BERG Kompressoren GmbH
Compressed Air Technology | Air Separation

OPERATING AND MAINTENANCE MANUAL

REFRIGERATION DRYER
DRYBERG RF

ATTENTION

Before starting units of this type, ensure that all personnel involved have read and understood Chapter 2 "Safety" and follow the procedures set down in Chapter 6 "Start-up".

0.1 Unit ON-OFF

The unit can be switched on and off from the keypad by pressing key for 1 second; OFF status (stand-by) is confirmed by a display message.
In addition, the unit can also be switched on and off by a digital input, if configured. If the unit is switched on from a digital input it can be switched off from the keypad.
Digital input OFF status is shown on the display by means of a lit decimal point "OF.F". When the unit is in "OF.F" status the ON-OFF key is inhibited. In the transition to ON from a digital input, the unit returns to the prior "OF.F" status unless the value of "controller On-off command" is changed from the supervision system.

0.2 Condensate discharge key

The yellow condensate discharge key serves to open the relative valve manually (if the condensate discharge function is set as timer controlled); moreover, if selected from parameter H1=3 the discharge time (H4) can be reprogrammed; in this case the flashing red discharge icon will be displayed.

0.3 Keypad lock

To lock or unlock the keypad, press keys ∧ + ∨ for 5 seconds.
The keypad lock is shown for a few seconds by the message "POF", keypad unlocked is shown with "POn".
The type of lock can be selected using parameter "**blK**" (the message "*bLH*" is shown on the display):
blK=0 keypad enabled
blK=1 entire keypad disabled
blk=2 only ON/OFF key enabled
When the keypad is disabled pressing any key will produce the message "POF".

NOTE

When the unit is shipped from the factory the keypad is unlocked.

0.4 Alarms reset

To reset manual reset alarms (even with the controller in OFF status):

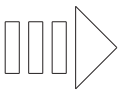
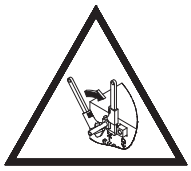
1. Press for more than 2 seconds but less than 5 seconds.
2. When the key is released the command is confirmed by the appearance of message "**rES**" for several seconds.

CONTENTS

CHAPTER 1

GENERAL INFORMATION

This manual refers to units denominated “dryers”.
Dryers are designed to remove the moisture from a flow of “compressed gas”.
The dryers are equipped with a refrigerant circuit designed to cool the compressed air to a temperature designated “pressurized dew point”.
Since, in the majority of applications, the gas to be dried is compressed air, hereinafter the term “compressed air” is used for the sake of simplicity, even though the specific gas in an individual application may be different. Hereinafter the expression “pressure” is used to indicate relative pressure.
The following general symbols are to be found on the decals affixed to the unit and also in the dimensional drawings and refrigerant circuit diagrams in this manual.
The meaning of each symbol is indicated below:

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	Unit air inlet		Unit air outlet
	Condensate discharge		Flow of cooling air (air-cooled models)
	Direction of fan rotation (air-cooled models)		Direction of the refrigerant gas flow
	See chap. 2.2.3 “Precautions to observe during installation and operation of the unit“		

ATTENTION

This manual gives the user, the installer and the maintenance technician all the technical information required to install, commission and operate the dryer and carry out the routine maintenance operations to ensure maximum service life. Use only genuine parts when carrying out routine maintenance or repairs.
For all INFORMATION or requests for SPARE PARTS concerning the dryer please contact your distributor or the nearest service centre, providing the SERIAL NUMBER and TYPE of the unit shown on the data plate as well as on the last page of this manual.

CHAPTER 2

SAFETY

ATTENTION

This plant is designed for safety in its intended use, provided it is installed, commissioned, and serviced in compliance with the instructions given in this manual.
The unit contains electrical components that operate at mains voltage and also moving parts such as fan units, it must therefore normally be disconnected from the electrical power supply before it is opened.
Operation, overhauls or repair of the unit or any maintenance operations that call for access to the plant must be executed by skilled or suitably qualified personnel who are fully aware of all the necessary precautions, preferably under the guidance of a qualified supervisor.

2.1 General

The user must ensure that all personnel involved in operating and servicing the unit and the auxiliary equipment have read and understood all the warnings, precautions, prohibitions and notes given in this manual and affixed to the unit.
If the user adopts operational procedures or uses tools or working procedures that are not specifically recommended, care must be taken to ensure that the dryer and the auxiliary equipment are not damaged or made unsafe and that no risks emerge in relation to persons or property.
Any improper use of the machine will relieve the manufacturer from any liability for possible personal injury or property damage.
Arbitrary modifications made to the unit will automatically invalidate all forms of guarantee provided by the manufacturer.

2.2 General precautions

2.2.1 Compressed gases to be dried

Compressed gases to be dried should be compatible with the materials used (aluminium alloys, carbon steel, cast iron, copper and its alloys) and could be, for example, air, nitrogen, argon and helium.

ATTENTION

The compressed gases must not give rise to phenomena of corrosion that could impair the condition of pressurized containers and they must not be able to cause fire or explosions in the event of leakage or expulsion.

2.2.2 Lifting and transport precautions

When a load is lifted from the ground keep well clear of the area beneath the load and the immediately surrounding area.
Keep rates of acceleration and lifting well within safety limits and never leave a suspended load attached to a hoist any longer than strictly necessary.
Handling of dryers must be carried out in compliance with the diagrams given (see the final part of this manual).
The manufacturer does not supply load spreaders, lifting straps or hooks with the unit.

ATTENTION

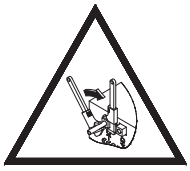
The unit's weight is shown on the data plate and on the label affixed to the crate.

2.2.3 Precautions to observe during installation and operation of the unit

For connection to the mains power supply follow the prescriptions given in Chapter 5 "Installation" and refer to the electrical diagrams.
All pipelines must be painted and marked clearly in compliance with local safety prescriptions in force in the place of installation.

ATTENTION

Keep all compressed air connectors blocked by means of a suitable wrench during connection to the compressed air supply system



Do not remove or tamper with safety devices, protections, or the insulating materials installed in the unit or in the auxiliary equipment.

The dryer and its auxiliary equipment must be connected to earth and protected against short circuits and overloads.
When the unit is powered, the voltage in the electrical circuit assumes potentially lethal values so the maximum precautions must be adopted if work is to be carried out on the electrical circuit.
Do not open the electrical equipment enclosure panels while the electrical system is powered unless this is strictly necessary for the execution of tests, measurements or settings.
This work must be carried out exclusively by qualified personnel equipped with suitable tools and wearing all the relevant protective equipment to safeguard against electrical hazards.

2.2.4 Maintenance precautions

If replacement parts are needed use only original spares.
Keep a written record of all work carried out on the unit and the auxiliary equipment.
The frequency and the nature of the work required over a period can reveal adverse operating conditions which should be corrected.
Use only refrigerant gas specified on the data plate of the unit.
Make sure that all instructions concerning operation and maintenance are strictly followed and that the complete unit, with all accessories and safety devices, is kept in good working order.
Always keep the plant clean.
Protect components and exposed openings, plugging them, for example, with clean rags.
Precautions must be taken when carrying out welding or any repair operation which generates heat, flames or sparks.
Components in the vicinity must be protected with non-flammable material.
Do not weld or perform work that generates heat close to a system that contains oil.
Before performing any such work all systems that may contain oil must be completely drained and flushed, for example, with steam.
Do not weld or modify a container that may be subject to pressurization.
To prevent an increase in working temperature, inspect and clean heat transfer surfaces (i.e. condenser fins) regularly.
For all dryers establish a convenient time interval for cleaning procedures.
Never use an open flame as a light source to inspect parts of the dryer.
Before dismantling parts of a plant ensure that all mobile and heavy parts are securely fixed, and ensure electrical power has been disconnected.
When a repair has been completed make sure that no tools, detached parts or rags are left in the dryer.
All guards must be refitted after carrying out repair or maintenance work.
Do not use flammable liquids to clean components while the unit is running.
If non-flammable hydrocarbons containing chlorine are used all the relevant safety precautions must be adopted to protect against the toxic fumes that may be given off.
Before removing any panels or dismantling any part of the unit, carry out the following operations:

- Isolate the unit from the electrical power supply by disconnecting the supply upstream of the power feeding line.
- Lock out the disconnect switch (if present) in the “OFF” position by fitting a padlock.
- Place a sign on the handle of the disconnect switch (if present) or in its immediate proximity stating “WORK IN PROGRESS - DO NOT CONNECT POWER”.
- Do not set the electrical power switch to ON or attempt to start the unit if the warning sign is displayed.

Coloured tracers can be used in service-maintenance operations.
Inspect all refrigerant circuit joints including connectors, flanges, and more generally all critical points (open joints) in order to prevent possible leakage of refrigerant gas.

2.3 Refrigerant gases

The plants can be charged only with R134a.
The use and storage of cylinders containing refrigerants must be in compliance with the prescriptions of the manufacturers of the cylinders and in compliance with the applicable safety laws and prescriptions in force in the place of installation.

2.3.1 Characteristics of R134a refrigerant

At normal temperature and pressure conditions, this is a class A1 colourless gas (classification EN 378-1).
Concentrations significantly above 1000 ppm v/v can cause narcotic effects.
In the event of leakages provide adequate ventilation of the room before entering.

2.4 Refrigerants safety datasheet

Denomination:	R134a (1,1,1,2 - tetrafluoroethane).

INDICATION OF HAZARDS

Major hazards:	Suffocation.
Specific hazards:	Unknown.

FIRST AID MEASURES

General information:	Do not attempt to administer liquids or solids to persons who have lost consciousness.
Inhalation:	Move victims to the open air. Use oxygen or artificial respiration if necessary. Do not administer adrenaline or similar substances.
Contact with the eyes:	Wash thoroughly with plenty of clean water for at least 15 minutes and seek medical assistance.
Contact with the skin:	Wash immediately in plenty of clean water. Remove contaminated clothing immediately.

FIRE-FIGHTING MEASURES

Means of extinction:	Any.
Specific hazards:	Pressure rise.
Specific methods:	Cool containers with water spray.

MEASURES IN THE EVENT OF ACCIDENTAL LEAKAGE

Individual precautions:	Evacuate personnel to safe muster points. Provide adequate ventilation. Use means of personal protection.
Environmental precautions:	Evaporates.
Cleaning methods:	Evaporates.

HANDLING AND STORAGE

Handling Technical measures/ precautions:	Use exclusively in well-ventilated places.
Recommendations for safe use:	Pressure test. Do not perform any pressure tests with air/R134a mixtures. The refrigerant may form a combustible mixture with air at pressures above atmospheric pressure when the ratio by volume is greater than 60%.
Storage:	Close properly and store in a cool, dry well-ventilated place.

