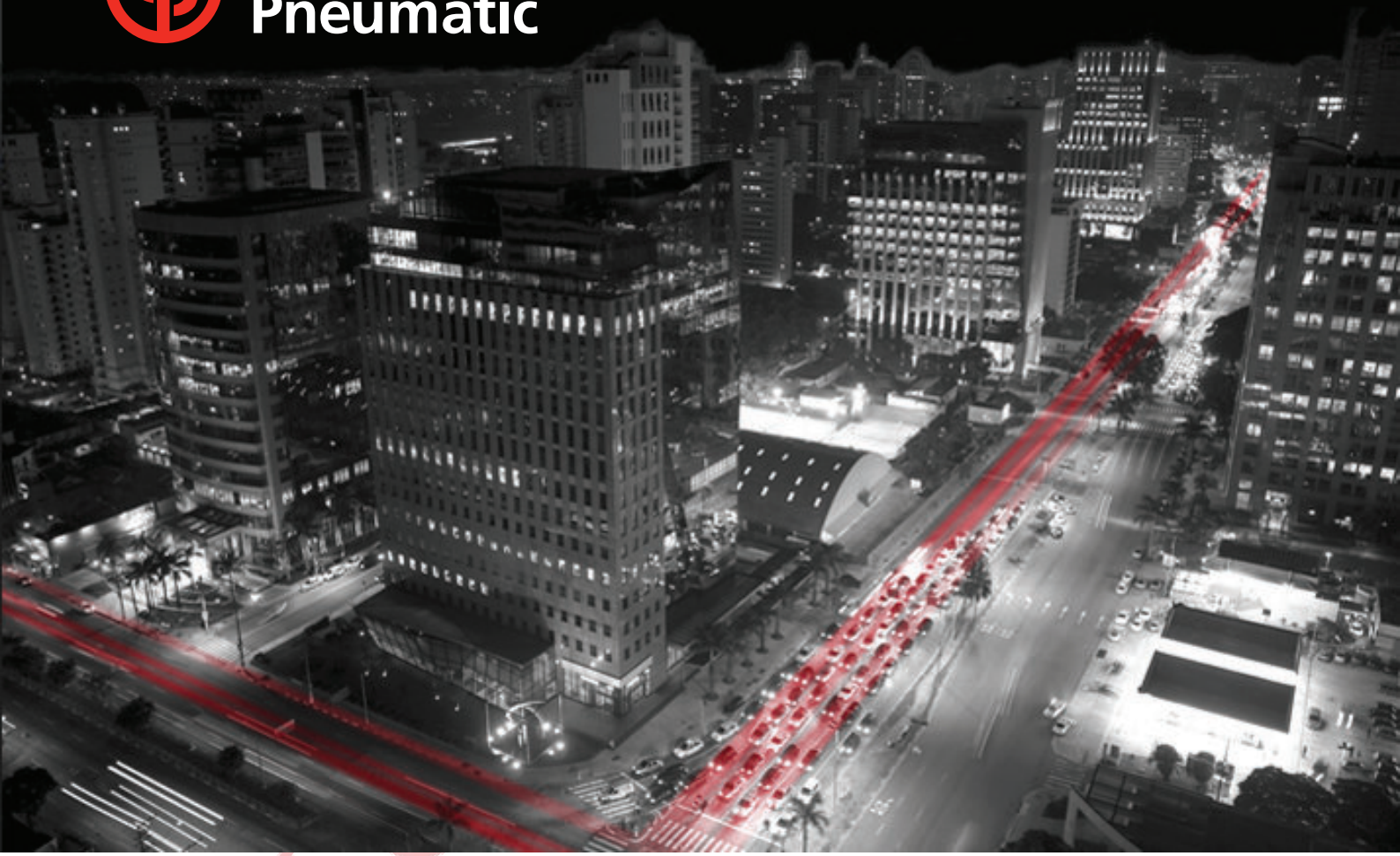
Oil-injected rotary screw compressors

Chicago Pneumatic



People. Passion. Performance.

# CPVS 40, CPVS 50, CPVS 60, CPVS 75, CPVS 95, CPVS 100, CPVS 120, CPVS 150

Instruction book

COMPRESSED
AIR ADVISORS
Inc.

# Oil-injected rotary screw compressors

## CPVS 40, CPVS 50, CPVS 60, CPVS 75, CPVS 95, CPVS 100, CPVS 120, CPVS 150

From following serial No. onwards: API172431

## 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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**No. 2920 7101 51**

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# 1 Safety precautions

## 1.1 Safety icons

**Explanation**

| | |
|---|---|
|  | Danger for 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. The compressor is not considered capable of producing air of breathing quality. For air of breathing quality, the compressed air must be adequately purified according to the applicable legislation and standards.
5. Before any maintenance, repair work, adjustment or any other non-routine checks:
   - Stop the compressor
   - Press the emergency stop button
   - Switch off the voltage
   - Depressurize the compressor
   - 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 if this 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! |

6. 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.
7. The owner is responsible for maintaining the unit in safe operating condition. Parts and accessories shall be replaced if unsuitable for safe operation.
8. 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 cannot be drawn in.
8. Ensure that the discharge pipe from the compressor to the aftercooler or air net is free to expand under heat 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 failure is 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. For water-cooled machines, the cooling water system installed outside the machine has to be protected by a safety device with set pressure according to the maximum cooling water inlet pressure.
18. If the ground is not level or can be subject to variable inclination, consult the manufacturer.
19. 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 and Safety precautions during maintenance.<br>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.<br>Some precautions are general and cover several machine types and equipment; hence some 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, 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 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.
   On machines without bodywork, wear ear protection in the vicinity of the machine.
7. People staying in environments or rooms where the sound pressure level reaches or exceeds 80 dB(A) shall wear ear protectors.
8. 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

9. 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.
10. 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.
11. Do not remove any of, or tamper with, the sound-damping material.
12. 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.
13. 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.<br>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.<br>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. Every time the separator element is renewed, examine the discharge pipe and the inside of the oil separator vessel for carbon deposits; if excessive, the deposits should be removed.
18. Protect the motor, air filter, electrical and regulating components, etc. to prevent moisture from entering them, e.g. when steam cleaning.
19. 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.
20. Never use caustic solvents which can damage materials of the air net, e.g. polycarbonate bowls.
21. **Only if applicable, the following safety precautions are stressed when handling refrigerant:**
    - Never inhale refrigerant vapors. Check that the working area is adequately ventilated; if required, use breathing protection.
    - Always wear special gloves. In case of refrigerant contact with the skin, rinse the skin with water. If liquid refrigerant contacts the skin through clothing, never tear off or remove the latter; flush abundantly with fresh water over the clothing until all refrigerant is flushed away; then seek medical first aid.

| | |
|---|---|
|  | Also consult following safety precautions: Safety precautions during installation and Safety precautions during operation.<br>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.<br>Some precautions are general and cover several machine types and equipment; hence some statements may not apply to your machine. |

# 2 General description

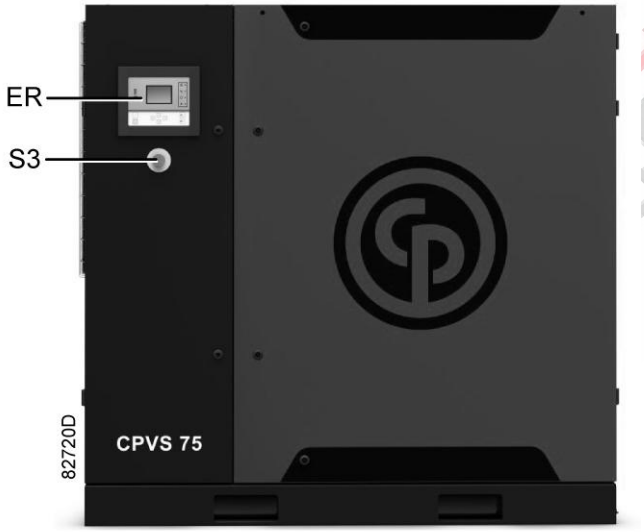
## 2.1 Introduction

### General

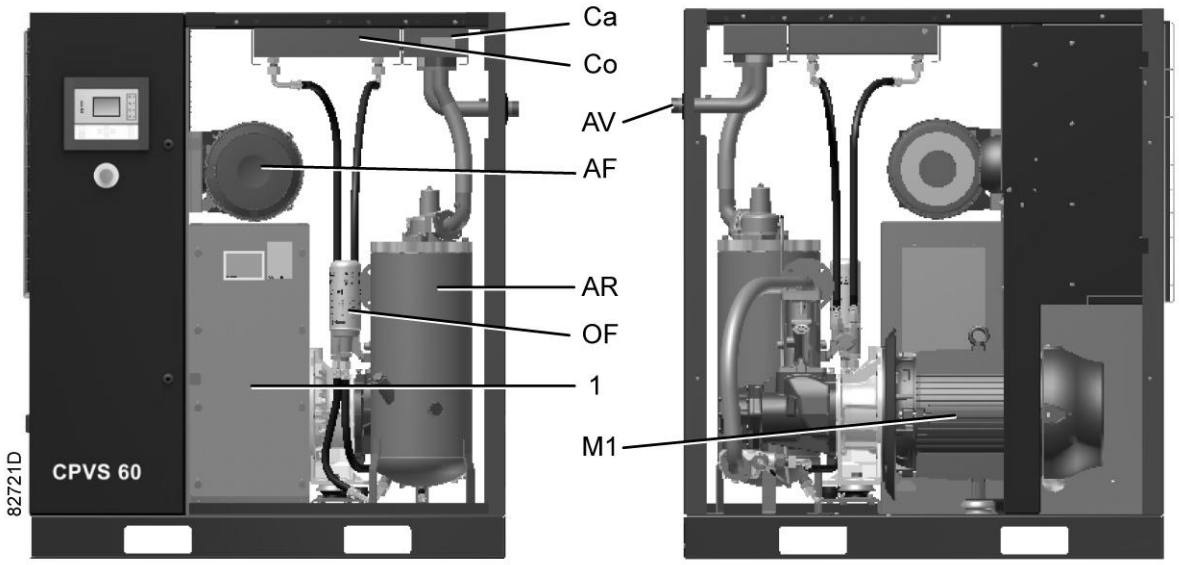
CPVS 40 up to CPVS 150 are single-stage, oil-injected screw compressors, gearbox driven by an electric motor. The compressors are available in air-cooled and water-cooled version. The compressors are enclosed in sound-insulated bodywork.

The compressors are controlled by the ES 4000 Advanced controller.

The ES 4000 controller and the emergency stop button are integrated in the door panel of the electric cubicle. An electric cabinet comprising the motor starter is located behind this panel.




*Front view*

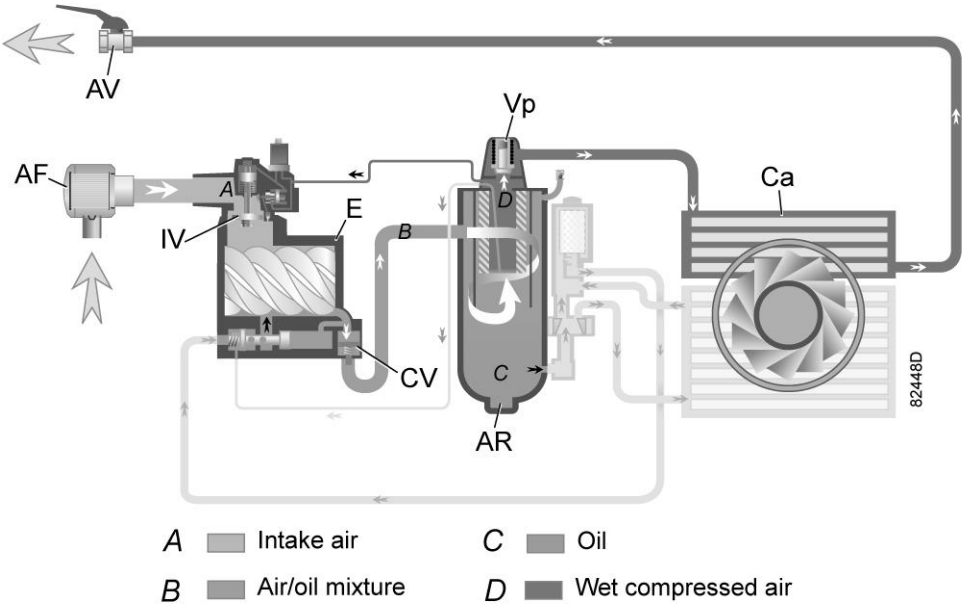



*Main components*

| Ref. | Name |
|---|---|
| AF | Air filter |
| AR | Air receiver |
| AV | Location of air outlet valve |
| Ca | Air cooler |
| Co | Oil cooler |
| ER | Controller |
| M1 | Drive motor |
| OF | Oil filter |
| S3 | Emergency stop button |
| 1 | Inverter |

# 2.2 Air and oil circuit

### Air circuit




*Flow diagram, air circuit*

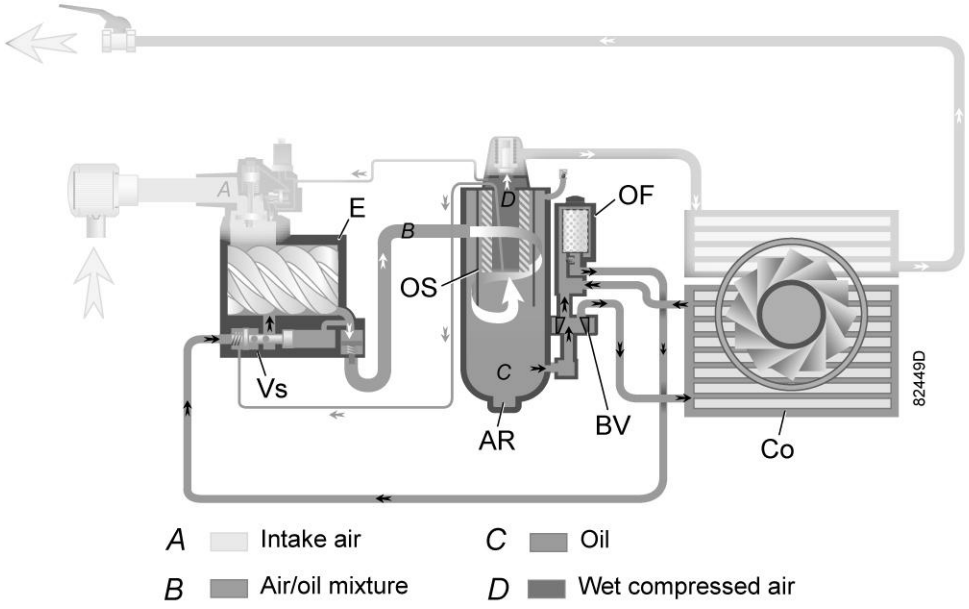
| Reference | Description |
|---|---|
| A | Intake air |
| B | Air/oil mixture |
| C | Oil |
| D | Wet compressed air |

**Description**

Air drawn through filter (AF) and open inlet valve (IV) into compressor element (E) is compressed. A mix of compressed air and oil flows into the air receiver/oil separator (AR) via check valve (CV). The air is discharged through outlet valve (AV) via minimum pressure valve (Vp) and air cooler (Ca).

During loaded operation, minimum pressure valve (Vp) keeps the pressure in the separator tank (AR) above a minimum value, required for lubrication. An integrated check valve prevents the compressed air downstream the valve from being vented to atmosphere during unloaded operation. When the compressor is stopped, check valve (CV) and inlet valve (IV) close, preventing compressed air (and oil) to be vented into the air filter.

## Oil circuit




*Flow diagram, oil circuit*

### Description

In air receiver/oil separator (AR), most of the oil is removed from the air/oil mixture by centrifugal action. The remaining oil is removed by oil separator (OS). The oil collects in the lower part of air receiver/oil separator (AR), which serves as an oil tank.

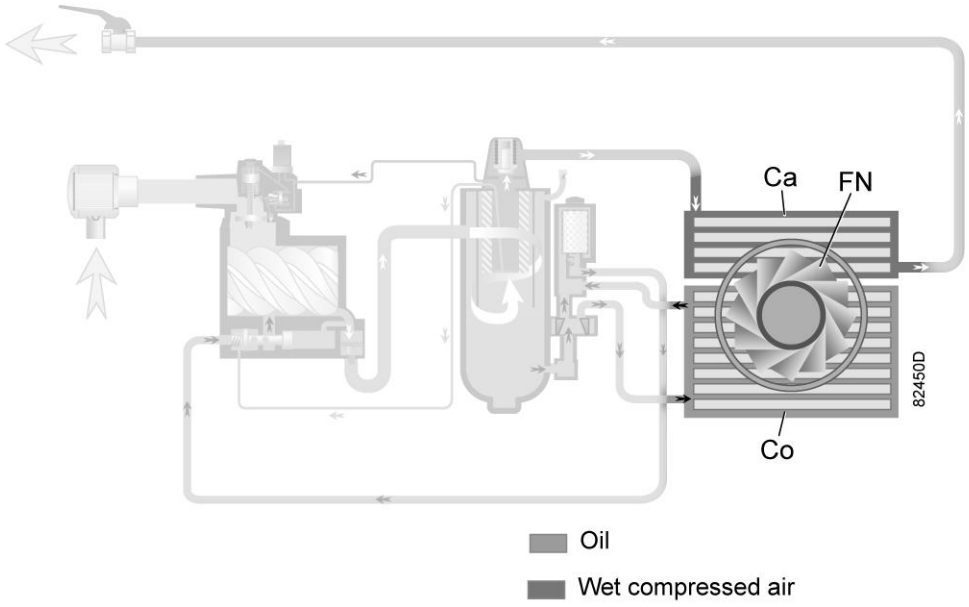
The oil system is provided with a thermostatic bypass valve (BV). When the oil temperature is below its set point, bypass valve (BV) shuts off the supply to oil cooler (Co) and the oil cooler is bypassed.

Air pressure forces the oil from air receiver/oil separator (AR) through oil filter (OF) and oil stop valve (Vs) to compressor element (E).

Bypass valve (BV) starts opening the supply from cooler (Co) when the oil temperature has increased to the set point. At approx. 15 ˚C (27 ˚F) above the set point, all the oil flows through the oil cooler.

Oil stop valve (Vs) prevents the compressor element from flooding with oil when the compressor is stopped. The valve is opened by element outlet pressure when the compressor is started.

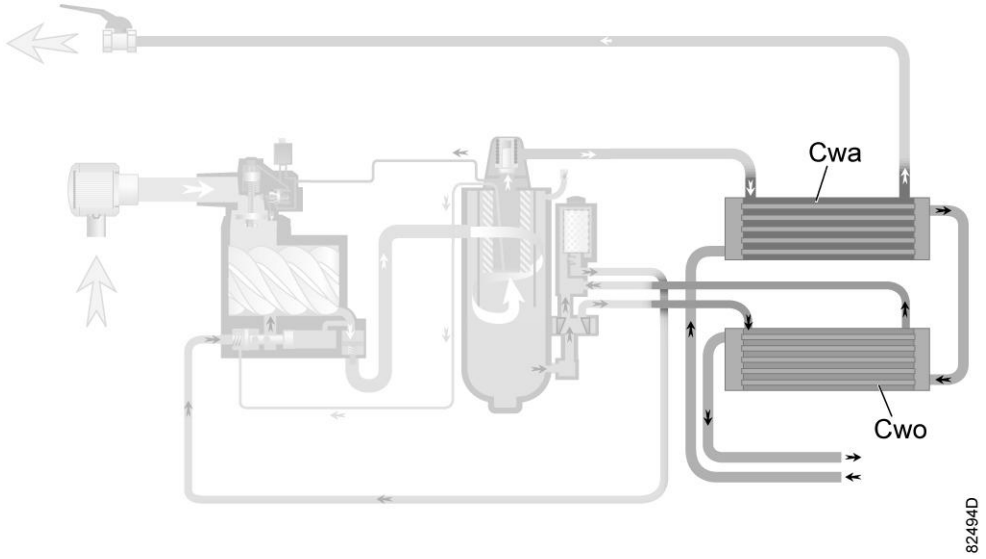
## Cooling system




*Cooling system air-cooled compressors*

The cooling system comprises air cooler (Ca) and oil cooler (Co).

On air-cooled compressors, the cooling air flow is generated by a fan (FN).

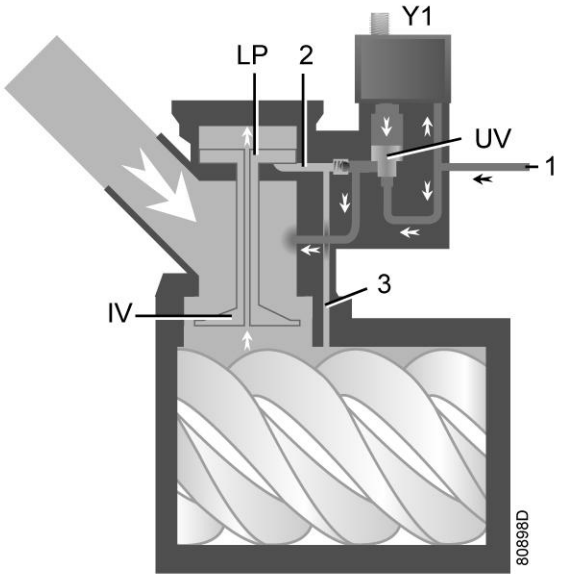



*Cooling system water-cooled compressors*

Water-cooled compressors are connected to a cooling water circuit. The water flows through the inlet pipe to the air cooler (Cwa), further through the oil cooler (Cwo) to the outlet pipe.

# 2.3 Regulating system

### Load/unload regulating system




*Regulating system (loaded condition)*

### Loading

When the net pressure is below the loading pressure, solenoid valve (Y1) is energised. Results:

- The space above unloading valve/blow-off valve (UV) is connected with the oil separator tank pressure (1) via the solenoid valve.
- Unloading valve/blow-off valve (UV) moves downwards, closing off the connection to channels (2) and (3).
- Underpressure from the compressor element causes loading plunger (LP) to move downwards and inlet valve (IV) to open fully.

Air delivery is 100%, the compressor runs loaded.

### Unloading

If the air consumption is less than the air output of the compressor, the net pressure increases. When the net pressure reaches the unloading pressure, solenoid valve (Y1) is de-energised. Results:

- The pressure above unloading valve/blow-off valve (UV) is released to atmosphere and the space above valve (UV) is no longer in connection with the oil separator tank pressure (1).
- Unloading valve/blow-off valve (UV) moves upwards, connecting the oil separator tank pressure (1) with channels (2) and (3).
- The pressure in channel (2) causes the loading plunger (LP) to move upwards, causing inlet valve (IV) to close, while the pressure is gradually released to atmosphere.
- The pressure in the separator tank stabilises at low value. A small amount of air is kept drawn in to guarantee a minimal pressure, required for lubrication during unloaded operation.

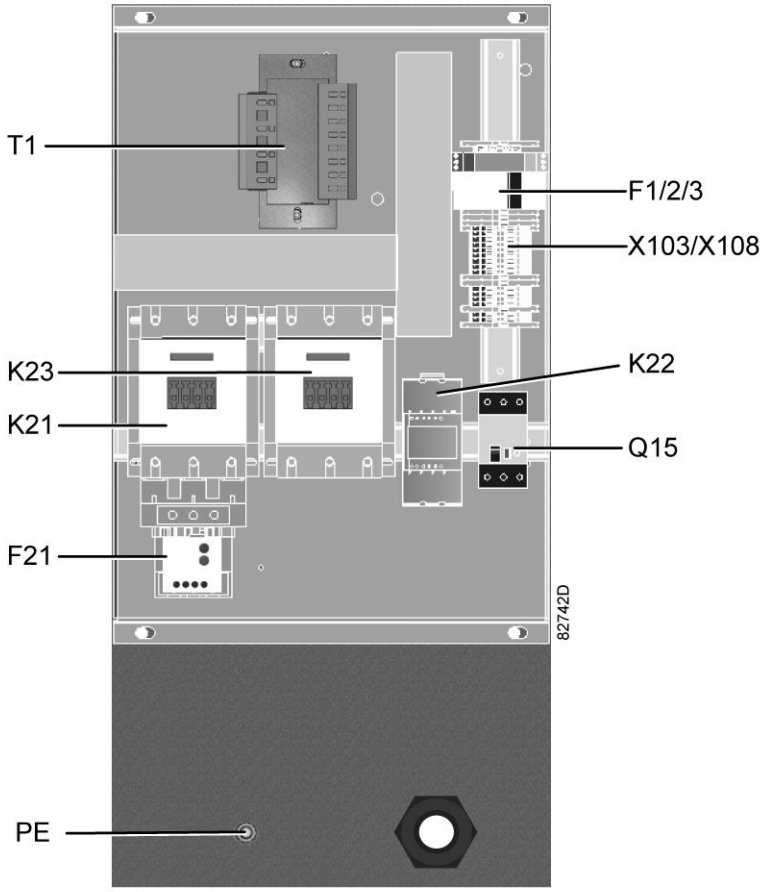
Air output is stopped, the compressor runs unloaded.

# 2.4 Electrical system

## General

## Electrical components

The electrical system comprises following components:




*Electric cubicle, typical example*

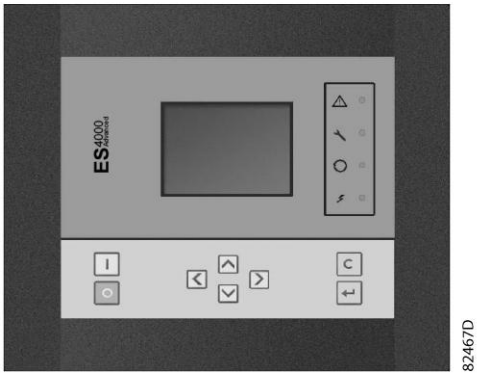
| Reference | Designation |
|---|---|
| F1/2/3 | Fuses<br>(F3 is only provided in case a phase sequence relay is provided) |
| F21 | Overload relay, compressor motor |
| Q15 | Circuit breaker, fan motor (on air-cooled compressors) |
| K21 | Line contactor |
| K22 | Star contactor |
| K23 | Delta contactor |
| T1 | Transformer |
| X103/X108 | Connectors |
| PE | Earth terminal |

## Electrical diagram

There is a copy of the electrical diagram inside the electrical cubicle.

# 3 Graphic controller

## 3.1 Controller




*View of the ES 4000 Advanced controller*

### Introduction

**The electronic controller has following functions:**

- Controlling the compressor
- Protecting the compressor
- Monitoring components subject to service
- Automatic restart after voltage failure

### Automatic control of the compressor

The controller maintains the net pressure between programmable limits by automatically loading and unloading the compressor (fixed speed compressors) or by adapting the motor speed (compressors with frequency converter). 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 taken into account.

The controller stops the compressor whenever possible to reduce the power consumption and restarts it automatically when the net pressure decreases. If the expected unloading period is to short, the compressor is kept running to prevent too short stand-still 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

**Shut-down**

Several sensors are provided on the compressor. If one of the measured signals exceeds the programmed shutdown level, the compressor will be stopped.

