessel must only be used as a compressed air/oil separator tank and must beoperated within the limits specified on the data plate.
3	No alterations must be made to this vessel by welding, drilling or other mechanical methods without the written permission of the manufacturer.
4	The pressure and temperature of this vessel must be clearly indicated.
5	The safety valve must correspond with pressure surges of 1.1 times the maximum allowable operating pressure. It should guarantee that the pressure will not permanently exceed the maximum allowable operating pressure of the vessel.
6	Use only oil as specified by the manufacturer.

12. Guidelines for inspection

Guidelines

On the Declaration of Conformity / Declaration by the Manufacturer, the harmonized and/or other standards that have been used for the design are shown and/or referred to.

The Declaration of Conformity / Declaration by the Manufacturer is part of the documentation that is supplied with this compressor.

Local legal requirements and/or use outside the limits and/or conditions as specified by the manufacturermay require other inspection periods as mentioned below.

13. Symbols

	Date of manufacture		Manufacturer
	Authorized representative in the European Community/ European Unio		Serial number
	CE mark and NB number		Medical device
	Caution		Consult instructions for use or consult electronic instructions for use
	Temperature limit		Unique device identifier

Manufacturer:

Atlas Copco (Wuxi) Compressor Co Ltd
No.45 Ximei Road, New District, Wuxi City,
Jiangsu Province 214029, China

European Authorized Representative

Atlas Copco Airpower N.V.
Boomsesteenweg 957, 2610 Wilrijk

14. Annex A Adsorption Dryer

A.1 Overview

Note: This manual is intended to provide operating and maintenance instructions for the dryer unit of the system, if equipped. Please read the information herein carefully before operation or maintenance of the dryer unit. If you fail to follow these operating and maintenance procedures, it may result in personal injury or property damage.

All information, specifications and illustrations herein are valid at the time of printing. The manufacturer reserves the right to make changes or improvements without notice and has no obligation to make any change or improvement to products already sold.

To inquire the information, request for maintenance or order parts, please refer to the information indicated on the serial number nameplate on the side of the control panel.

To help you maintain your dryer, we provide recommended spare parts according to dryer models.

If you fail to use the recommended spare parts and/or filter elements, it may result in the costly and unnecessary shutdown of your dryer. Furthermore, the manufacturer is not liable for such shutdown. To request an offer of or order recommended spare parts or emergency spare parts, please contact BeaconMedaes Service at 400-616-9018.

A.1.1 Drying cycle

The compressed air flows into the fully automatic heatless dryer unit and gets dried in both desiccant-filled dryers alternately. The moisture contained in the air is adsorbed and removed here.

During normal operation, one dryer is in use and performs the drying cycle and the other dryer is backup and performs the regeneration cycle in order to remove the adsorbed moisture or run the economic cycle of the regeneration controller under the pipe network pressure.

Normal mode (if the dew point sensor or the controller fails)
In the forced mode, the dryer unit switches dryers every 90 seconds. Under normal working conditions, one dryer works at the system pressure while the other keeps a pressure of 0bar. Any other pressure indicates abnormality and may result in an increase of dew point. During switchover, the dryer in use discharges the air and the other dryer in the regeneration (purification) mode is pressurized to the pipe network pressure. There pressurization cycle takes 5seconds.If the dryer unit runs the regeneration cycle continuously (manual mode), about 15% of the air flow in the system will be used for regeneration.

Purge saving mode
In the auto mode, the dew point sensor controls the regeneration cycle of the dryers. The regeneration cycle depends on the dew point. When the dew point reading exceeds the setting, i.e. -40°C, the dryer unit will operate normally (one dryer at system pressure and the other at 0 psig). When the dew point falls below the setting, i.e.-40°C, the regeneration valve will close. At this time, both dryers are at about 100psi and the dryer unit will not switch dryers until the dew point is above-40°C.

A.1.2 Prefilter

The dryer unit is equipped with a prefilter and filters out moisture and contaminants. Such prefilter works to remove moisture and suspended particles in the airflow immediately before the dryer unit.