CONTROL OF EXPOSURE/INDIVIDUAL PROTECTION

Control parameters:	1000 ppm v/v or ml/m3 as weighted average over an 8 hour period.
Respiratory protection:	For rescue and maintenance work in tanks, use autonomous breathing apparatus. The vapours are heavier than air and can cause suffocation, reducing the oxygen available for breathing.
Protection of the eyes:	Safety spectacles.
Protection of the hands:	Rubber gloves.
Hygiene measures:	Do not smoke.

PHYSICAL AND CHEMICAL PROPERTIES

Colour:	Colourless.
Odour:	Similar to ether.
Boiling point:	-26.5 °C / -15.7 °F at atmospheric pressure.
Flash point:	Non-flammable.
Relative density:	1.21 kg/l at 25°C.
Water solubility:	0.15% by weight at 25 °C at atmospheric pressure.

STABILITY AND REACTIVITY

Stability:	No reactivity if used in compliance with the relative instructions.
Materials to avoid:	Alkaline metals, alkaline earth metals, granulated metal salts, Al, Zn, Be, etc. in powder form.
Hazardous decomposition products:	Halogen acids, traces of carbonyl halides.

TOXICOLOGICAL INFORMATION

Acute toxicity:	ALC/inhalation/4 hours/in rat = 567 ml/l.
Local effects:	concentrations significantly above 1000 ppm v/v can cause narcotic effects. Inhalation of products in decomposition can lead to respiratory difficulty (pulmonary oedema).
Long-term toxicity:	No carcinogenic, teratogenic, or mutagenic effects observed in laboratory animals.

ECOLOGICAL INFORMATION

Global warming potential HGWP (R11=1):	0.28
Ozone depletion potential ODP (R11=1):	0
Considerations on disposal:	Can be recycled after reconditioning.

CHAPTER 3

TECHNICAL DATA

3.1 Data plate and meaning of abbreviations

The main data of the dryer are specified on the data plate of the unit:

MODEL and CODE	The model number and the code identify the size of the unit and the type of construction.
MANUAL	This is the code number of the manual.
SERIAL NUMBER	This is the serial or construction number of the unit.
MANUFACTURING YEAR	This is the year of the final test of the unit.
VOLTAGE/PHASE/FREQUENCY	Electrical power supply characteristics.
MAX CURRENT INPUT (I max)	Current consumed by the unit during the limit working conditions (refrigerant condensing and evaporation temperature of respectively 70 °C/158 °F and 10 °C/ 50 °F).
INSTALLED POWER (P max)	Current consumed by the unit during the limit working conditions (refrigerant condensing and evaporation temperature of respectively 70 °C/158 °F and 10 °C/ 50 °F).
PROTECTION RATING	According to European standard EN 60529.
REFRIGERANT	This is the refrigerant fluid in the unit.
REFRIGERANT QUANTITY	This is the quantity of refrigerant fluid contained in the unit.
MAX. REFRIGERANT PRESS.	Refrigerant circuit design pressure.
MAX. REFRIGERANT TEMP.	Refrigerant circuit design temperature.
USER CIRC. FLUID	Fluid cooled by unit.
MAX. WORKING PRESSURE	Max. design pressure of the user circuit.
MAX. TEMPERATURE	Maximum design temperature of the user circuit; this should not be confused with the maximum working temperature which is established when the offer is made.
SOUND PRESSURE LEVEL	Sound pressure level in a free field in hemispherical irradiation conditions (open field) at a distance of 1 m (39.37in) from the unit, condenser side, and at 1.6m (63.0in) from the ground.
AMBIENT TEMPERATURE	Min. and max. cooling air temperature value.
WEIGHT	This is the approximate weight of the unit before packing.
CONDENSER COOLING FLUID	Fluid used by the unit to cool the condenser (this data is not present if the unit condenser is air cooled).
MAX. WORKING PRESSURE	Max. design pressure of the condenser cooling circuit (this data is not present if the unit condenser is air cooled).
MAX. TEMPERATURE	Condenser cooling circuit maximum design temperature (this information is not given if the unit condenser is air cooled).

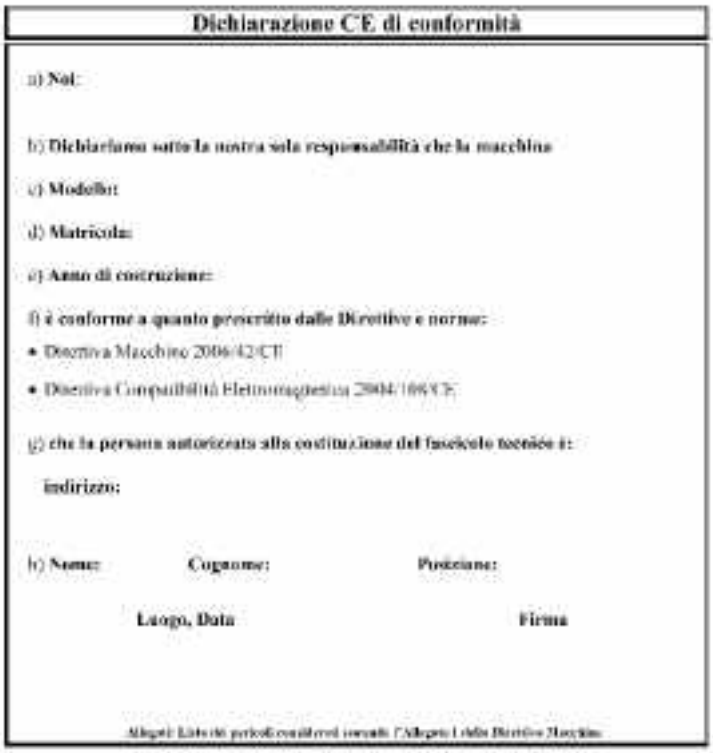
On the data plate and on the wiring diagram you will find the following abbreviations:

IMAX full load amperage;

PMAX full load power;

ILR locked rotor current.

3.2 Declaration of conformity



Dichiarazione CE di conformità

a) **Noi:**

b) **Dichiariamo sotto la nostra sola responsabilità che la macchina**

c) **Modello:**

d) **Matricola:**

e) **Anno di costruzione:**

f) **è conforme a quanto prescritto dalle Direttive e norme:**

- Direttiva Macchine 2006/42/CE
- Direttiva Compatibilità Elettromagnetica 2004/108/CE

g) **che la persona autorizzata alla costituzione del fascicolo tecnico è:**

indirizzo:

h) **Nome:** **Cognome:** **Posizione:**

Luogo, Data **Firma**

Allegati: Lista di pericoli rilevanti secondo l'Allegato I della Direttiva Macchine

List:
a) Name of manufacturer
b) Definition of responsibility
c) Unit model
d) Serial or construction number of the unit
e) Year of the unit's final test
f) Directives and standards
g) Officer responsible for technical file
h) Technical supervisor personal data

3.3 Performance

ATTENTION

The performance of the dryer (dew point, power consumption, pressure drops, etc.) depends mainly on the flow rate and pressure of the compressed gas to be dried and on the condenser cooling fluid temperature (ambient temperature).
These data, which are usually defined at the time of the offer, constitute the basic point of reference in relation to dryer performance.

3.3.1 Sound level measurements

The noise emission values measured are below 70 dB(A).

CHAPTER 4

DESCRIPTION

4.1 Operating principle

In the dryers described in this manual a refrigerant circuit cools the aluminium surface of an evaporator through which the humid compressed air to be dried flows. The air cools, condensing the water vapour it contains, which is then separated and discharged.
Before leaving the plant, the cold compressed air passes through an air/air exchanger in which it heats up while cooling the humid compressed air entering the dryer.
If the cooling output generated by the unit is greater than that required, a solenoid valve is activated, located on intake to the compressor and equipped with an additional calibrated hole: closure of the solenoid valve forces the refrigerant to pass through the additional calibrated hole, reducing the flow rate of the refrigerant processed by the compressor. This enables a reduction in cooling output and electrical consumption.
On units with capacity step control, if the cooling output is still too high, the cooling compressor will be shut down, to exploit the thermal mass of the aluminium heat exchanger.

4.2 Overall dimensions

For the drawings, consult the annexes to the manual.

4.3 Minimum distances from the walls of the installation room

For the drawings, consult the annexes to the manual.

4.4 Air and refrigerant circuits

For the drawings, consult the annexes to the manual.

4.4.1 Air circuit

The air/air heat exchangers and the evaporator are of compact type in aluminium.
The warm and moist compressed air enters the dryer through the air/air exchanger; here, the air is precooled by the cold dry compressed air at the outlet of the air/refrigerant exchanger or evaporator. The precooled air then enters the evaporator, where it is cooled further, transferring heat to the refrigerant, which consequently evaporates.
At the point, the compressed air is in a saturated condition and it entrains the condensate resulting from the cooling process. The condensate is separated from the air flow by a metal mesh (AISI304) demister and it falls due to gravity onto the bottom of the thermal module, from where it is collected and expelled.
The dry cold air flows a second time through the air/air exchanger where it warms up and cools the humid air entering the dryer.
This air/air exchanger both reduces the amount of energy required to dry a given flow of air and also has the benefit of reducing the relative humidity thereby avoiding the risk of the formation of condensate at the dryer outlet.

4.4.2 Refrigerant circuit

The refrigerant gas is forced by the compressor into the condenser, where it changes from the gaseous to the liquid phase.
The condenser is a finned core heat exchanger and it is cooled by an air flow produced by a fan unit.
Downstream from the condenser, the liquid refrigerant flows through a lamination device that reduces its pressure.
The refrigerant then enters the evaporator where it cools the compressed air; when it flows out of the evaporator it is in the form of a saturated vapour that entrains a small quantity of liquid.
The refrigerant is then sucked into the compressor again and the cycle is repeated.
If the cooling capacity produced by the unit is greater than the required cooling capacity, a solenoid valve trips to reduce the capacity of the circuit. This capacity control reduces the cooling capacity of the unit and also reduces energy consumption.
If the cooling capacity remains too high even with capacity control active, the refrigerant compressor will be stopped and the thermal mass of the aluminium exchanger will be utilized for cooling purposes.

4.5 Electrical circuit

The drawings are given in the annexes to the manual.