Example: If the compressor element outlet temperature exceeds the programmed shut-down level, the compressor will be stopped. This will be indicated on the display of the controller. The compressor will also be stopped in case of overload of the drive motor.

Air-cooled compressors will also be stopped in the event of overload of the fan motor.

| | |
|---|---|
| ⚠ | Before remedying, consult the Safety precautions. |

**Shut-down warning**

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

If one of the measurements exceeds the programmed shut-down warning level, this will also be indicated to warn the operator before the shut-down level is reached.

### Service warning

If the service timer exceeds a programmed value, this will be indicated on the display to warn the operator to carry out some service actions.

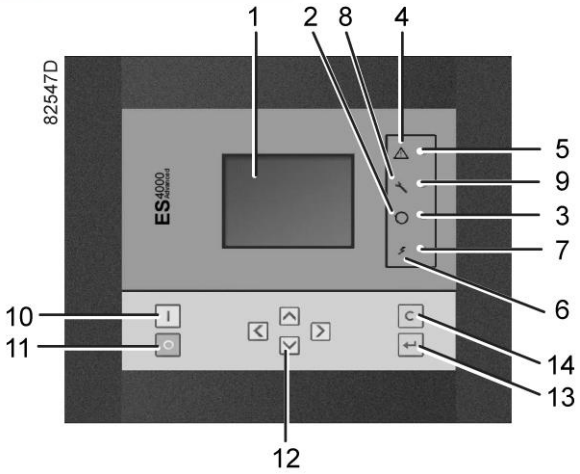
### Automatic restart after voltage failure

The controller has a built-in function to automatically restart the compressor when the voltage is restored after voltage failure. For compressors leaving the factory, this function is made inactive. If desired, the function can be activated.

| | |
|---|---|
| ⚠ | 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. |

## 3.2 Control panel

### Detailed description




*Function keys of the controller*

| Reference | Designation | Function |
|---|---|---|
| 1 | Display | Shows icons and operating conditions. |
| 2 | Automatic operation symbol | |
| 3 | LED, Automatic operation | Indicates that the regulator is automatically controlling the compressor: the compressor is loaded, unloaded, stopped and restarted depending on the air consumption and the limitations programmed in the regulator. |
| 4 | Warning symbol | |
| 5 | LED, Warning | Flashes in case of a shut-down, is lit in case of a warning condition. |
| 6 | Voltage symbol | |
| 7 | LED, Voltage on | Indicates that the voltage is switched on. |
| 8 | Service symbol | |
| 9 | LED, Service | Is lit when service is needed. |
| 10 | Start button | This button starts the compressor. Automatic operation LED (3) lights up. The controller is operative. |
| 11 | Stop button | This button is used to stop the compressor. Automatic operation LED (3) goes out. |
| 12 | Scroll buttons | Use these buttons to scroll through the menu. |
| 13 | Enter button | Use this button to confirm the last action. |
| 14 | Escape button | Use this button to go to previous screen or to end the current action. |

## 3.3 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 |

| Name | Icon | Description |
|---|---|---|
| Machine control mode |  57790F<br>or<br>  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 lines display icon |
| |  82196F | Chart display icon |
| General icons |  81105D | No communication / network problem |

| Name | Icon | Description |
|---|---|---|
| |  82418D | Not valid |

## Input icons

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

## System icons

| Icon | Description |
|---|---|
|  57803F | Compressor element (LP, HP, ...) |
|  57804F | Dryer |
|  57805F | Fan |
|  57806F | Frequency converter |
|  57807F | Drain |
|  57808F | Filter |
|  57809F | Motor |
|  57810F | Failure expansion module |
|  81105D | Network problem |

| Icon | Description |
|---|---|
|  | General alarm |

## Menu icons

| Icon | Description |
|---|---|
|  | Inputs |
|  | Outputs |
|  | Protections (Warnings, shutdowns) |
|  | Counters |
|  | Test |
|  | Regulation (Settings) |
|  | Service |
|  | Event history (saved data) |
|  | Access key / User password |
|  | Network |
|  | Setpoint |
|  | Information |
|  | Week Timer |
|  | General |

### Navigation arrows

| Icon | Description |
|---|---|
|  57821F | Up |
|  57822F | Down |

## 3.4 Main screen

### Function

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

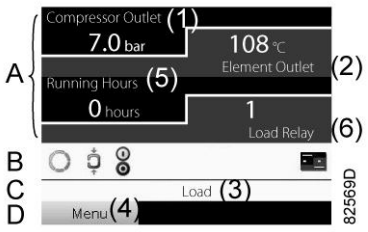
Typically, 5 different main screen views can be chosen:

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

### Two and four value lines screens

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


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




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

Text on figures

| | |
|---|---|
| (1) | Compressor Outlet |

| | |
|---|---|
| (2) | Element outlet |
| (3) | Load, ... (text varies upon the compressors actual condition) |
| (4) | Menu |
| (5) | Running hours |
| (6) | Load relay (one of the input signals of fixed speed compressors)<br>Flow (compressors with frequency converter) |

- **Section A** shows information regarding the compressor operation (e.g. the outlet pressure or the temperature at the compressor outlet). On compressors with a frequency converter, the load degree (flow) is given in % of the maximum flow.
- **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

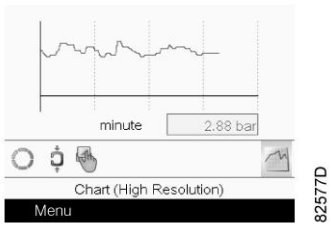
  The function of the buttons depends on the displayed menu. The most common functions are:

| 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.

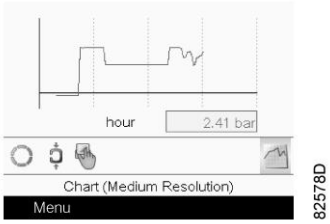
## Chart views

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.

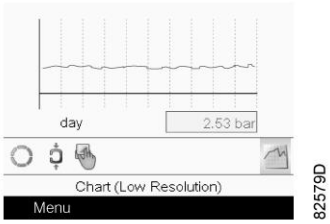


When Chart (High Resolution) is selected, the chart shows the variation of the selected input (in this case the pressure) per minute. Also the instantaneous value is displayed. The screen shows the last 4 minutes.

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



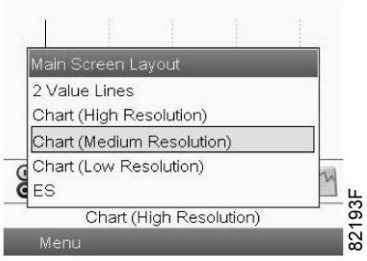

When the Chart (Medium Resolution) is selected, the chart shows the variation of the selected input per hour. The screen shows the last 4 hours.




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 Used icons) and press the Enter key. A screen similar to the one below opens:

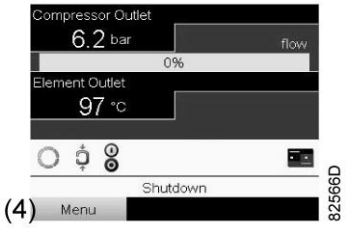



Select the layout required and press the Enter key. See also section Inputs menu.

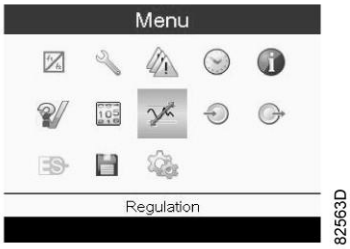
## 3.5 Calling up menus

### Description

When the voltage is switched on, the main screen is shown automatically:




- To go to the Menu screen, highlight the Menu button (4), using the Scroll keys.
- Press the Enter key to select the menu. Following screen appears:




- 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 corresponds with the selected icon.
- Use the Scroll keys to select an icon.
- Press the Escape key to return to the Main screen.

## 3.6 Inputs menu

### Menu icon, Inputs

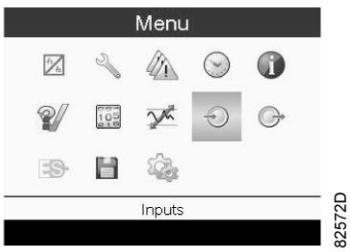

### Function

- 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.

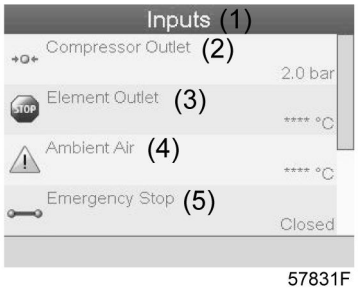
### Procedure

Starting from the main screen,

- Move the cursor to the action button Menu and press the Enter key.
- Using the Scroll keys, move the cursor to the Inputs icon, as shown in the following screen:



- Press the Enter key. A screen similar to the one below appears:




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.e. the Stop icon and the Warning icon in the screen shown above).

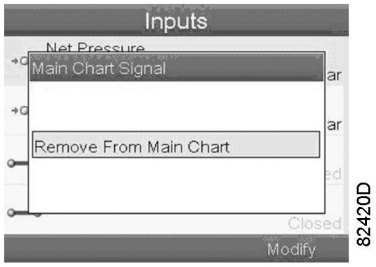
A small chart icon, shown below an item in the list means this input signal is shown on the chart at the main screen. Any analog input can be selected.

### 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:


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

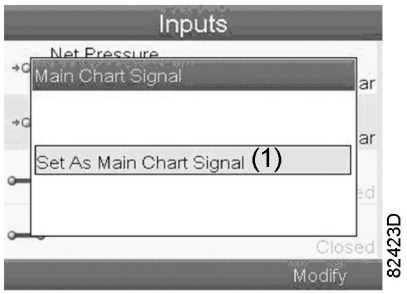
To change, press the Enter button again: a pop-up window opens:




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


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:


(1): Set as main chart signal

## 3.7 Outputs menu

### Menu icon, Outputs

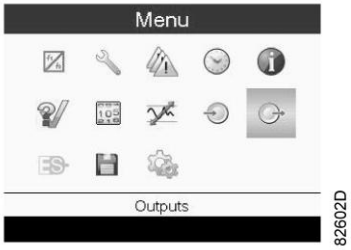

### Function

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

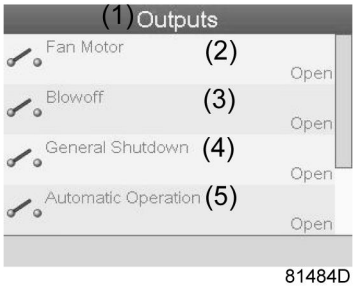
### Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key.
- Move the cursor to the Outputs icon (see below).




- Press the Enter key. A screen similar to the one below appears:




*Outputs screen (typical)*

Text on image

| | |
|---|---|
| (1) | Outputs |
| (2) | Fan motor contact |
| (3) | Blow-off contact |
| (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.

## 3.8 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,

- Move the cursor to the action button Menu and press the Enter key.
- Using the Scroll keys, move the cursor to the Counters icon (see below)


- Press the Enter key. A screen similar to the one below appears:


Text on image

| | |
|---|---|
| (1) | Counters |
| (2) | Running hours |
| (3) | Motor starts |
| (4) | Load relay |
| (5) | VSD 1-20 % rpm in % (the percentage of the time during which the motor speed was between 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, the actual screen will be somewhat different.

## 3.9 Control mode selection

### Function

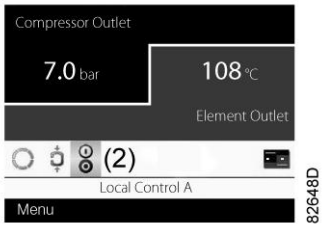
To select the control mode, i.e. whether the compressor is in local control, remote control or controlled via a local area network (LAN).

### Procedure

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

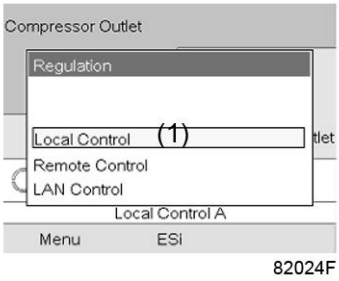

Next, use the scroll buttons to go to the Status icons (see section Main screen) and select the Regulation icon (2). When the icon is active, this icon is highlighted with a grey background colour.

Press the enter button:




There are 3 possibilities:

- Local control
- Remote control
- LAN (network) control




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 Used icons for the meaning of the icons.

## 3.10 Service menu

### Menu icon, Service


### Function

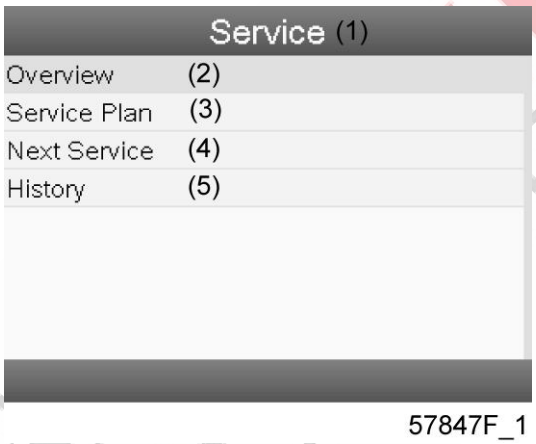
- To reset the service plans which are carried out.
- To check when the next service plans are to be carried out.
- To find out which service plans were carried out in the past.
- To modify the programmed service intervals.

## Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key.
- Using the Scroll keys, move the cursor to the Service icon (see below).


- Press the Enter key. Following screen appears:

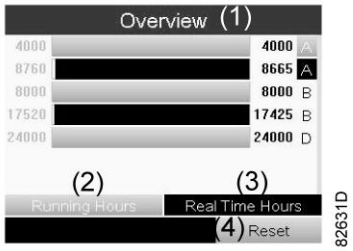



Text on image

| | |
|---|---|
| (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 as explained below.

## Overview



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 at the end of 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 8299 hours to go before the next Service intervention.

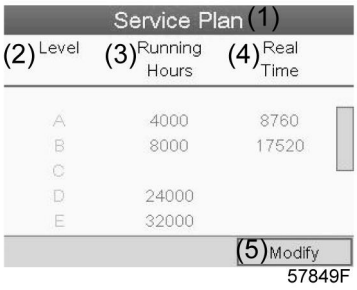
## Service plans

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 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:

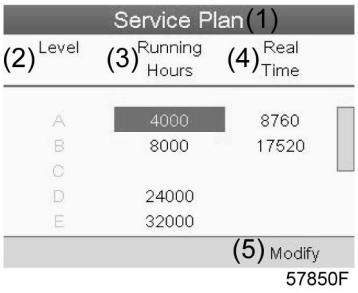



Text on image

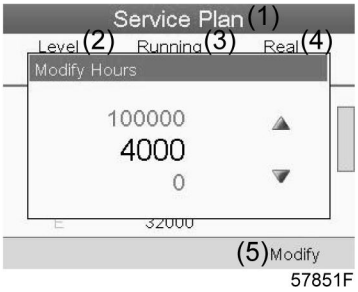
| | |
|---|---|
| (1) | Service plan |
| (2) | Level |
| (3) | Running hours |
| (4) | Real time hours |
| (5) | Modify |

## Modifying a service plan

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



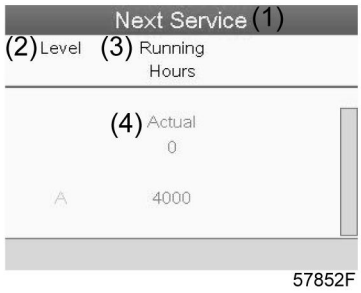

Press the Enter key. Following screen appears:




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

**Note:** Running hours can be modified in steps of 100 hours, real time hours can be modified in steps of 1 hour.

## Next Service




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.

## 3.11 Regulation menu

### Menu icon, Setpoint

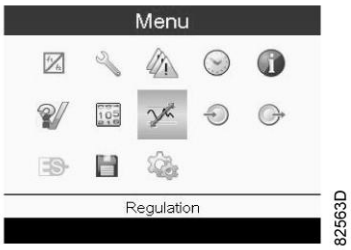

### Function

**On fixed speed compressors** , the operator can program two different pressure bands. This menu is also used 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.
- Using the Scroll keys, move the cursor to the Setpoint icon (see below).




- Press the Enter key. Following screen appears:


Text on figure

| | |
|---|---|
| (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:

57834F

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

57835F

- 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.

## 3.12 Modifying the setpoint

### Menu icon, Setpoint


57820F

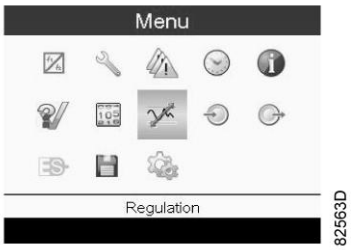
### Function

**On compressors with a frequency converter driven main motor**, it is possible to program two different setpoints. This menu is also used to select the active setpoint.

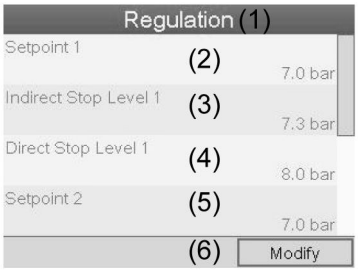
### Procedure

Starting from the Main screen,

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



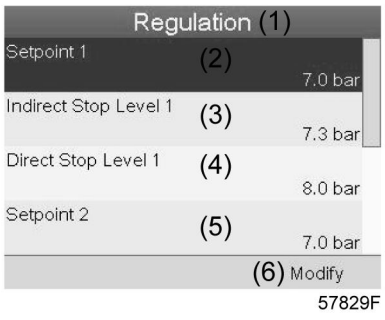

- Activate the menu by pressing the enter key. A screen similar to the one below appears:



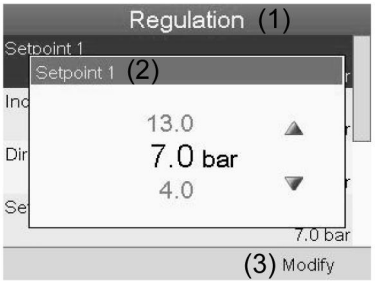

Text on image

| | |
|---|---|
| (1) | Regulation |
| (2) | Setpoint 1 |
| (3) | Indirect stop level 1 |
| (4) | Direct stop level 1 |
| (5) | Setpoint 2 |
| (6) | Modify |

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




- The first line of the screen is highlighted. Use the Scroll keys to highlight the setting to be modified and press the Enter key (2). Following screen appears:




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.

Indirect stop: occurs when the pressure rises to the pre-set Indirect stop setpoint (= setpoint plus Indirect stop level). The motor will decelerate to minimum speed and the compressor will switch to unloaded condition.

Direct stop: occurs when the compressor runs at a speed between minimum and maximum and the net pressure rises above the direct stop setpoint (= setpoint plus Direct stop level).

Both settings (Indirect stop level and Direct stop level) are programmable, see section Programmable settings.

## 3.13 Event history menu

### Menu icon, Event History


### Function

To call up the last shut-down and last emergency stop data.

### Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key.
- Using the Scroll keys, move the cursor to the Event History icon (see below).


- Press the Enter key.
  The list of last shut-down and emergency stop cases is shown.


*Example of Event History screen*

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

## 3.14 Week timer menu

### Menu icon, Week timer

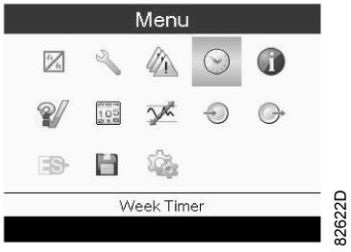

### Function

- To program time-based start/stop commands for the compressor
- To program time-based change-over 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 the cycle, one of the four programmed week schemes can be chosen.

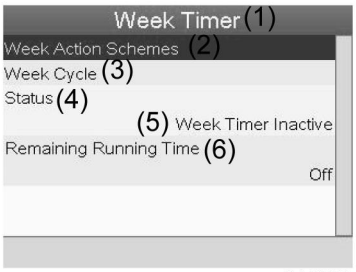
### Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key.
- Use the Scroll buttons to select the Timer icon. (see below)




- Press the Enter key. Following screen appears:



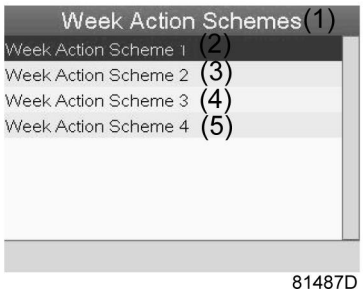

Text on image

| | |
|---|---|
| (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.

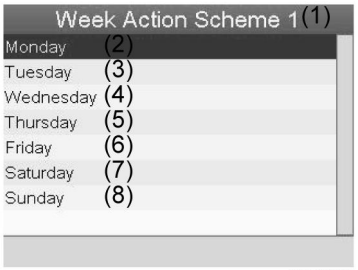
### Programming week schemes

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




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

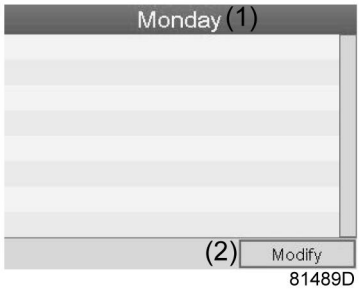
- A weekly list is shown. Monday is automatically selected and highlighted in red. Press the Enter key on the controller to set an action for this day.



81488D

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

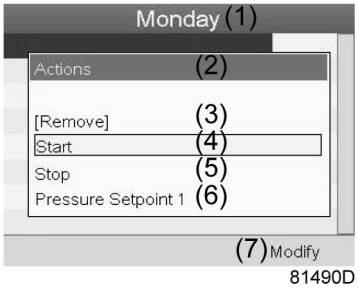
- A new window opens. The Modify action button is selected. Press the enter button on the controller to create an action.



81489D

| | |
|---|---|
| (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.

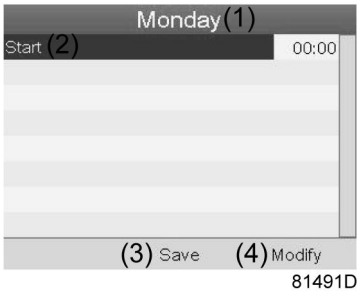


81490D

| | |
|---|---|
| (1) | Monday |
| (2) | Actions |

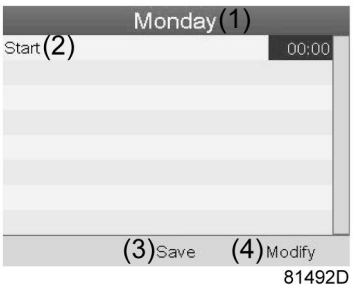
| | |
|---|---|
| (3) | Remove |
| (4) | Start |
| (5) | Stop |
| (6) | Pressure Setpoint 1 |
| (7) | Modify |

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




| | |
|---|---|
| (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.

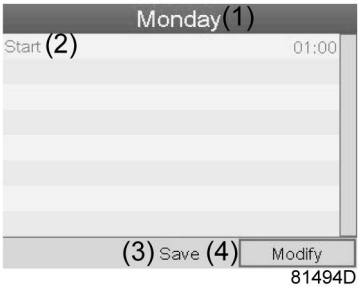



| | |
|---|---|
| (1) | Monday |
| (2) | Start |
| (3) | Save |
| (4) | Modify |

- 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 modify the minutes.

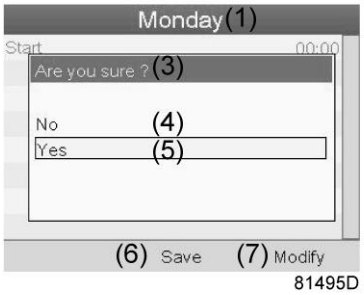

| | |
|---|---|
| (1) | Monday |
| (2) | Time |
| (3) | Save |
| (4) | Modify |

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




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

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

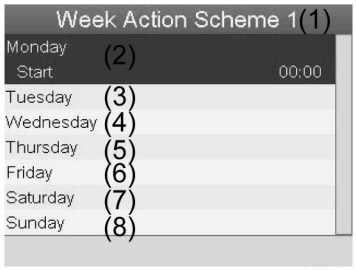



| | |
|---|---|
| (1) | Monday |
| (3) | Are you sure? |
| (4) | No |

| | |
|---|---|
| (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.




81497D

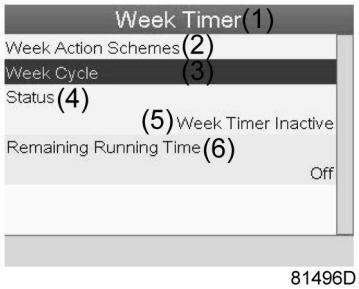
| | |
|---|---|
| (1) | Week Action Scheme 1 |
| (2) | Monday - Start |
| (3) | Tuesday |
| (4) | Wednesday |
| (5) | Thursday |
| (6) | Friday |
| (7) | Saturday |
| (8) | Sunday |

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.

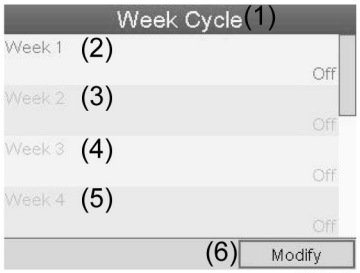



81496D

| | |
|---|---|
| (1) | Week Timer |
| (2) | Week Action Schemes |
| (3) | Week Cycle |
| (4) | Status |

| | |
|---|---|
| (5) | Week Timer Inactive |
| (6) | Remaining Running Time |

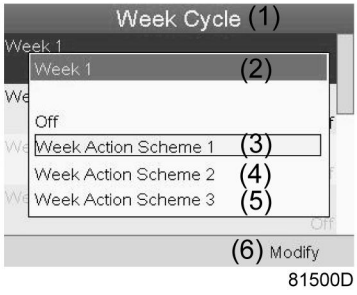
- A list of 10 weeks is shown.




| | |
|---|---|
| (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



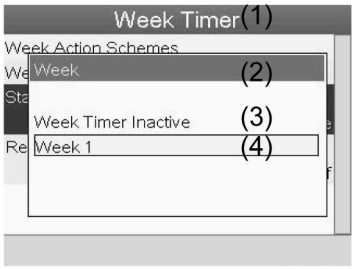

| | |
|---|---|
| (1) | Week Cycle |
| (2) | Week 1 |
| (3) | Week Action Scheme 1 |
| (4) | Week Action Scheme 2 |
| (5) | Week Action Scheme 3 |
| (6) | Modify |

- 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 of the Week Timer.

81501D

| | |
|---|---|
| (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.



81502D

| | |
|---|---|
| (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.

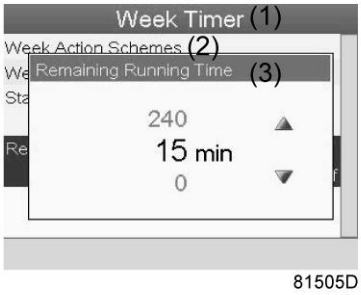
81503D

| | |
|---|---|
| (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.


| | |
|---|---|
| (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.




| | |
|---|---|
| (1) | Week Timer |
| (2) | Week action schemes |
| (3) | Remaining Running Time |

# 3.15 Test menu

### Menu icon, Test

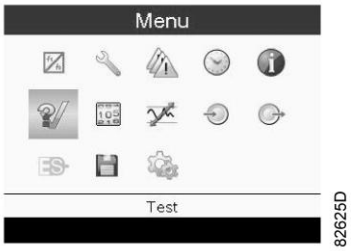

### Function

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

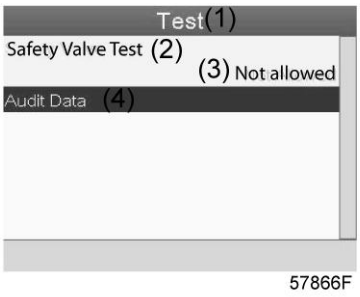
### Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key.
- Using the scroll keys, move the cursor to the Test icon (see below).




