BERG Kompressoren GmbH
Compressed Air Technology | Air Separation

OPERATING AND MAINTENANCE MANUAL

REFRIGERATION DRYER
DRYBERG RFE

USER'S QUICK GUIDE

Units in the RFE range are equipped with an electronic controller that manages correct operation of the appliance on the . basis of signals read on the analogue and digital inputs
This quick guide contains a list of the main functions of the electronic board. For more detailed information consult Chapter 7 "Electronic controller".

0.1 Unit start/stop

The unit can be started and stopped as follows:

- Using the keypad
- Using the clock (inactive function)
- Using a digital input configured as remote ON/OFF

0.1.1 Start-up using the keypad

With unit OFF (stand-by) press and release  to switch the unit on or off in chiller mode. With the unit on, the  LED is lit.

The instrument is in stand-by when  is off. Stand-by mode is set each time the unit is powered off from chiller operating mode. Also in stand-by the controller makes it possible to:

- Show the parameter readings on the display
- Manage alarm situations, displaying alarms and signalling them.

0.1.2 Start-up using time bands

This function is available if the controller features a clock.
Parameters ES01÷ES06 allow to set the time band start and end times
Parameters ES07÷ES13 allow to enable the time bands for each day of the week.

0.1.3 Start-up using digital input

Using a digital input configured as remote ON/OFF that depending on the polarity selected, active, activates operation in OFF:

- Assumes priority over the keypad
- From the keypad you can start and stop the unit only with the input disabled

With the input disabled, the instrument returns to the status prior to activation.
For details concerning the connection, refer to the electrical diagram.

0.2 Setpoint

0.2.1 Displaying setpoint

To display the setpoint press and release  ; the icons identifying the circuits switch off and the working setpoint is displayed.

With the unit in stand-by, press  once to show **SetE** on the lower display.

When  button is pressed a second time, the lower display shows **Setr** indicating the real work setpoint (with dynamic setpoint active DDF).
The upper display will show the set value.

0.2.2 Changing setpoint

To change the unit working setpoint press  for at least 3 seconds and the working setpoint **SetE** will be displayed flashing.

The setpoint can be changed using  or  .

To save the new setpoint, press  or wait timeout to exit programming mode.

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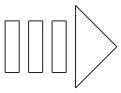
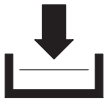
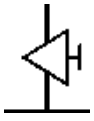
CHAPTER 1

GENERAL INFORMATION

The units described in this manual are called “dryers”. They are designed to dry a “compressed gas” flow.
In most applications the gas to be dried is “compressed air” and this is why this term will be used even if the gas to be dried is different.
These dryers are equipped with a refrigerant circuit with a scroll compressor that is utilised to cool the compressed air to a temperature designated “pressure dew point”.
This manual has been written for the installer, the maintenance technician and the end-user of the dryer.
Here below the term “pressure” will be used to indicate the gauge pressure.
The following symbols, with explanations, are found on the adhesive labels attached to the machine, stamped onto the structure work, and in the overall layout drawings and cooling circuit diagrams:

ICON	DESCRIPTION	ICON	DESCRIPTION
	Unit air inlet		Unit air outlet
	Cooling air flow (for air-condensed units)		Direction of fan rotation (for air-condensed units)
	Direction of the refrigerant gas flow and water circuit		Condensate drain relay
	Consult the manual		Attention: danger
	Risk of injury from sharp edges		Risk of burns from contact with high-temperature surfaces
	Water filling point		Electric shock risk
	Water drain / filling point		Air bleed valve
	Indication of the axis to refer to in unit lifting operations		Opening to be used for the insertion of bars for the purpose of lifting the unit

ICON	DESCRIPTION	ICON	DESCRIPTION

Moving parts can crush and cut.
Do not operate with guard removed.
Follow lockout procedure before servicing.

1.1 How to interpret the model

MODEL	DESCRIPTION
RFE XXX	Nominal air flow IN M3/MIN FAD 20° **E**nhanced **T**hermal **M**ass Dry Energy

ATTENTION

This manual, which is addressed to users, installers, and service personnel, supplies all the technical information required to install and work with the unit and to perform the routine maintenance operations required to maximise its working life.
Use only genuine parts when carrying out routine maintenance or repairs.
Requests for SPARE PARTS and any INFORMATION concerning the unit must be made to your dealer or nearest service centre, specifying the MODEL and SERIAL NUMBER shown on the unit's dataplate and on the last page of this manual.

CHAPTER 2

SAFETY

This unit is designed to ensure the best guarantees of safety and efficiency in its intended use, on the condition that it is
. installed, commissioned, and serviced in compliance with the instructions given in this manual
. The manual must therefore be studied by all those who want to install, use or maintain the unit
. The unit contains electrical components operating at mains voltage, moving parts and pressurised parts
All work on the unit must be carried out only after disconnecting the electrical supply, and after all pressure has been
. (discharged from the system (for this purpose check the air pressure gauge on the machine
Maintenance operations involving work inside the unit must be performed by skilled and adequately qualified
. personnel equipped with suitable protection means (active and passive, e.g. work gloves) to ensure maximum safety
.Keep unauthorized persons (e.g. children) away from the place of installation of the unit

2.1 General

When handling or maintaining the unit and all auxiliary equipment, personnel must operate with care observing all instructions concerning health and safety at the installation site.

ATTENTION

Numerous accidents that occur during operation and maintenance of the units are caused by failure to comply with basic safety rules and precautions.

An accident can often be avoided by recognising a situation that is potentially hazardous.
The user must ensure that all personnel involved in operating and servicing the unit have read and understood all the warnings, precautions, prohibitions and notes given in this manual and affixed to the unit. Improper operation or maintenance of the unit and auxiliary equipment can be dangerous and can cause serious or fatal accidents.
We cannot anticipate every possible circumstance which might constitute a potential hazard.
The warnings in this manual are therefore not all-inclusive.
If the user adopts operational procedures or uses tools or working procedures that are not specifically recommended, he must take care to ensure that the unit 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 unit 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

The compressed gases that can be dried must be compatible with the unit's construction materials (carbon steel, cast iron, aluminium, copper and copper alloys) and can be, for example air, nitrogen, argon and helium. In any case they must not cause corrosion dangerous for the pressure vessels and fire in event of leakage, they must be included among the non-hazardous fluids classified in group 2 of “PED” directive 97/23/EC.