CHAPTER 5

INSTALLATION

ATTENTION

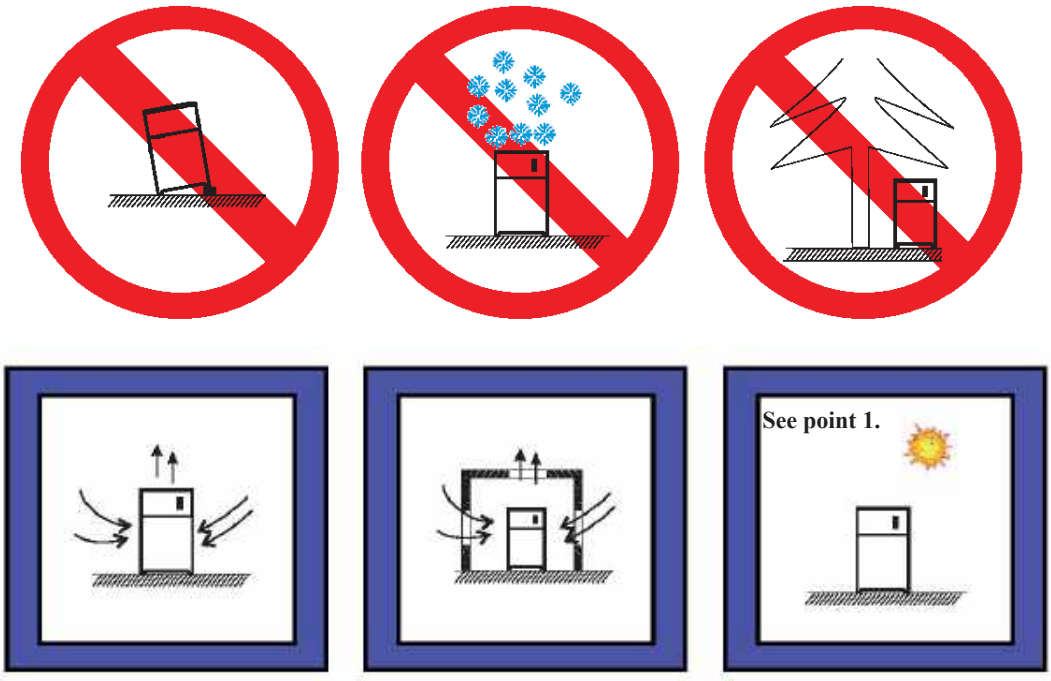
Before installing or operating these dryers, ensure that all personnel involved have read and understood Chapter 2 "Safety" in this manual.

ATTENTION

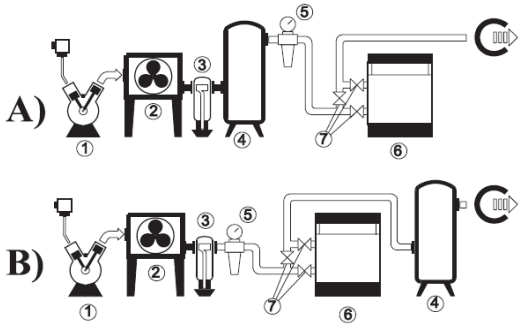
It is mandatory to install a prefilter upstream of the dryer to avoid exchanger fouling problems. It is good practice to install also a coalescent deoiler filter.

5.1 Location

1. The unit can be installed either outdoors or in an enclosed environment, depending on the degree of IP protection of the electrical panel and the unit itself.
2. If the unit is installed indoors the place of installation must be well ventilated. In certain cases it may be necessary to install ventilation fans or extractor fans in order to reduce room temperature.
3. The ambient air must be clean, avoid sea ambients (brackish air), and not contain flammable gas or corrosive solvents.
4. The minimum and maximum working ambient temperature are specified on the unit data plate. Ensure that the unit is not installed in flows of hot air emitted by other equipment.
   In extremetemperature conditions, the protection devices may trip.
5. Do not obstruct or interfere with the air flow produced by the unit; comply strictly with the minimum spaces/ distances specified in the installation drawings.
6. The machine must be installed on a perfectly horizontal flat surface, built and calculated to withstand the machine's operating weight, especially in the contact points highlighted in the installation drawing. **In the event of installations which fail to comply with the above requirements, the manufacturer's warranty cover will immediately become null and void and the unit could malfunction or even lock out.**
7. Leave free space around the unit for access during service interventions (see Attachments).
8. Do not install the plant in sites exposed to strong winds; if unavoidable, install suitable windscreens.



9. The position of the dryer in the compressed air distribution system depends on the methods of use of the compressed air (see installation drawing).
   A The dryer must be installed downline of the tank when the air compressor runs intermittently and the maximum compressed air working flow rate is no higher than the flow rate delivered by the compressor (this is the most common type of installation).
   B The dryer should be installed upline from the tank when it is sized in order to allow wide fluctuations of the air flow rate utilized with peak values that are significantly higher than the maximum flow rate of the compressor.



1. air compressor
2. after-cooler
3. condensate separator
4. compressed air receiver
5. pre-filter
6. dryer
7. isolating valve

5.2 Pipelines

(see installation drawing)

1. The inlet and outlet connections are clearly marked (see Chapter 1 “General information”). Pipes and connections must be of the correct size and suitable for the working pressure. Remember to remove the protective caps from the connections. and ensure that no debris or other material enters the connections during installation procedures. Any foreign material that enters the connections can damage the exchanger irreparably.
2. If using steel pipes, it is advisable to install a magnesium anode on the line to prevent problems of corrosion on the aluminium exchanger.
3. All pipelines must be equipped with suitable supports. **Flexible connections are recommended to avoid pipe stress or the transmission of vibration.**
4. Make suitable arrangements so that the condensate discharge pipe drains to a suitable point. The dryer drain must not be connected to the drains of other equipment; ideally, the dryer should drain into an open funnel. Do not route the condensate to a common drain header because of the possibility of oil contents. We recommend the use of oil/ water separators for the collection of discharged oil. Ensure that the drainage system complies with all local regulations.
5. Install shut-off valves on the compressed air inlet and outlet connections so that the dryer can be isolated if necessary.
   Fit as suitably sized pressure relief valve upline from the shut-off valves.
6. Install a bypass line with shut-off valves so that dryer maintenance operations can be carried out without interfering with the compressed air supply.
7. Pipelines and other parts whose temperature may exceed 60 °C (140 °F) and that may be accidentally touched by personnel must be protected or insulated.
8. In order to discharge the compressed air from the dryer so that the unit can be depressurized prior to maintenance operations, fit a venting valve in the pipe between the dryer and one of the two shut-off valves.

5.3 Electrical connections

The unit’s connection to the power supply must be made in compliance with laws and prescriptions in force in the place of installation, after having consulted the electrical diagram supplied with the plant.
The power input voltage must not surpass the tolerance limits shown on the electrical schematic, even momentarily; the frequency and number of phases must comply with the indications on the unit’s data plate.
Unless otherwise specified, the frequency tolerance is +/-1% of the nominal value (+/-2% for short periods).
Voltage must be supplied between phase and neutral and the neutral conductor must be connected to earth in the factory substation (TN system to IEC 364) or by the electricity company (TT system to IEC 364).
The positions of the phase conductor and the neutral conductor must not be switched.

For the electrical power supply:

1. Connect the unit (terminal ⏚ in the electrical panel) to the electrical earthing system of the building.
2. Ensure automatic suspension of the power supply in the event of an insulation fault (protection against indirect contact in compliance with the prescriptions of IEC 364) by means of a residual current device (the nominal trip current of which should normally be set to 0.03 A).
3. Make sure the level of protection against indirect contact at the source of the power feeding cable is equivalent at least to IP2X or IPXXB.
4. At the start of the power feeding cable or the power cable supplied with the unit install a device that protects the cable from overcurrent (short circuits) (refer to the indications in the electrical schematic).

ATTENTION

Install protection devices that limit the short circuit current to 17 kA peak in correspondence with the rated breaking capacity if the short-circuit current in the point of installation is greater than an effective value of 10 kA.

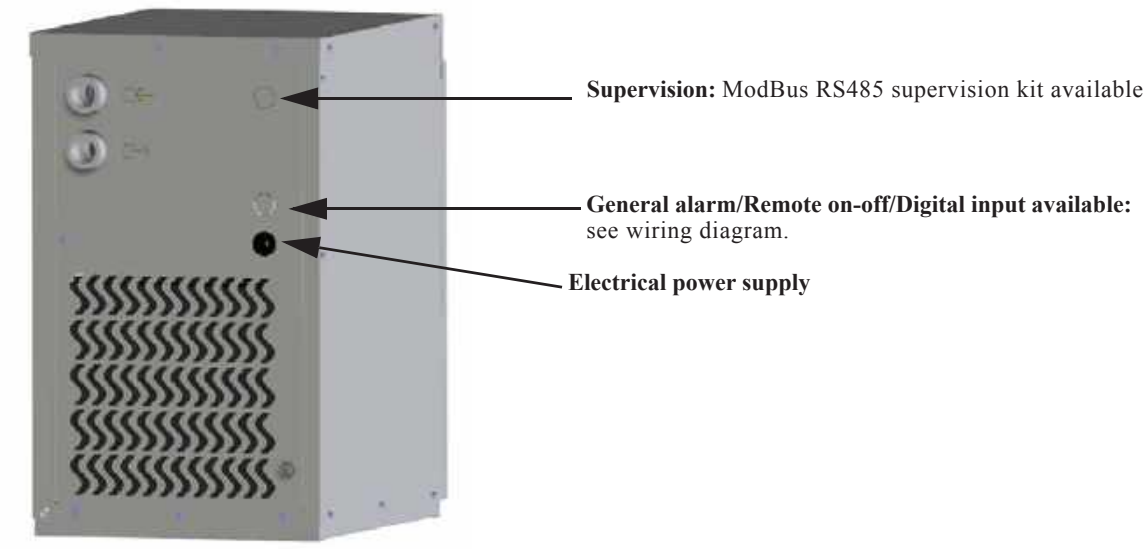
5. Use connectors rated for the maximum required voltage at the maximum operating ambient temperature, according to the chosen installation type (see the indications on the electrical schematic).

Indications on the electrical schematic:

1. maximum permissible size of the fuse type gG.
   In general, fuses can be replaced by an automatic circuit breaker adjusted in relation to the machine maximum current input (consult the manufacturer if necessary).
2. section and type of power cable (if not already supplied):
   - A installation: insulated conductors, multicore cable in a cable duct, installed overhead or fixed to a masonry structure (type C in compliance with IEC 364-5-523 1983) or without any other cables in contact;
   - B operating temperature: maximum operating ambient temperature of the unit;
   - C cable type: copper conductors, 70 °C / 158 °F PVC insulation (unless otherwise specified) or 90 °C / 194 °F EPR insulation.

5.3.1 Supervision kit and general alarm connection

There are two knock-outs on the rear panel for controller supervision and remote connection of the general alarm:



For access to the dryer refer to Chapter 12 “Operation and maintenance”.

CHAPTER 6

START-UP

ATTENTION

Before starting up or operating these dryers be sure that all personnel have read and understood Chapter 2 "Safety" in this manual.