- Press the Enter key, following screen appears:




Text on image

| | |
|---|---|
| (1) | Test |
| (2) | Safety Valve Test |
| (3) | Not allowed |
| (4) | Audit Date |

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

# 3.16 Modifying general settings

### Menu icon, Settings

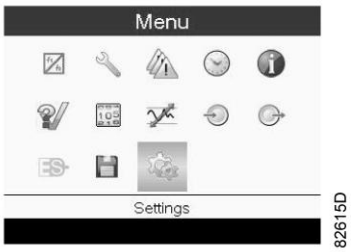

### Function

To display and modify a number of settings.

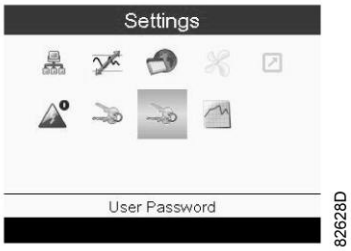
### Procedure

Starting from the Main screen,

- Move the cursor to the action button Menu and press the Enter key.
- Using the Scroll keys, move the cursor to the Settings icon (see below).




- Press the Enter key. A second menu screen appears:

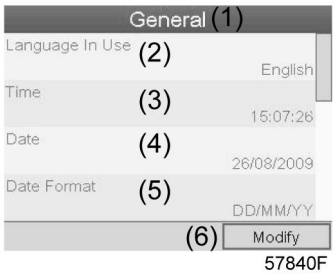



This screen shows again a number of icons. By default, the User Password icon is selected. The status bar shows the description that corresponds with the selected icon. Each icon covers one or more items (depending on the configuration), such as

- Access level
- Elements
- Dryer
- Fan
- Converter(s)
- Filter(s)
- Motor/Starter
- General
- Automatic restart after voltage failure (ARAVF)
- Network
- Regulation
- Remote

For adapting certain parameters, a password may be necessary.

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




Text on image

| | |
|---|---|
| (1) | General |
| (2) | Language used |
| (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 to confirm.

## 3.17 General menu

### Menu icon, General

### Function

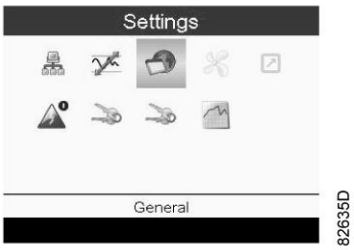
This menu covers a list of general settings:

- Language
- Time
- Date
- Date Format
- Units

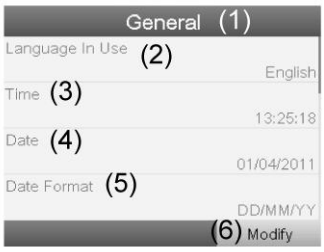
### Procedure

Starting from the submenu screen (see Modifying general settings),

- Using the Scroll keys, move the cursor to the General icon (see below).



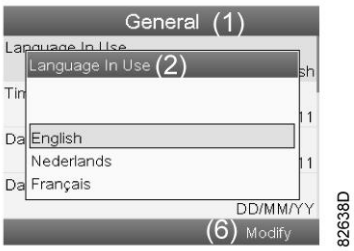

- Press the Enter key. A screen similar to the one below appears:




Text on figure

| | |
|---|---|
| (1) | General |
| (2) | Language in use |
| (3) | Time |
| (4) | Date |
| (5) | Date format |
| (6) | Modify |

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




## 3.18 User password menu

### Menu icon, Password

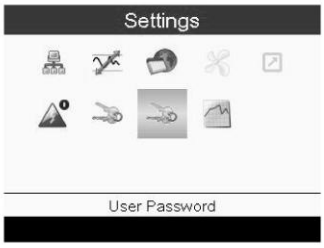
## Function

The end customer can activate and choose a personal password. Once the password option activated, it is impossible for not authorized persons to modify any setting.

## Procedure

Starting from the submenu screen (see Modifying general settings),

- Using the Scroll keys, move the cursor to the User Password icon (see below)




- Press the Enter key. Next screen appears.


- Select the Activate button and press the Enter key.
- Next, fill in the User Password and press the Enter key, a confirmation window opens.
- Fill in the password again and press the enter key to confirm.


Text on figure

| | |
|---|---|
| (1) | User Password |
| (2) | Not activated |
| (3) | Activate |

# 3.19 Access key menu

### Menu icon, Access Key

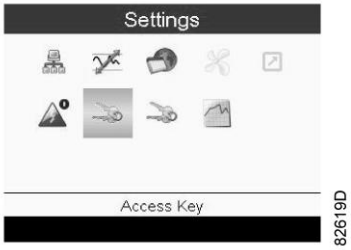

### Function

Only a number of basic Icons will be displayed in the Menu screen. Using the Access Key with the proper access code allows the user to see more Icons, or have access to more parameters.

### Procedure

Starting from the submenu screen (see Modifying general settings),

- Using the Scroll keys, move the cursor to the Access Key icon (see below)




- Three Access levels are possible.
  - **0** : A basic set of parameters is visualized, no password is required.
  - **1** : A basic set of parameters can be modified.
  - **2** : Extra parameters will be visualized and can be modified.
- Changing the Access level can be done through the Modify button. A new pop-up window will be activated asking to enter an Access Key.


# 3.20 Programmable settings

### Parameters: unloading/loading pressures

| | Minimum setting | Factory setting | Maximum setting |
|---|---|---|---|
| Unloading/loading pressures | see Compressor data | see Compressor data | see Compressor data |

### Parameters variable speed drive

| | | Minimum setting | Factory setting | Maximum setting |
|---|---|---|---|---|
| Motor running time in star | sec | NA | NA | NA |
| Load delay time (star-delta) | sec | NA | NA | NA |
| Number of motor starts | starts/day | NA | NA | NA |
| Minimum stop time | sec | 10 | 10 | 30 |
| Programmed stop time | sec | 0 | 3 | 20 |
| Power recovery time (ARAVF) | sec | 30 | 30 | 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 (shut-down warning level) | ˚C | 50 | 113 | 119 |
| | ˚F | 122 | 235 | 246 |
| Compressor element outlet temperature (shut-down level) | ˚C | 111 | 120 | 120 |
| | ˚F | 232 | 248 | 248 |

### Service plan

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

Also see section Maintenance schedule.

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

### Terminology

| Term | Explanation |
|---|---|
| ARAVF | Automatic restart after voltage failure. See section Controller and . |
| 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. To activate the automatic restart function, consult your supplier. |
| 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 regulator does not accept inconsistent 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 your supplier. |

| Term | Explanation |
|---|---|
| Minimum stop time | Once the compressor has automatically stopped, it will remain stopped for the minimum stop time, whatever happens with the net air pressure. Consult your supplier if a setting lower than 20 seconds is required. |
| Unloading/ Loading pressure | The regulator does not accept illogical 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)). |

# 4 Installation

## 4.1 Dimension drawings

*CPVS 100 and CPVS 120 air-cooled compressors*

See document 9820 6706 09 on the CD supplied with your machine

*CPVS 100 and CPVS 120 water-cooled compressors*

See document 9820 6706 15 on the CD supplied with your machine

*CPE 150 and CPVS 150 air-cooled compressors*

See document 9820 7100 60 on the CD supplied with your machine

*CPE 150 and CPVS 150 water-cooled compressors*

See document 9820 7100 50 on the CD supplied with your machine

| Text on drawings | Translation or Explanation |
|---|---|
| Compressor cooling air outlet | Cooling air outlet of compressor and motor |
| Compressor cooling air inlet | Cooling air inlet of compressor and motor |
| Compressed air outlet | Compressed air outlet connection |
| Electrical cable passage | Electrical cable passage |
| Cubicle cooling air outlet | Cubicle cooling air outlet |
| Doors fully open | Dimensions with doors fully open |
| Cooling water outlet | Cooling water outlet connection |
| Cooling water inlet | Cooling water inlet connection |
| Prepared for manual drain | Prepared for manual drain |
| Dryer cooling air inlet | Dryer cooling air inlet |
| Dryer cooling air outlet | Dryer cooling air outlet |
| Centre of gravity | Centre of gravity |
| Mass | Mass of the machine |
| Type | Machine type |

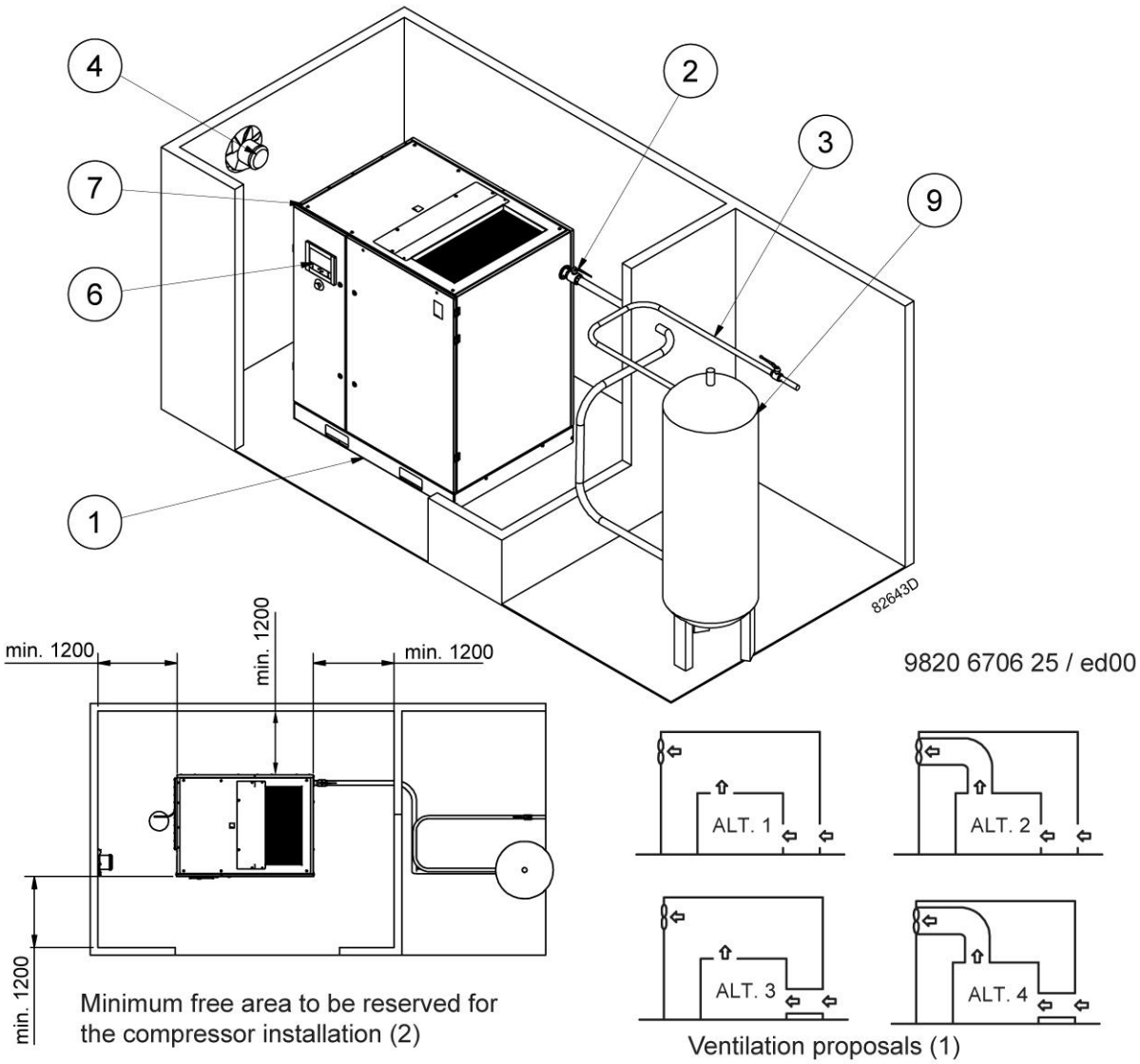
## 4.2 Installation proposal

### Outdoor/altitude operation

| | |
|---|---|
|  | The compressor is not designed for installation outdoors.<br>Also, if the ambient temperature can fall down below 0 ˚C (32 ˚F), and if operating above 1000 m (3300 ft) precautions must be taken. In this case, , consult your supplier. |

## Moving/lifting

| | |
|---|---|
| | The compressor can be moved by a lift truck using the slots in the frame. Take care not to damage the bodywork during lifting or transport. Make sure that the forks protrude from the other side of the frame. The compressor can also be lifted after inserting beams in the slots. 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 a way that the compressor is lifted perpendicularly. Lift gently and avoid twisting. |




Text on drawing

| Reference | Designation |
|---|---|
| (1) | Ventilation proposals |
| (2) | Minimum free area to be reserved for the compressor installation |

| | |
|---|---|
|  | All piping to be connected stress free to the compressor. |

## Installation guidelines

1. Install the compressor unit on a solid, level floor suitable for taking its weight.
2. Position of the compressed air outlet valve.
3. The pressure drop over the air delivery pipe can be calculated from:

$\Delta p = (L \times 450 \times Q_c^{1.85}) / (d^5 \times P)$, with

- $\Delta p$ = Pressure drop in bar (recommended maximum: 0.1 bar (1.5 psi))
- L = Length of the pipe in m
- $Q_c$= Free air delivery of the compressor in l/s
- d = Inner diameter of the pipe in mm
- P = Absolute pressure at the compressor outlet in bar

It is recommended that the connection of the compressor air outlet pipe is made on top of the main air net pipe in order to minimise carry-over of possible condensate residue.

4. Ventilation: the inlet grids and ventilation fan should be installed in such a way that any re-circulation of cooling air to the compressor or dryer 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) for gear driven units and 43 °C (109 °F) for belt driven units. (minimum 0 °C / 32 °F).
   **The required ventilation capacity to limit the compressor room temperature can be calculated as follows:**

$Q_v = 1.06\ N/\Delta T$ for versions without dryer
$Q_v = (1.06\ N + 1.3)/\Delta T$ for versions with dryer

- $Q_v$ = Required ventilation capacity in $m^3/s$
- N = Shaft input of compressor in kW
- $\Delta T$ = Temperature increase in the compressor room in °C

5. The drain pipes to the drain collector must not dip into the water of the drain collector. Any flow back must be avoided. Oil/water separators to separate the major part of the oil from the condensate to ensure that the condensate meets the requirements of the environmental codes are available.
6. Control module with monitoring panel.
7. Position of the main cable entry. Power supply cable to be sized and installed by a qualified electrician.

| | |
|---|---|
|  | 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 proper cable gland when connecting the supply cable to the compressor. |

8. Provision for inlet and outlet of the energy recovery system (system is optional).
9. The air receiver (optional) should be installed in a frost-free room on a solid, level floor For normal air consumption, the volume of the air net (receiver and piping) can be calculated as follows:

$V=(0.25 \times Qc \times P1 \times To)/(fmax \times \Delta P \times T1)$

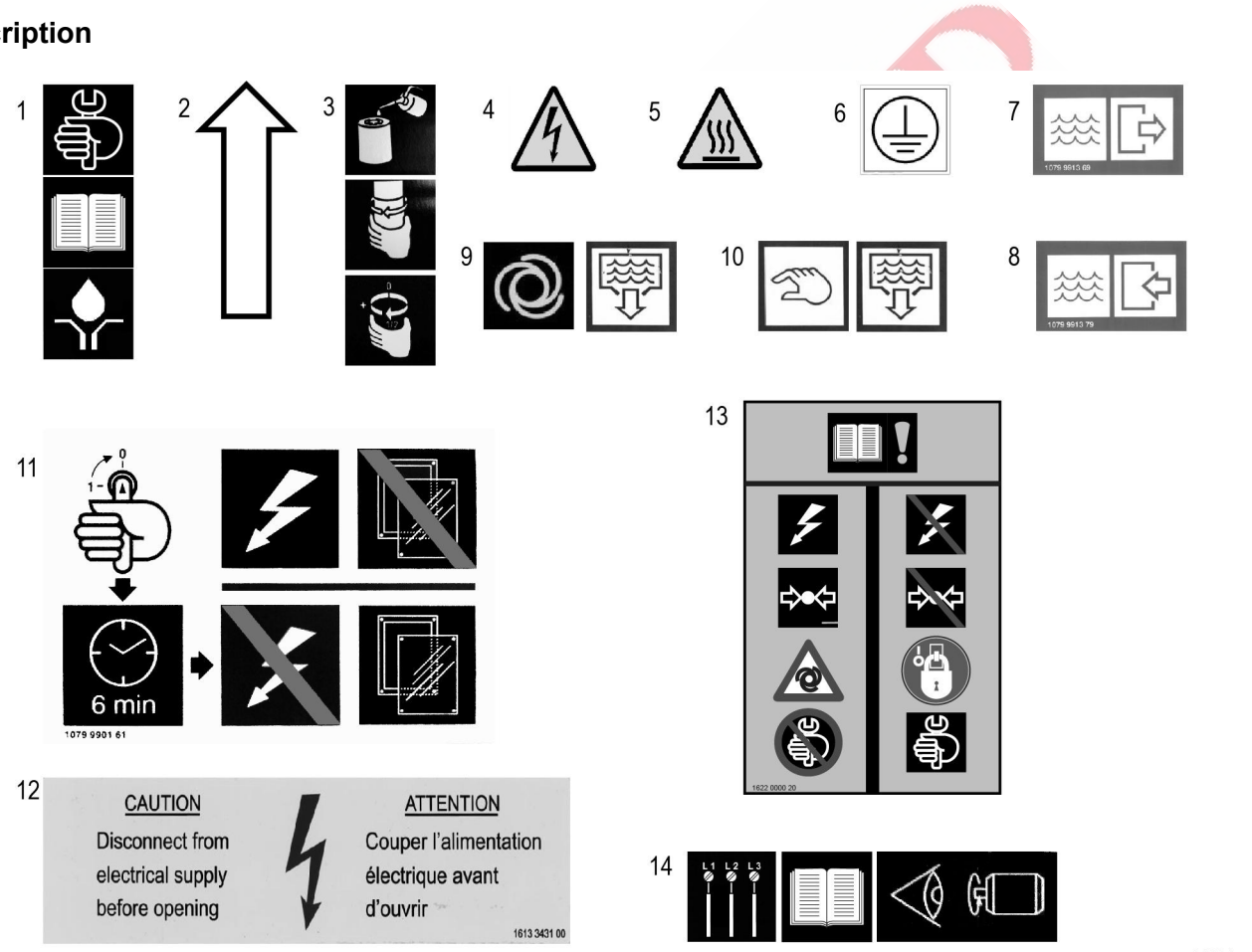
- V= Volume of the air net in l.

- Qc= Free air delivery of the compressor in l/s
- P1= Compressor air inlet pressure in bar absolute
- fmax= Cycle frequency =1 cycle/30s
- ΔP= P unload - P load in bar
- T1= Compressor air inlet temperature in K
- To= Air receiver temperature K

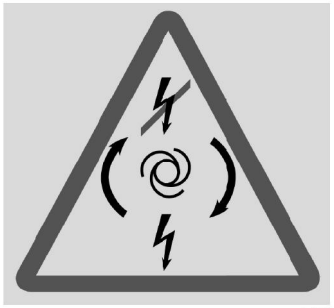
10. To prevent feedback of exhaust air to the cooling inlet, sufficient space should be foreseen above the unit to evacuate the exhaust air.

## 4.3 Pictographs

### Description




*Pictographs*




*15*

| Reference | Designation |
|---|---|
| 1 | Read manual for oil specification |
| 2 | Rotation arrow |
| 3 | Lightly oil the gasket of the oil filter, screw it on and tighten by hand (approx. half a turn) |
| 4 | Warning: Voltage |
| 5 | Warning: Hot surface |
| 6 | Earth connection |
| 7 | Cooling water outlet |
| 8 | Cooling water inlet |
| 9 | Automatic condensate drain |
| 10 | Manual condensate drain |
| 11 | Switch of the voltage and at least wait 6 min. before removing the screen |
| 12 | Disconnect the electric supply before opening |
| 13 | Lock out/ tag out |
| 14 | Before connecting compressor electrically, consult instruction book for motor rotation direction |
| 15 | Auto Restart After Voltage Failure (ARAVF) |

# 5 Operating instructions

## 5.1 Initial start-up

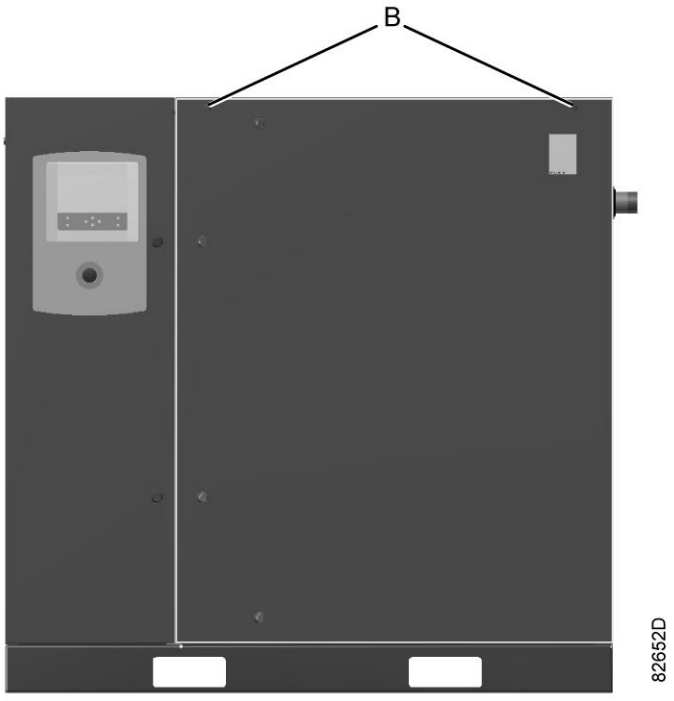
### Safety

| | |
|---|---|
|  | The operator must apply all relevant Safety precautions. |

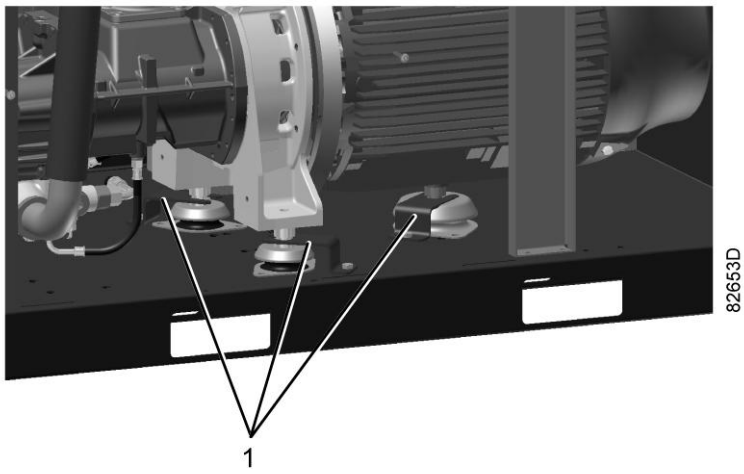
### Procedure

| | |
|---|---|
|  | For the position of the air outlet valve and the drain connections, see sections Introduction. |

1. Consult the sections Electric cable size, Installation proposal and Dimension drawings
2. **The following transport fixtures, painted red, must be removed:**
   - Bolts on service door (B)

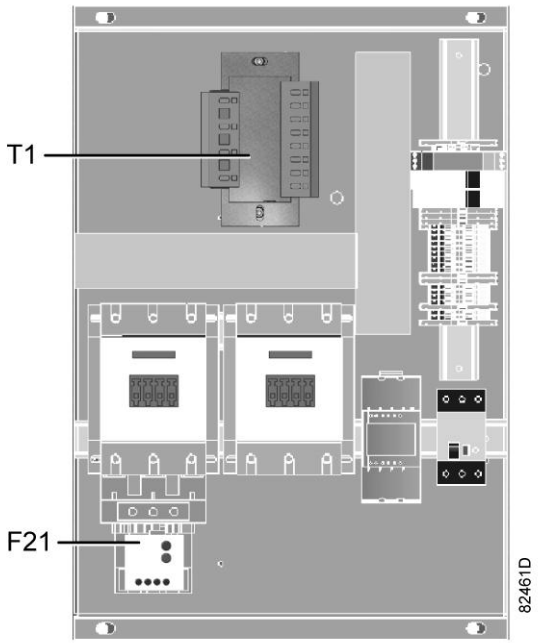



   - Supports (1)




*Transport fixtures*

3. Check that the electrical connections correspond to the local codes and that all wires are clamped tight to their terminals.
   The installation must be earthed and protected against short circuits by fuses of the inert type in all phases. An isolating switch must be installed near the compressor.
4. Check transformer (T1) for correct connection.
   Check the settings of drive motor overload relay (F21).
   Check that the motor overload relay is set for manual resetting.

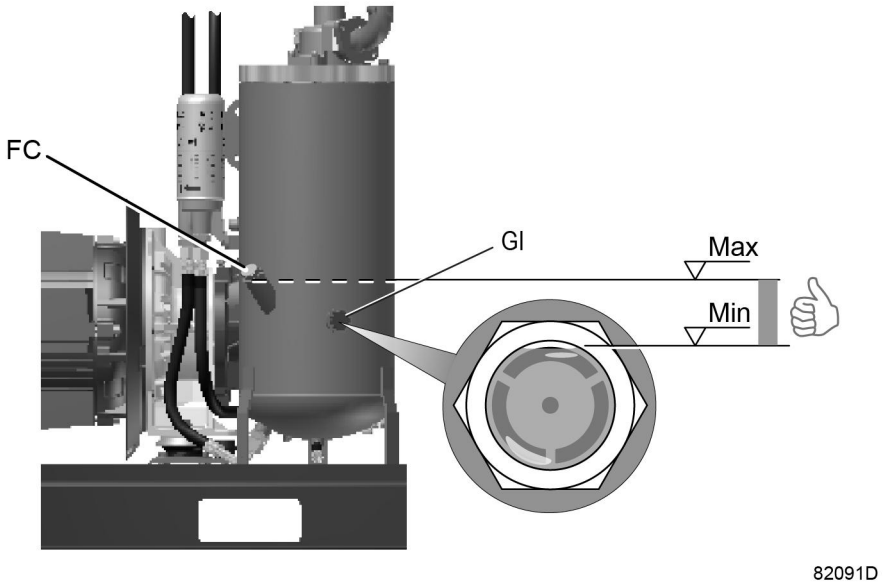



*Electric cubicle, typical example*

5. Fit the air outlet valve (AV); see section Introduction for the position of the valve.
   Close the valve.
   Connect the air net to the valve.
6. Connect the automatic drain outlet (Da) to a drain collector.