2.2.2 Precautions on the use of compressed air

If using compressed air for cleaning purposes, ensure safety regulations are followed and appropriate clothing and eye protection is worn. Never direct compressed air on to your skin or at other people. Never use compressed air to clean loose dirt from clothing. Before releasing compressed air through a hose make sure that the free end is held securely so that it cannot whip and cause injury.

2.3 Lifting, transport and storage precautions

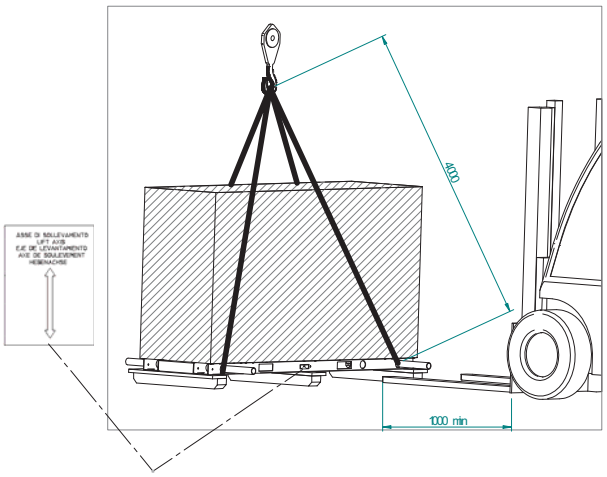
Avoid injury by using a hoist to lift heavy loads.
Check all chains, hooks, shackles and slings are in good condition and are of the correct capacity.
They must be tested and approved according to local safety regulations.
Cables, chains or ropes must never be attached directly to lifting eyes.
Always use an appropriate shackle or hook properly positioned. Arrange lifting cables so that there are no sharp bends.
Use a spreader bar to avoid lateral loading of hooks and eyebolts.
When a load is lifted from the ground keep well clear of the area beneath the load and the immediately surrounding area.
Keep lifting acceleration and speed well within safety limits and never leave a suspended load attached to a hoist any longer than strictly necessary.
The weight values shown in the following table were obtained with the unit tank full and with axial fans.
The manufacturer does not supply load spreaders, lifting straps or hooks with the unit.

Model RFE	032	037	045	052	060	077	090	110	130	150	190	225
Weight (kg)	521	537	546	628	655	655	1005	1010	1323	1323	1895	1930

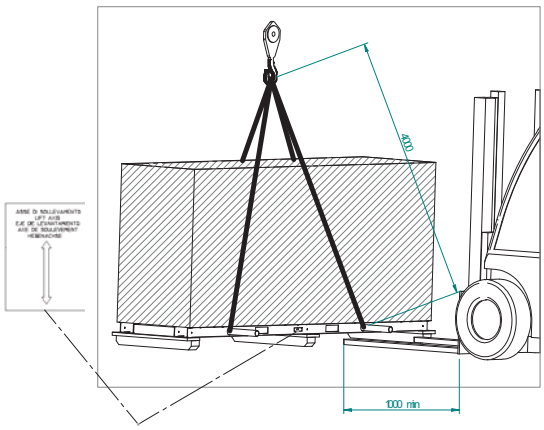
NOTE

Weight values are guideline, with the water circuit load. The values may vary in relation to the configuration of the unit.

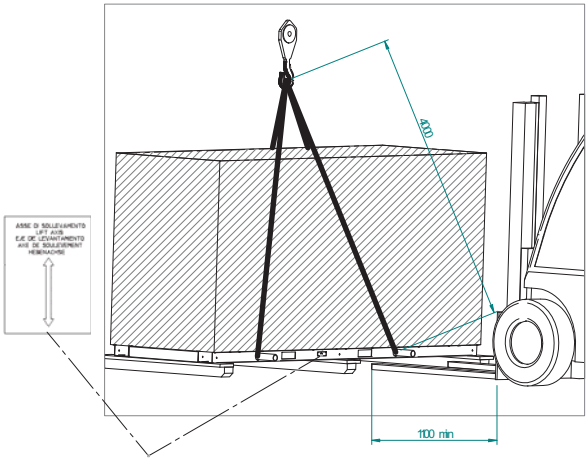
RFE 032÷077



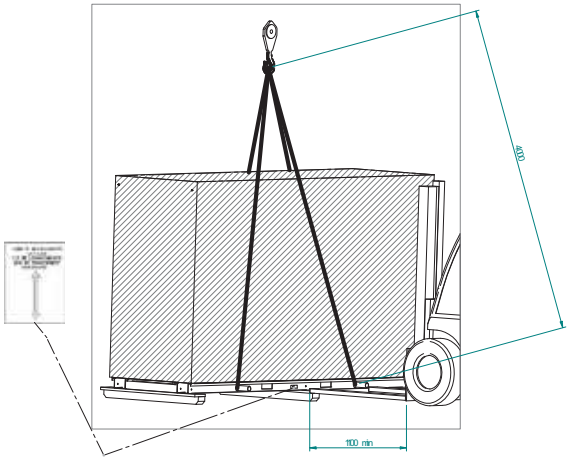
RFE 090÷110



RFE 130÷150



RFE 190÷225



When handling systems by crane, two carbon steel pipes must be used, attaching the lifting slings to the end of each. Pipes with threaded terminal sections are recommended, with a fitting or flange at the ends to enable secure attachment of the slings and avoid slippage during movements.
The position is marked by the following adhesive label.

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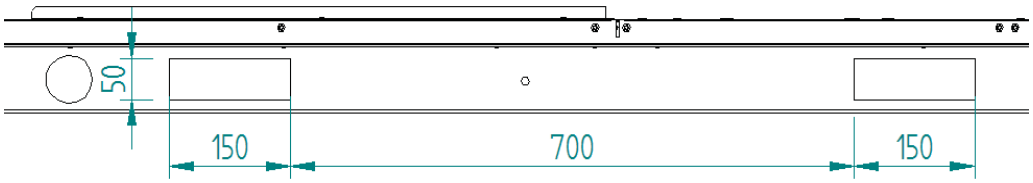
Lifting pipe diameters and recommended minimum/maximum lengths:
The specified measurements (diameter, thickness, length) will ensure safe handling procedures.
The specified minimum length depends on the width of the machine, while the maximum length takes into account the slings attached to the ends of the pipe.