1. Check that the dryer shut-off valves are closed and the by-pass valve is open.
2. Check that the ambient temperature is within the range indicated on the unit's data plate.
3. Power the dryer by means of the line protection device.
4. When the unit is powered the control unit display switches on (see Chapter 7 "Electronic controller RF").
5. Press button on the controller.
   Once the programmed delay has elapsed the compressor and fan unit will start.
6. Wait for the compressor to stop when the thermal mass has reached the programmed temperature.
7. Slowly open the dryer inlet valve to pressurize the unit.
8. Slowly open the dryer outlet valve.
9. Close the dryer by-pass valve.
10. Press the manual discharge button and check that the discharge solenoid valve opens.
11. If the unit is equipped with a smart condensate discharge system, check that it is correctly installed. Check also that it is functioning correctly.
12. If the unit is equipped with timer controlled condensate discharge, check that the discharge solenoid valve opens again after the time interval set on the electronic controller.

The dryer is now ready for efficient operation (see Chapter 12 "Operation and maintenance").

CHAPTER 7

ELECTRONIC CONTROLLER RF

7.1 User interface

Display:

- Machine status display
- Condensate discharge relay status
- Energy saving level
- Compressor and capacity control status
- Alarms status

7.2 Keypad buttons

The electronic control unit buttons perform the following functions:

BUTTON	FUNCTION
	Switches controller on and off (press for 1 second).
	Manual condensate discharge (press for 1 second).
SET	Direct parameters display or edit (press for 5 seconds) or display and edit of password-protected parameters (press for 2 seconds). During programming phase it selects a parameter or confirms a value.
	In programming mode scrolls parameter codes or increases a parameter value.
	In programming mode scrolls parameter codes or decreases a parameter value.
	To lock or unlock the keypad (press for 5 seconds).
	To mute the siren, display and reset alarms.

7.3 Display and LEDs

Display and display functions:

LED	LED STATUS	FUNCTION
	Off	Compressor OFF
	Lit	Compressor ON
	Flashing	Compressor stopped due to times management
	Off	Unit ON, compressor ON
	Lit	- Unit ON, compressor ON + Step capacity control ON - Unit ON, compressor OFF
	Flashing	Not used
	Off	Condensate discharge disabled
	Lit	Condensate discharge enabled
	Flashing	Not used
	Off	Step capacity control OFF
	Lit	Step capacity control ON
	Flashing	Not used
	Off	No alarm condition
	Lit	Only illuminates during consultation of the alarms history
	Flashing	Active alarm
	Off	Normal operation
	Lit	Not used
	Flashing	Alarm for information only
	Off	Discharge programming not in progress
	Lit	Discharge programming in progress
	Flashing	Not used
	Off	Unit ON, compressor ON
	Lit	Unit ON, compressor OFF
	Flashing	Not used

7.4 Display messages

The controller displays the unit status by means of the following messages on the display:

- OFF
- dry
- hdP

The message “OFF” appears when the machine is switched off via the off key.

NOTE

The decimal point (“OF.F”) is shown when the machine is switched off via digital input.

The message “dry” appears when the unit is running in the normal operating range.

The message “hdP” appears when the dew point temperature is too high.

7.5 Programming and use of the keypad

7.5.1 Unit ON-OFF

The unit can be switched on and off from the keypad by pressing key for 1 second; OFF status (stand-by) is confirmed by a display message.
In addition, the unit can also be switched on and off by a digital input, if configured. If the unit is switched on from a digital input it can be switched off from the keypad.
Digital input OFF status is shown on the display by means of a lit decimal point “OF.F”. When the unit is in “OF.F” status the ON-OFF key is inhibited. In the transition to ON from a digital input, the unit returns to the prior “OF.F” status unless the value of “controller On-off command” is changed from the supervision system.

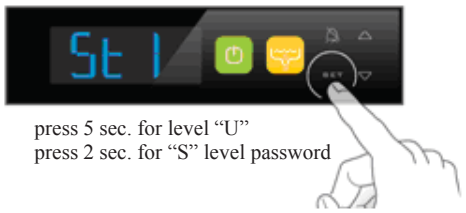
7.5.2 Condensate discharge key

The yellow condensate discharge key provides the facility to activate (if condensate discharge is set as timer controlled) the condensate discharge valve in manual mode.
In addition, if parameter H1 is set to 3, discharge time (H4) can be reprogrammed, i.e. the discharge time becomes equal to the time for which the yellow key is pressed; in this case the flashing red discharge icon is displayed.

7.5.3 Controller programming

The instrument has 2 programming levels; the first (U= USER) concerns parameters that can normally be changed by the user. The second level (S= SERVICE) concerns the SERVICE parameters, which are password protected.

1. Access by pressing SET for 5 s.
2. Select the parameter with △, ▽.
3. Press SET to display the value.
4. Edit the value with △, ▽.
5. Press SET to save the new value and go to the next parameter.



press 5 sec. for level “U”
press 2 sec. for “S” level password

To access the “S” parameters hold down the SET key for more than 2 seconds and less than 5 seconds, then enter the required password (a flashing “0” will be displayed). All the parameters are visible and editable in this menu, including the “U” parameters. To quit parameters display mode and save your changes, hold down SET for 5 seconds. If no keys are pressed for more than 60 seconds the system will automatically quit parameters programming mode. The changes already made are saved automatically.

7.5.4 Keypad lock

To lock or unlock the keypad, press keys ▲ + ▼ for 5 seconds.
The keypad lock is shown for a few seconds by the message “POF”, keypad unlocked is shown with “POn”.
The type of lock can be selected using parameter “**blK**” (the message “*bLH*” is shown on the display):
blK=0 keypad enabled
blK=1 entire keypad disabled
blk=2 only ON/OFF key enabled
When the keypad is disabled pressing any key will produce the message “POF”.

NOTE
When the unit is shipped from the factory the keypad is unlocked.

CHAPTER 8

FUNCTIONS

The main controller functions are listed below; for functions that are not illustrated, refer to the explanation of the individual parameters shown in the following chapter.

8.1 Compressor

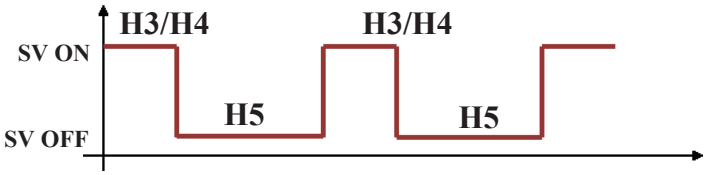
Each time the controller is switched ON (On from button, On from digital input or after power loss) after a preset time the compressor is started, disregarding the requests status of the two probes. At the time of start-up the compressor will always have capacity control valve open (capacity control active) for a preset programmable time after which control of the unit returns to the two probes in accordance with a neutral zone control logic and in accordance with the setpoints described below:

- **St3** temperature value **above** which the -BEAOT probe activates the temperature control steps, observing the time between starts outside the neutral zone, only if the -BET probe is above value **St4**.
- **St4** temperature value **below** which the -BET probe deactivates the temperature control steps, observing the time between stops outside the neutral zone, only if the -BEAOT probe is below the preset value.

The control steps are active only if there are no alarms present in the circuit or in the unit. If the control of a step calls for the compressor to be started or stopped, this can occur only if its minimum Off and On times are concluded.

8.2 Condensate discharge

The system offers four condensate discharge modes selectable by means of parameter "**H1**":
H1= 0 disabled
H1= 1 timer
H1= 2 fixed
H1= 3 timed from keypad
With timer controlled condensate discharge the relay is energized cyclically at intervals "**H5**" for time "**H3**" if the compressor is stopped, or for time "**H4**" if the compressor is running.
When the unit is powered on cyclic control starts with a relay energization.



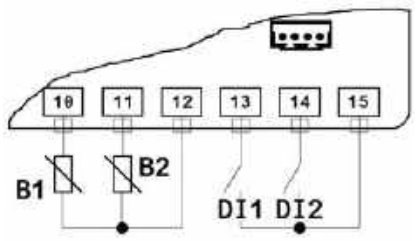
With fixed condensate discharge the condensate discharge relay is constantly energized.
Parameter "**H2**" can be used to select whether condensate discharge is active also with the unit OFF or only with the unit ON.
If H1=3 time parametrization can be performed from the yellow key (see 7.5.2 "Condensate discharge key")
If condensate discharge is timer controlled the yellow key provides the facility to activate the discharge valve in manual mode. After having performed manual discharge (yellow key), the control system restarts the condensate discharge OFF time count.

8.3 Remote On/Off

The electronic controller is equipped with a digital input (DI1) for management of a remote on/off signal, if present.
The unit is supplied with the remote on/off input jumpered; to use the function make the electrical connection as shown on the wiring diagram supplied.

8.4 Available digital input

There is also a second digital input (DI2) configurable via parameter **A5**; the available functions are:
A5=0 disabled
A5=1 external alarm
A5=2 external blocking alarm
A5=3 pressure switch
A5=4 remote on/off (do not use)
The unit is supplied with this input open.



8.4.1 External alarm function

An alarm is generated after a delay following activation of the input set by parameter **A6**.
Message **E12** is displayed and the status of the outputs is not changed.
The alarm switches off automatically as soon as the digital input is deactivated.

8.4.2 External blocking alarm function

A blocking alarm is generated after a delay following activation of the input set by parameter **A6**.
Message **E13** is displayed and the compressor output is switched off.
The alarm switches off automatically as soon as the digital input is deactivated.

8.4.3 Pressure switch trip function

If, in the time interval established by parameter **A6** a number of pressure switch trips is reached equivalent to the number set in parameter **A7** the alarm will be generated.
The message **E14** is displayed, the compressor is stopped and control suspended.
When the input is active the compressor is always stopped.

8.5 Serial connection

The electronic controller can be equipped with a ModBus RS485 serial output.
The optional installation kit can be ordered separately.
For correct electrical connection refer to the wiring diagram supplied with the unit; the unit also has a knock-out on the LH side panel to allow ingress of the RS485 serial cable.
Serial connection main specifications:

- Protocol: ModBus® RTU;
- 8 data bits;
- 1 start bit;
- 2 stop bits;
- parity control disabled;
- Baud rate 19200.

The controlled variables are listed in heading 10.2 “Parameters table”.

CHAPTER 9

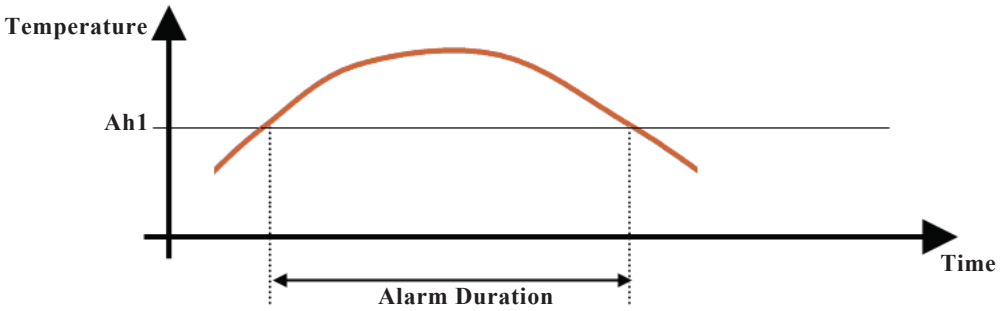
ALARMS

9.1 Alarms description

The alarms are displayed when the unit is ON; for all alarms the symbol is displayed, while for warnings the symbol displayed is .
Alarms reset may be automatic, in which case the indication clears when the alarm is reset, or manual.