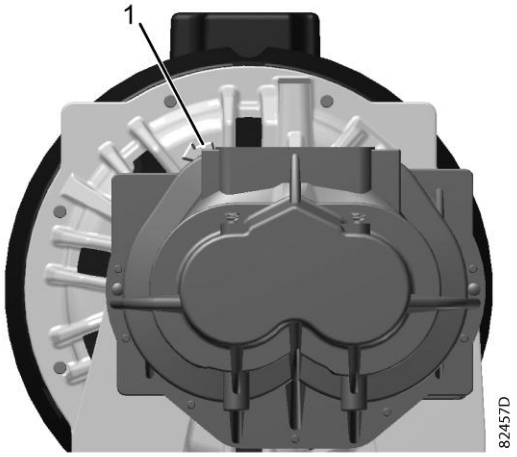
The drain pipes to the drain collector must not dip into the water. If the pipes have been fitted outside the room where freezing is possible, they must be insulated.

7. On water-cooled compressors, drain valves, shut-off valves and a regulating valve should be fitted by the customer in the cooling water piping.
8. Check the oil level.
   3 to 5 minutes after stopping, the oil level should be between the top of the sight glass (GI) and the filling point (FC).




*Position of oil level sight-glass*

9. **Provide labels, warning the operator that:**
   - The compressor may automatically restart after voltage failure.
   - The compressor is automatically controlled and may be restarted automatically.
10. Check the voltage between the three phases before using the unit for the first time.



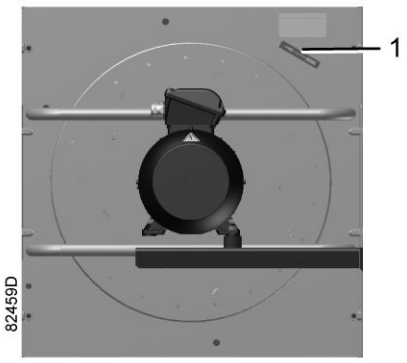

*Motor direction arrow*

Check the direction of rotation (following the arrow on the coupling housing (1) by pressing the "Start" button, followed immediately by the emergency stop button.

If it does not spin in the right direction reverse two mains cables. When it rotates in the correct direction, the oil level should drop after 4 or 5 seconds of operation

| | |
|---|---|
| | Incorrect rotation of the drive motor can cause damage to the compressor. |

11.




*Fan direction arrow*

It is very important to remember to check the direction of rotation of the fan (shown by an arrow on the fan (1)).

## 5.2 Before starting

### Remarks

| | |
|---|---|
| | • If the compressor has not run for the past 6 months, it is strongly recommended to improve the lubrication of the compressor element at starting. Disconnect the inlet hose, remove the unloader (UA) and pour 0.75 l (0.20 US gal, 0.17 Imp gal) of oil into the compressor element. Reinstall the unloader and reconnect the inlet hose. Make sure that all connections are tight.<br>• On compressors with dryer, switch on the voltage 4 hours before starting to energise the crankcase heater of the refrigerant compressor of the dryer. |

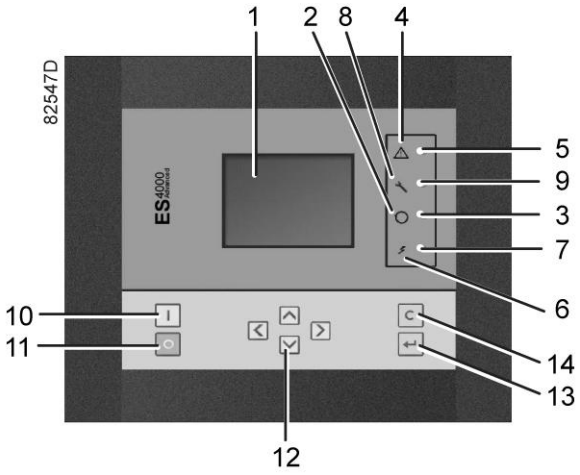
### Procedure

| | |
|---|---|
| - | Check the oil level, top up if necessary. See section Initial start-up |
| - | **On water-cooled compressors, also:**<br>• Check that the cooling water drain valves in the inlet and outlet pipes are closed.<br>• Open the cooling water inlet valve.<br>• Open the water flow regulating valve. This step can be skipped if, after previous operation, the setting of this valve has not been changed. |

# 5.3 Starting

## Procedure

| | |
|---|---|
| | For the position of the air outlet valve and the drain connections, see sections Introduction. |




*Control panel ES 4000 Advanced*

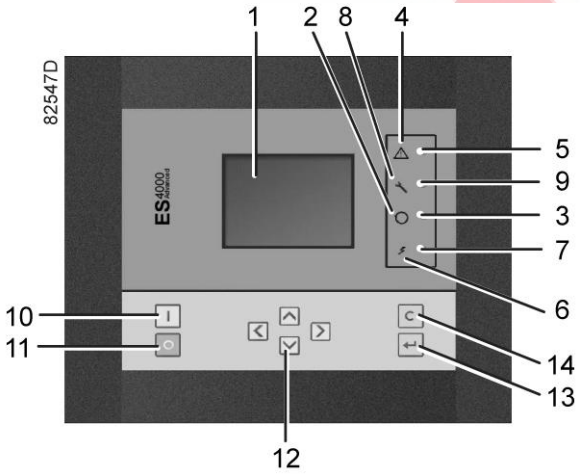
| Step | Action |
|---|---|
| - | Switch on the voltage. Check that voltage on LED (7) lights up. |
| - | Open the air outlet valve. |
| - | Press start button (10) on the control panel. The compressor starts running and the automatic operation LED (3) lights up. After the start-up cycle, the compressor starts running loaded. |
| - | On water-cooled compressors, regulate the cooling water flow during loaded running to obtain the most suitable temperature at the outlet of the compressor element, i.e. between 2 and 7 ˚C (4 and 13 ˚F) above the relevant temperature in the figure below. For optimum operation, the cooling water outlet temperature must never exceed the value specified in section Compressor data. Consult your supplier if condensate should form during frequent unloading periods. |

# 5.4 During operation

### Warnings

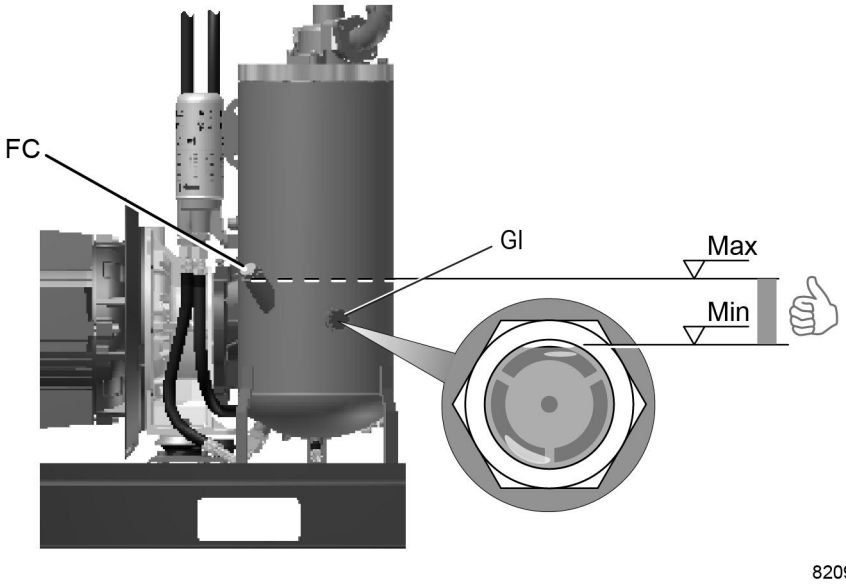
| | |
|---|---|
|  | The operator must apply all relevant Safety precautions. Also consult section Problem solving. |
|  | Removing the front panel (service panel) during operation will lead to an automatic shutdown of the unit after a certain time depending of the compressor version. |
|  | Keep the doors closed during operation; they may be opened for short periods only to carry out checks. |
|  | When the motors are stopped and LED (3) (automatic operation) is alight, the motors may start automatically. |

### Regulator




*Control panel ES 4000 Advanced*

### Checking the oil level




*Position of oil level sight-glass*

Regularly check the oil level. To do so:

1. Press stop button (11).
2. A few minutes after stopping, the oil level should be between the oil filler neck (FC) and the top of the sight glass (Gl).
3. If the oil level is too low, push the emergency stop button to avoid the compressor to start unexpectedly.
4. Next, close the air outlet valve and open the manual drain valve (Dm) until the air system between oil separator/air receiver vessel and outlet valve is fully depressurized.
5. Unscrew oil filler plug (FC) one turn to permit any pressure left in the system to escape. Wait a few minutes.
6. Remove the plug and add oil until the level reaches the filler opening.
7. Fit and tighten the plug (FC).
8. Unlock the emergency stop button and press the "Reset key" on the controller before restarting

## 5.5 Automatic restarting

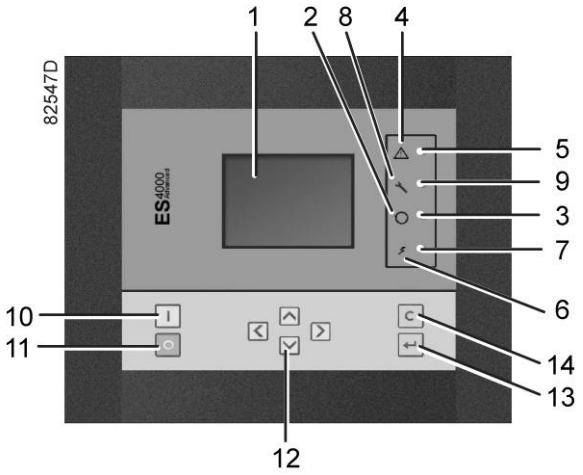
### Description

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

| | |
|---|---|
| | Whenever the compressor is shut down, the emergency push-button must be pressed or the electricity isolating switch opened. |

# 5.6 Stopping

## Regulator




*Control panel ES 4000 Advanced*

## Procedure

| Step | Action |
|---|---|
| - | Press stop button (11). Automatic operation LED (3) goes out and the compressor stops after 30 seconds of unloaded operation. |
| - | **To stop the compressor in the event of an emergency,** press emergency stop button. Alarm LED flashes (5).<br>• Remedy the problem cause and unlock the button by pulling it out.<br>• Navigate to the Stop icon on the display by means of the navigation keys (12) and press the Select key.<br>Press reset.<br>**Do not use emergency stop button for normal stopping!** |
| - | Close the air outlet valve (AV). |
| - | Press the test button on the top of the electronic water drain(s) until the air system between the air system receiver and the outlet valve is fully depressurised. See section Automatic drain Switch off the voltage. |
| - | If available, open the condensate drain valve of the compressor (Dm) to drain the water trap completely. |
| - | **On water-cooled compressors:**<br>• Close the cooling water inlet valve.<br>• If freezing temperatures can be expected, drain the cooling system completely. |

## 5.7 Taking out of operation

### Procedure

| Step | Action |
|---|---|
| - | Stop the compressor and close the air outlet valve. |
| - | Switch off the voltage and disconnect the compressor from the mains. |
| - | If available, open the condensate drain valve(s) (Dm). |
| - | Shut off and depressurise the part of the air net which is connected to the outlet valve. Disconnect the compressor air outlet pipe from the air net. |
| - | **On water-cooled compressors:**<br>• Isolate and disconnect the water system from the cooling water net.<br>• Drain the water circuit. |
| - | Drain the oil. |
| - | Drain the condensate circuit and disconnect the condensate piping from the condensate net. |

# 6 Maintenance

## 6.1 Preventive maintenance schedule

### Warning

| | |
|---|---|
|  | **Before carrying out any maintenance, repair work or adjustments, proceed as follows:**<br>• Stop the compressor.<br>• Press the emergency stop button.<br>• Switch off the voltage.<br>• Close the air outlet valve and open, if provided, the manual condensate drain valve.<br>• Depressurise the compressor.<br>For detailed instructions, see section Problem solving.<br>The operator must apply all relevant Safety precautions. |

| | |
|---|---|
|  | **Before lifting the electric motor, all build-on parts shall be removed** |

### Warranty - Product Liability

Use only authorised parts. Any damage or malfunction caused by the use of unauthorised parts is not covered by Warranty or Product Liability.

### Service kits

For overhauling or carrying out preventive maintenance, service kits are available (see section Service kits).

### Service contracts

CHICAGO PNEUMATIC offers several types of service contracts, relieving you of all preventive maintenance work. Consult your Customer Center.

### General

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

### Intervals

The local Customer Center may overrule the maintenance schedule, especially the service intervals, depending on the environmental and working conditions of the compressor.

The longer interval actions and checks must also include the shorter interval actions and checks.

## Preventive maintenance schedule

| Period | Operation |
|---|---|
| Daily | Check oil level.<br>Check readings on display.<br>Check that condensate is discharged during loaded operation of the compressor.<br>On water-cooled units: check for cooling water flow.<br>Check the pressure dew-point temperature (compressors with integrated dryer). |
| 3-monthly (1) | Check coolers, clean if necessary.<br>On units with dryer : check condenser of dryer and clean if necessary.<br>Remove the air filter element and inspect. If necessary, clean using an air jet. Replace damaged or heavily contaminated elements.<br>Check the filter element of the electric cabinet (if applicable). Replace if necessary<br>Press the test button on top of the electronic water drain (EWD). Open the manual drain valve(s) (Dm, Dm1) to clean the filter inside the EWD. |

(1): More frequently when operating in a dusty atmosphere.

## Interval operations

| | **Interval (hours)** | **500** | **2000<br>4000<br>8000<br>10000<br>14000<br>18000<br>16000<br>20000<br>22000** | **6000<br>18000** | **12000** | **24000** |
|---|---|---|---|---|---|---|
| | **Operations to be carried out** | | Visit A | Visit B | Visit C | Visit D |
| 1 | Control measured parameters | x | x | x | x | x |
| 2 | Clean the filtermats | x | x | x | x | x |
| 3 | Change the oil filter | | x | x | x | x |
| 4 | Change the lubricant | | x | x | x | x |
| 5 | Change the air filter | | x | x | x | x |
| 6 | Re-grease the drive motor bearings, according to use | | x | x | x | x |
| 7 | Change the inverter filter (*) and the cubicle filter | | | x | x | x |
| 8 | Change the air inlet filters | | | x | x | x |
| 9 | Change the oil separator element | | | x | x | x |
| 10 | Unloader valve kit | | | | x | x |
| 11 | Oil-stop- and check-valve kit | | | | x | x |
| 12 | Minimum pressure valve kit | | | | x | x |
| 13 | Thermostatic valve kit | | | | x | x |
| 14 | Hoses kit | | | | | x |
| 15 | Overhaul compressor element (use exchange element) | | | | | x |
| 16 | Replace the shaft seal | | | | | x |

| | Interval (hours) | 500 | 2000<br>4000<br>8000<br>10000<br>14000<br>18000<br>16000<br>20000<br>22000 | 6000<br>18000 | 12000 | 24000 |
|---|---|---|---|---|---|---|
| 17 | Overhaul the main drive motor | | | | | x |

(*) If available

When compressor oil Rotair Xtra is used, the standard oil change interval can be extended to 8000 h

The indicated oil exchange intervals 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, operation at high humidity combined with low duty cycles or operation at higher temperatures may require a shorter oil exchange interval. Contact your supplier if in doubt.

**Important**

| | |
|---|---|
| | • Always consult your supplier if a service timer setting has to be changed.<br>• For the change interval of oil and oil filter in extreme conditions, consult your Customer Centre.<br>• Any leakage should be attended to immediately. Damaged hoses or flexible joints must be replaced. |

## 6.2 Storage after installation

**Procedure**

Run the compressor regularly, e.g. twice a week, until warm. Load and unload the compressor a few times.

| | |
|---|---|
| | If the compressor is going to be stored without running from time to time, protective measures must be taken. Consult your supplier. |

## 6.3 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 parts while keeping the maintenance budget low.

Consult the Spare Parts List for part numbers.

## 6.4 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 2002/96/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 environmental friendly manner.

# 7 Adjustments and servicing procedures

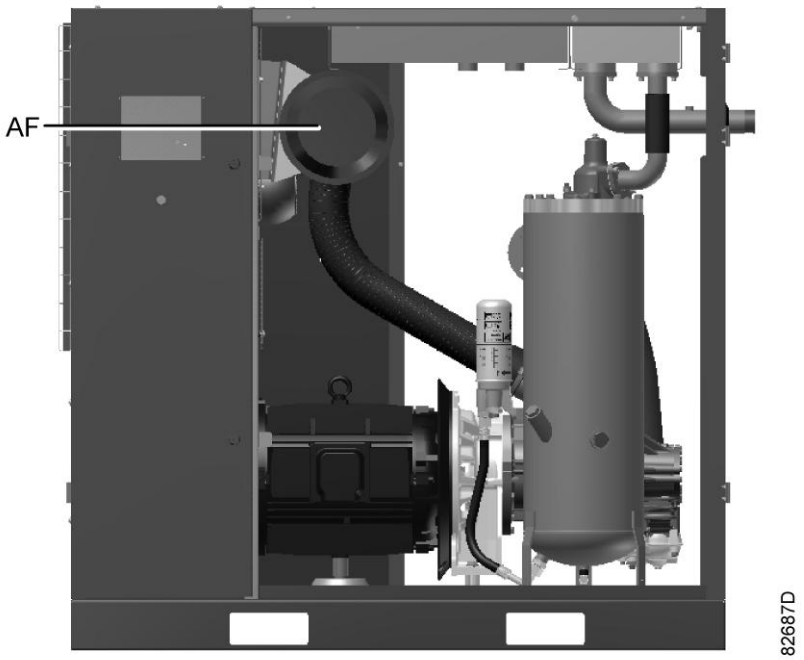
## 7.1 Air filter

| | |
|---|---|
| | IMPORTANT<br>If you do not replace the filtering element when needed, permanent dirt build-up will result. This reduces the air inflow to the compressor and could damage the oil separator and the compressor. |

1. Never remove the element while the compressor is running.
2. For minimum downtime, replace the dirty element by a new one.
3. Discard the element when damaged.

### Procedure

1. Stop the compressor. Switch off the voltage.
2. Release the snap clips of air filter (AF) and remove the dust trap and the air filter element. Clean the trap. Discard the filter element.




*Position of air filter*

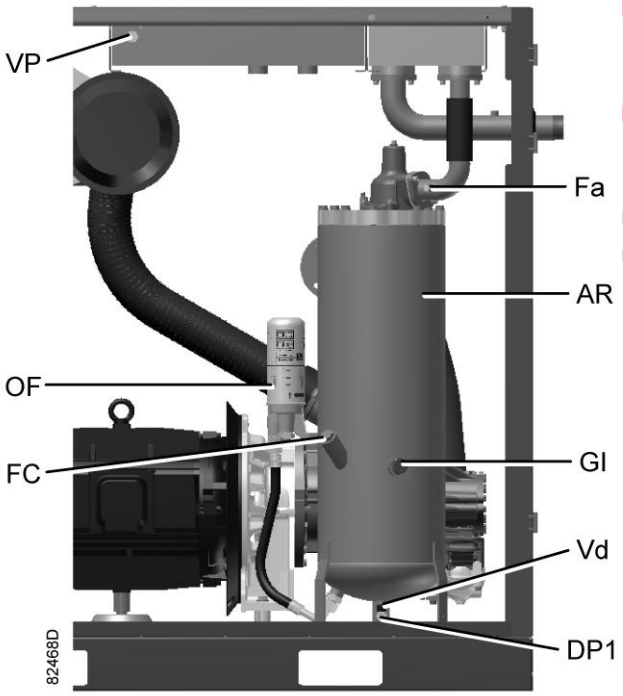
3. Fit the new element and the cover.
4. Reset the air filter service warning.
   For compressors equipped with an ES 4000 Advanced regulator, see section Service menu.

# 7.2 Oil and oil filter change

### Warning

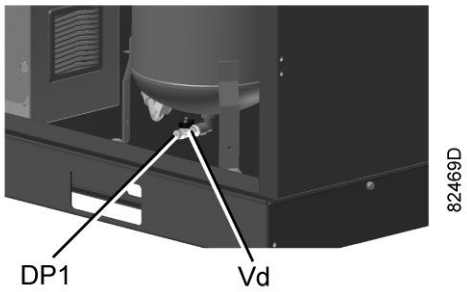
| | |
|---|---|
| | The operator must apply all relevant Safety precautions.<br>Always drain the compressor oil at all drain points. Used oil left in the compressor can contaminate the oil system and can shorten the lifetime of the new oil.<br>Never mix lubricants of different brands or types as they may not be compatible and the oil mix will have inferior properties. A label, indicating the type of oil filled ex-factory, is stuck on the air receiver/oil tank. |

### Procedure




*Oil system components*

1. Run the compressor until warm. Stop the compressor. Close the air outlet valve and switch off the voltage. Depressurise the compressor by opening manual drain valve(s) (if available). Wait a few minutes and depressurise the air receiver/oil tank (AR) by unscrewing oil filler plug (FC) just one turn to permit any pressure in the system to escape. Also depressurize the air pipe by unscrewing the air vent plug (Fa) with one turn.
2. Loosen the vent plug (VP) of the oil cooler and wait for 5 minutes.
3. Remove oil drain plug (DP1). Drain the oil by opening valve (Vd). Close the valve and fit the plug after draining.




*Oil drain plugs*

4. Collect the oil and deliver it to the local collection service. Refit and tighten the drain and vent plugs after draining.
   Re-tighten the top connection of the oil cooler.
5. Remove the oil filter (OF). Clean the seat on the manifold. Oil the gasket of the new filter and screw it into place. Tighten firmly by hand.
6. Remove filler plug (FC).
   Fill the air receiver/oil tank (AR) with oil until the level reaches the filler neck.
   Take care that no dirt drops into the system. Refit and tighten filler plug (FC).
7. Run the compressor loaded for a few minutes. Stop the compressor and wait a few minutes to allow the oil to settle.
8. Depressurise the system by unscrewing filler plug (FC) just one turn to permit any pressure in the system to escape. Remove the plug.
   Add oil, the oil level should be between the top of the sight glass (Gl) and the filling point (FC).
   Tighten the filler plug.
9. Reset the service warning after carrying out all service actions in the relevant Service Plan: see Service menu.

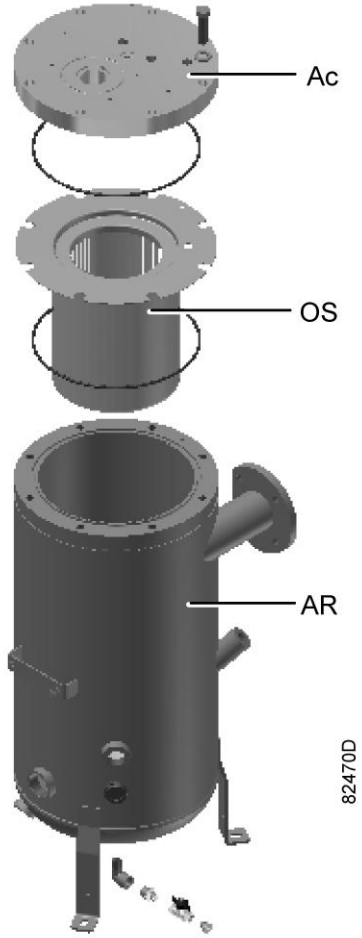
## 7.3 Oil separator change

### Warning

| | |
|---|---|
| ⚠ | The operator must apply all relevant Safety precautions. |

### Procedure

1. Run the compressor until warm. Stop the compressor, close the air outlet valve and switch off the voltage. Wait a few minutes and depressurize by unscrewing oil filler plug (FC) just one turn to permit any pressure in the system to escape.
2. Remove the cover (Ac) from the air receiver/oil tank (AR) by unscrewing the bolts.




*Oil separator components*

3. Remove the oil separator (OS).
4. Clean the seat on air receiver/oil tank (AR).
   Place the new separator into the air receiver/oil tank and replace the vessel cover (Ac) with the bolts. Take care that no dirt drops into the system. Refit and tighten filler plug (FC).
5. Remove filler plug (FC).
   Fill the oil tank (AR) with oil until the level reaches the middle of sight-glass (Gl).
6. Run the compressor loaded for a few minutes. Stop the compressor and wait a few minutes to allow the oil to settle.
7. Depressurise the system by unscrewing filler plug (FC) just one turn to permit any pressure in the system to escape. Remove the plug.
   Fill the oil tank with oil. The oil level should be between the top of the sight glass (Gl) and the filling point (FC).
   Tighten the filler plug.
8. Reset the service timer: see Service menu.

## 7.4 Coolers

### General

Keep the coolers clean to maintain their efficiency.

| | |
|---|---|
| ⚠ | Never use a high pressure water jet to clean the compressor. |

### Instructions for air-cooled compressors

1. Stop the compressor, close the air outlet valve and switch off the voltage.
2. Remove any dirt from the coolers with a fibre brush. Never use a wire brush or metal objects.
3. Cover all parts under the coolers.
4. Next, clean with an air jet in the reverse direction to normal flow. Use low pressure air. If necessary, the pressure may be increased up to 6 bar(e) (87 psig).

### Instructions for water-cooled compressors

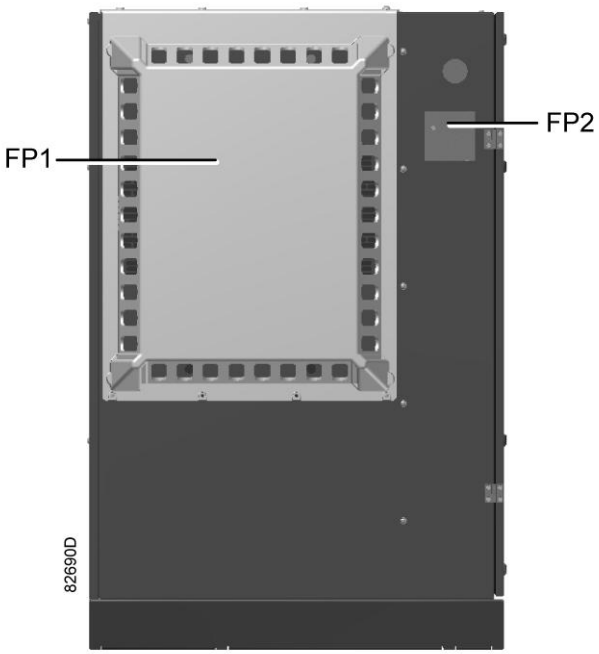
Consult your supplier.

## 7.5 Filtering panel

### Cleaning the filtering panel

| | |
|---|---|
| ⚠ | Before carrying out any operation on the machine, ensure that the electric power supply has been disconnected. |

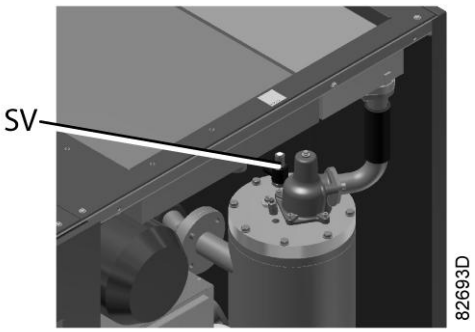
- Stop the compressor.
  Close the air outlet valve and switch off the voltage.
- Remove the air inlet filter panel(s) (FP1) and the cubicle filter (FP2).