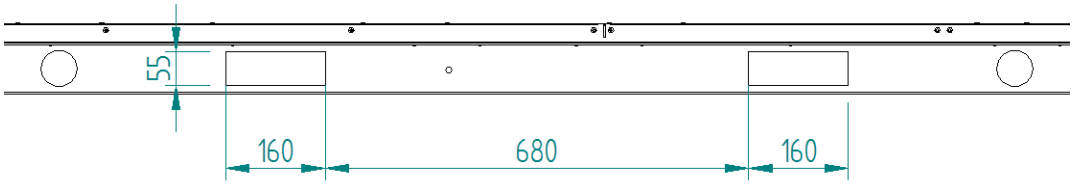
Ø PIPE [inches] x thickness [mm]	Length Min [mm]	Length Max [mm]
1-1/4" x 4 min.	1100	1200

Pipe material: carbon steel.
When handling systems by lift truck, use the longitudinal slots present on the sides of each machine.
The c/c distances of these slots are specified below:

RFE 032÷110



RFE 130÷225



ATTENTION

After inserting the forks, before proceeding with lifting, ensure that the forks are fully inserted holding the entire width of the machine.

The device has an electronic control unit which ensures that it is only able to operate when the necessary conditions are met.

Operation down to ambient temperature +5°C	Operation down to ambient temperature -5°C	Transport/Storage down to -13 °C	Transport/storage from -13°C to -40 °C
STD thermal mass	STD thermal mass + electrical heater option	STD thermal mass No particular instructions	The device is shipped with the thermal mass separate.

Notes on temperatures:
The machine contains a PED steel tank with minimum operating temperature of -20°C
If transport is at lower temperatures, before putting the device into operation return it to the permitted operating conditions (+5°C/-5°C depending on the option installed).
The device's control system prevents it from starting with temperatures below the permitted operating minimum.

2.4 Precautions to be adopted during installation and operation

For the connection to the mains electrical supply net see Chapter 5 "Installation". Operation must be carried out by competent personnel under a qualified supervisor. Piping or other parts with a temperature in excess of 60 °C (140 °F) and which may be accidentally touched by personnel during normal operation must be guarded or insulated. All compressed air and cooling water piping must be painted or clearly marked in accordance with the local safety code.

ATTENTION

Never remove or tamper with the safety devices, guards or insulation materials fitted to the unit or auxiliary equipment. All electrical connections must comply with local codes.

ATTENTION

Do not perform any type of maintenance or repairs on pressurised parts.

To ensure the compressed air circuit is depressurised, check the pressure gauge fitted on all unit models as indicated in heading 10.3 "Access to the unit".

The unit and auxiliary equipment must be earthed and protected by fuses against short-circuits and overloading. When mains power is switched on, lethal voltages are present in the electrical circuits and extreme caution must be exercised whenever it is necessary to carry out any work on the electrical system. Do not open any electrical panels or cabinets or touch any electrical components or associated equipment while voltage is applied unless it is necessary for measurements, tests or adjustments. Such work should be carried out only by a qualified electrician equipped with the proper tools and wearing appropriate body protection against electrical hazards.

ATTENTION

The condensate contained in the unit and expelled by the discharge device must be collected in appropriate tanks or an oil/water separator must be installed in order to avoid ambient pollution. It is recommended to consult the rules for the treatment of discharge fluids.

ATTENTION

The first time the machine is started after several days' stoppage, turn on the casing resistance of every compressor at least 6 hours before pressing the ON/OFF button.

ATTENTION

If the system is to be shut down for long periods of time, the condensation should be drained from the discharge line (by holding down the manual discharge key for a few minutes).
Failure to perform this drainage procedure may cause damage (ice and/or dirt in drain lines).

2.5 Maintenance precautions

ATTENTION

When it is necessary to discharge waste material do not pollute water pipelines, groundwater or watercourses. Avoid the combustion of materials that could produce fumes that are toxic and harmful when released into the atmosphere. Protect the environment by using only approved methods of disposal.

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 that should be corrected.

ATTENTION

Use only the refrigerant 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. The accuracy of pressure and temperature gauges must be regularly checked. If values are discovered that exceed the permissible tolerances, the gauges must be replaced.

ATTENTION

Do not perform welding procedures or other operations that can produce heat in the vicinity of elements containing oil or flammable liquids. Systems which may contain oil or flammable liquids must be completely purged and cleaned, e.g. with steam, before carrying out such operations.

Components in the vicinity must be protected with non-inflammable material and, if the operation is to be performed close to parts of the lubrication system or in the vicinity of components that may contain oil or inflammable liquids, the system must first be purged.
Never use an open flame as a light source to inspect parts of the unit.

For all units establish a suitable time interval for cleaning procedures.

ATTENTION

If replacement parts are needed use only original spares.

Take care not to damage pressure limiting devices.
All guards must be refitted after carrying out repair or maintenance work.

ATTENTION

Check the direction of rotation of the motors when starting the unit for the first time and after work has been performed on the electrical connections or on the power supply sectioning device.

Do not use flammable liquids to clean the unit when it is running. If chlorinated hydrocarbon non-flammable fluids are used for cleaning, safety precautions must be taken against any toxic vapours that may be released.

ATTENTION

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 in the "OFF" position by fitting a padlock.
- Affix a tag to the disconnect switch handle stating "WORK IN PROGRESS - DO NOT SWITCH ON".
- Do not set the electrical power switch to ON or attempt to start the unit if it has been tagged out with a warning sign.

ATTENTION

During maintenance or repairs, the compressed air circuit may be pressurised. If necessary, ensure that pressure is discharged and shut off inside (see chapter 5.4 "Piping")

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

2.6 Refrigerant gases

The units are charged with R410A refrigerant
Do not replace or mix one gas with another because different gases are not mutually compatible.
To clean out a very heavily contaminated refrigerant system, e.g. after a refrigerant compressor burnout, a qualified refrigeration engineer must be consulted to carry out the task.
The manufacturer's instructions and local safety regulations should always be observed when handling and storing high pressure gas cylinders.

2.6.1 Refrigerants safety datasheet

Denomination:	R410A (50% Difluoromethane (R32); 50% Pentafluoroethane (R125)).

INDICATION OF HAZARDS

Major hazards:	Suffocation.
Specific hazards:	Rapid evaporation can cause frostbite.