The first press of key mutes the sounder; if the key is kept pressed for longer than 5 seconds the system enters the alarms queue, which can be scrolled using the and keys, while by pressing key SET the duration of the temperature alarms is shown, while a second press of SET returns the display to the alarms queue; finally the message "rES" is displayed and the entire queue can be reset if SET is pressed for 2 seconds.

Example of probe -BET high temperature alarm



To review the alarm duration:

1. Press for 5 seconds.
2. Scroll through the list with the arrow keys.
3. Use the SET key to review the duration.
4. A second press of serves to quit the alarms queue.

NOTE
The duration is to be construed as a partial value if the alarm is still in progress.

The alarms for which this function is active are as follows:
E03, E04, E05, E06
PS: the duration of the last alarm to trip is displayed (the duration value overwrites the previous one).

To clear the alarms queue (also with controller OFF):

1. Press for 5 seconds.
2. Use the arrow keys to scroll through the list until reaching parameter "**rES**".
3. Hold down SET for 3 seconds on parameter "**rES**" to reset and exit the alarms queue.

To reset manually reset alarms (also with the controller OFF):

1. Press for more than 2 seconds but less than 5 seconds.
2. When the key is released the command is confirmed by the appearance of message "**rES**" for several seconds.

9.2 Alarms table

Display	Alarm cause	Buzzer	Reset	Compressor	Alarm relay	Icon
E01	BET probe faulty alarm	On	automatic	OFF	See parameter “AA”	
E02	Probe -BEAOT faulty alarm	On	automatic		See parameter “AA”	
E03	-BET high temperature alarm	On	automatic		See parameter “AA”	
E04	High temperature alarm -BEAOT	On	automatic		See parameter “AA”	
E05	Low temperature alarm -BET	On	automatic	OFF	See parameter “AA”	
E06	Low temperature alarm -BEAOT	On	automatic	OFF	See parameter “AA”	
E07	Eeprom error: unit parameters	On	automatic	OFF	See parameter “AA”	
E08	Eeprom error: operating parameters	On	automatic	OFF	See parameter “AA”	
E09	DI1 display only warning	On	automatic		See parameter “AA”	
E10	DI1 delayed alarm	On	automatic	OFF	See parameter “AA”	
E11	DI1 alarm after multiple trips	On	Manual	OFF	See parameter “AA”	
E12	DI2 display only warning	On	automatic		See parameter “AA”	
E13	DI2 delayed alarm	On	automatic	OFF	See parameter “AA”	
E14	DI2 alarm after multiple trips	On	Manual	OFF	See parameter “AA”	
E15	Compressor maintenance warning	On	Manual		See parameter “AA”	

CHAPTER 10

PARAMETERS

10.1 Description of parameters

Brief descriptions of the parameters are given below:

Parameter	Label	Description
/5	/5	Temperature measurement unit: • /5=0 temperatures expressed in °C • /5=1 temperatures expressed in °F When the unit of measurement is changed both the readings and the parameters are converted. **NOTE** *The decimal point change occurs automatically from -19.9 to 99.9 for both units of measurement. In practice, outside the foregoing range the values are read without a decimal point.*
H0	H0	Selection of condensate discharge type: • H1=0 off • H1=1 timer controlled condensate discharge • H1=2 fixed condensate discharge • H1=3 timer controlled condensate discharge from keypad
H1	H1	Sets the condensate discharge valve closing time.
H2	H2	Selection of condensate discharge type: • H1=0 off • H1=1 timer controlled condensate discharge • H1=2 fixed condensate discharge • H1=3 timer controlled condensate discharge from keypad
H3	H3	Adjusts condensate discharge output activation: • H2=0 always on • H2=1 on only with unit ON With H2=1 when unit switches to OFF the condensate discharge intervals are reset.
H4	H4	Sets the condensate discharge valve opening time with compressor stopped.
H5	H5	Sets the condensate discharge valve opening time with compressor running.
AcH	AcH	Defines compressor maintenance alarm set-point. Each unit equals 10h. AcH=0 inhibits the alarm.
AA	AA	Defines alarm output activation: • AA=0 relay disabled • AA=1 relay On for all alarms (NO alarms = relay OFF) • AA=2 relay On for serious alarms (NO alarms = relay OFF) • AA=3 relay Off for all alarms (NO alarms = relay ON) • AA=4 relay Off for serious alarms (NO alarms = relay ON) Serious alarms are alarms that shut down the compressor.
cH	cH	Compressor operation hours (h/10) display-only parameter.
A1 (A4 for DI2)	A1	Defines digital input polarity: • A1=0 digital input is active when contact is opened • A1=1 digital input is active when contact is closed
A2 (A5 for DI2)	A2	Defines digital input function: • A2=0 disabled • A2=1 external alarm • A2=2 external blocking alarm • A2=3 pressure switch • A2=4 remote on/off

Parameter	Label	Description
A3 (A6 for DI2)	A3	With A2=1 or 2 defines the signalling delay for an alarm on the digital input, i.e. the delay between detection of an external alarm condition and the time it is signalled. With A2=3 defines the pressure switch function time. If A7 trips are reached in time A3 restarting is only manual by means of a key-operated reset. In this case A3 is expressed in minutes rather than in seconds.
A7	A7	Defines the number of trips for the pressure switch function. At each activation of the digital input the control is blocked; if A7 activations are reached in time A3 restarting is manual only by means of a key-operated reset.
A9	A9	Time interval between detection of a temperature alarm and relative signalling.
A10	A10	Defines the time to apply to controller ON and Power ON (Power-up and ON/OFF) for exclusion of the temperature alarms.
rev	rEu	Firmware update

10.2 Parameters table

Key:
A= analog, **D**= digital, **I**= integer,
R= Reading, **W**= writing,
U= USER parameters.

10.2.1 User interface parameters

Parameter	Label	Description	Value	Min.	Max.	U.M.	Type	ModBus	R/W	Lev.
/5	/5	Temperature measurement unit: 0= °C 1= °F	0	0	1	-	D	39	R/W	U
H0	H0	Serial connection address	1	0	207	-	I	130	R/W	S
H1	H1	Condensate discharge type: 0= Disabled 1= Timer controlled 2= Fixed 3= Timer controlled from keypad	1 if timed discharge; 2 if ID discharge	0	3	-	I	131	R/W	U
H2	H2	Condensate discharge activation: 0= Always on 1= On only with unit on	0	0	1	-	D	40	R/W	U
H3	H3	Condensate discharge ON time with compressor off	1	0	999	s	I	132	R/W	U
H4	H4	Condensate discharge ON time with compressor on	**DEiT018÷060:** 1 **DEiT070-080:** 2	0	999	s	I	133	R/W	U
H5	H5	Condensate discharge OFF time	**DEiT018÷060:** 300 **DEiT070-080:** 240	0	999	s	I	134	R/W	U
AcH	AcH	Compressor run hours threshold.	0	0	999	10h	I	135	R/W	U
AA	AA	Alarm relay management: 0= Relay inactive 1= Relay active for all alarms (relay OFF) 2= Relay active for all alarms serious (relay OFF) 3= Relay inactive for all alarms (relay ON) 4= Relay inactive for all serious alarms (relay OFF)	3	0	4	-	I	136	R/W	U

Parameter	Label	Description	Value	Min.	Max.	U.M.	Type	ModBus	R/W	Lev.
cH	cH	Compressor run hours	-	0	999	10h	I	137	R	U
A1	A1	Digital input 1 polarity: 0= Active with open contact 1= Active with closed contact	1	0	1	-	D	44	R/W	U
A2	A2	Digital Input 1: 0= Relay inactive 1= External alarm 2= External blocking alarm 3= Pressure switch alarm 4= Remote ON/OFF	4	0	4	-	I	149	R/W	U
A3	A3	Digital input 1 alarm delay (if A2=3 minutes)	0	0	999	s (min)	I	151	R/W	U
A4	A4	Digital input 2 polarity: 0= Active with open contact 1= Active with closed contact	0	0	1	-	D	45	R/W	U
A5	A5	Digital Input 2: 0= Relay inactive 1= External alarm 2= External blocking alarm 3= Pressure switch alarm 4= Remote ON/OFF	0	0	4	-	I	150	R/W	U
A6	A6	Digital input 2 alarm delay (if A5=3 minutes)	0	0	999	s (min)	I	152	R/W	U
A7	A7	Number of pressure switch trips	1	1	15	-	I	154	R/W	U
A9	A9	Temperature alarm delay	600	0	999	s	I	155	R/W	U
A10	A10	Temperature alarm delay at controller ON	60	0	999	min	I	156	R/W	U
rev	rEv	Firmware update	-	0	99.9	-	A	0	R	U

10.2.2 Alarms queue

Parameter	Label	Description	Value	Min.	Max.	U.M.	Type	ModBus	R/W	Lev.
AL3	AL3	Alarm duration E03		0	999	min	I	145	R	U
AL4	AL4	Alarm duration E04		0	999	min	I	146	R	U
AL5	AL5	Alarm duration E05		0	999	min	I	147	R	U
AL6	AL6	Alarm duration E06		0	999	min	I	148	R	U

10.2.3 Variables accessible solely via supervision

Description	Value	Min.	Max.	U.M.	Type	ModBus	R/W
Compressor status	-	0	1	-	D	0	R
EV1 status	-	0	1	-	D	1	R
Alarm status	-	0	1	-	D	2	R
Discharge status	-	0	1	-	D	3	R
EV2 status	-	0	1	-	D	4	R
DI1 status	-	0	1	-	D	5	R
DI2 status	-	0	1	-	D	6	R
Probe -BET faulty alarm (E01)	-	0	1	-	D	9	R
Probe -BEAOT faulty alarm (E02)	-	0	1	-	D	10	R
-BET high temperature alarm (E03)	-	0	1	-	D	14	R
-BEAOT high temperature alarm (E04)	-	0	1	-	D	15	R
-BET low temperature alarm (E05)	-	0	1	-	D	16	R
-BEAOT low temperature alarm (E06)	-	0	1	-	D	17	R

Description	Value	Min.	Max.	U.M.	Type	ModBus	R/W
Machine parameters Eeprom error (E07)	-	0	1	-	D	26	R
Operating parameters Eeprom error (E08)	-	0	1	-	D	27	R
DI1 display-only warning (E09)	-	0	1	-	D	18	R
Delayed alarm DI1 (E10)	-	0	1	-	D	19	R
Alarm DI1 after several trips (E11)	-	0	1	-	D	20	R
DI2 display-only warning (E12)	-	0	1	-	D	21	R
Delayed DI2 alarm (E13)	-	0	1	-	D	22	R
Alarm DI2 after several trips (E14)	-	0	1	-	D	23	R
Compressor maintenance warning(E15)	-	0	1	-	D	24	R
Manual reset alarms reset	0	0	1	-	D	38	R/W
Alarms queue reset	0	0	1	-	D	37	R/W
Controller On-off from keypad/supervision	1	0	1	-	D	42	R/W
Controller On-Off status	1	0	1	-	D	43	R
Compressor run time minutes	-	0	999	min	I	138	R

SAFETY PRESSURE SWITCHES / CONDENSATE DISCHARGE UNIT

11.1 Pressure switches

The presence of the pressure switch depends on the model of the unit.
For information refer to the attached refrigerant diagram.
Depending on the model, the dryer may be equipped with the following pressure switches:

1. **fan pressure switch (PV)**
   Controls condensing pressure.
   This pressure switch is only fitted to air-cooled units.