- Clean the inlet filtering panel with a jet of air wash it with water, do not use solvents.
- Replace the cubicle filter.
- Once the operation has been completed, reassemble the filter panel.

## 7.6 Safety valves

### Location of safety valve




### Operating

Operate the safety valve by unscrewing the cap one or two turns and retighten it.

### Testing

Before removing the valve, depressurise the compressor.

See section Problem solving.

Valve (SV) can be tested on a separate air line. If the valve does not open at the set pressure stamped on the valve, it needs to be replaced.

### Warning

No adjustments are allowed. Never run the compressor without safety valve.

## 7.7 Dryer maintenance instructions

### Safety precautions

Refrigeration dryers of ID type contain refrigerant HFC.

**When handling refrigerant, all applicable safety precautions must be observed. Please be specifically aware of the following points:**

- Contact of refrigerant with the skin will cause freezing. Special gloves must be worn. If contacted with the skin, the skin should be rinsed with water. On no account may clothing be removed.
- Fluid refrigerant will also cause freezing of the eyes; always wear safety glasses.
- Refrigerant is harmful. Do not inhale refrigerant vapours. Check that the working area is adequately ventilated.

Be aware that certain components such as the refrigerant compressor and the discharge pipe can become quite hot (up to 110 °C - 230 °F). Therefore, wait until the dryer has cooled down before removing the panels.

Before starting any maintenance or repair work, switch off the voltage and close the air inlet and outlet valves.

## Local legislation

**Local legislation may stipulate that:**

- Work on the refrigerant circuit of the cooling dryer or on any equipment which influences its function must be undertaken by an authorised control body.
- The installation should be checked once a year by an authorised control body.

## General

For all references see section Introduction.

**The following remarks should be kept in mind:**

- Keep the dryer clean.
- Brush or blow off the finned surface of condenser monthly.
- Switch off the voltage and close the air outlet valve.
- Remove the panel where the condenser is situated (see the picture below).
- Clean the condenser fins with compressed air. Do not use water or solvents.
- Close the panel.
- Inspect and clean the electronic condensate drain monthly.
  - Functioning of the drains can be checked by pushing the TEST button of the drain.
  - Cleaning of the drain filter can be done by opening the manual drain valve during a few seconds.

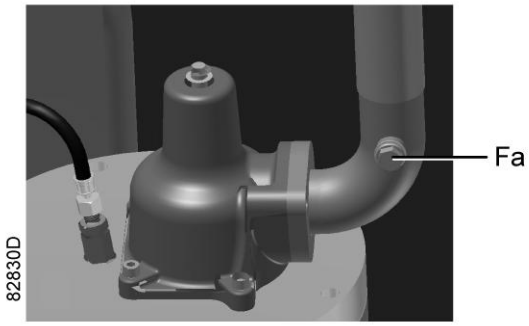

81566D


81567D

# 8 Problem solving

## Warning

| | |
|---|---|
| | Before carrying out any maintenance, repair work or adjustment, press the stop button, wait until the compressor has stopped, press the emergency stop button and switch off the voltage. Close the air outlet valve and lock it if necessary.<br>Depressurize the air connection between the minimum pressure valve and the compressor outlet ball valve. Turn slowly the air vent plug (Fa) just one turn to permit any pressure in the system to escape.<br>If provided, open the manual condensate drain valves. Depressurise the compressor by opening the oil filler plug one turn.<br>**For location of components, see sections:** Introduction and Initial start-up. |
| | Open and lock the isolating switch. |
| | The operator must apply all relevant Safety precautions. |




*Position of air vent plug*

## Compressor

On compressors equipped with an ES 4000 Advanced controller: if the alarm LED is lit or flashes, consult sections Main screen and following.

| - | Condition | Fault | Remedy |
|---|---|---|---|
| | Compressor starts running, but does not load after a delay time | Solenoid valve out of order | Replace valve |
| | | Inlet valve stuck in closed position | Have valve checked |
| | | Leak in control air flexibles | Replace leaking flexible |
| | | Minimum pressure valve leaking (when net is depressurised) | Have valve checked |

| - | Condition | Fault | Remedy |
|---|---|---|---|
| | Compressor does not unload, safety valve blows | Solenoid valve out of order | Replace valve |
| | | Inlet valve does not close | Have valve checked |

| - | Condition | Fault | Remedy |
|---|---|---|---|
| | Compressor air output or pressure below normal | Air consumption exceeds air delivery of compressor | Check equipment connected |
| | | Choked air filter element | Replace filter element |
| | | Solenoid valve malfunctioning | Replace valve |
| | | Leak in control air flexibles | Replace leaking flexibles |
| | | Inlet valve does not fully open | Have valve checked |
| | | Oil separator clogged | Have element replaced |
| | | Air leakage | Have leaks repaired |
| | | Safety valve leaking | Have valve replaced |
| | | Compressor element out of order | Consult your supplier |

| - | Condition | Fault | Remedy |
|---|---|---|---|
| | Excessive oil consumption; oil carry-over through discharge line | Oil level too high | Check for overfilling. Release pressure and drain oil to correct level |
| | | Incorrect oil causing foam | Change to correct oil |
| | | Oil separator defective | Have element checked. Replace if necessary. |
| | | Scavenge line clogged | Check and remedy |

| - | Condition | Fault | Remedy |
|---|---|---|---|
| | Excessive oil flow through air inlet filter after stopping compressor | Check valve leaking or oil stop valve jammed | Replace defective parts. Replace air filter element |

| - | Condition | Fault | Remedy |
|---|---|---|---|
| | Safety valve blows after loading | Inlet valve malfunctioning | Have valve checked |
| | | Minimum pressure valve malfunctioning | Have valve checked |
| | | Safety valve out of order | Have valve replaced |
| | | Compressor element out of order | Consult your supplier |
| | | Oil separator element clogged | Have element replaced |

| - | Condition | Fault | Remedy |
|---|---|---|---|
| | Compressor element outlet temperature or delivery air temperature above normal | Oil level too low | Check and correct |
| | | On air-cooled compressors, insufficient cooling air or cooling air temperature too high | Check for cooling air restriction or improve ventilation of the compressor room. Avoid circulation of cooling air. If installed, check capacity of compressor room fan |

| - | Condition | Fault | Remedy |
|---|---|---|---|
| | | On water-cooled compressors, cooling water flow too low | Increase flow |
| | | On water-cooled compressors, restriction in cooling water system | Consult your supplier |
| | | Oil cooler clogged | Clean cooler |
| | | Thermostatic bypass valve malfunctioning | Have valve tested |
| | | Air cooler clogged | Clean cooler |
| | | Compressor element out of order | Consult your supplier |
| | | Oil filter clogged | Replace |

## Dryer

(Compressors with an integrated dryer)

For all references hereafter, consult section Air dryer.

| | Condition | Fault | Remedy |
|---|---|---|---|
| 1 | Pressure dew point too high | Air inlet temperature too high | Check and correct; if necessary, clean the aftercooler of the compressor |
| | | Ambient temperature too high | Check and correct; if necessary, draw cooling air via a duct from a cooler place or relocate the compressor |
| | | Shortage of refrigerant | Have circuit checked for leaks and recharged |
| | | Refrigerant compressor (M1) does not run | See 3 |
| | | Evaporator pressure too high | See 5 |
| | | Condenser pressure too high | See 2 |
| 2 | Condenser pressure too high or too low | Fan control switch out of order | Replace |
| | | Fan blades or fan motor out of order | Check fan/fan motor |
| | | Ambient temperature too high | Check and correct; if necessary, draw cooling air via a duct from a cooler place or relocate the compressor |
| | | Condenser externally clogged | Clean condenser |
| 3 | Compressor stops or does not start | Electric power supply to compressor is interrupted | Check and correct as necessary |
| | | Thermal protection of refrigerant compressor motor has tripped | Motor will restart when motor windings have cooled down |

| | Condition | Fault | Remedy |
|---|---|---|---|
| 4 | Electronic condensate drain remains inoperative | Electronic drain system clogged | Have system inspected<br>Clean the filter of the automatic drain by opening the manual drain valve.<br>Check functioning of the drain by pushing the test button. |
| | Condensate trap continuously discharges air and water | Automatic drain out of order | Have system checked. If necessary, replace the automatic drain. |
| 5 | Evaporator pressure is too high or too low at unload | Hot gas bypass valve incorrectly set or out of order | Have hot gas bypass valve adjusted |
| | | Condenser pressure too high or too low | See 2 |
| | | Shortage of refrigerant | Have circuit checked for leaks and recharged |

# 9 Technical data

## 9.1 Electric cable size and fuses

### Important

- The voltage on the compressor terminals must not deviate more than 10% of the nominal voltage.
  It is however highly recommended to keep the voltage drop over the supply cables at 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 use cables 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 proper cable gland when connecting the supply cable to the compressor.**
- Local regulations remain applicable if they are stricter than the values proposed below.
- Currents are calculated with the full service factor, but we suggest to add 10% due to over- and under-voltage. Fuses are maximum allowed values for full service factor and 10% over- and under-voltage.
- **Causion**
  - Always double check the fuse size versus the calculated cable size. If required, reduce the fuse size or enlarge the cable size
  - Cable lenght should not exceed the maximum lenght according to IEC60204 table 10

### Currents and fuses

IEC approval

| **Compressor specification** | | | | **I(1)** | **Max Fuse (1)** | **I(2)** | **Max Fuse (2)** |
|---|---|---|---|---|---|---|---|
| **Type** | | | | | **gL/gG** | | **gL/gG** |
| | | V | Hz | A | A | A | A |
| A1 | 30kW | 400 | 50 | 66 | 80 | 72 | 80 |
| A2 | 30kW | 400 | 50 | 66 | 80 | 72 | 80 |
| X | 30kW | 400 | 50 | 66 | 80 | - | - |
| A2 | 30kW | 440 | 60 | 59 | 63 | 65 | 80 |
| X | 30kW | 440 | 60 | 59 | 63 | - | - |
| A1 | 30kW | 380 | 60 | 69 | 80 | 76 | 100 |
| A2 | 30kW | 380 | 60 | 69 | 80 | 76 | 100 |
| X | 30kW | 380 | 60 | 69 | 80 | - | - |

IEC approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | gL/gG | | gL/gG |
| | | V | Hz | A | A | A | A |
| A1 | 37kW | 400 | 50 | 85 | 100 | 91 | 100 |
| A2 | 37kW | 400 | 50 | 85 | 100 | 91 | 100 |
| X | 37kW | 400 | 50 | 85 | 100 | - | - |
| A2 | 37kW | 440 | 60 | 76 | 100 | 82 | 100 |
| X | 37kW | 440 | 60 | 76 | 100 | - | - |
| A1 | 37kW | 380 | 60 | 89 | 100 | 96 | 125 |
| A2 | 37kW | 380 | 60 | 89 | 100 | 96 | 125 |
| X | 37kW | 380 | 60 | 89 | 100 | - | - |

IEC approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | gL/gG | | gL/gG |
| | | V | Hz | A | A | A | A |
| A1 | 45kW | 400 | 50 | 103 | 125 | 109 | 125 |
| A2 | 45kW | 400 | 50 | 103 | 125 | 109 | 125 |
| X | 45kW | 400 | 50 | 103 | 125 | - | - |
| A2 | 45kW | 440 | 60 | 91 | 100 | 98 | 125 |
| X | 45kW | 440 | 60 | 91 | 100 | - | - |
| A1 | 45kW | 380 | 60 | 107 | 125 | 114 | 125 |
| A2 | 45kW | 380 | 60 | 107 | 125 | 114 | 125 |
| X | 45kW | 380 | 60 | 107 | 125 | - | - |

IEC approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | gL/gG | | gL/gG |
| | | V | Hz | A | A | A | A |
| A1 | 55kW | 400 | 50 | 119 | 160 | 126 | 160 |
| A2 | 55kW | 400 | 50 | 117 | 125 | 124 | 160 |
| X | 55kW | 400 | 50 | 117 | 125 | - | - |
| A2 | 55kW | 440 | 60 | 106 | 125 | 115 | 125 |
| X | 55kW | 440 | 60 | 106 | 125 | - | - |
| A1 | 55kW | 380 | 60 | 125 | 160 | 136 | 160 |
| A2 | 55kW | 380 | 60 | 123 | 160 | 133 | 160 |
| X | 55kW | 380 | 60 | 123 | 160 | - | - |

IEC approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | gL/gG | | gL/gG |
| | | V | Hz | A | A | A | A |
| A1 | 75kW | 400 | 50 | 164 | 200 | 171 | 200 |
| A2 | 75kW | 400 | 50 | 163 | 200 | 170 | 200 |
| X | 75kW | 400 | 50 | 163 | 200 | - | - |
| A2 | 75kW | 440 | 60 | 149 | 160 | 157 | 200 |
| X | 75kW | 440 | 60 | 149 | 160 | - | - |
| A1 | 75kW | 380 | 60 | 168 | 200 | 179 | 200 |
| A2 | 75kW | 380 | 60 | 166 | 200 | 176 | 200 |
| X | 75kW | 380 | 60 | 166 | 200 | - | - |

IEC approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | gL/gG | | gL/gG |
| | | V | Hz | A | A | A | A |
| A1 | 90kW | 400 | 50 | 200 | 250 | - | - |
| A2 | 90kW | 400 | 50 | 197 | 224 | - | - |
| A2 | 90kW | 440 | 60 | 178 | 200 | - | - |
| A1 | 90kW | 380 | 60 | 201 | 224 | - | - |
| A2 | 90kW | 380 | 60 | 197 | 224 | - | - |

IEC approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | gL/gG | | gL/gG |
| | | V | Hz | A | A | A | A |
| A1 | 110kW | 400 | 50 | 213 | 225 | - | - |
| A1 | 110kW | 440 | 60 | 213 | 225 | - | - |
| A1 | 110kW | 380 | 60 | 214 | 225 | - | - |

UL/cUL approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | UL class RK5 CSA HRC form II | | UL class RK5 CSA HRC form II |
| | | V | Hz | A | A | A | A |
| A2 | 30kW | 460 | 60 | 56 | 70 | - | - |

UL/cUL approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | UL class RK5 CSA HRC form II | | UL class RK5 CSA HRC form II |
| | | V | Hz | A | A | A | A |
| A2 | 37kW | 460 | 60 | 73 | 80 | - | - |

UL/cUL approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | UL class RK5 CSA HRC form II | | UL class RK5 CSA HRC form II |
| | | V | Hz | A | A | A | A |
| A2 | 45kW | 460 | 60 | 88 | 100 | - | - |

UL/cUL approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | UL class RK5 CSA HRC form II | | UL class RK5 CSA HRC form II |
| | | V | Hz | A | A | A | A |
| A2 | 55kW | 460 | 60 | 102 | 125 | - | - |

UL/cUL approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | UL class RK5 CSA HRC form II | | UL class RK5 CSA HRC form II |
| | | V | Hz | A | A | A | A |
| A2 | 75kW | 460 | 60 | 136 | 150 | - | - |

UL/cUL approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | UL class RK5 CSA HRC form II | | UL class RK5 CSA HRC form II |
| A2 | 90kW | 460 | 60 | 162 | 175 | - | - |

UL/cUL approval

| Compressor specification | | | | I(1) | Max Fuse (1) | I(2) | Max Fuse (2) |
|---|---|---|---|---|---|---|---|
| Type | | | | | UL class RK5 CSA HRC form II | | UL class RK5 CSA HRC form II |
| A1 | 110kW | 460 | 60 | 212 | 225 | - | - |

I: current in the supply lines at maximum load and nominal voltage

(1): compressor without integrated dryer

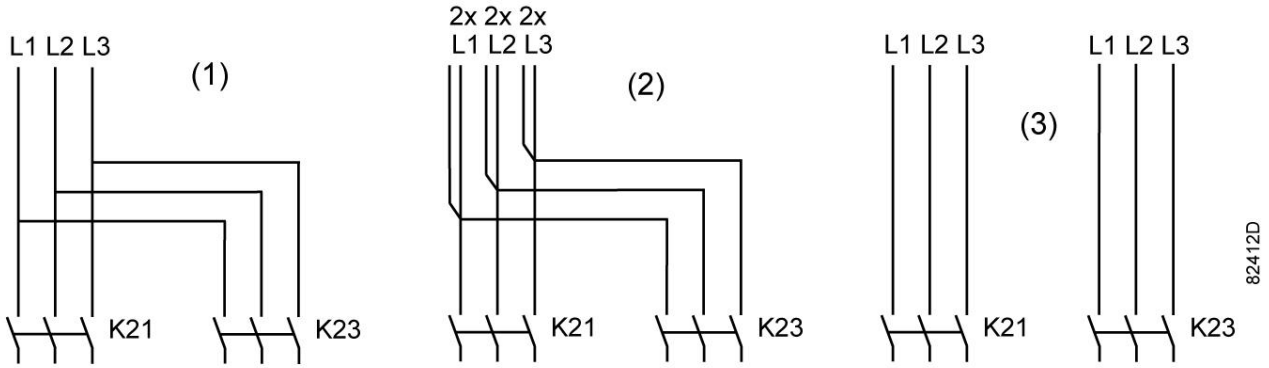
(2): compressor with integrated dryer

**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 protect the cable against short circuit.

**Fuse calculations for cUL and UL**: The indicated fuse size is the maximum fuse size in order to protect the motor against short circuit. For cUL fuse HRC form II, for UL fuse class RK5.

## Possible configurations

There are 3 possible cabling layouts:

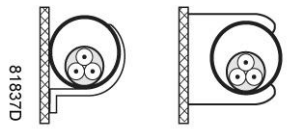



- (1): Single supply cables.
- (2): Parallel supply cables
- (3) is only valid for Y-D versions

## Cable sizing according IEC

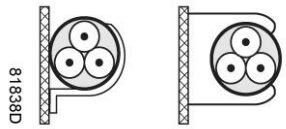
The tables below indicate the current carrying capacities of cables for 3 commonly used installation methods, calculated according to standard 60364-5-52 - electrical installations of buildings part 5 - selection and erection equipment and section 52 - current carrying capacities in wiring systems.

The allowed currents are valid for PVC insulated cables with three loaded copper conductors (maximum conductor temperature 70 °C).

| | |
|---|---|
|   | Installation method B2 according table B.52.1.<br>Multi-core cable in conduit on a wooden wall |

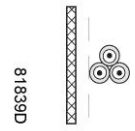
Maximum allowed current in function of the ambient temperature for installation method B2

| | **Ambient temperature** | | | | |
|---|---|---|---|---|---|
| **Cable section** | **30 °C** | **40 °C** | **45 °C** | **50 °C** | **55 °C** |
| 4 mm² | < 27 A | < 23 A | < 21 A | < 19 A | < 16 A |
| 6 mm² | < 34 A | < 30 A | < 27 A | < 24 A | < 21 A |
| 10 mm² | < 46 A | < 40 A | < 36 A | < 33 A | < 28 A |
| 16 mm² | < 62 A | < 54 A | < 49 A | < 44 A | < 38 A |
| 25 mm² | < 80 A | < 70 A | < 63 A | < 57 A | < 49 A |
| 35 mm² | < 99 A | < 86 A | < 78 A | < 70 A | < 60 A |
| 50 mm² | < 118 A | < 103 A | < 93 A | < 84 A | < 72 A |
| 70 mm² | < 149 A | < 130 A | < 118 A | < 106 A | < 91 A |
| 95 mm² | < 179 A | < 156 A | < 141 A | < 127 A | < 109 A |
| 120 mm² | < 206 A | < 179 A | < 163 A | < 146 A | < 126 A |

| | |
|---|---|
|   | Installation method C according table B.52.1.<br>Single-core or multi-core cable on a wooden wall |

Maximum allowed current in function of the ambient temperature for installation method C

| | **Ambient temperature** | | | | |
|---|---|---|---|---|---|
| **Cable section** | **30 °C** | **40 °C** | **45 °C** | **50 °C** | **55 °C** |
| 4 mm² | < 32 A | < 28 A | < 25 A | < 23 A | < 20 A |
| 6 mm² | < 41 A | < 36 A | < 32 A | < 29 A | < 25 A |
| 10 mm² | < 57 A | < 50 A | < 45 A | < 40 A | < 35 A |
| 16 mm² | < 76 A | < 66 A | < 60 A | < 54 A | < 46 A |
| 25 mm² | < 96 A | < 84 A | < 76 A | < 68 A | < 59 A |
| 35 mm² | < 119 A | < 104 A | < 94 A | < 84 A | < 73 A |
| 50 mm² | < 144 A | < 125 A | < 114 A | < 102 A | < 88 A |
| 70 mm² | < 184 A | < 160 A | < 145 A | < 131 A | < 112 A |
| 95 mm² | < 223 A | < 194 A | < 176 A | < 158 A | < 136 A |
| 120 mm² | < 259 A | < 225 A | < 205 A | < 184 A | < 158 A |

| | |
|---|---|
|   | Installation method F according table B.52.1.<br>Single-core cables, touching in free air<br>Clearance to wall not less than one cable diameter |

Maximum allowed current in function of the ambient temperature for installation method F

| | **Ambient temperature** | | | | |
|---|---|---|---|---|---|
| **Cable section** | **30 °C** | **40 °C** | **45 °C** | **50 °C** | **55 °C** |
| 25 mm² | < 110 A | < 96 A | < 87 A | < 78 A | < 67 A |
| 35 mm² | < 137 A | < 119 A | < 108 A | < 97 A | < 84 A |
| 50 mm² | < 167 A | < 145 A | < 132 A | < 119 A | < 102 A |
| 70 mm² | < 216 A | < 188 A | < 171 A | < 153 A | < 132 A |
| 95 mm² | < 264 A | < 230 A | < 209 A | < 187 A | < 161 A |
| 120 mm² | < 308 A | < 268 A | < 243 A | < 219 A | < 188 A |

**Calculation method for IEC:**

- Single supply cables (3 phases + PE - configuration (1)):
  - Add 10 % to the total compressor current ($I_{tot}$Pack or $I_{tot}$FF from the tables)
  - Install the prescribed fuse on each cable
- Parallel supply cable (2 x 3 phases + PE - configuration (2)):
  - Add 10 % to the total compressor current ($I_{tot}$Pack or $I_{tot}$FF from the tables) and divide by 2
  - Multiply the ampacity of the cables with 0.8 (see table A.52.17 (52-E1))
  - Install fuses of half the size of the recommended maximum fuse size on each cable.

- When using 2 x 3 phases + PE as in (3):
  - Add 10 % to the total compressor current ($I_{tot}$Pack or $I_{tot}$FF from the tables) and divide by √3
  - Multiply the ampacity of the cables with 0.8 (see table A.52.17 (52-E1))
  - Fuse size: the recommended maximum fuse size divided by √3 on each cable.
- Size of the PE cable:
  - For supply cables up to 35 mm²: same size as supply cables
  - For supply cables larger than 35 mm²: half the size of the supply wires

Always check the voltage drop over the cable (less than 5 % of the nominal voltage is recommended).

**Example:** $I_{tot}$ = 89 A, maximum ambient temperature is 45 °C, recommended fuse = 100 A

- Single supply cables (3 phases + PE - configuration (1)):
  - I = 89 A + 10 % = 89 x 1.1 = 97.9 A
  - The table for B2 and ambient temperature = 45 ° C allows a maximum current of 93 A for a 50 mm² cable. For a cable of 70 mm², the maximum allowed current is 118 A, which is sufficient. Therefore, use a 3 x 70 mm² + 35 mm² cable.
    If method C is used, 50 mm² is suffficient. (35 mm² for method F) => cable 3 x 50 mm² + 25 mm².
- Parallel supply cable (2 x 3 phases + PE - configuration (2)):
  - I = (89 A + 10 %)/2 = (89 x 1.1)/2 = 49 A
  - For a cable of 25 mm², B2 at 45 °C, the maximum current is 63 A x 0.8 = 50.4 A. So 2 parallel cables of 3 x 25 mm² + 25 mm² are sufficient.
  - Install 50 A fuses on each cable instead of 100 A.

## Cable sizing according CSA

Calculation method according CEC part 1, table 2: allowable ampacities for not more than 3 copper conductors in raceway or cable (based on an ambient temperature of 30 °C (86 °F). Correction factors for other temperatures table 5A.

Maximum allowed current in function of the ambient temperature, based on a 75 °C (167 °F) cable temperature

| | Ambient temperature | | | | |
|---|---|---|---|---|---|
| **Cable section (AWG or kcmil)** | **30 °C (86 °F)** | **40 °C (104 °F)** | **45 °C (113 °F)** | **50 °C (122 °F)** | **55 °C (131 °F)** |
| 10 | < 35 A | < 31 A | < 29 A | < 26 A | < 23 A |
| 8 | < 50 A | < 44 A | < 41 A | < 38 A | < 34 A |
| 6 | < 65 A | < 57 A | < 53 A | < 49 A | < 44 A |
| 4 | < 85 A | < 75 A | < 70 A | < 64 A | < 57 A |
| 3 | < 100 A | < 88 A | < 82 A | < 75 A | < 67 A |
| 2 | < 115 A | < 101 A | < 94 A | < 86 A | < 77 A |
| 1 | < 130 A | < 114 A | < 107 A | < 98 A | < 87 A |
| 1/0 | < 150 A | < 132 A | < 123 A | < 113 A | < 101 A |
| 2/0 | < 175 A | < 154 A | < 144 A | < 131 A | < 117 A |
| 3/0 | < 200 A | < 176 A | < 164 A | < 150 A | < 134 A |
| 4/0 | < 230 A | < 202 A | < 189 A | < 173 A | < 154 A |

### Calculation method for CSA

- Single supply cables (3 phases + PE - configuration (1)):

    - Add 10 % to the total compressor current ($I_{tot}$Pack or $I_{tot}$FF from the tables)
    - Install the prescribed fuse on each cable
- Parallel supply cable (2 x 3 phases + 2 PE - configuration (2)):
    - Add 10 % to the total compressor current ($I_{tot}$Pack or $I_{tot}$FF from the tables) and divide by 2
    - Multiply the ampacity of the cables with 0.8 (see CEC Part 1 table 5C)
    - Install fuses of half the size of the recommended maximum fuse size on each cable.
- When using 2 x 3 phase + 2 PE as in (3):
    - Add 10 % to the total compressor current ($I_{tot}$Pack or $I_{tot}$FF from the tables) and divide by √3
    - Multiply the ampacity of the cables with 0.8 (see CEC Part 1 table 5C)
    - Fuse size: the recommended maximum fuse size divided by √3 on each cable.
- Size PE cable:
    - For supply cables up to AWG8: same size as supply cables
    - For supply cables larger than AWG8: use maximum allowed ampacity of the selected supply cables and compare with value in table below (see CEC Part 1 table 16)

| |
|---|
| < 100 A: use AWG8 |
| < 200 A: use AWG6 |
| < 400 A: use AWG3 |

Always check the voltage drop over the cable (less than 5 % of the nominal voltage is recommended).