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 personal protective equipment.
Environmental precautions:	Evaporates.
Cleaning methods:	Evaporates.

HANDLING AND STORAGE

Handling Technical measures/ precautions:	Ensure the presence of sufficient ventilation and/or air extraction means in the workplace.
Recommendations for safe use:	Do not breath fumes or aerosol.
Storage:	Close hermetically and store in a cool, dry and well-ventilated place. Store in its original containers. Incompatible products: explosives, flammable materials, organic peroxide

CONTROL OF EXPOSURE/INDIVIDUAL PROTECTION

Control parameters:	AEL (8-h and 12-h TWA) = 1000 ml/m3 for each of the two components.
Respiratory protection:	For rescue and maintenance work in tanks use autonomous breathing apparatus. The vapours are heavier than air and can cause suffocation, by 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:	Faint.
Boiling point:	-52.8°C at atmospheric pressure.
Flash point:	Non-flammable.
Relative density:	1.08 kg/l at 25°C.
Solubility in water:	Negligible.

STABILITY AND REACTIVITY

Stability:	No reactivity if used in compliance with instructions.
Materials to avoid:	Highly oxidising materials. Incompatible with magnesium, zinc, sodium, potassium and aluminium. Incompatibility is more critical if the metal is present in the form of powder or if surfaces have been recently unprotected.
Hazardous decomposition products:	These products are halogen compounds, hydrofluoric acid, carbon monoxides (CO, CO2), carbonyl halides.

TOXICOLOGICAL INFORMATION

Acute toxicity:	(R32) LC50/inhalation/4 hours/lab. rats 760 ml/l (R125) LC50/inhalation/4 hours/lab. rats 3480 mg/l
Local effects:	Concentrations significantly above the TLV 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 GWP (R11=1):	1730
Ozone depletion potential ODP (R11=1):	0
Considerations on disposal:	Usable with reconditioning.

CHAPTER 3

TECHNICAL DATA

The data plate affixed to the unit bears the following technical data

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 construction number of the unit.
MANUFACTURING YEAR	This is the year of the final test of the unit.
VOLTAGE/PHASE/FREQUENCY	Power supply characteristics.
MAX. CONSUMPTION (I max)	This is the electrical current consumed by the unit during the limit when working at the limit of its operating conditions (refrigerant condensing temperature is 65 °C = 149 °F; refrigerant evaporating temperature is 10 °C = 50 °F).
INSTALLED POWER (P max)	It is the power absorbed by the unit during the limit when working at the limit of its operating conditions (refrigerant condensing temperature is 65 °C = 149 °F; refrigerant evaporating temperature is 10 °C = 50 °F).
PROTECTION	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. PRESSURE HP SIDE	This is the design pressure of the refrigeration circuit of the high pressure side.
MAX. REFRIGERANT. PRESSURE LP SIDE	This is the design pressure of the refrigeration circuit of the low pressure side.
USER CIRC. FLUID	Fluid cooled by the unit (normally air).
MAX. WORKING PRESSURE (*)	Max. design pressure of the user circuit.
MAX. TEMPERATURE (*)	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 (39.37 in) from the machine, condenser side, and at 1.6 m (63.0 in) 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 is air-cooled condensed).
MAX. WORKING PRESSURE	Max. design pressure of the condenser cooling circuit (this data is not present if the unit is air-cooled condenser).
MAX. TEMPERATURE (*)	Condenser cooling circuit maximum design temperature (this information is not given if the machine condenser is air-cooled).

(*) Maximum limit of the compressed air circuit:

- Max air pressure 14 bar
- Max air inlet temperature 60 °C

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

IMAX max. electric current adsorbed by the unit;

PMAX max. power of the unit;

ILR electric current with rotor stopped;

ATTENTION

(**) With room temperatures below 0°C the condensation produced by the system as it dries the air may freeze, causing serious damage to the evaporator and the condensation drainage system.

3.1 Declaration of conformity

CE

Dichiarazione CE di conformità

a) **Noi**:

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

c) **Tipo:**

d) **Modello:**

e) **Matricola:**

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

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

- UNI EN ISO 12100
- CEI EN 61000-6-1 : 2007-10
- CEI EN 61000-6-3 : 2007-11
- CEI EN 61000-6-2 : 2006-10
- CEI EN 61000-6-4 : 2007-11

g) **inoltre è stata progettata, costruita e ispezionata conformemente ai requisiti richiesti dalla Direttiva PED 97/23/CE**

- EN 378

- l'insieme ricade in categoria:
- la procedura di valutazione di conformità utilizzata è secondo il modulo (rif. Allegati II e III della Direttiva 97/23/CE)
- l'organismo notificato incaricato della sorveglianza del sistema di qualità:
- estremi dell'Attestato di approvazione del sistema qualità:
- la macchina è considerata insieme ai fini della direttiva PED. Le attrezzature in pressione che la compongono e le relative procedure di valutazione di conformità sono le seguenti:

Gli altri componenti non recano la marcatura CE in quanto rientrano nelle prescrizioni dell'Art. 1 par. 3.6 della Direttiva 97/23/CE

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

i) **Nome:** **Cognome:** **Posizione:**

j) **Luogo, Data** **Firma**

Allegati: Lista dei pericoli considerati secondo l'Allegato I della Direttiva Macchine

List:
a) Name of manufacturer
b) Definition of responsibility
c) Unit type
d) Unit model
e) Serial or construction number of the unit
f) Directives and standards
g) PED directive
h) Officer responsible for technical file
i) Technical supervisor personal data
j) Place and date

3.2 Performance

ATTENTION

The performance of the dryer (dew-point, electrical power consumption, pressure drop, etc.) depends mainly on the flow rate and pressure of the compressed gas to be dried and on the temperature of the fluid used to cool the condenser.
These data are specified in the quotation and are those to which reference must be made when checking dryer performance.

3.3 Data for standard units

3.3.1 Dimensions

See attached drawings.