COMPONENT	REFRIGERANT	TRIP				RESET			
		barg	psig	°C	°F	barg	psig	°C	°F
Fan pressure switch (PV)	R134a	11.0	159.5	46.5	115.7	8.5	123.2	37.7	99.9

2. **high pressure switch (HP)**
   This monitors the refrigerant compressor discharge pressure and prevents it increasing to levels dangerous to the operation of the dryer and people within its vicinity.
   The pressure switch is of the "manual reset" type.
   Tripping of the pressure switch disconnects the power supply to the compressor and hence shuts down the compressor (see electrical schematic).

COMPONENT	REFRIGERANT	TRIP				RESET			
		barg	psig	°C	°F	barg	psig	°C	°F
High pressure switch (HP)	R134a	20.0	290	69.8	157.6	14.0	203	55.5	131.9

11.2 Condensate discharge system

The unit is furnished with a condensate discharge unit which can be of timed or of intelligent type.
The type of discharge system will be decided at the time of the offer.
The timed discharge unit is controlled automatically by the electronic controller on which the condensate discharge intervals can be set (see Chapter 7 "Electronic controller RF").
The smart discharge unit features an electronic condensate level control system with a two-level capacitive sensor.
The discharger electronic board monitors the signal sent by the capacitive sensor continuously.
When the condensate level reaches the sensor lower limit, the solenoid valve is de-energized, thereby interrupting condensate discharge.

11.2.1 Timed condensate discharge system

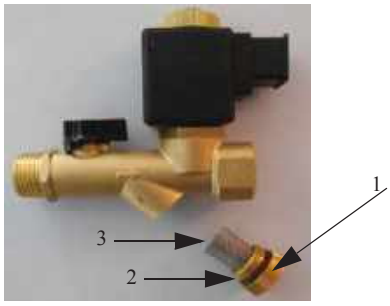
The timed condensate discharge system must be carefully checked and serviced in order to prevent the separated condensate from being entrained with the flow of compressed air into the distribution system.

11.2.1.1 Filter cleaning

The filter should be cleaned every month and in certain cases more frequently.
All models are equipped with a shut-off valve with integral filter and solenoid valve (see figures below).

- Open the line circuit breaker to disconnect the power supply to the dryer.
- To remove the metal strainer [3] simply close the shut-off valve.
- Press the manual condensate discharge button to check that the filter is not pressurized.
- Carefully unscrew filter cap [1] retaining gasket [2] and remove strainer mesh [3].
- Once cleaned, refit the strainer making sure it is correctly seated and refit cap [1].
- Renew the O-ring [2] if it is damaged.

Shut-off valve with filter and solenoid valve



1. Filter cap
2. O-ring
3. Strainer

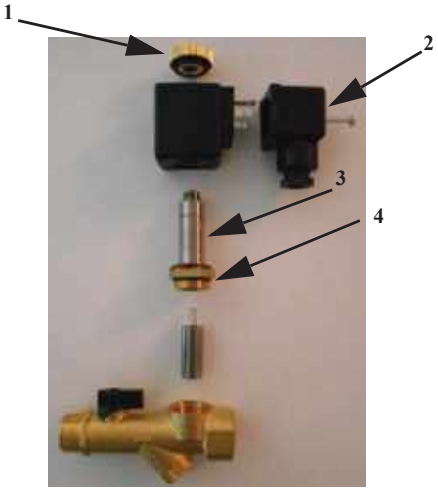
After re-opening the shut-off valve, power on the unit again and restart it.

11.2.1.2 Solenoid valve maintenance

If any particles are not captured by the filter and consequently cause the valve to malfunction, all the valve's internal components must be cleaned.
Proceed as follows:

- isolate and depressurize the dryer;
- open the line switch to disconnect the power supply to the dryer;
- undo the screw in the centre of the valve power supply connector cap;
- lift up and remove the cap;
- remove the solenoid valve from the pipe and tightly clamp the body in a vice;
- unscrew the nut [1] fixing the solenoid valve [2] and remove it from shaft [3];
- unscrew the shaft from the valve seat; check the condition of the black O-ring [4] and of all other components and clean them carefully;
- re-assemble the components by reversing the above procedures;
- make sure that the valve is re-installed with the arrows on the body pointing in the right direction.

Condensate discharge solenoid valve



1. Fixing Nut
2. Solenoid
3. Shaft
4. black O-ring

ATTENTION

Take care not to overtighten the nut [1] as this could obstruct movement of the valve element and prevent the valve from opening and closing correctly.

11.2.2 Smart condensate discharge system

The smart condensate discharge system is supplied pre-installed in the unit.
Instructions concerning operation and maintenance of the intelligent condensate discharge unit are given in the discharge unit handbook, which is attached to this manual.

CHAPTER 12

OPERATION AND MAINTENANCE

12.1 Operation

In this case power-on the dryer at least 10-15 minutes before the air compressor.
The controller will switch the compressor off automatically in the absence of a flow of compressed air.
It is not necessary to switch off the dryer in the absence of a compressed air flow.
If the dryer switches off, it will restart automatically as soon as the air flow is restored.

12.2 Maintenance

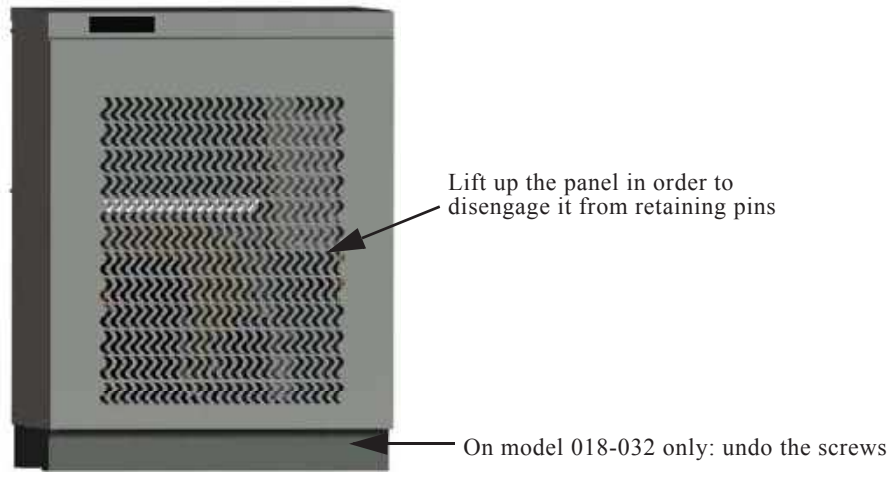
ATTENTION

Before installing or operating these dryers, ensure that all personnel involved have read and understood Chapter 2 "Safety" in this manual.

These dryers will give many years of trouble-free service if they are properly maintained and serviced.

12.2.1 Access to the dryer

To access the components of the refrigerant and electrical circuits remove the front panel: lift up the panel in order to disengage it from the retaining pins.



12.3 Maintenance Schedule

OPERATION	1 day	1 month	6 months	1 year
Check to ensure there are no alarm indications.	•			
If the dryer is equipped with a timer-controlled condensate discharge system, press the manual condensate discharge control button and check that the valve drains off the condensate correctly.	•			
If the dryer is equipped with a timed condensate discharge unit, check for possible excessive production of condensate; in this case increase the valve opening time (ON). Make sure the solenoid valve opens properly observing the times set with the electronic controller.	•			
Check that compressed air inlet temperature is lower than the limit for which the dryer was selected (normally 35-40 °C / 95-104 °F).		•		
When the compressor is running, check that its upper part is not too hot (more than approximately 50 °C / 122 °F). Check that the dryer's current draw is within the rated values.			•	
Remove, clean and refit the condensate filter. If the filter is always clogged with material, it may be necessary to dismantle and clean the solenoid valve.		•		
Make a visual inspection of the refrigerant circuit to make sure the piping has not deteriorated and there are no traces of oil, which may indicate a refrigerant leak.			•	
Check the condition and safety of piping connections.			•	
Check the condition and safety of wiring and electrical connections.			•	
Check that ambient air temperature is lower than the limit value used to select the dryer (normally 25-30 °C / 77-86 °F). Check that the area in which the unit is installed is well-ventilated.		•		
Check that the fan starts automatically and that it does not run noisily. Clean the condenser fins with a jet of clean compressed air. Make sure the grilles are free from dirt and any other obstructions.			•	
Clean the condenser fins with a mild detergent.				•
Clean the air filter, if present.			•	

ATTENTION

The above maintenance schedule is based on average operating conditions.

In some installations it may be necessary to increase the frequency of maintenance.

CHAPTER 13

TROUBLE SHOOTING

NOTE

The following Trouble Shooting table is of a general nature for DEiT units equipped with the RF controller.

PROBLEM	CAUSE	SYMPTOM	REMEDY
A Dew-point temperature higher than expected.	**A1** Compressed air to be dried temperature too high.	**A1.1** • Dew-point and compressed air inlet temperatures higher than expected; • the alarm signal concerning the problem is displayed on the controller panel (see heading 9.2 "Alarms table"); • main alarm relay tripped (if present on the controller fitted on the unit, see Chapter 7 "Electronic controller RF").	Reduce the compressed air inlet temperature within design limits.
	A2 Compressed air flow to be dried too high.		Take steps to reduce the compressed air flow rate within the design limits.
	A3 Compressed air pressure to be dried too low.		Take steps to restore the air working pressure within the design limits.
	A4 Air-cooled dryers: Ambient temperature too high.		If the unit is installed indoors, reduce ambient temperature to within rated limits, e.g. installing fans to extract the air.
	A5 Water-cooled dryers: cooling water temperature too high (low water flow).		Take steps to reduce the water inlet temperature within the design limits (increase the water flow).
	A6 Air-cooled dryers: Condenser fins fouled.		Clean the condenser.
	A7 Air-cooled dryers with three-phase power supply: fan running in reverse.		Invert the position of two of the three phases of the power supply.
	A8 Water-cooled dryers: surface of exchanger pipes dirty. If the cooling circuit uses mains water or it is an open circuit with cooling towers the concentration of calcium carbonates and magnesium in the water may reach such levels as to cause the formation of scale on the hot walls of the exchanger tubes (the higher the condenser outlet water temperature the greater the probability that scale will form).		Clean the surfaces of the pipes with a descaling solution that does not react with steel or copper.