Annex A Adsorption Dryer

A.2 Operation

A.2.1 Initial start

1. Turn on the power supply of a dryer.

2. Close the isolation valve at the outlet of the dryer.

3. Check whether the compressed air is available. Wait for the system pressurization.

4. Slowly open the isolation valve at the air inlet of the dryer.

5. The dryer connected to the system start circulating the compressed air.

6. Check if the regenerated air flows out of the regeneration silencer.

7. Slowly open the isolation valve at the air outlet of the dryer.

8. Open the isolation valves of the dew point sensor and the CO detector (if equipped).

9. Check if there is airflow at orifice of the dew point sensor.

10. Run the dryer for five to ten minutes with the air supply isolation valve closed.

11. During the test run, check the airtightness of all joints with leakage detection mist or by any other feasible method to identify all potential leakage. Tighten or repair the leakage points and retest the leakage.

Note: A little bit air leakage at the outlet of the dryer will cause the dew point to rise.

12. Make sure the dryer is working in automatic mode.

13. At the end of the test run, slowly open the air supply isolation valve. Then, the dryer will run normally.

A.2.2 Stop procedure

Switchover of the dryers

1. Repeat steps 4 through 7 above to activate the second dryer.

2. Close the isolation valve at the outlet of the second dryer.

3. Cut off the power supply to the first dryer.

4. Close the isolation valve at the inlet of the first dryer. The dryer must be depressurized.

Warning:

Wait for minimum 2 minutes until the dryer is depressurized before maintenance.

A.2.3 Normal start

If the dryer unit stops for a short period of time and the desiccant is not exposed to moisture, follow the steps below:

1. Restart the compressor (if it stops).

2. Select the appropriate dryer with the controller.

3. Slowly open the isolation valve at the air inlet of the dryer.

4. Select the dryer on the central controller.

5. Check the conditions of the dryer.

Annex A Adsorption Dryer

A.2.4 Maintenance stop

1. Close the isolation valve at the air inlet of the first dryer.

2. Switch to the second dryer on the central controller.

3. Run the dryer to circulate the air until the air flows out of the regeneration vent and both drying chambers are fully depressurized.

4. Remove the fuse and cut off the power supply to the dryer unit.

A.3 Troubleshooting

Warning:

For life safety of patients, it is necessary to notify the appropriate medical personnel before maintaining or repairing the air system. The quality of compressed air may be affected during maintenance or repairing.

Warning:

Some of the troubleshooting activities below must be performed on an active dryer unit.

So, there is a risk of electric shock. Please assign a qualified electrician for such activities. Cut off the power supply to the dryer unit before electrical maintenance or repairing.

Warning:

Ensure that the dryer unit and the isolation valves of connected pre-filter and post-filter are closed and that the dryer unit is fully depressurized before removing or disassembling any subassemblies or parts. Otherwise, it may result in serious personal injury and/or equipment damage.

Note: All parts are carefully selected to ensure that all of them can achieve the best performance in the system. Therefore, the use of any unauthorized part or improper operation can result in degradation of system performance.

Warning:

The compressed air is hazardous so that the corresponding safety precautions must be observed during use of the compressed air and the compressed air equipment. Please depressurize the compressed air equipment completely before removing any subassemblies or parts, or performing any work on the compressed air equipment. Please follow the maintenance stop procedure to release the compressed air in the equipment.

Annex A Adsorption Dryer

A.4 Maintenance

Warning:

For life safety of patients, it is necessary to notify the appropriate medical personnel before maintaining or repairing the air system. The quality of compressed air may be affected during maintenance or repairing.

Warning:

The compressed air is hazardous so that the corresponding safety precautions must be observed during use of the compressed air and the compressed air equipment. Please depressurize the compressed air equipment completely before removing any subassemblies or parts, or performing any work on the compressed air equipment. Please follow the maintenance stop procedure to release the compressed air in the equipment.

The compressed air dryer can work for a long period of time without fault if the preventive maintenance is done as recommended.