3.3.2 Characteristics of pumps and fans

Model			RFE 032	RFE 037	RFE 045	RFE 052	RFE 060	RFE 077
Tank capacity	water volume	(litres)	109	109	107	107	107	107
Pump	rated power	(kW)	0.34	0.34	0.34	0.34	0.46	0.46
Axial flow fan	No. of fans		1	1	1	1	1	1
	total airflow	(m^3/h)	6500	6500	6150	6150	7200	7200
Centrifugal fan	No. of fans		1	1	1	1	1	1
	residual pressure	(Pa)	159	159	188	188	174	174
	total airflow	(m^3/h)	6600	6600	6000	6000	9200	9200

Model			RFE 090	RFE 110	RFE 130	RFE 150	RFE 190	RFE 225
Tank capacity	water volume	(litres)	240	240	236	236	310	308
Pump	rated power	(kW)	0.46	0.46	0.59	0.59	0.59	2.19
Axial flow fan	No. of fans		2	2	2	2	2	3
	total airflow	(m^3/h)	14200	13600	13600	13600	16000	21600
Centrifugal fan	No. of fans		2	2	2	2	2	3
	residual pressure	(Pa)	134	115	115	115	144	142
	total airflow	(m^3/h)	12800	12800	12800	12800	14600	20100

NOTE

The values in the table may vary in relation to the unit model and configuration. In this case refer to the offer data.

3.3.3 Sound level measurements

	Fan	Lp dB(A) *	Lw dB(A) **
RFE 32	axial	68,1	81,1
	centrifugal	73,8	86,8
RFE 37	axial	68,1	81,1
	centrifugal	73,8	86,8
RFE 45	axial	68,1	81,1
	centrifugal	73,8	86,8
RFE 52	axial	68,1	81,1
	centrifugal	73,8	86,8
RFE 60	axial	68,6	81,6
	centrifugal	80,6	93,6
RFE 77	axial	68,6	81,6
	centrifugal	80,6	93,6
RFE 90	axial	69,1	82,1
	centrifugal	76,2	89,2
RFE 110	axial	69,1	82,1
	centrifugal	76,2	89,2
RFE 130	axial	70,0	83
	centrifugal	76,2	89,2
RFE 150	axial	70,0	83
	centrifugal	76,2	89,2
RFE 190	axial	71,3	84,3
	high pressure	72,0	85,0
RFE 225	axial	73,0	86
	high pressure	72,0	85,0

* at distance of 1 m (3,2 FT)

** global

Test conditions

Noise levels refer to operation of the unit at full load in nominal conditions.

Sound pressure level in hemispherical irradiation conditions at a distance of 1 m (3,2 FT) from the condensers side of the unit and height of 1.6 m (5,2 FT) from the ground. Values with tolerance of ± 2 dB.

Sound pressure level: according to ISO 3744.

CHAPTER 4

DESCRIPTION

4.1 Operating principle

All dryers described in this manual operate in accordance with the same principle.
Their main feature is that they are equipped with a water chiller with refrigerant circuit and a series of bar & plate exchangers.
The chiller produces chilled water, which is utilised to cool the compressed air.
The exchangers assembly is composed of an aluminium core (air/air and air/water exchanger) and vertical single demister condensate separator.
The refrigerant compressor is controlled by an electronic control unit that regulates the dew-point temperature and maintains it within the preset limits.

4.2 Components

Data for materials are referred to standard units. Non-standard materials may be utilised in order to meet specific requirements. In this case refer to the offer data.
The units are basically composed of the following parts:

- Refrigerant compressor
- Condenser
- Evaporator
- Tank
- Pump
- Frame/cabinet
- Electronic controller
- Water circuit pipelines
- Compressed air exchanger/s
- Air in/out manifold couplings

4.2.1 Refrigerant circuit

The units feature a single refrigerant circuit with one or two compressors connected in parallel (tandem).
Each refrigerant circuit is equipped with the following components:

- refrigerant fluid utilised R410A;
- hermetic scroll compressor;
- pressure switch for fans with On/Off control;
- high and low refrigerant pressure switches;
- high pressure transducer for fan management (RFE 090÷150 with two centrifugal fans, RFE 190 ÷225 with high-head fans);
- ;(anti-freeze thermostat (RFE 090÷225
- thermostatic lamination valve complete with external pressure equalizer;
- filter dryer;
- liquid sight-glass;
- refrigerant pressure gauges;
- schrader service valves.

For more information consult the attached diagrams.

4.3 Compressors

The compressors are of the SCROLL type and are characterised by high energy efficiency, low vibration and consequent very low noise during normal operation.
The compressors are cooled by the refrigerant on the suction line, protected against possible overheating of the windings by an internal module that monitors windings temperature, and protected upline by thermal magnetic cutouts. These components are housed in an enclosed compartment, but they are readily accessible.

NOTE

During the short periods of starting and stopping the compressor you may hear a metallic noise due respectively to the initial contact between the coils and to the momentary reversal of their rotation. This noise is absolutely normal and does not affect the reliability of the compressor.

ATTENTION

At the time of the first start following a prolonged stoppage lasting several days, ensure the crankcase heater of each compressor is switched on at least 6 hours before pressing the start button.

4.4 Condenser

Condensation occurs in finned core coils made up of copper tubes and headers, corrugated aluminium fins, and galvanized sheet metal shoulders.
Alternatively the coils may be supplied pre-painted.
Optional supply of the water-condensed version.

4.5 Fans (condensing section)

4.5.1 Axial

The axial flow fans comprise a die cast aluminium fan wheel with sickle shaped blades.
The protection rating of the fans is IP54.
All electric motors of the fans feature insulation class F to ensure they are compatible with outdoor operation in all climates. To complete the assembly, a top safety grille (supporting the fan) is fitted, and in the case of models RFE 190÷225 also an internal safety grille.
The axial flow fans are controlled in ON/OFF mode.

Centrifugal 4.5.2

Centrifugal fans are supplied optionally as an alternative to axial fans, and can be fitted to RFE 032÷150 models. These are high head fans with the impeller coupled directly to the motor shaft, with ON/OFF control. The fan outlet port is located on . the top of the unit
.The centrifugal fans feature ON-OFF control for RFE 032÷077 models and STEP control for RFE 090÷150 models

High head axial fans 4.5.3

These fans are supplied optionally as an alternative to standard axial fans, and can be fitted to RFE 190÷225 models. The fans are high head units with an integral bell mouth made of composite material and are equipped with a permanent magnet motor with inverter type electronic speed control integrated in the motor itself, controlled by a proportional signal sent by the electronic controller on board the machine.