PROBLEM	CAUSE	SYMPTOM	REMEDY
	A9 No refrigerant fluid in the circuit. If you are in doubt concerning the refrigerant charge level, measure the manometric temperature (pressure) on the refrigerant compressor suction side using the Schraeder valve provided. Gradually change the airflow through the dryer in such a way that the dryer operates without capacity steps; the manometric temperature (read on the temperature scale of the refrigerant utilized) must vary from approximately -3 °C (26.6 °F) to 0 °C (32 °F); if the manometric temperature is lower than these values the circuit probably contains insufficient refrigerant.	**A9.1** • Compressor doesn't stop even if there is a little air flow; • frosting on the evaporator capillary inlet; • power absorption lower than expected; • also see **A1.1**	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Have the circuit charged by a qualified refrigeration engineer.
	A10 Solenoid valve on the low pressure line not functioning correctly.	**A10.1** See **A1.1**	Check operation of the solenoid valve. If necessary, renew the solenoid valve coil or the entire solenoid valve.
B Excessive air pressure drop.	**B1** See **A2** and **A3**.	**B1.1** • Dew-point temperature increased (see **A1.1**); • pressure downstream of the dryer lower than expected.	Reduce the compressed air flow and pressure to within rated limits.
	B2 There is an increase in the pressure drop and the dryer freezes.	**B2.1** See point **C**.	See point **C**.
	B3 Exchanger obstructed by impurities entrained by the compressed air.	**B3.1** Pressure down-line from the dryer lower than expected.	Renew the exchanger.
C The dryer is obstructed and the air does not flow.	**C1** Incorrect position of temperature probe so the thermal mass has fallen below zero thereby freezing the condensate (it may have occurred that following maintenance work carried out inside the dryer the temperature probe has become dislodged)	**C1.1** The value measured by the probe remains above 0 °C (32 °F) even when the compressor runs for prolonged periods (e.g. more than 10-15 minutes) without any compressed air flow.	Correct the position of the probe in the socket by inserting it correctly.
	C2 Incorrect setting or malfunctioning of the electronic controller or alteration of the setpoint (if required by the electronic controller supplied with the unit, see Chapter 7 "Electronic controller RF") will cause ice formation.	**C2.1** The compressor fails to stop even though the dew point temperature is very close to 0 °C (32 °F).	Increased the setpoint by 1 or 2 °C (1.8...3.6 °F) (if envisaged by the electronic control unit supplied with the unit, see Chapter 7 "Electronic controller RF"). If this doesn't solve the problem, renew the control board.
	C3 Temperature probe not calibrated.	**C3.1** Apparently everything is functioning correctly but there is no air flow.	Use a tester to check the impedance of the probe at 20 °C / 68 °F (the value should be 12.1 kΩ). Renew the probe if necessary.

PROBLEM	CAUSE	SYMPTOM	REMEDY
D Presence of water downstream from dryer.	**D1** The piping of the distribution line is located in a cold environment (temperature lower than the pressure dew-point of the compressed air) and is not insulated. In this case, condensation forms on the internal surfaces of the piping.	**D1.1** Dryer runs normally. Problems are caused by external factors.	Insulate the piping exposed to low ambient temperatures.
	D2 The compressed air flow and/or the pressure are out of their rated limits. If you are in doubt concerning the refrigerant charge level, measure the manometric temperature (pressure) on the refrigerant compressor suction side using the Schraeder valve provided. Gradually change the airflow through the dryer in such a way that it operates without capacity steps; the manometric temperature (read on the temperature scale of the refrigerant utilized) must vary from approximately -3 °C (26.6 °F) to 0 °C (32 °F); if the manometric temperature is lower than these values the circuit probably contains insufficient refrigerant. Refer also to **A2** and **A3**.	**D2.1** • Dew-point and compressed air inlet temperatures higher than expected; • the alarm signal associated with the problem is displayed on the controller panel (see heading 9.2 “Alarms table”); • main alarm relay tripped (if present on the controller fitted on the unit, see Chapter 7 “Electronic controller RF”). • Dew-point and compressed air inlet temperatures higher than specified values.	Reduce the compressed air flow and pressure to within rated limits. If necessary, position the dryer upline from the air receiver or increase the capacity of the air receiver.

PROBLEM	CAUSE	SYMPTOM	REMEDY
E Presence of condensate downline from dryer (units with timed discharge system).	**E1** Condensate discharge solenoid valve coil burnt out.	**E1.1** The condensate and/or compressed air are not discharged when the manual control button is pressed.	Replace the condensate discharge solenoid valve coil.
	E2 Blocked strainer upline from the solenoid valve.	**E2.1** Very little condensate is discharged when the valve opens.	Remove and clean the strainer (see 11.2 “Condensate discharge system”).
	E3 Solenoid valve opening time too short.	**E3.1** The condensate continues to flow when the manual check button is pressed after a programmed discharge.	Increase the solenoid valve opening time (see 11.2 “Condensate discharge system”).
	E4 (if envisaged by the electronic controller fitted on the unit, refer to Chapter 7 “Electronic controller RF”) An excessively long closing time has been set for the solenoid valve.		Reduce the solenoid valve closing time (if envisaged by the controller fitted on the unit, see Chapter 7 “Electronic controller RF”).
	E5 Solenoid valve orifice blocked.	**E5.1** The condensate and/or compressed air are not discharged when the manual check button is pressed.	Isolate the dryer from the compressed air net, dismantle the solenoid valve, clean the components and re-assemble the solenoid valve (see 11.2 “Condensate discharge system”).
	E6 The electronic board relay controlling the solenoid valve doesn’t work.		Use a tester to check that the relay contacts controlling the solenoid valve do not close when the manual discharge button is pressed. If the relay doesn’t work, replace the electronic board.
F Presence of condensate downline from the dryer (units with smart discharge system).	**F1** Condensate discharge system fault.	**F1.1** The condensate and/or compressed air are not discharged when the manual control button is pressed.	Repair or replace the condensate discharge system.
G Tripping of high pressure switch (HP) - if supplied with the unit.	**G1** The fan doesn’t work.	**G1.1** • Refrigerant compressor stops; • main alarm relay tripped (if present on the controller fitted on the unit, see Chapter 7 “Electronic controller RF”).	Repair or replace the fan. Where fitted, check the circuit breaker of the fan. Restart the unit (see heading 9.2 “Alarms table”).
	G2 Air-cooled dryers: ambient air temperature too high.	**G2.1** • Ambient air temperature higher than maximum permitted value; • the condenser is invaded by warm air expelled by the air compressor; • see also **G1.1**.	If the unit is installed indoors, reduce ambient temperature to within rated limits, e.g. installing fans to extract the air. Restart the unit (see heading 9.2 “Alarms table”).

PROBLEM	CAUSE	SYMPTOM	REMEDY
	G3 Air-cooled dryers: recirculation of warm air due to incorrect installation.	**G3.1** • Condenser cooling air temperature higher than the max. permitted value; • see also **G1.1**.	Change the position of the unit or the position of any nearby obstructions in order to prevent recirculation. Restart the unit (see heading 9.2 “Alarms table”).
	G4 Air-cooled dryers: see also **A6.**	**G4.1** See **G1.1.**	Clean the condenser fins. Restart the unit (see heading 9.2 “Alarms table”).
	G5 Air-cooled dryers: see also **A6.**		Remove the obstruction from the front surface of the compressor. Start the unit again (see heading 9.2 “Alarms table”).
	G6 Air-cooled dryers: ambient temperature relatively high and fan (if three-phase power supply) running in reverse.	**G6.1** • The cooling air flows through the fan and then crosses the condenser; • Refrigerant compressor stops; • main alarm relay tripped (if present on the controller fitted on the unit, see Chapter 7 “Electronic controller RF”).	Invert the position of two phases of the mains supply.
	G7 Water-cooled dryers: excessively high water inlet temperature.	**G7.1** • Refrigerant compressor stops; • the alarm signal relative to the problem is displayed on the electronic controller panel (see heading 9.2 “Alarms table”): • main alarm relay tripped (if present on the controller fitted on the unit, see Chapter 7 “Electronic controller RF”).	Reduce the water temperature to within rated limits. Start the unit again (see heading 9.2 “Alarms table”).
	G8 Water-cooled dryers: excessively low water flow rate. If the cooling circuit uses mains water or it is an open circuit with cooling towers the concentration of calcium carbonates and magnesium in the water may reach such levels as to cause the formation of scale on the hot walls of the exchanger tubes (the higher the condenser outlet water temperature the greater the probability that scale will form).		Increase the available head pressure at the dryer in order to increase the water flow. Restart the unit (see heading 9.2 “Alarms table”).
	G9 Water-cooled dryers: exchanger tube surfaces are fouled.		Clean the surfaces of the pipes with a descaling solution that does not react with steel or copper. Start the unit again (see heading 9.2 “Alarms table”).
	G10 Compressed air flow or temperature too high combined with high ambient temperatures.	**G10.1** • High dew-point (high evaporation pressure and therefore high load on condenser); • Refrigerant compressor stops; • main alarm relay tripped (if present on the controller fitted on the unit, see Chapter 7 “Electronic controller RF”).	Reduce the compressed air flow and temperature to within rated limits. Restart the unit (see heading 9.2 “Alarms table”).

PROBLEM	CAUSE	SYMPTOM	REMEDY
H Compressor protection trips.	**H1** Compressed air flow or temperature too high combined with high ambient temperatures.	**H1.1** • The head and the body of the compressor are very hot; • the compressor stops and tries to restart after a short time (even a few seconds)	Stop the unit and reduce the air flow and temperature to within rated limits. Wait a few minutes before starting the unit again. Use special attention to check operation of the safety devices present (thermal protections incorporated in the motors and/ or external and high pressure switch, if present). In case of doubt, replace all the devices.
	H2 Compressed air flow or temperature too high together with insufficient charge in refrigerant circuit (see also **A9**).		Call in a qualified refrigeration engineer to check for leaks and eliminate them. Have the circuit charged by a qualified refrigeration engineer. Use special attention to check operation of the safety devices present (thermal protections incorporated in the motors and/ or external and high pressure switch, if present). In case of doubt, replace all the devices.
	H3 See points **G1** to **G8**.		Use special attention to check operation of the safety devices present (thermal protections incorporated in the motors and/ or external and high pressure switch, if present). In case of doubt, replace all the devices. See also points from **G1** to **G8**.
I Electronic board off even if main power switch is on ("I").	**I1** Damaged circuit board.	**I1.1** Power on the circuit board terminals.	Renew circuit board (contact a specialized service centre).
J Temperature probe fault alarm (see heading 9.2 "Alarms table").	**J1** Probe in open circuit or in short circuit.	**J1.1** • Refrigerant compressor stops; • main alarm relay tripped (if present on the controller fitted on the unit, see Chapter 7 "Electronic controller RF").	Check that the temperature probe is correctly connected to the control board terminals and that the cable is undamaged. If necessary replace the temperature probe.
K Alarm relative to the microprocessor or its Eeprom memory (see heading 9.2 "Alarms table").	**K1** Control board microprocessor initialising error or microprocessor mistake in reading data.	**K1.1** The alarm signal relative to the problem is displayed on the electronic board (see heading 9.2 "Alarms table") and the unit is blocked.	Turn the unit off and on. If this doesn't solve the problem, contact the nearest service centre.