**Example of supply cable calculation:** $I_{tot}$ = 128 A, maximum ambient temperature is 45 °C, recommended fuse = 150 A

- Single supply cables (3 phases + PE - configuration (1)):
    - I = 128 A + 10 % = 128 x 1.1 = 140.8 A
    - AWG3/0 (000), allows a maximum current of 200 A at 30 °C (86 °F).When the conductor has a maximum temperature of 75 °C at 45 °C, the maximum current is 164 A ( 200 A * 0.82 = 164 A, see table 5A col. 3) which is sufficient.
    - Fuses: 150 A
- Parallel supply cables (2 x 3 phases + 2 PE - configuration (2)):
    - I = (128 A + 10 %)/2 = (128 x 1.1)/2 = 70.4 A
    - For AWG2 at 45 °C (113 °F), when the conductor has a maximum temperature of 75 °C, the maximum current is 95A * 0.82 * 0.8 = 62.3 A, which is insufficient. For an AWG1/0 (0), the maximum current is 125 * 0.82 * 0.8 = 82 A. So 2 parallel cables of 3 x AWG1/0 + 2x AWG8 are sufficient.
    - Install fuses of 80 A instead of 150 A.

### Cable sizing according UL/cUL

Calculation method according UL 508A, table 28.1 column 5: allowable ampacities of insulated copper conductors (75 °C (167 °F)).

Maximum allowed current in function of the wire size

| AWG or kcmil | Maximum current |
|---|---|
| 10 | < 30 A |
| 8 | < 50 A |
| 6 | < 65 A |
| 4 | < 85 A |
| 3 | < 100 A |

| AWG or kcmil | Maximum current |
|---|---|
| 2 | < 115 A |
| 1 | < 130 A |
| 1/0 | < 150 A |
| 2/0 | < 175 A |
| 3/0 | < 200 A |

**Calculation method for UL:**

- Single supply cables (3 phases + 1 PE - configuration (1)):
  - Add 25 % to the total current from the tables (see UL 508A 28.3.2: "Ampacity shall have 125 % of the full load current")
  - Install the prescribed maximum fuse on each cable
- Parallel supply cable (2 x 3 phases + 2 PE - configuration (2)):
  - Add 25 % to the total current from the tables and divide by 2
  - Multiply the ampacity of the cables with 0.8 (see UL 508A table 28.1 continued)
  - Install fuses of half the size of the recommended maximum fuse size on each cable.
- When using 2 x 3 phase + 2 PE as in (3):
  - Add 25 % to the total current from the tables and divide by √3
  - Multiply the ampacity of the cables with 0.8 (see UL 508A table 28.1 continued)
  - Fuse size: the recommended maximum fuse size divided by √3 on each cable.
- Size PE cable:
  - For supply cables up to AWG8: same size as the supply cables
  - For supply cables larger than AWG8: use maximum allowed ampacity of the selected supply cables and compare with value in table below (see CEC Part 1 table 17)

| |
|---|
| < 100 A: use AWG8 |
| < 200 A: use AWG6 |
| < 300 A: use AWG4 |

Always check the voltage drop over the cable (less than 5 % of the nominal voltage is recommended).

**Example of supply cable calculation:** $I_{tot}$ = 128 A, maximum ambient temperature is 45 °C, recommended fuse = 150 A

- Single supply cables (3 phases + 1 PE - configuration (1)):
  - I = 128 A + 25 % = 128 x 1.25 = 160 A
  - For AWG2/0, the maximum current is 175 A, which is sufficient => use AWG2/0
  - Install the prescribed maximum fuse (150 A) on each cable
- Parallel supply cable (2 x 3 phases + 2 PE - configuration (2)):
  - I = (128 A + 25%)/2 = (128 x 1.25)/2 = 80 A
  - For a AWG4, the maximum current is 85 A x 0.8 = 68 A, which is insufficient. For an AWG3, the maximum current is 100 x 0.8 = 80 A. So 2 parallel cables of 3 x AWG3 + 2 x AWG8 are sufficient.
  - Install 80 A fuses on each cable.

| | |
|---|---|
|  | • Recommended fuse values are based on full service factor and 10% under- and over-voltage.<br>• **Causion:**<br>Always double check the fuse size against the calculated cable size.If required, increase the cable size. |

## 9.2 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 |

| | | |
|---|---|---|
| **On water-cooled units also:** | | |
| Cooling water inlet temperature | ˚C | 20 |
| Cooling water inlet temperature | ˚F | 68 |

### Limits

| | | |
|---|---|---|
| Maximum working pressure | | See section Compressor data |
| Minimum working pressure | bar(e) | 4 |
| Minimum working pressure | psig | 58 |
| Maximum air inlet temperature | ˚C | 46 |
| Maximum air inlet temperature | ˚F | 115 |
| Minimum ambient temperature | ˚C | 0 |
| Minimum ambient temperature | ˚F | 32 |

| | | |
|---|---|---|
| **On water-cooled units also:** | | |
| Maximum cooling water outlet temperature | ˚C | 50 |
| Maximum cooling water outlet temperature | ˚F | 122 |
| Maximum cooling water inlet temperature | ˚C | 35 |
| Maximum cooling water inlet temperature | ˚F | 95 |
| Maximum cooling water inlet pressure | bar(e) | 5 |
| Maximum cooling water inlet pressure | psig | 72.5 |

## 9.3 Compressor data

### Reference conditions

| | |
|---|---|
|  | All data specified below apply under reference conditions, see section Reference conditions and limitations. |

## Gearbox driven units

| | Units | 7.5 bar | 8 bar | 10 bar | 13 bar | 100 psi | 125 psi | 150 psi | 175 psi |
|---|---|---|---|---|---|---|---|---|---|
| Frequency | Hz | 50 | 50 | 50 | 50 | 60 | 60 | 60 | 60 |
| Nominal working pressure | bar(e) | 7 | 8 | 9.5 | 12.5 | 6.9 | 8.6 | 10.3 | 12 |
| | psig | 102 | 116 | 138 | 181 | 100 | 125 | 150 | 175 |
| Maximum working pressure | bar(e) | 7.5 | 8 | 10 | 13 | 7.4 | 9.1 | 10.8 | 12.5 |
| | psig | 109 | 116 | 145 | 189 | 107 | 132 | 157 | 181 |
| Unloading pressure Maximum setting | bar(e) | 7.2 | 8.2 | 9.7 | 12.7 | 7.1 | 8.8 | 10.5 | 12.2 |
| | psig | 104 | 119 | 141 | 184 | 103 | 128 | 152 | 177 |
| Unloading pressure Factory setting | bar(e) | 7 | 8 | 9.5 | 12.5 | 6.9 | 8.6 | 10.3 | 12 |
| | psig | 102 | 116 | 138 | 181 | 100 | 125 | 150 | 175 |
| Unloading pressure Minimum setting | bar(e) | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 |
| | psig | 59.5 | 59.5 | 59.5 | 59.5 | 59.5 | 59.5 | 59.5 | 59.5 |
| Loading pressure Maximum setting | bar(e) | 7.1 | 8.1 | 9.6 | 12.6 | 7 | 8.7 | 10.4 | 12.1 |
| | psig | 103 | 117.5 | 139 | 183 | 101.5 | 126 | 151 | 175.5 |
| Loading pressure Factory setting | bar(e) | 6.4 | 7.6 | 8.9 | 11.9 | 6.3 | 8 | 9.7 | 11.4 |
| | psig | 93 | 110 | 129 | 173 | 91 | 116 | 141 | 165 |
| Loading pressure Minimum setting | bar(e) | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | psig | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |
| Set point, thermostatic valve | ˚C | 40 | 40 | 40 | 65 | 40 | 40 | 40 | 65 |
| | ˚F | 104 | 104 | 104 | 149 | 104 | 104 | 104 | 149 |

| | Units | 7.5 bar | 8 bar | 10 bar | 13 bar | 100 psi | 125 psi | 150 psi | 175 psi |
|---|---|---|---|---|---|---|---|---|---|
| Set point, thermostatic valve (converter) | ˚C | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | ˚F | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 |

| Power | hp | 40 | 50 | 60 | 75 | 100 | 100 | 125 | 150 |
|---|---|---|---|---|---|---|---|---|---|
| Refrigerant type, units with Dryer | | R404a | R404a | R404a | R404a | R404a | | | |
| Total amount (refrigerant), units with Dryer | kg | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | | | |
| Oil capacity, air-cooled units | l | 20 | 20 | 20 | 25 | 25 | 30 | 33 | 42 |
| A-weighted sound level | dB(A) | | | | | | | | |

# 10 Options

## 10.1 Energy recovery

### 10.1.1 Energy recovery unit

#### Description

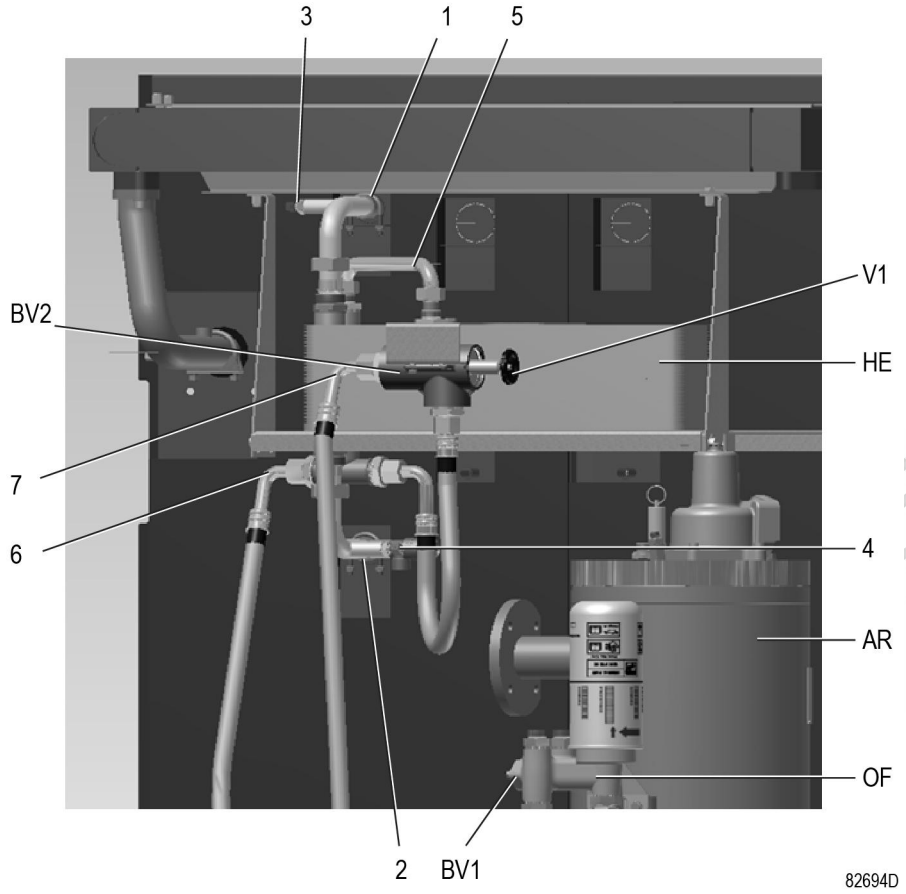
A large part of the energy required for any compression process is transformed into heat. For oil-injected screw compressors, the major part of the compression heat is dissipated through the oil system. The energy recovery (ER) systems are designed to recover most of the above-mentioned heat by transforming it into warm or hot water without any adverse influence on the compressor performance. The water can be used for diverse applications.

#### Components

**The energy recovery system is completely integrated and mainly comprises:**

- Stainless steel oil/water heat exchanger
- Selector handle (V1) to enable/disable Energy Recovery
- Thermostatic by-pass valve for energy recovery heat exchanger(s) (BV)
- Two temperature sensors for water inlet and outlet control (3 and 4)
- The necessary bolts, flexibles, etc.

## Energy recovery unit (ER-unit)




*Main components of the ER unit (typical installation)*

| Reference | Designation |
|---|---|
| 1 | Water inlet pipe |
| 2 | Water outlet pipe |
| 3 | Temperature sensor, water inlet pipe |
| 4 | Temperature sensor, water outlet pipe |
| 5 | Oil line to HE |
| 6 | Oil line from compressor oil separator vessel to ER unit |
| 7 | Oil line from ER unit to oil filter housing |
| BV2 | Location of heat exchanger by-pass valve (BV2) |
| HE | Heat exchanger |
| V1 | Selector valve |
| AR | Oil separator vessel |
| OF | Oil filter housing |
| BV1 | Location of oil cooler bypass valve (BV1) |

### Field installation

The main components are assembled ex-factory as a compact unit which fits inside the bodywork of the compressor. Consult your customer centre for installing and connecting the energy recovery unit.

## 10.1.2 Energy recovery systems

### General

The energy recovery systems can be applied as low temperature rise/high water flow systems or as high temperature rise/low water flow systems.

### Low temperature rise/high water flow systems

For this type of application, the temperature difference between the water in the energy recovery system and the compressor oil is low. As a consequence, a high water flow is needed for maximum energy recovery.

Example: The heated water is used to keep another medium at a moderately high temperature, in a closed circuit, e.g. central heating.

### High temperature rise/low water flow systems

For this type of application, a high water temperature rise in the energy recovery system is obtained, which consequently brings on a low flow rate.

Example: An open circuit where cold water from a main supply is heated by the energy recovery system for use in a factory, e.g. pre-heating of boiler feed water.

### Recovery water flow

The recovery water enters the unit at inlet connection (1). In heat exchanger (HE) the compression heat is transferred from the compressor oil to the water. The water leaves heat exchanger (HE) via outlet connection (2).

### Water requirements for closed water circuits

The use of a closed water circuit minimises make-up water requirements. Therefore, the use of soft or even demineralised water is economically feasible and eliminates the problem of scale deposits. Although the heat exchanger is made of stainless steel, the water circuit connected to the compressor may require corrosion inhibitors. If in any doubt, consult your customer centre.

Add an anti-freeze product such as ethylene-glycol to the water in proportion to the expected temperature to avoid freezing.

### Water requirements for open water circuits

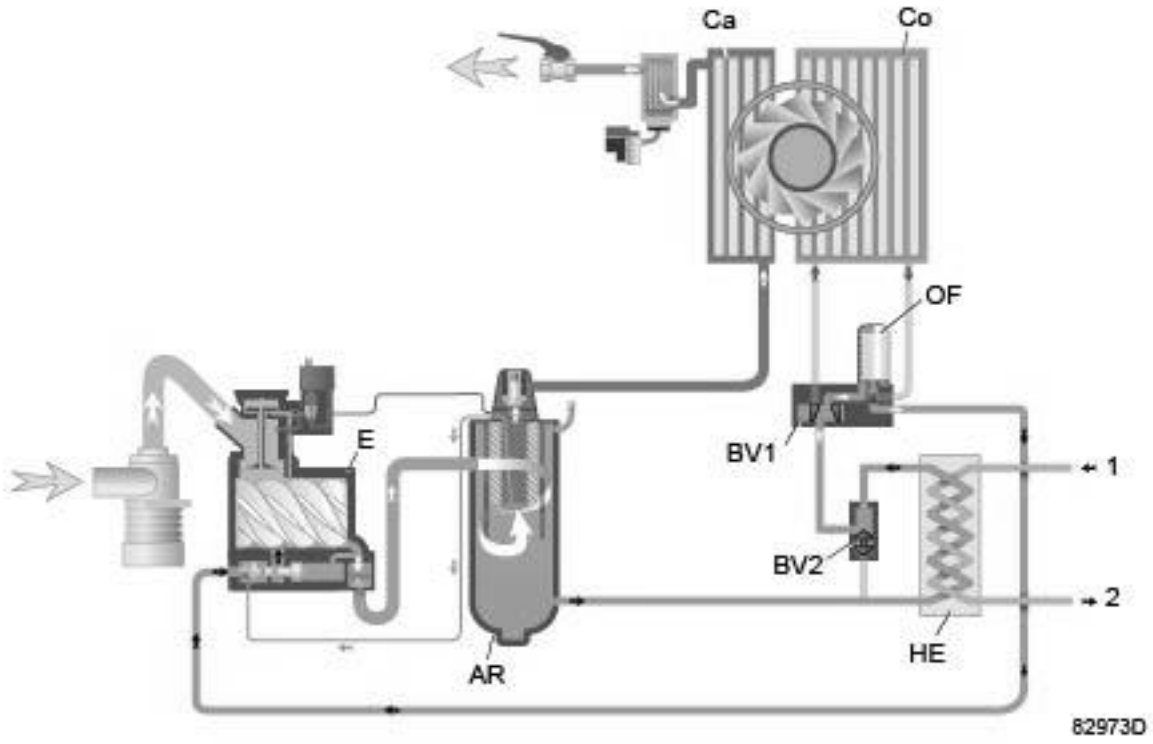
For open, non-recirculation water circuits, the major problems usually encountered are related to deposit control, corrosion control and microbiological growth control. To minimize these problems, the water should meet a number of requirements. If in any doubt, consult your customer centre.

## 10.1.3 Operation

### Description

The compressor oil flow is controlled by two thermostatic valves (BV1 and BV2), ensuring reliable compressor operation and optimum energy recovery.

Bypass valve (BV1) is integrated in the oil filter housing of the compressor and controls the oil flow through the main oil cooler (Co) of the compressor. Bypass valve (BV2) controls the oil flow through the oil/water heat exchanger (HE) of the ER unit. Both valves consist of an insert (thermostat) mounted in a housing.




*Flow diagram of compressor with energy recovery system*

| Reference | Designation | Reference | Designation |
|---|---|---|---|
| BV2 | Thermostatic bypass valve of ER unit | OF | Oil filter |
| HE | Oil/water heat exchanger (ER unit) | AR | Oil separator vessel |
| E | Compressor element | BV1 | Thermostatic bypass valve in oil filter housing |
| Co | Oil cooler (compressor) | Ca | Aftercooler (compressor) |
| 1 | Water inlet | 2 | Water outlet |

BV2 starts closing the bypass line over the heat exchanger (HE) at the lower limit of its temperature range. At the upper limit of its temperature range, the bypass line is completely closed and all the oil flows through the ER heat exchanger.

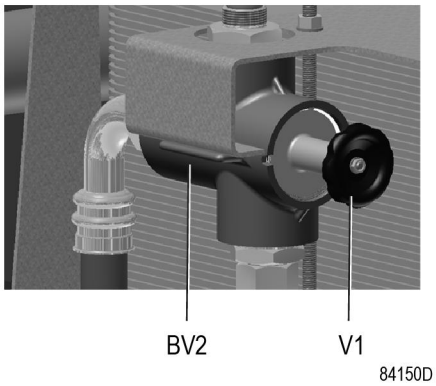
Variable speed driven (VSD) air-cooled compressors are equipped with a bypass valve BV2 that starts opening at 40 ˚C (104 ˚F) and which is completely open at 55 ˚C (131 ˚F).

Variable speed driven (VSD) water-cooled compressors are equipped with a bypass valve BV2 that starts opening at 60 ˚C (140 ˚F) and which is completely open at 75 ˚C (167 ˚F).

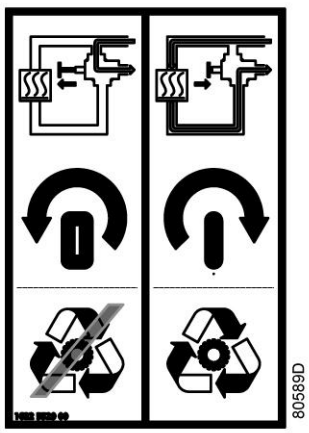
The housing of BV2 is provided with a special wheel (V1), allowing to control the energy recovery system.

As can be seen on the ER label, the ER unit is integrated in the oil circuit and will recover energy when the wheel is completely turned in clockwise.

When the wheel is turned out anticlockwise, the heat exchanger (HE) is bypassed and no energy will be recovered.




*valve housing of BV2 with wheel V1*




*ER label*

| | |
|---|---|
| | Attention: It is only allowed to turn the wheel completely in or out. No in-between position is allowed! |

The oil cooler bypass valve (BV1) starts closing the bypass over the oil cooler (Co) at the lower limit of its temperature range. At the upper limit of its temperature range, the bypass is completely closed and all the oil flows through the oil cooler (Co).

BV1 must have a higher opening temperature (set point) than BV2 in order to prevent the heat from being dissipated in the compressor oil cooler (Co) rather than in the oil/water heat exchanger (HE) when using the compression heat as source for energy recovery.

Thermostat BV1 starts to open at 60 ˚C (140 ˚F) and is completely open at 75 ˚C (167 ˚F).

### Energy recovery system in use (see drawing)

The wheel (V1) of BV2 (bypass valve of the HE) is totally **turned in clockwise**.

- Compressor start-up

When the compressor is started up from cold, the oil temperature will be low. Bypass valve (BV2) shuts off the oil supply through the heat exchanger (HE) and bypass valve (BV1) shuts off the oil supply through the oil cooler (Co) to prevent the compressor oil from being cooled. The oil flows from the oil separator vessel (AR) through the oil filter(s) (OF) back to compressor element (E).

All energy input is used to rapidly warm up the compressor oil. No energy is recovered.

- Maximum energy recovery

As soon the oil temperature reaches the set point (opening temperature) of bypass valve (BV2), the valve starts closing off the bypass over the heat exchanger (HE) oil line, gradually allowing the oil to flow through the heat exchanger (HE). As the oil temperature rises to approx. 15 ˚C (27 ˚F) above the set point, all the oil passes through the heat exchanger. The exchange of heat between the compressor oil and the heat recovery water is maximum. The oil from the heat exchanger outlet flows via oil filter (OF), oil stop valve (Vs - if present), compressor element (E) and separator (AR) back to the inlet of heat exchanger (HE). Bypass valve (BV1) bypasses the oil cooler (Co) as long as the oil temperature remains below its set point.

Operation principle at different loads:

- Low consumption of recovered energy
  The temperature of the oil leaving heat exchanger (HE) rises. When the temperature rises above its set point, oil cooler bypass valve (BV1) will gradually allow the oil to be cooled in the oil cooler (Co).
- Recovery water flow too high/temperature too low
  In this case, bypass valve (BV2) will open the bypass line allowing oil from heat exchanger (HE) to be mixed with oil from separator (AR). Energy is transferred from the compressor oil to the water, but at a relatively low temperature level.

### Energy recovery system not in use

The wheel (V1) is **completely turned out anti-clockwise**.

The oil circuit is the same as without installation of the energy recovery system.

No energy is recovered.

This situation should be considered as exceptional, e.g. in case of maintenance of the energy recovery system or when no energy is required for a long period.

On VSD compressors: close the air outlet valve and run the unit at minimum speed for a few minutes before isolating the energy recovery system from the compressor.

### Stopping the unit for a long period

In case of an open water system and/or if freezing temperatures can be expected, isolate the compressor water system and blow it through with compressed air.

## 10.1.4 Maintenance

### Compressor oil

For references used consult section Energy recovery

**Oil change:**

1. Check if the wheel (V1) is totally turned in clockwise (energy recovery in use).
2. Run the unit until warm. Stop the unit, switch off the isolating switch and close the air outlet valve of the compressor.
3. Depressurize the compressor and drain the oil by opening the drain valve on the oil separator vessel. See Oil and oil filter.
4. Resume oil change as described in section Oil and Filter Change in this book.

### Thermostatic bypass valves

The inserts (thermostats) must be replaced by new ones when abnormal function is noticed. Examples: regulating temperature is not within the normal range, ER heat exchanger remains cold,...

### Heat exchanger (HE)

If the temperature rise over the energy recovery system declines over a period of time with the same basic working conditions, the heat exchanger should be inspected. To clean the oil side, soak the heat exchanger in a degreasing solution. To remove scale formation in the water compartment, a proper descaling process should be applied. Consult your customer centre.

## 10.1.5 Energy recovery data

### Reference conditions

See section Reference conditions and limitations.

### Effective working pressure

Consult section Compressor data for the normal working pressure.

### Maximum allowed pressure of the heat exchanger

| | |
|---|---|
| Oil side | 15 bar (217 psi) |
| Water side | 10 bar (145 psi) |

### Reading settings

**In addition to other data, the following temperatures can be read on the Elektronikon display:**

**For air-cooled units:**

- The water inlet temperature of the energy recovery system
- The water outlet temperature of the energy recovery system

**For water-cooled units:**

- The water inlet temperature of the energy recovery system
- The water outlet temperature of the energy recovery system

- The cooling water outlet temperature of the compressor

## Modifying settings

If the programmed warning settings for the water temperatures are exceeded, a warning indication is shown on the Elektronikon:

| Temperature input | | Minimum setting | Nominal setting | Maximum setting |
|---|---|---|---|---|
| Water inlet temperature of energy recovery | ˚C | 0 | 50 | 99 |
| Water inlet temperature of energy recovery | ˚F | 32 | 122 | 210 |
| Delay at warning signal | sec | 0 | Consult your customer centre | 255 |
| Delay at start ( should be less than delay at warning signal ) | sec | 0 | Consult your customer centre | 255 |
| Energy recovery water outlet temperature | ˚C | 0 | Depends on application | 99 |
| Energy recovery water outlet temperature | ˚F | 32 | Depends on application | 210 |
| Delay at signal | sec | 0 | Consult your customer centre | 255 |
| Delay at start ( should be less than delay at signal ) | sec | 0 | Consult your customer centre | 255 |

To modify a setting, consult the relevant section in the description of the Elektronikon controller.

## Recoverable energy

The recoverable energy can be calculated from:

RECOVERED ENERGY (kW) = 4.2 x water flow (l/s) x water temperature rise (˚C)

In the tables below, typical examples are given.

## Data for low temperature rise/low water flow systems

Typical values

| Parameters | Units | 30kW | 37kW | 45kW |
|---|---|---|---|---|
| Recoverable energy | kW | 20 | 24,67 | 30 |
| Water flow | l/Min | 28,93 | 35,67 | 43,4 |
| Temperature at inlet | °C | 50 | 50 | 50 |
| Temperature at outlet | °C | 60 | 60 | 60 |
| Pressure drop | bar | 0,151 | 0,22 | 0,22 |

| Parameters | Units | 55kW | 75kW | 90kW | 110kW |
|---|---|---|---|---|---|
| Recoverable energy | kW | 48,4 | 66 | 79,2 | 80,4 |
| Water flow | l/Min | 69,3 | 94 | 113,4 | 114 |
| Temperature at inlet | °C | 50 | 50 | 50 | 50 |
| Temperature at outlet | °C | 60 | 60 | 60 | 60 |
| Pressure drop | bar | 0,21 | 0,46 | 0,53 | 0,55 |

### Data for high temperature rise/low water flow systems

Typical values

| parameters | units | 30kW | 37kW | 45kW |
|---|---|---|---|---|
| Recoverable energy | kW | 18,67 | 23,02 | 28 |
| Water flow | l/Min | 2,28 | 2,79 | 3,4 |
| Temperature at inlet | °C | 20 | 20 | 20 |
| Temperature at outlet | °C | 92 | 92 | 92 |
| Pressure drop | bar | 0,001 | 0,001 | 0,001 |

| parameters | units | 55kW | 75kW | 90kW | 110kW |
|---|---|---|---|---|---|
| Recoverable energy | kW | 48,4 | 50,2 | 79,2 | 79,7 |
| Water flow | l/Min | 9,8 | 10,3 | 16,0 | 16,5 |
| Temperature at inlet | °C | 20 | 20 | 20 | 20 |
| Temperature at outlet | °C | 91 | 91 | 91 | 91 |
| Pressure drop | bar | 0,005 | 0,009 | 0,013 | 0,014 |

# 10.2 ECO6i

## 10.2.1 General description

### Introduction

**ECO6i**

All graphic controllers can be used to control a number of other compressors. They can automatically start, load, unload and stop the connected compressors in order to regulate the air net pressure within programmable limits.