4.6 E vaporator

The evaporator is of the finned core type; the Thermal Mass fluid flows in contact with the finned surface at velocities such as to ensure low pressure drops, while the refrigerant flows through the tubes.
In these models the exchanger is protected from the risk of ice formation caused by low evaporation temperatures, with anti-freeze strategies handled by the electronic controller on board the machine. The evaporator water outlet temperature is controlled by a probe.
On models RFE 090÷150 with two centrifugal fans and on models RFE 190÷225 with high-head fans (see chap. 4.5 “Fans (condensing section)”) the anti-freeze function is performed by an additional thermostat as the evaporator water outlet probe is not available.

4.7 Tank and Enhanced Thermal Mass

The storage tank is cylindrical and contains the thermal mass system.
It is protected against freezing by means of a probe managed by the electronic controller on board the machine. The unit is pre-charged with a water and propylene glycol solution plus a series of specific chemical components used to stabilise the solution, prevent corrosion and the formation of micro-organisms and algae, to proportions that ensure that freezing is prevented to temperatures down to -13°C (30% by weight).
A level sensor in the tank serves to signal low thermal mass conditions and an insufficient level to guarantee safe operation of the machine. In this case the level is restored by replenishing with the same solution as described below.
The standard supply includes anti-condensation cladding, a drain valve and an air bleed valve.

A semi-transparent plastic container kit is supplied on the circuit containing the thermal mass (located in an accessible point outside the machine) to facilitate checks on the level. In steady state conditions the liquid level in the container must be approximately at the half-way point.
In this case filling with the thermal mass solution is performed via the outlet at the top of the tank (closed by a plastic cap); otherwise the solution can be added using the specific connection shown on the layouts and diagrams enclosed with the machine.

NOTE

The addition and/or total replacement, for any reason, of the thermal mass liquid must always be performed using the same solution. Failure to observe this requirement will render the warranty null and void and may impair performance of the machine. In particular, when making partial top-ups, it is important to comply with the stated percentage of glycol (30%). Drinking water should be used, together with the antifreeze liquid (glycol) approved by the constructor.

ATTENTION

The liquid thermal mass contains propylene glycol and additives classed for foodgrade use in compliance with FDA regulation - 21 CFR - Ch.1 - Part 184 (Direct Food Substances Generally Recognized As Safe) and European Directive 95/2/EC (on food additives other than colours and sweeteners). Small leaks do not generate serious environmental problems, but the liquid should nonetheless be collected, and disposed of via specialised firms authorised to handle these substances, in accordance with the laws and regulations of the country where the machine is installed.

ATTENTION

The pH of the liquid thermal mass must be checked periodically, at least every 6 months. Readings between 8 and 11 should be obtained.
If the pH is below 8, the entire liquid thermal mass must be replaced as soon as possible.

4.8 Pump serving the Thermal Mass circuit

The pump serving the Thermal Mass system is a centrifugal model.

NOTE
The pump must never run dry.

4.9 Cabinet

The entire plinth, the uprights, and the outer panels are made of galvanized carbon steel sheet and are assembled by means of screws and/or rivets. All panels undergo phosphor degreasing treatment followed by epoxy polyester power coating.
The frame is designed to allow easy access to all components of the unit.

Model		Width	Depth	Height
RFE 032÷077	(mm) (in)	658 25.9	2250 87.6	1347 53.0
RFE 090÷110	(mm) (in)	757 29.8	2910 114.6	1439 56.6
RFE 130÷150	(mm) (in)	1005 39.6	2910 114.6	1439 56.6
RFE 190÷225	(mm) (in)	1005 39.6	3405 134.0	2104 82.8

4.10 Materials in contact with compressed air

Standard chillers:

- exchangers in aluminium, condensate separator in carbon steel and demister in AISI 316 stainless steel.
- any presence of manifolds or fittings to join the client's line, in carbon steel with cataphoresis treatment.

Alternatively:

- condensate separator in 100% AISI 304 and demister in AISI 316.

4.11 Aluminium exchanger

The exchanger (bar & plate type) for air treatment is composed of a section that operates as an economiser and a refrigerant section that makes it possible to reach the required DW as set on the controller.
The first part allows free pre-cooling of the inlet air using air exhausted from the lower part of the exchanger (at DW temperature) thus heating the exhaust air by removing heat from the inlet air.
The lower part accommodates the compressed air - water-glycol solution exchanger that cools the air exhausted from the first air-air side until reaching the dew point temperature.
All connections between the customer's line and the exchanger are made by means of curves or manifolds (unit with double module) made of carbon steel with cathode electrophoretic surface treatment.

4.12 Condensate drain

The condensate drain can be of the capacity (ID) or timer controlled (TEMP) type.
The former is self-contained and it features a condensate drain test button and a remotisable alarm on the electrical panel.
The second type features a solenoid valve the opening and closing times of which are managed by the controller.

4.13 Heating elements

In the case of negative environment temperatures (-5°C minimum acceptable value) the machine is equipped with systems to guarantee perfect operation also at severe temperatures.
The additional elements comprise:

- electrical panel heater;
- heating elements for the demister, condensate separator and at the bottom of the exchanger.

4.14 Electrical circuit

Refer to Chapter 5 “Installation” for information on electrical hook-ups and consult the attached diagrams.

4.15 Overall dimensions and minimum clearances with respect to walls

See the enclosed electrical diagrams.

CHAPTER 5

INSTALLATION

ATTENTION

Before installing or operating these units, ensure that all personnel involved have read and understood Chapter 2 "Safety". The unit must be installed in accordance with current national legislation in the country of use.

5.1 Inspection

As soon as the unit has been unpacked check it carefully for damage.

5.2 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.

5.3 Freeze protection

The minimum cooling temperatures are stated on the unit data plate according to the optional accessories fitted. See chap. 4.13 "Heating elements".

5.3.1 Operating limits

The operating limits are decided at the time of sale. Refer to the data specified in the contract.

Ambient air temperature		
Min	Max	Fans control type
°C		
-5	43 (*)	ON/OFF
5	43 (*)	

NOTE

(*) reference value for the range with dew-point temperatures as per standard listed in catalogue.