CHAPTER 14

RISK ANALYSIS: RESIDUAL RISK

Description of risk:	Effect:	User instructions:
1. Risk of crushing	Falling of machine onto persons and/ or crushing of limbs.	Use lifting equipment suited to the task in hand, to be performed by qualified personnel with reference to the labelling instructions and manual.
2. Risk of cutting and detachment caused by sheets or profiles in general.	Risk of cutting upper limbs on sharp edges caused by shearing of sheets or saw cutting of profiles.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 5 “Installation” and Chapter 12 “Operation and maintenance”.
3. Risk of cutting or detachment due to the finned surface of air-cooled condensers.	Risk of cutting upper limbs.	Strictly observe all manual instructions. Chapter 1 “General information”; Chapter 2 “Safety” and Chapter 12 “Operation and maintenance”.
4. Risk of cutting or detachment due to fan blades.	Risk of cutting or detachment.	Strictly observe all manual instructions. Chapter 1 “General information”; Chapter 2 “Safety” and Chapter 12 “Operation and maintenance”.
5. Risk of impact caused by movement of condensate drain flexible hose during drainage.	Impact of body parts with condensate drain flexible hose.	Strictly observe all manual instructions. Chap. 5.2 “Pipelines” and firmly attach the condensate drain hose.
6. Risk of high pressure fluid ejection from pipelines and/or pressure tanks in cooling circuit due to accidental bursting.	Contact of body parts with refrigerant gas or parts of cooling circuit pipelines launched at high speed.	Strictly observe all manual instructions. Chapter 2 “Safety” and Chapter 5 “Installation”
7. Risk of high pressure fluid ejection from pipelines and/or pressure tanks in cooling circuit due to design pressure values being exceeded.	Contact of body parts with refrigerant gas or residual parts of cooling circuit pipelines launched at high speed.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 5 “Installation” and Chapter 12 “Operation and maintenance”
8. Risk of high pressure fluid ejection from pipelines and/or pressure tanks in pneumatic circuit due to accidental bursting.	Contact of body parts with fluids or residual parts of pneumatic circuit pipelines launched at high speed.	Disconnect the machine from the electrical mains during interventions on the pneumatic circuit. Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 5 “Installation” and Chapter 12 “Operation and maintenance”
9. Risk of high pressure fluid ejection from pipelines and/or pressure tanks in pneumatic circuit due to design pressure values being exceeded.	Contact of body parts with fluids or residual parts of circuit pipelines launched at high speed.	Depressurise the machine during interventions on the pneumatic circuit. Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 5 “Installation” and Chapter 12 “Operation and maintenance”
10. Electrical hazards due to direct contact with live parts.	Risk of electrocution and burns.	Strictly observe all manual instructions. Chapter 2 “Safety” and Chapter 5 “Installation”

Description of risk:	Effect:	User instructions:
11. Electrical hazards due to indirect contact with parts that are live due to faults, in particular due to an insulation fault.	Risk of electrocution and burns.	Strictly observe all manual instructions. Chapter 2 “Safety” and Chapter 5 “Installation”
12. Electrical hazards: electrostatic phenomena.	Uncontrolled movements by victim of electrostatic discharge due to contact	Strictly observe all manual instructions. Chap. 5.3 “Electrical connections”
13. Electrical hazard: heat radiations or other phenomena, such as projection of melted particles, and chemical effects deriving from short circuits, overloads.	Risk of electrocution with live parts due to short circuits, scalding on contact with hot components due to overload.	Strictly observe all manual instructions. Chapter 2 “Safety” and Chap. 5.3 “Electrical connections”
14. Heat-associated risk: burns and/or scalding	Scalding on contact with pipelines at temperatures over 65°C and/or freezing due to contact with surfaces at temperatures below 0°C.	Strictly observe all manual instructions. Chapter 2 “Safety” and Chap. 5.2 “Pipelines”
15. Hazards generated by noise levels that may impair hearing capacity (deafness) and other physical disorders (such as loss of balance, consciousness).	Loss of hearing capacity by operator.	Secure all components of the pneumatic circuit correctly after interventions and maintenance.
16. Hazards generated by materials or substances handled, used, produced or offloaded from the machine and by materials used to construct the machine: inhalation of refrigerant gases.	Inhalation of refrigerant gas.	Strictly observe all manual instructions. Chapter 2 “Safety”
17. Hazards generated by materials or substances handled, used, produced or offloaded from the machine and materials used to construct the machine: drainage of condensate containing oils or discharge of oil contained in cooling circuit.	Danger of environmental pollution caused by dispersion of oil into the environment.	Strictly observe all manual instructions. Chap. 5.2 “Pipelines”
18. Hazards generated by materials or substances handled, used, produced or offloaded from the machine and materials used to construct the machine: fire or explosion.	Risk of fire or explosion.	Install the system in an environment fitted with adequate fire fighting equipment. Strictly observe all manual instructions. Chap. 5.1 “Location” and Chap. 5.2 “Pipelines”
19. Hazards generated by failure to use personal protective equipment.	Lacerations to upper limbs during maintenance or installation.	Use adequate personal protective equipment and observe all instructions in the manual. Chapter 1 “General information”; Chapter 2 “Safety”; Chapter 5 “Installation”; Chapter 11 “Safety pressure switches / Condensate discharge unit” and Chapter 12 “Operation and maintenance”
20. Hazards generated by failure to observe principles of ergonomics during machine design, caused, for example, by: inadequate design, layout or identification of manual controls.	Hazards associated with failure to correctly identify manual controls.	Consult all sections of the manual.

Description of risk:	Effect:	User instructions:
21. Hazards generated by failure to observe principles of ergonomics during machine design, caused, for example, by: inadequate design, or layout/location of visual display units.	Hazards associated with failure to correctly understand visual display units.	Consult all sections of the manual.
22. Inadvertent start-up, overtravel/ unexpected excess speed (or any other similar malfunction) caused by: fault or malfunction of control system.	Electrical or mechanical hazard due to incorrect settings of operating parameters or settings.	Strictly observe all manual instructions. Chapter 2 “Safety” and Chapter 12 “Operation and maintenance”
23. Inadvertent start-up, overtravel/ unexpected excess speed (or any other similar malfunction) caused by: fault or malfunction of control system with possibility of disabling safety devices.	Electrical hazard during interventions on machine with safety devices inhibited.	Strictly observe all manual instructions. Chapter 2 “Safety” and Chap. 5.3 “Electrical connections”
24. Inadvertent start-up, overtravel/ unexpected excess speed (or any other similar malfunction) caused by: fault or malfunction of control system.	Electrical hazards associated with environmental work conditions.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 3 “Technical data” and Chapter 5.3 “Electrical connections”
25. Inadvertent start-up, overtravel/ unexpected excess speed (or any other similar malfunction) caused by: return of electric power supply after failure.	Hazards associated with inadvertent start-up of the machine when electric power supply is restored.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chap. 5.3 “Electrical connections” and Chapter 6 “Start-up”
26. Inadvertent start-up, overtravel/ unexpected excess speed (or any other similar malfunction) caused by external factors on the electrical equipment (EMC).	Electrical hazards associated with electric stress on internal machine components, short circuits and overloads.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chap. 5.3 “Electrical connections” and Chapter 12 “Operation and maintenance”
27. Hazards caused by assembly errors.	Hazards associated with machine instability caused by vibrations. Hazards on contact with operating fluids, risk of pollution due to dispersion of fluids into the environment.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 5 “Installation” and Chapter 6 “Start-up”
28. Risk of falling or projection of objects or fluids: condensate.	Contact of body parts with pressurised condensate.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chap. 5.2 “Pipelines” ; Chapter 11 “Safety pressure switches / Condensate discharge unit” and Chapter 12 “Operation and maintenance”
29. Risk of falling or projection of objects or fluids.	Contact of body parts with metallic materials such as the fan blades or moving parts of the compressor.	Disconnect the machine from the electrical mains during interventions on the pneumatic circuit. Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 5 “Installation” and Chapter 12 “Operation and maintenance”
30. Loss of stability/upturning of machine.	Crushing of body parts.	Strictly observe all manual instructions. Chapter 5 “Installation” and instructions on packaging.

Description of risk:	Effect:	User instructions:
31. Loss of stability/upturning of machine due to installation on unstable ground and/or vibrations generated on connection pipelines.	Crushing of body parts due to upturning of the machine, contact of body parts with compressed air due to failure of connections to the pneumatic circuit caused by excessive vibrations.	Strictly observe all manual instructions. Chap. 5.1 “Location” ; Chap. 5.2 “Pipelines” and Chapter 6 “Start-up”
32. Hazards generated by absence of and/or position of measures/ instruments influencing safety: all guards.	Hazard of contact, due to sudden ejections, with machine components and processed or used materials.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chap. 5.1 “Location” ; Chap. 5.2 “Pipelines” ; Chapter 6 “Start-up” and Chapter 12 “Operation and maintenance”
33. Hazards generated by absence of and/or position of measures/ instruments influencing safety: graphic safety signs.	Hazard associated with the lack of or inadequate graphic instruction and warning symbols related to dangers that could not be eliminated in design.	The operator must observe all graphic safety signs on the machine and replace when worn or illegible. Strictly observe all manual instructions. Chapter 1 “General information”
34. Hazards generated by absence of and/or position of measures/ instruments influencing safety: manual.	Hazards associated with incorrect preparation of the manual due to lack of and/or unclear information required to ensure operator safety and safe use of the machine.	Consult all sections of the manual.
35. Hazards generated by absence of and/or position of measures/ instruments influencing safety: disconnection of power sources.	Contact with live parts, contact with high pressure fluids or gas.	Strictly observe all manual instructions. Chapter 2 “Safety” and Chap. 5.3 “Electrical connections”
36. Hazards generated by absence of and/or position of measures/ instruments influencing safety: instruments and accessories for adjustments and/or maintenance in safety conditions.	Hazard of cutting, ejection of fluids or gas at high pressure, scalding, or vibrations caused by incorrect maintenance.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 5 “Installation”; Chapter 11 “Safety pressure switches / Condensate discharge unit”; Chapter 12 “Operation and maintenance”