ECO 6i can be used to control up to 6 compressors.

This integrated central controller function (ECOi) can be activated when a software license is provided.

### Local Area Network (LAN)

The compressors to be controlled must be connected with each other in a Local Area Network (LAN) using CAN (Controller Area Network) technology.

The controller with the integrated ECOi function serves as master regulator for the compressors. The regulators of the other compressors act as slave regulators.

Relay regulated compressors can be connected to the network by means of a conversion box and/or a communication module between regulator and network (see the next chapters for details).

Select the compressor regulator which will serve as the master regulator for all compressors in the LAN and label this compressor as Master Compressor 1.

Select the compressor regulators which will serve as slave regulators. (Label the compressors Compressor 2, 3 and 4, 5, 6 respectively).

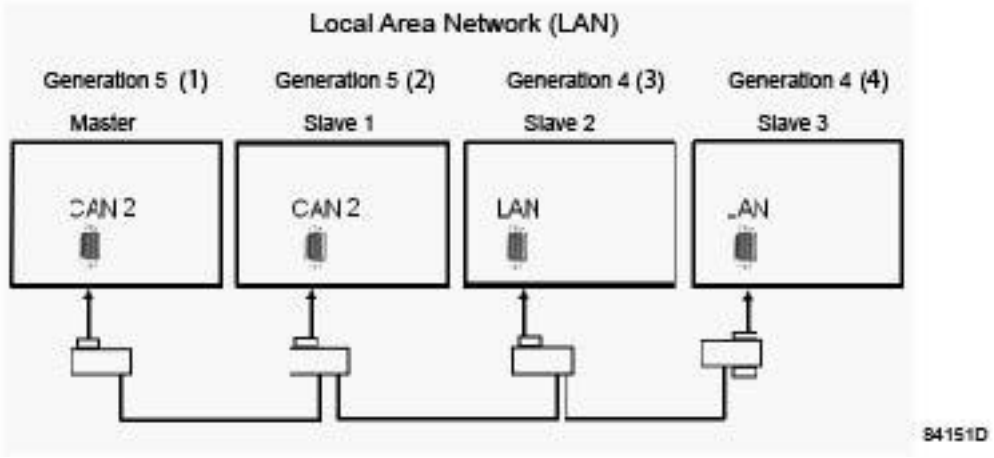
## 10.2.2 Installation instructions

### Important remark

| | |
|---|---|
| | Always stop each compressor and switch off the voltage before making any connection! |

### Connecting compressors equipped with 4th generation controllers

All electronic control modules of the fourth generation can directly be connected with each other using the LAN port as shown in below figure:

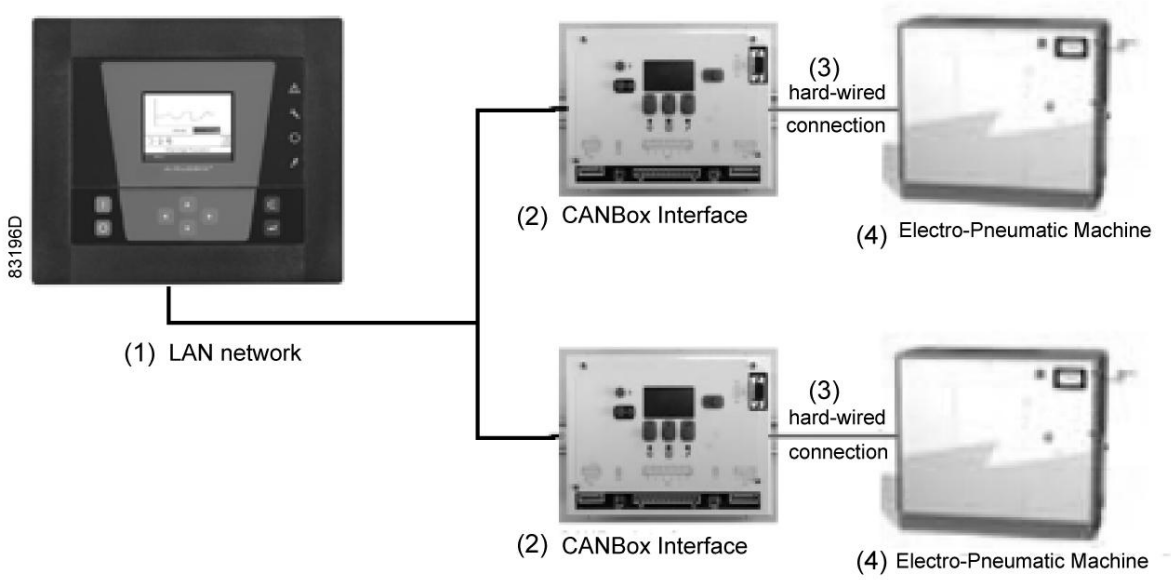



*LAN setup in case of 4th generation controller*

| Reference | Description | Reference | Description |
|---|---|---|---|
| (1) | Compressor 1 Master | (4) | Compressor 4 Slave |
| (2) | Compressor 2 Slave | | |
| (3) | Compressor 3 Slave | | |

### Connecting electro-pneumatically controlled machines and machines of other brands

The only way to connect this type of machines to the regulator with the activated ECOi function is to use a CANBox interface (part number 1900 0712 61) , which in turn is connected to the LAN network via hardwiring.




*Connecting electro-pneumatic controlled machines to the LAN*

| Reference | Description | Reference | Description |
|---|---|---|---|
| (1) | LAN network | (3) | hardwired connection |
| (2) | CANBox interface | (4) | Electro-pneumatically controlled machine |

## 10.2.3 Set-up of parameters

### Remarks

There are 2 ways to modify the ECOi parameters in the regulators:

1. Via the display
2. Via Modi5 ( the previous version of this program called FSP: Field Service Program )

However, some modifications are only possible via the display, while some other modifications are only possible via the specific software. Consult the survey at the end of this chapter.

| | |
|---|---|
| ⚠ | Always stop the compressors before making changes to the settings |

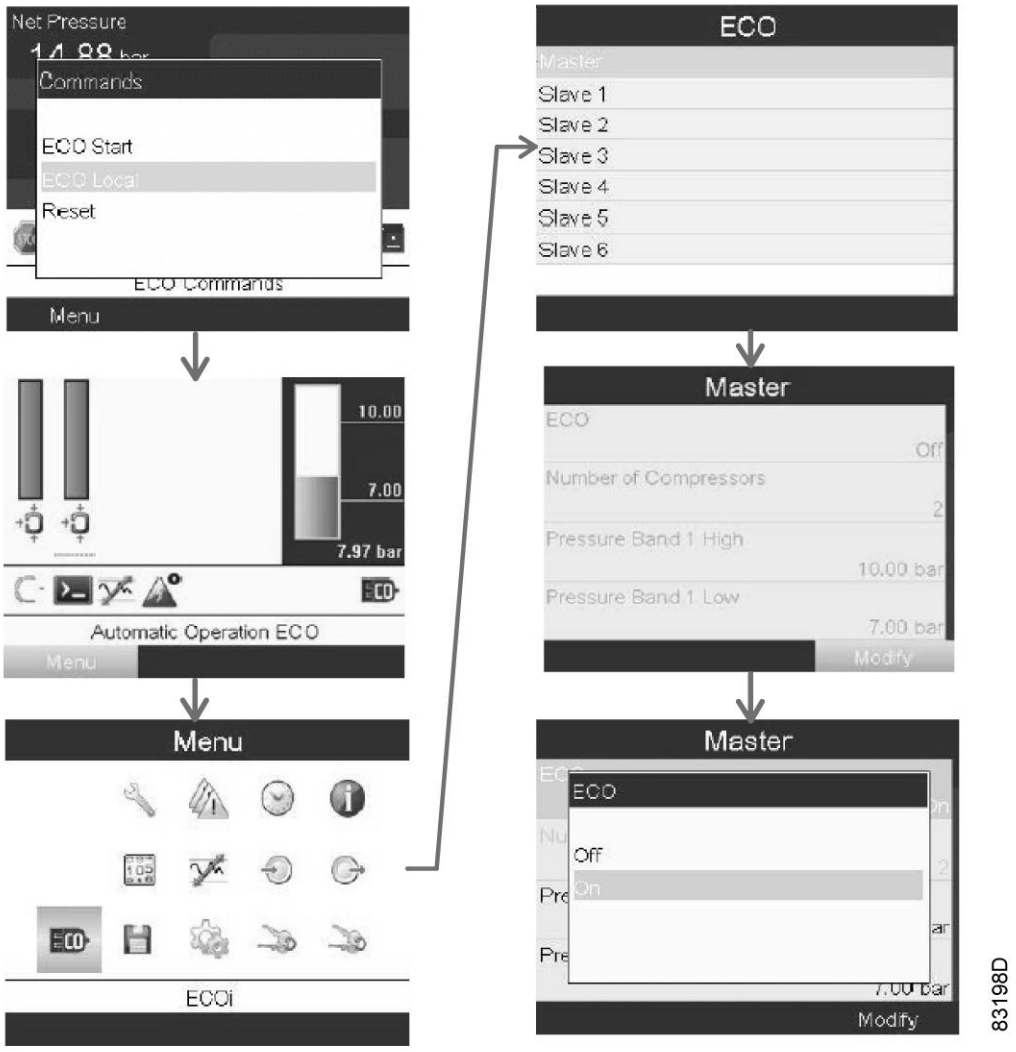
## Commissioning via the display

### Programming the ECOi in the master regulator

How to activate the ECOi in the master regulator ?

1. Starting from the main screen
2. Press the enter button
3. Use the scroll buttons ▲▼►◄ to select the ECO icon


4. A modify button appears, press enter (ECO is highlighted) press enter again
5. A dialogue screen opens (choose ON to activate or OFF to deactivate)

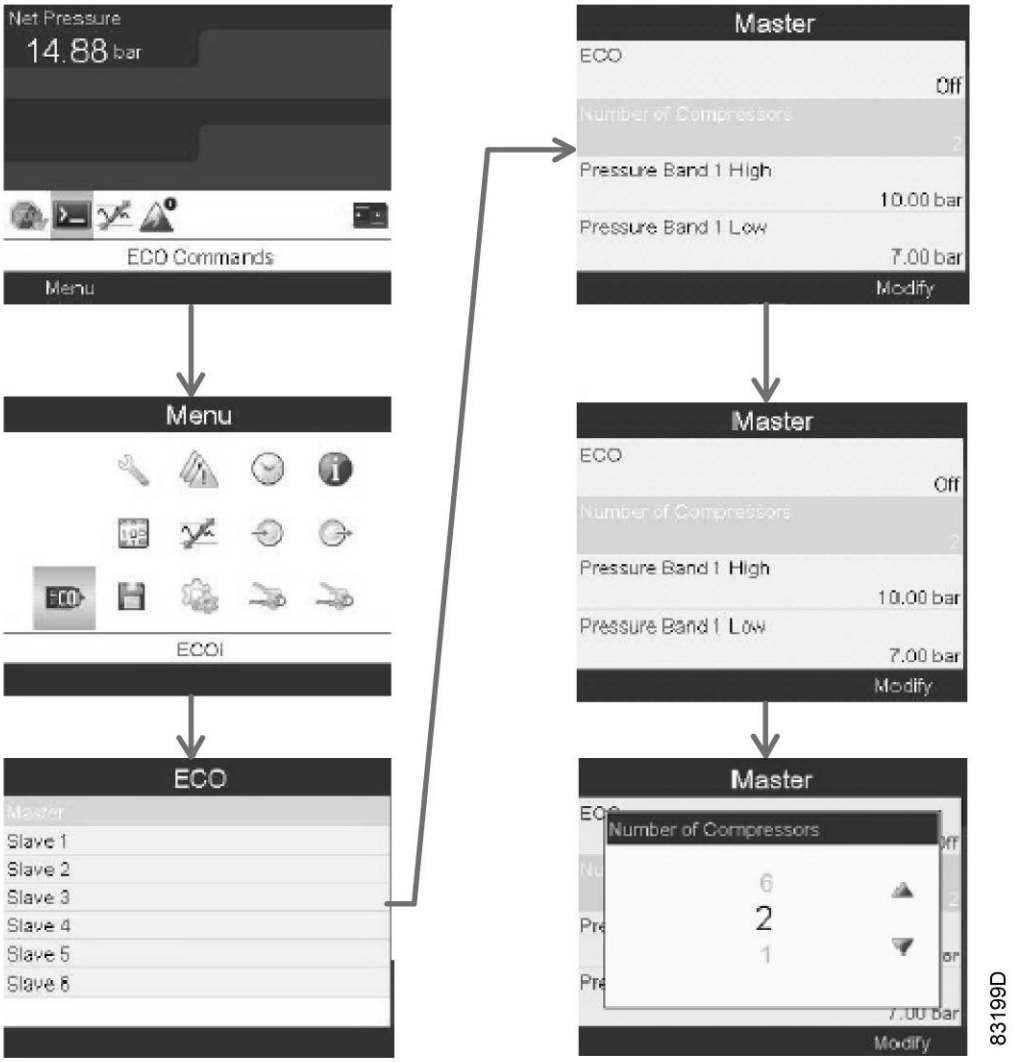



*Flowchart how to activate the ECOi in the master regulator*

### Select the number of compressors that will be used in the LAN

1. Starting from the main screen
2. Press the enter button
3. Use the scroll buttons ▲▼►◄ to select the ECO icon
4. Press the enter button (the master is highlighted), press enter again

5. A list of items is shown, the button modify is selected, press enter and use the scroll buttons ▲▼►◄ to select the menu item “Number of Compressors”. Press enter.
6. A dialogue screen opens (choose between 1 to 6 by using the scroll buttons ▲▼►◄).
7. Press enter to confirm.
8. Press the escape button to leave this screen.



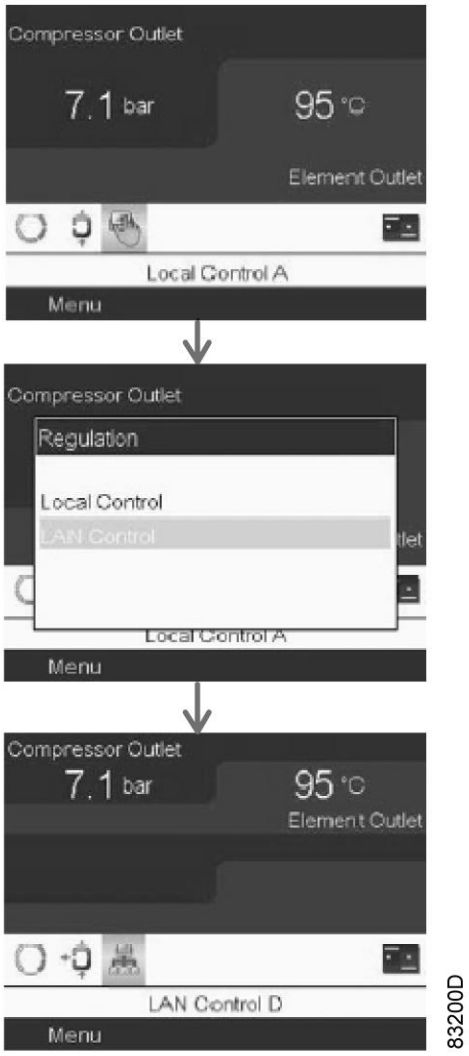

*Flowchart how to select the number of compressors in the LAN*

**Activating into LAN for master and slave regulators**

For the master regulator:

1. Switch on the voltage.
2. Starting from the main screen.
3. Use the scroll buttons ▲▼►◄ to select the Local control icon in the main screen.
4. Press the enter button.
5. A dialogue screen appears choose LAN Control from the list.
6. Press the enter button

Each slave needs to be programmed separate, by repeating all actions like described above.



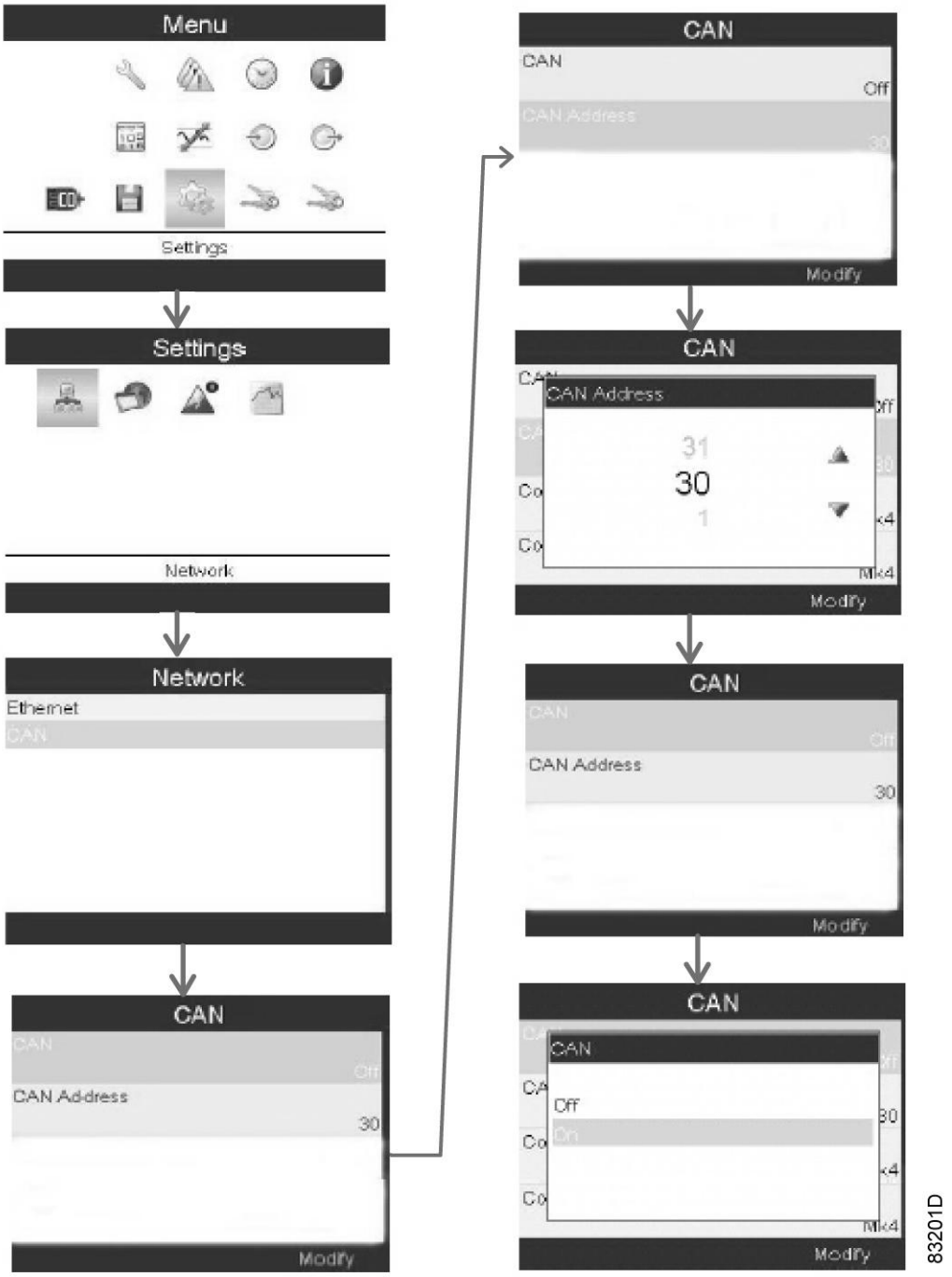

*Flowchart how to integrate the compressors into the LAN*

**Programming the node ID number**

For the master regulator:

1. Starting from the main screen, press the enter button.
2. Use the scroll buttons ▲▼►◄ to select the settings icon.
3. Press the enter button.
4. Use the scroll buttons ▲▼►◄ to select the network icon and press the enter button.
5. Use the scroll buttons ▲▼►◄ to select CAN from the list and press the enter button.
6. Use the scroll buttons to select CAN Address from the list
7. Use the ▲ and ▼ scroll buttons to modify the node ID number and press the enter button. (ID should be set to 30 for the master regulator)
8. Select CAN item from the list and press the enter button.
9. Select in the next dialogue ON and press the enter button
10. Press the escape button as much as necessary to go back to the main screen.

For each slave, repeats the steps like described above.




*Flowchart how to program the node ID number*

**Parameters that can be modified via the display**

| **Parameters master module** | |
|---|---|
| ECO | Number of Compressors |
| Pressure Band 1 High | Pressure Band 2 High |
| Pressure Band 1 Low | Pressure Band 2 Low |
| Pressure Band in Use | Digital Pressure Band Selection |
| Scheme in Use | Digital Scheme Selection |

| | |
|---|---|
| Forced time | Remote To Local Time |
| Start/Load Time | Unload Time |
| Delta Time | Remote Start/Stop |
| System Stop Function | System Forced Function |
| Automatic restart | Maximum Power Down Time |

| **Parameters slave module(s)** | |
|---|---|
| Scheme 1 Priority | Start/Load Reaction time |
| Scheme 2 Priority | Load Reaction Time |
| Unload Reaction Time | Stop Reaction Time |
| VSD Maximum Starts Per Day | VSD Zero RPM Band Factor |
| VSD Maximum RPM Factor | Running hours |
| VSD Minimum RPM Factor | |

## 10.2.4 Operation

### 10.2.4.1 Remarks

#### Local start/stop function

All local start and stop functions on the control panels of the compressors are disabled, except for the emergency stop buttons which remain active.

#### Clock functions

In case time-based automatic start/stop commands were programmed in the regulators of the participating compressors (via menu Clock function), these commands will not be taken into account.

#### Variable speed compressors

In case one or more IVR compressors are participating, one IVR will act as control IVR:

1. • The set point of the control IVR will be in the middle of the net pressure band.
1. • The Indirect stop level will equal the maximum level of the net pressure band.
1. • The Direct stop level will equal the sum of the new Set point and the programmed direct stop level of the control IVR compressor; the direct stop level must be higher than the Indirect stop level.

Example:

Pressure band levels programmed in the master regulator: max. 8.0 bar(e) - min. 7.0 bar(e) and Direct stop level programmed in the regulator of the variable speed compressor: 1 bar

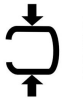
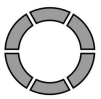
In LAN configuration, the IVR compressor will have a Set point of 7.5 bar(e), an Indirect stop level of 8.0 bar(e) and a Direct stop level of 8.5 bar(e).

### 10.2.4.2 Before starting

Status icons for each compressor on the main screen of the master regulator.

| Icon | Status | Description |
|---|---|---|
|  81947D | **No valid compressor type** | An unknown compressor type is detected |
|  81948D | **No communication** | Fixed Speed or VSD: No reply from the connected compressor within a time out. Electro pneumatic compressor: Status red from the compressor is not consistent or illogical. |
|  57797F | **No answer** | Connected compressor is not responding ( or not responding correctly) to the commands. (example: no reaction on a load command) |
|  81949D | **Not available** | Compressor is stopped and is counting out the Minimum Stop Time. During this time the compressor is Not Available to the ECOntrol6 algorithm. |
|  57796F | **Shutdown** | Compressor is in Shutdown condition |
|  57790F | **Stopped / Running** | The compressor is running local |

Input icons for each compressor on the main screen of the master regulator.

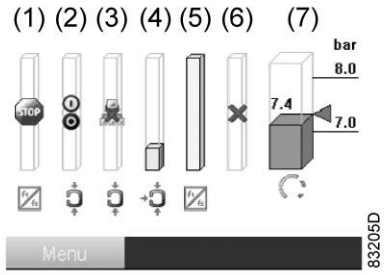
| Icon | Description |
|---|---|
|  57806F | Frequency converter driven compressor |
|  57787F | Unload compressor |
|  57789F | Load compressor |
|  57786F | When the ECO6 is controlling the connected units, the icon is rotating |

### 10.2.4.3 Starting

After pressing the start button, the ECOi regulator will start, load, unload and stop the compressors needed to keep the net pressure between the programmed pressure bands, while taking into account the programmed ECOi parameters.

### 10.2.4.4 During operation

The ECOi main screen will be similar to the one below.




*ECO main screen*

| Reference | Description |
|---|---|
| (1) | Compressor 1 is stopped |
| (2) | Compressor 2 is running local |
| (3) | Compressor 3 : No communication between regulator and related slave |
| (4) | Compressor 4 is starting up |
| (5) | Compressor 5 : Master VSD is loaded |
| (6) | Compressor 6 : No valid compressor type |
| (7) | The maximum pressure is set on 8.0 bar<br>The minimum pressure is set on 7.0 bar<br>The actual pressure is 7.4 bar |

### 10.2.4.5 Isolating a compressor

It is possible to isolate a compressor from regulation by the master regulator.

1. On the regulator of the compressor to be isolated use the scroll buttons to select the icon LAN Control on the main screen.
2. Press the enter button.
3. Scroll to Local control in this list.
4. Press the enter button.
5. The icon Local Control appears on the main screen.

### 10.2.4.6 Integrating a compressor

To integrate an isolated compressor again:

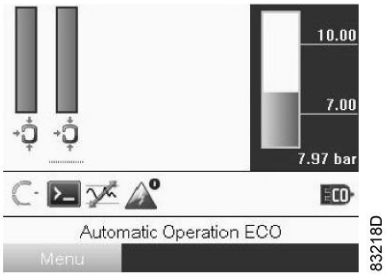
1. On the regulator of the compressor to be itegrated use the scroll buttons to select the icon Local Control on the main screen.
2. Press the enter button.
3. Scroll to LAN Control in this list.
4. Press the enter button.
5. The icon LAN Control appears on the main screen

#### 10.2.4.7 Stopping

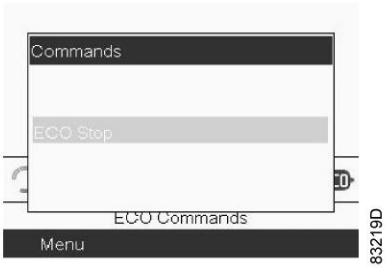
To stop all compressors:

- Use the scroll buttons ▲▼►◄ to select the ECO icon


- Press the enter button

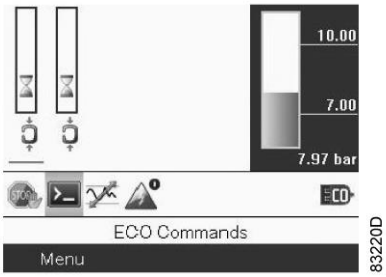



- In the next screen, select the ECO Stop by using the scroll buttons ▲▼
- Press the enter button to confirm




l

- All compressors are stopped




### 10.2.5 Integration of a remote pressure sensor

#### 10.2.5.1 Adding an external net pressure sensor

The net pressure (also called System Pressure) is provided by the Master controller and is identical to the Compressor Output pressure of this controller.