5.4 Piping

(see installation drawing)

ATTENTION

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

1. Air inlet and outlet connections are clearly marked on the dryer. Pipes and connections must be of the correct size and suitable for the working pressure.
   Do not forget to remove blanking plugs from the pipe connections but take care not to let swarf, metal filings, pieces of tape or other solid particles enter the dryer during installation. These may block the filter or drain valve or partially obstruct the heat exchangers.
2. All piping must be properly supported. Flexible connections are recommended to avoid pipe stress or the transmission of vibration.
3. Make suitable arrangements so that the condensate drain pipe drains to a suitable point. The dryer discharge must not be connected to those from any other compressed air equipment; ideally it should discharge into a open funnel. Condensate drainage must never be piped into a common sewerage drain due to its possible oil content. We recommend the use of oil/water separators for the collection of discharged oil. Ensure that the drainage system complies with all local regulations.
4. The safety valve must be installed by the customer.
5. We recommend the installation of a pre-filter before the dryer, or even a coalescence type oil-removing filter after the dryer, and the installation of isolating valves on the dryer inlet and outlet to isolate the dryer.
   The pre-filter before the dryer stops impurities from partially obstructing the heat exchangers which could cause the dryer to malfunction.
6. It is recommended that a bypass line with on-off valves be installed to enable servicing to be carried out without interfering with the compressed air supply.
7. Piping or other parts with a temperature in excess of 60 °C (140 °F) and which may be touched by personnel must be guarded or insulated.
8. Take care when installing the dryer in areas subject to low ambient temperatures. Steps should be taken to avoid any discharged condensate freezing in the drainage system. The minimum operating ambient temperature of dryers in this range is in accordance with the optionals supplied.
9. To enable compressed air to be released from the dryer during service work, it is recommended that a discharge valve be fitted to the air piping between the dryer and one of the two on-off valves fitted in the line.
10. Check that the inlet air temperature/flow to the dryer does not exceed the design ratings. Install an appropriate aftercooler if necessary.
    In extreme cases the dryer may be overloaded to the point at which a safety device trips.

MOD.	CONNECTION TYPE	Ø “	Ø mm
RFE 032 **RFE 037** **RFE 045**	Victaulic	4”	114.3
RFE 052 **RFE 060** **RFE 077**	Victaulic	5”	139.7
RFE 090 **RFE 110**	Victaulic	6”	168.3
RFE 130 **RFE 150**	Flanged	8”	219.0
RFE 190 **RFE 225**	Flanged	10”	273.0

Air connection size:

Unit model	**RFE 032**	**RFE 037**	**RFE 045**	**RFE 052**	**RFE 060**	**RFE 077**
Air IN/OUT connections	DN100 (4") + welded socket KIT			DN125 (5") + welded socket KIT		
Unit model	**RFE 090**	**RFE 110**	**RFE 130**	**RFE 150**	**RFE 190**	**RFE 225**
Air IN/OUT connections	DN150 (6") + welded socket KIT		DN200 flanged PN16 EN1092-1		DN250 flanged PN16 EN1092-1	

5.5 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. The voltage, frequency and number of phases must comply with the data on the unit’s nameplate.
The power supply voltage must not be outside the tolerances shown on the electrical schematic, even in terms of transients.
Unless otherwise specified, the frequency tolerance is +/-1% of the nominal value (+/-2% for short periods).
With a three-phase power supply the voltage must be symmetrical (the effective values of phase to phase voltages and consecutive phase angles must be identical).
In particular, unless otherwise indicated, the maximum permissible phase imbalance is 2%, calculated for each phase according to the formula:

$$\frac{MaxPhaseVoltageDifferenceFromVavg}{Vavg} \bullet 100$$

Vavg= average phase voltage
With a single phase power supply the voltage must be supplied between the phase line and neutral and the neutral conductor must be connected to earth in the relative step-down substation (TN system in compliance with IEC 364) or must be connected to earth upline by the electricity company (TT system in compliance with IEC 364).
The line conductor and neutral conductor are not interchangeable and their positions cannot be switched.

For the electrical power supply:

1. connect the unit to the building’s protective earth system
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 cable install a device that protects it from current surges (short-circuits) (refer to the indications given in the electrical diagram)
5. use conductors rated to carry the maximum current required at the maximum operating ambient temperature, according to the chosen installation type (IEC 364-5-523) (see the indications on the electrical diagram)

6. 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.

Indications on the electrical diagram:

A maximum permissible size of the fuse type gG.
In general, fuses can be replaced by an automatic circuit breaker set in relation to the unit's maximum current input (consult the manufacturer if necessary)

B section and type of power cable (if not already supplied):

- 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
- operating temperature: maximum operating ambient temperature for the unit
- cable type: copper conductors, 70°C PVC insulation (unless otherwise specified) or EPR 90°C insulation

For further details refer to the attached electrical schematic.

5.6 Phase Monitor

By means of a Phase Monitor device (see unit electrical schematic) the electronic controller is able to monitor the unit's power supply, stopping the unit in the case of missing phases or an incorrect phase sequence.
Tripping of the Phase Monitor shuts down the unit and displays alarm ALc1.
A certain level of power supply instability is perfectly normal. If the frequency with which the unit is shut down due to tripping of the Phase Monitor tends to increase unacceptably, contact your local electricity company to find a solution.

ATTENTION

Never tamper with the Phase Monitor under any circumstances.

CHAPTER 6

STARTING

ATTENTION

Before starting this type of unit, ensure that all personnel involved have read and understood Chapter 2 "Safety".

ATTENTION

On starting the unit:

1) If the high pressure alarm trips (b1HP/b2HP/b1hP/b2hP) without the compressor having started, stop the unit immediately by setting it to off on the controller.
Now check the refrigerant circuit high pressure value.
2) If the Phase Monitor alarm ALc1 trips check the correct phase sequence upline from the unit. The ALc1 alarm may be generated by tripping of the protections upline from the phase monitor.

1. Check that the unit shut-off valves are open.
2. Check that the tank is completely full of water by means of the level gauge on the filling container.
3. Check that the ambient temperature is within the range indicated on the unit's data plate.

4. Check that the main switch is in the OFF position ("O").
5. Check that the unit power supply voltage is correct.
6. Power the unit by means of the line protection device.
7. Close the unit's main switch by setting it to the ON position ("I").
8. Check that water is flowing through the evaporator.
9. To start the unit perform the following procedure (For more information consult Chapter 7 "Electronic controller")

From unit OFF (stand-by) press and release button  to switch the unit on or off in chiller mode. With the unit on LED  is lit.