If required, the net pressure can be measured locally on the net itself (net vessel or piping). To do so two type of sensors can be used: 0-5 V pressure transducer (similar to the sensor used on the compressor) or by a 4-20 mA pressure transmitter.

- **0-5 V pressure transducer:**
  - If a Pressure input is free on the Master controller, this input can be used to connect the pressure transducer. If no input is free an additional I/O2 module (expansion module) is required.
- **4-20 mA pressure transmitter:**
  - To connect this type of sensor always an I/O2 module (expansion module) is required.

## 10.3 Automatic drain

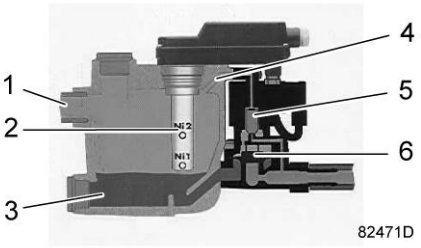
### Description

The automatic drain valve allows all air consumption to be avoided while the compressor is not running.

For machines with a built-in dryer, two water separation outlet may be provided, one up-line from the dryer and the other on the dryer drain.

### Overview

- There is no air loss due to the level detection system : an inductive sensor detects the level of water and thus controls the opening of the electric bleed valve. A low level of condensation is also detected in order to close the electric drain valve and to prevent compressed air from being wasted.
- This type of purge valve does not require any maintenance. The purge valve does not require the use of the metallic intake filter that is usually installed on electronic purge valves to protect the solenoid valve. The solenoid valve will not be damaged.
- Condensate discharge facilitated as condensates are not discharged under pressure facilitating separation of the condensate oil and water phases.




*Main components*

| Reference | Designation |
|---|---|
| 1 | Condensation intake |
| 2 | Capacitive sensor |
| 3 | Receiver |
| 4 | Main duct |
| 5 | Solenoid valve |
| 6 | Membrane |

### Technical features

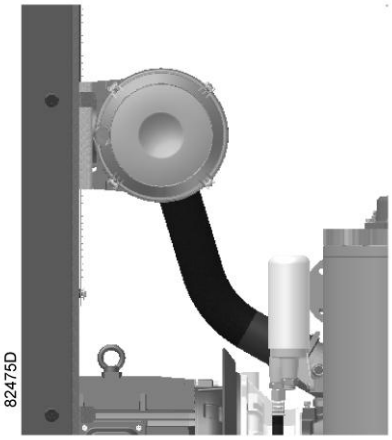
| | |
|---|---|
| Maximum capacity of the compressor : | 5 $m^3$/min |
| Working pressure : 0.8 / 16 bar Operating temperature : | + 1 / + 60°C |
| Electric power supply : | 230 / 110 / 24/ … |
| AC socket in the compressor electric cabinet. | |

## 10.4 Heavy duty filter

### Description

This system is equipped for "high efficiency" air filtration in order to improve the quality of the air intake and to preserve the compressor's oil and internal filter components.

This option is particularly useful in very dusty surroundings.




### Overview

- This option is used as a replacement for the standard filter
- The quality of the air intake by a compressor is essential. Low quality air creates the following :
- Quick pollution of the oil thus an increase in draining cycles.
- Binding of the air / oil separator before 4000 hours thus an increase in maintenance cycles and operation costs.
- Pollution increases the elements that filter into the air and oil, speeding up the damage to the mechanical components of the compressor, screw element, ...
- Installation of the filter(s), depending on the model, outside the compressor, for intake of fresh air, hence resulting in a lower oil temperature and more efficient compression.

## 10.5 Pre-filtration panels

### Description

Installing air filtration panels on the ventilation intakes guarantees protection of the compressor's internal components and an increase in air sucked into the compression assembly.

This option is recommended if the heavy duty filtration option is installed

## Overview

The pre-filtration panels eliminate 90% of the particles normally admitted inside the compressor and considerably decrease internal contamination of the machine.

The high quality of the ventilation air is also essential for protecting internal components of the compressor and, more specifically, the motor and the air / air and air / oil exchangers. Clogging in the exchangers creates an increase in temperature, deterioration of the lubricant and the motor becomes overloaded thus increasing the energy consumed.

The quality of the air drawn in by a compressor is essential. Low quality air results in the following :

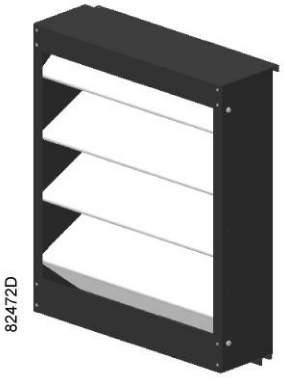
- Fast pollution of the oil thus an increase in oil change cycles.
- Increased pollution of the air and oil filtering components that increases the deterioration of the mechanical components in the compressor, screw block, ...
- Binding of the air / oil separator before 4000 Hours thus an increase in maintenance cycles and maintenance costs.

Access to the filtering media is allowed by removal that does not require any particular tool. The panel frame can be unlocked manually in order to clean the medium.

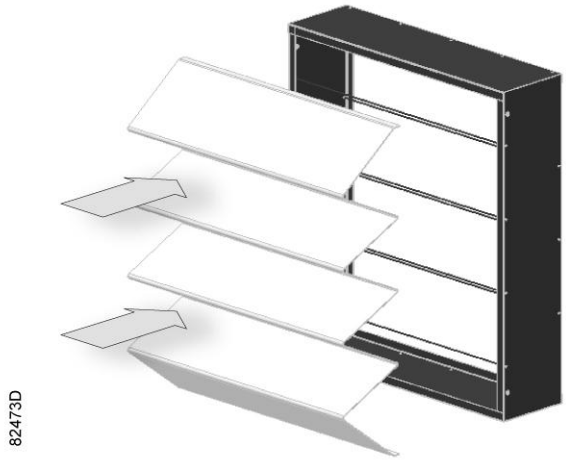
Exceptional longevity of the medium that is quick to take apart. The medium can be scoured by blowing compressed air in thus increasing the usage term for the filtering medium.

Galvanised steel covered frame.

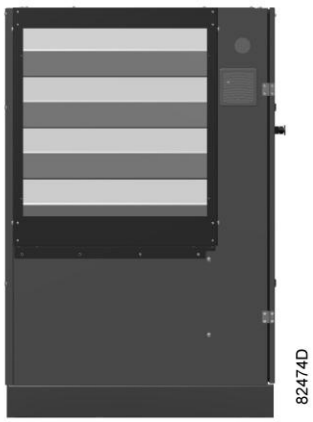
Non flammable medium (belonging to fire protection class M1) made of polyester fibres.




*Easy to disassemble for rapid cleaning.*




*Pleated medium on support grid placed downstream the direction of the airflow*




*Assembly*

## Technical features

### Filter medium:

| | |
|---|---|
| Degree of filtration : | 90% of the dust emitted is filtered. |
| Total nominal flow : | 6 000 m3/h |
| Filter panel number : | 2 |
| Initial charge loss : | 75 Pa |

| **Dimensions** | |
|---|---|
| Width : | 500 mm |
| Height : | 500 mm |
| Thickness : | 200 mm |

This option may be fitted to a compressor already installed.

## 10.6 Rotation direction indicator - Phase controller

### Description

The phase controller enables permanent and easier verification of the rotation direction of the machine by means of a diode. This prevents any risk of physical damage by disabling the compressor start up in case of phase reversal or if a phase is disconnected and indicates a machine fault.

Marking on the motor of the standard machine version identifies the motor fan rotation direction during the start up phase. Work on the electric network or the machine may change the rotation direction and damage the compressor which must be detected quickly.

## 10.7 Special oils

### Description

Different oils meet different needs:

4000 hours oil : longer interval between 2 drainage operations - 4000 hours under standard conditions of use.

8000 hours oil : longer interval between 2 drainage operations - 8000 hours under standard conditions of use.

Food Grade Oil: use of the compressor in the agricultural food & beverage industry.

**Note:**

If this option is chosen on a machine that has previously run on standard oil, the flushing procedure must first be strictly complied with.

### Overview

**4000 and 8000 hours oil**

The qualities of these oils enable the maintenance planning schedule to be based on main drainage operations of 4000 or 8000 hours (under standard conditions of use).

The maintenance tasks are consequently less frequent, thus making for certain savings, such as the availability of the equipment and lower operating cost of the compressor.

**Food Grade Oil**

This oil has been specially developed for use as a lubricant that may come into contact with foodstuffs.

## 10.8 Centrifugal water separation

### Description

This device enables the separation of condensates formed in the air cooler.


**Note:**

This option is always included with the dryer option.

### Overview

The cooling of the compressed air allows the suction air to be dried, thus removing the humidity that collects in the bottom of the separator after being condensed in the aftercooler. The condensates are evacuated from the separator through a trap with a solenoid drip valve or a trap with level detector if this option is installed.

### Drains

Regularly check that condensate is discharged during operation. The amount of condensate depends on environmental and working conditions.

## 10.9 Tropical thermostatic valve

### Description

Installing a tropical thermostat allows the compressor running at higher environment-temperature. This option is advised in places with a high humidity.

# 11 Specific information frequency converter

## 11.1 Description

| | |
|---|---|
|  | CPVS<br>machines are compliant with the Electromagnetic compatibility in industrial environments Standards 50081-2 and 50082-2 |

### Standard equipment

A electronic frequency adjusting device replaces the star-delta starter.

A fuse holder section switch completes the compressor standard's safety devices.

A protection foam to protect the frequency converter against dust contamination.

### Safety

For your safety, please respect the instructions carrying the warning symbols as given below:

**Safety rules**

The safety rules require:

- The presence of an earth socket
- The existence of a manual switch cutting-off the three phases that should be placed visibly near the compressor.
- It is necessary to cut out the electric current before any intervention on the machine (except drainage under pressure).

| | |
|---|---|
|  | Dangerous voltage |
|  | Attention |

| | |
|---|---|
|  | Electrical installations must only be carried out by a specialised and competent technician. |

**1 - Warning**

| | |
|---|---|
|  1 | The internal components and the plates (except the electrically insulated I/O terminals) are at the mains voltage when the inverter is connected to the mains. This voltage is extremely dangerous and can cause severe injuries or even death in case of involuntary contact. |
|  2 | When the inverter is connected to the mains, the connection terminals U, V, W of the motor as well as +/- connectors of the braking resistors are under power even if the motor is not running. |
|  3 | The I/O control terminals are insulated from the mains, the relay outputs can nevertheless be under power even if the inverter is disconnected. This also applies to other I/O control terminals even if the X4 switch is in OFF position (Stop). |
|  4 | The inverter has a load circuit of thermally limited capacitors. Therefore, it is important to allow minimum 5 minutes between two successive power-ons. If this instruction is not respected, the switch and the resistor of the load circuit may be damaged. |

**2 - Safety instructions**

| | |
|---|---|
|  1 | No connection work is allowed when the inverter is under power. |
|  2 | No measurement work is allowed on the inverter when it is under power. |
|  3 | To undertake any work on the inverter, it is necessary to disconnect the equipment from the mains. Wait for the internal ventilation to stop and the indicators to be turned off. Then, wait 5 minutes before opening the cover. |
|  4 | No voltage or insulation verification test is allowed on the inverter components. |
|  5 | Disconnect the cables from the motor and the inverter before taking measurements on them. |
|  6 | Do not touch the integrated circuits, the electrostatic discharges may damage them. |
|  7 | Before connecting the inverter, make sure that its cover is properly closed. |
|  8 | Make sure that no compensation capacitor of cosine phi is connected to the motor cable. |

## Installation

The compressor must be installed away from a transformer or auto-transformer.

The fuses for the section switch are defined as follows

| **Motor power (kW)** | | | | | |
|---|---|---|---|---|---|
| **Mains voltage 380/400/415 Volt / 3 / 50/60 Hz** | | | | | |
| Nominal current (400 V) | | | | | |
| Power supply cable H 07<br>Section mm² L= 10 m maxi | | | | | |
| Upstream fuses (type gG) | | | | | |

| | |
|---|---|
|  | **Attention**<br>Motors and drives can only be guaranteed where the supply voltage does not exceed the rated voltage by more than 10%. The connection of the power supply to the section switch (so present) requires the use of properly insulated terminals. |

## Commissioning

### 1 - Preparation for start up

| | |
|---|---|
|  | **Attention**<br>The power circuit will have to be cut off when adjusting the electrical equipment or if inadvertent start-up is to be avoided. |

Before start-up, check the following points:

1. Ensure that the unit has a suitable earth,
2. Check the oil level in the compressor,

   NOTE: the tank was filled in the factory with a suitable oil.

3. Check that the oil drain valve is properly closed.
4. Make sure that the transport pads (compressor) have been removed from the compressor silent blocks.

| | |
|---|---|
|  | **Attention**<br>The oil filler plug, the valve and the drain plugs have always to be closed during operation and must never be opened before the system has reached atmospheric pressure. |

**ADAPTATION OF THE INVERTER BUILT IN RFI FILTER FOR IT ELECTRICAL SUPPLY NETWORK**

(For TN and TT network, inverter has to be kept in its factory configuration)

In case of inverter drive units installed on IT network, the built in RFI filter has to be disabled as following "photo vacon". This upper operation will modify the EMC level from the inverter from class H to class T.

**NOTE:** Do not attempt to change the EMC-level back to class H (TN and TT). Even if the procedure above is reversed, the frequency converter will no longer fulfil the EMC requirements of class H.


82477D

**2 - Control of rotation direction on start up**

This control must be implemented when the machine is put into operation for the first time, after any work has been carried out on the motor and after any changes to the mains supply.

| | |
|---|---|
| | **Important**<br>• Check the direction of rotation (as per the arrow shown on Initial start-up) by jogging over with the START button. If it is incorrect, swap over two of the motor's phase cables under the drive.<br>When rotating in the right direction, the oil level must drop after 4 to 5 seconds of operation.<br>• Also check the direction of rotation of the fan for air-cooled compressors (counter-clockwise, as seen from inside the casing).<br>a. Press the START button so that the motor starts.<br>b. Allow to rotate for several seconds with the discharge valve slightly open to observe the compressor at load.<br>c. Press the STOP button. The motor stops and the plant automatically returns to atmospheric pressure. |

**3 - Setting of pressure - machine**

The unit is factory pre-set for a given delivery pressure. As an energy saving measure, it is strongly advised to reduce the pressure to the exact requirement by adjusting the "Set point 1" setting.

The stop pressure "Indirect shutdown" used when running at less than the minimum flow-rate - must be set to 0.5 bar above that of the "Set point 1". In this way, the current used by the compressor is minimised.

Do not set the stop pressure at a level beyond the machine's maximum pressure.

**4 - Assembly and settings for parallel operation with other compressors**

Pressure for the compressor must be adjusted at a value within the range of adjustment values for the rest of the compressors.

**5 - Regulating the pressure by changing the speed**

This method of regulating the pressure allows precise adjustment of the compressor's flow-rate at the compressed air demand valve:

The accuracy is of the order of 0.1 bar when pressure control is achieved by changing the speed, provided that the flow-rate lies between the maximum and minimum rates for the machine.

**The principle of the pressure control by changing the speed**

The controller controls the motor and the compressor as a function of the system pressure as measured by an internal pressure sensor.

- If the mains pressure is weaker than the pressure set point
  (user-defined parameter in the controller) the motor will accelerate and the pressure will increase.

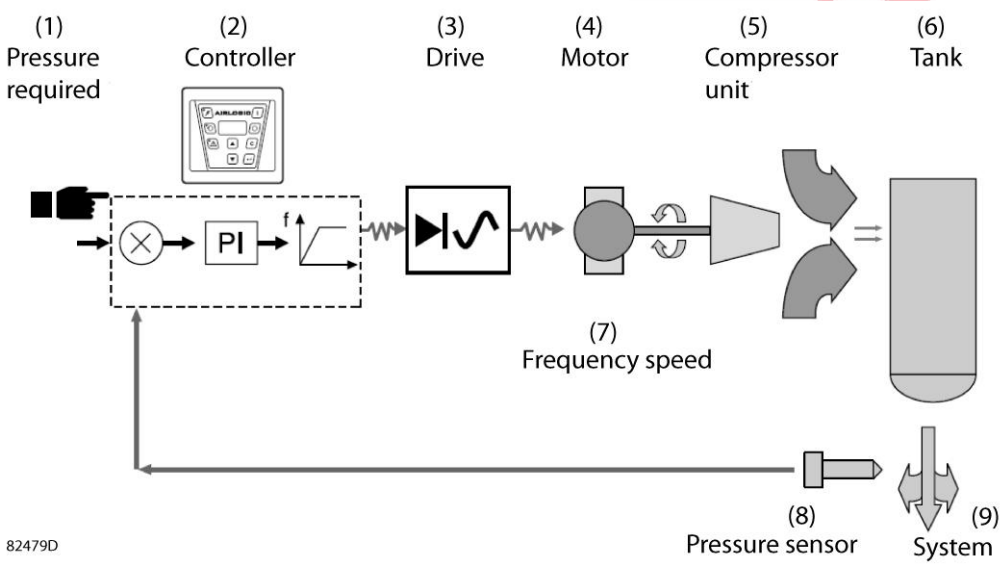
- If the mains pressure is stronger than the pressure set point, the motor will slow down causing the pressure to drop.

The controller provides the compressor control functions and also controls the whole pressure feedback loop. It therefore includes a device to compare the indicated pressure with that from the pressure sensor, associated with a compensating device, Proportional integral control PI.

The drive, a result of the latest developments in power electronics, is one of the smallest in size on the market, thanks to its use of high cut-out frequencies with IGBT transistors.

At the same time, the motor control method known as "open loop vector flux control " provides good stability for the system against disruption.

In this way, the pressure feedback loop is more stable to sudden changes in consumption (changes in the flow-rate).




| | |
|---|---|
| 1 | Pressure required |
| 2 | Controller |
| 3 | Drive |
| 4 | Motor |
| 5 | Compressor unit |
| 6 | Tank |
| 7 | Frequency speed |
| 8 | Pressure sensor |
| 9 | System |

**Pressure control for low rates of flow**

For an air consumption rate lower than the minimum rate of flow for the machine, the pressure is adjusted by the machine's time-delayed START/STOP controls.

Since the operation element cannot function below a certain speed (corresponding to the minimum output), the compressor continues to run and compress at the minimum speed until the pressure reaches the limit called "Indirect shutdown".

Once this threshold has been reached, the motor will stop, the machine will go into stand-by mode after a certain period of inactivity and the full drainage process will be carried out. The pressure then drops

towards the indicated pressure and, at the end of the minimum time delay (since reaching the no-load pressure), the drive allows the motor to restart. The pressure then rises again and the cycle starts over.

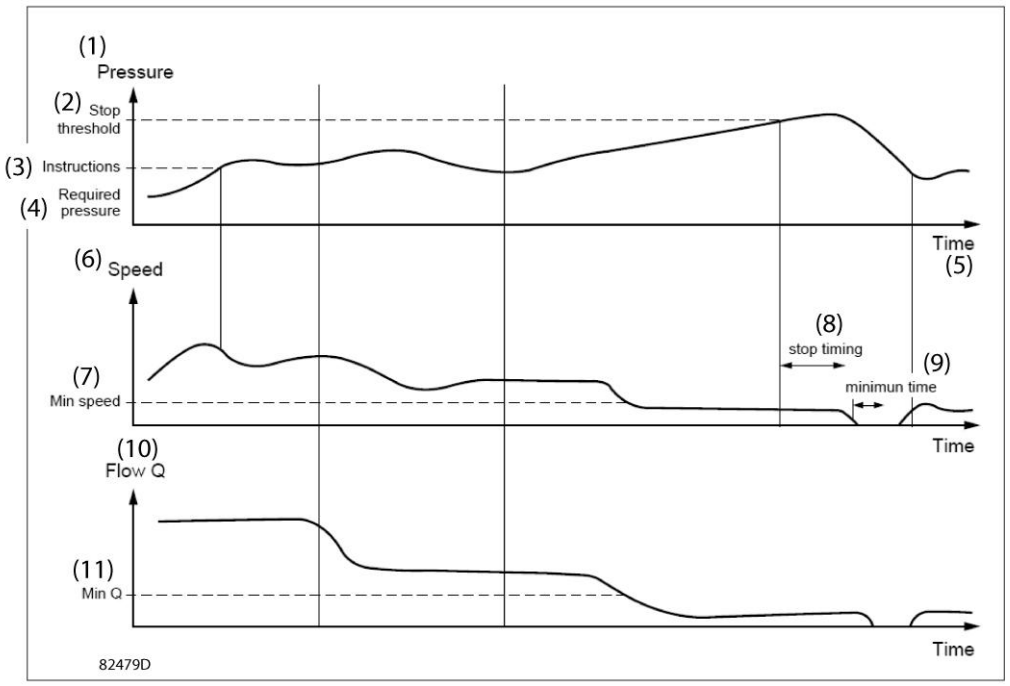
To avoid pumping the system - frequent stop / start - drainage time may be increased.

**Energy saving**

For demand of compressed air within the machine's flow range - minimum flow to maximum flow, the frequency converter or the variable speed drive feed the motor in order to ensure that it turns at the speed required to supply air demand both for pressure and flow.

It is used to adjust the power supply to the motor (and thus the machine) to the exact power requirement for the compression of the air, without a drainage stage being necessary.

| | |
|---|---|
| | **Comment**<br>Energy savings are increased if machine maintenance is carried out in accordance with the maintenance instructions and frequency. |




| | | | |
|---|---|---|---|
| 1 | Pressure | 7 | Minimum speed |
| 2 | Stop threshold | 8 | Stop timing |
| 3 | Instructions | 9 | Minimum time |
| 4 | Required pressure | 10 | Flow Q |
| 5 | Time | 11 | Minimum Q |
| 6 | Speed | | |

## Operating incidents

The staff in charge of maintenance of the compressor must be fully trained to maintain this machine, in order to be able to easily diagnose any incident. Under normal operating conditions, the compressor must provide full satisfaction.

**Main incidents**

The most likely incidents, along with the procedures to be applied, are listed in the controller manual.

# 12 Guidelines for inspection

## Guidelines

On the Declaration of Conformity / Declaration by the Manufacturer, the harmonised 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 manufacturer may require other inspection periods as mentioned below.

# 13 Pressure equipment directives

### Components subject to 97/23/EC Pressure Equipment Directive

The following table contains the necessary information for the inspection of all pressure equipment of category II and higher according to the Pressure Equipment Directive 97/23/EC and all pressure equipment according to the Simple Pressure Vessel Directive 209/105/EC.

| Compressor type | Component | Description | Volume | Design pressure | Minimum and maximum design temperature | PED Class |
|---|---|---|---|---|---|---|
| 30-45 kW | 1631 0137 80 | Vessel | 41 l | 15 bar(e) | -10 ˚C/ 120 ˚C | SPV |
| 55 kW (belt FS) | 1631 0137 80 | | 41 l | | | SPV |
| 55-75 kW (belt IVR / gear) | 1631 0138 80 | | 51 l | | | SPV |
| 75-90 kW | 1631 0164 80 | | 70 l | | | SPV |
| 110 kW | 1631 0831 80 | | 84l | | | SPV |
| 75-90 kW | 1631 0164 80 | | 70 l | | | SPV |
| 30-45 kW (<10bar) | 0830 1000 78 | Safety valve | - | - | - | IV |
| 30-45 kW (≥10bar) | 0830 1000 79 | Safety valve | - | - | - | IV |
| 55-90 kW (<10bar) | 1202 5749 00 | Safety valve | - | - | - | IV |
| 55-90 kW (≥10bar) | 1202 5401 00 | Safety valve | - | - | - | IV |
| 110 kW | 6211 1116 69 | Safety valve | - | - | - | IV |

| Compressor type | Component | Description | Minimum wall thickness | Visual inspection frequency |
|---|---|---|---|---|
| 30-45 kW | 1631 0137 80 | Vessel | 3 mm | Yearly |
| 55 kW (belt FS) | 1631 0137 80 | | 3 mm | Yearly |
| 55-75 kW (belt IVR / gear) | 1631 0138 80 | | 3 mm | Yearly |
| 75-90 kW | 1631 0164 80 | | 3 mm | Yearly |
| 110 kW | 1631 0831 80 | | 4 mm | Yearly |
| 75-90 kW | 1631 0164 80 | | 3 mm | Yearly |
| 30-45 kW (<10bar) | 0830 1000 78 | Safety valve | | |
| 30-45 kW (≥10bar) | 0830 1000 79 | Safety valve | | |
| 55-90 kW (<10bar) | 1202 5749 00 | Safety valve | | |

| Compressor type | Component | Description | Minimum wall thickness | Visual inspection frequency |
|---|---|---|---|---|
| 55-90 kW (≥10bar) | 1202 5401 00 | Safety valve | | |
| 110 kW | 6211 1116 69 | Safety valve | | |

## Overall rating

The compressors conform to PED smaller than category I.

# 14 Declaration of conformity

## EC DECLARATION OF CONFORMITY

We, (1) ....., declare under our sole responsibility, that the product
Machine name
Machine type
Serial number

Which falls under the provisions of article 12.2 of the EC Directive 2006/42/EC on the approximation of the laws of the Member States relating to machinery, is in conformity with the relevant Essential Health and Safety Requirements of this directive.

The machinery complies also with the requirements of the following directives and their amendments as indicated.

| | Directive on the approximation of laws of the Member States relating to | | Harmonized and/or Technical Standards used | Att' mnt |
|---|---|---|---|---|
| a. | Pressure equipment | 97/23/EC | | |
| b. | Machinery safety | 2006/42/EC | EN ISO 12100 – 1<br>EN ISO 12100 – 2<br>EN 1012 – 1 | |
| c. | Simple pressure vessel | 2009/105/EC | | |
| d. | Electromagnetic compatibility | 2004/108/EC | EN 61000-6-2<br>EN 61000-6-4 | |
| e. | Low voltage equipment | 2006/95/EC | EN 60034<br>EN 60204-1<br>EN 60439 | |
| f. | Outdoor noise emission | 2000/14/EC | | |
| g. | Equipment and protective systems in potentially explosive atmospheres | 94/9/EC | | |
| h. | Medical devices General | 93/42/EEC | EN ISO 13845<br>EN ISO 14971<br>EN 737-3 | |
| i. | | | | |

The harmonized and the technical standards used are identified in the attachments hereafter

*(Product company)* is authorized to compile the technical file.

| | Conformity of the specification to the directives | Conformity of the product to the specification and by implication to the directives |
|---|---|---|
| Issued by | Product engineering | Manufacturing |
| Name | | |
| Signature | | |
| Date | | |

81679D

*Typical example of a Declaration of Conformity document*

(1): Contact address:

International Compressor Distribution NV

Boomsesteenweg 957

B-2610 Wilrijk (Antwerp)

Belgium

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 device.

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AIR ADVISORS
Inc.

People.

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Performance.



Chicago Pneumatic

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