10. Make sure the compressor operates correctly (no anomalous noise and no overheating) and check that the fans and the pump rotate in the correct direction.
    If necessary, invert two phase wires of the power supply line.
11. **To avoid pressure shocks open the dryer inlet valve very slowly to pressurise the dryer.**
12. **Slowly open the dryer outlet valve.**
13. **Close the dryer by-pass valve (if present on the customer's line).**
14. Models with high pressure centrifugal/axial flow fans:
    Check that the outlet of the fans is correctly directed and that the pressure drops of the air ducting system are approximately equal to the available pressure value. If the pressure drops are:
    - higher, this means that there is a reduction in the flow rate of cooling air with consequent impairment of the unit's performance and possible tripping of the thermal cutouts even at relatively low ambient temperatures;
    - lower, this means that the air flow rate may be too high creating a situation of potential risk for the fan motor in the case of a centrifugal fan.
15. Press the manual drain button and check that the condensate drain solenoid valve opens.
16. The unit is now **ready to start operating**.
    If the thermal load is lower than the load produced by the unit, the DW temperature will decrease until it reaches the set-point value set in accordance with the directions given in Chapter 7 "Electronic controller".
    Once the SET-POINT value has been reached, the controller monitoring the water inlet temperature will stop the compressor. In these conditions the water pump runs constantly.

NOTE

Do not switch off the dryer if the compressed air flow is suspended for short intervals.
Switch off the dryer only when the air compressor is switched off (e.g. during the night or at weekends).
The first time the machine is started after several days' stoppage, turn on the casing resistance of every compressor at least 6 hours before pressing the ON/OFF button.
In this case, remember to turn on the dryer at least 10-15 minutes before the air compressor.

CHAPTER 7

ELECTRONIC CONTROLLER

7.1 User interface

7.2 Display icons and LEDs

ICON	DESCRIPTION	ICON	DESCRIPTION
°C -°F	Lit when a circuit temperature or pressure value is displayed		Lit if at least one of the water pumps or the delivery fan is running
BAR-PSI	Lit in programming mode if the displays show the temperature or pressure setpoints or differentials		Lit if at least one condensing fan is running
	Lit when the lower display shows the time. Lit in programming mode if the lower display shows working hours of the loads or the time	1 2 3 4	Lit if the associated compressor is on. Flashing if the compressor is in timer controlled starting mode
	Lit if at least one alarm is present	AUX	Lit if the auxiliary output is active
	Lit if the domestic hot water production function is active		Lit if the unit is on
menu	Lit during menu navigation	FC	Lit if AUX function is active
	Lit if heaters (anti-freeze/support) heaters are on		Lit during condensate draining
Flow!	Flashing if flow switch digital input is active with pump running		

7.3 Button functions

BUTTON	ACTION	FUNCTION
	Press and release	To enable signal for unit starting / stopping
	Press and release	To allow activation of condensate drain valve
SET	Press and release with default display	To show dew-point setpoint (label **SetE**)
	Press and release twice with default display	With unit in chiller or heat pump mode, if the energy saving or dynamic setpoint function is active, shows the effective working setpoint (label **Setr**).
	Press for 3 seconds and release with default display	Dew-point setpoint editing
	Press and release in programming	To access parameter value editing; confirms parameter value.
	Press and release in ALrM menu	For alarm reset
	Press and release with a probes label shown in the lower display	To toggle the display between circuit 1 parameters and circuit 2 parameters
	Press and release	To display temperature / pressure values on the upper / lower display.
	Press and release in parameters programming	To scroll parameter groups and parameters; to increase the parameter value during editing.
	Press for 1 second and release during parameters programming and in password display (Pr1, Pr2)	If pressed once from “Pr1” display, displays Pr2 If pressed once from “Pr2” display, displays Pr3
	Press and release	To display temperature / pressure values on the upper / lower display.
	Press and release in programming	To scroll parameter groups and parameters; decrease the parameter value during editing.
menu	Press and release	To open the functions menu
	Press for 3 seconds and release	To set time.
	Press and release in programming	To quit the view of the families of parameters or the parameter editing function

7.3.1 Combined button functions

BUTTONS	ACTION	FUNCTION
SET + ▽	Press for 3 seconds and release	To enter programming mode
	In programming mode, with SET button pressed, press and release DOWN button; the options are:	**Function active only with access levels Pr2 and Pr3:** to change parameters visibility
	- Press and release once	Parameter visible in Pr1 / Pr2, LED no. 3 – 4 ON
	- Press and release twice	Parameter visible in Pr1, LED no. 4 ON
	- Press and release 3 times	Parameter visible only in Pr3, LED no. 3 – 4 OFF
SET + △	Press and release	To quit programming mode
SET + menu	In parameters programming mode: with SET button pressed, press and release Menu button; the options are:	**Function active only with access level Pr3:** to set visibility and editing possibility of parameters in the two parameters access levels (Pr1 and Pr2)
	- Press and release once	Parameter shown but not editable in Pr1 / shown and editable in Pr2; LED no.3 flashing LED no.4 lit steady
	- Press and release twice	Parameter shown but not editable in Pr1 / shown and not editable in Pr2 (editable in Pr3 only); LED no.3 flashing LED no.4 flashing
	- Press and release 3 times	Parameter shown and editable in Pr1 / shown and editable in Pr2; LED no.3 lit steady LED no.4 lit steady
	- Press and hold SET, then press MENU and release when the main menu is displayed	To show the energy saving percentage and the acronym ES (energy saving). In the event of an overload, OuLd is displayed in place of the value.

7.4 Key to probes

This chapter refers to the Pb1, Pb2, Pb3, Pb4, Pb5 and Pb6 probes; for the position of these probes consult the refrigerant circuit diagram and the electrical diagram.
Descriptions of the probes utilised are given below:

Probe code	Board label	Board terminals	Description
BEWOT	**Out1**	**PB3**	Evaporator outlet water temperature probe (anti-freeze, in models (with axial fans, and in model RFE 032÷077 with centrifugal fans
BTWOT	**EOut**	**PB1**	Tank outlet water temperature probe
BAT1	**Et**	**PB6**	Ambient temperature probe
BCP1	**CdP1**	**PB3**	Circuit 1 high pressure transducer (in models RFE 090÷150 with (centrifugal fans and in models RFE 190÷225 with high pressure fans
BDPT	**dPnt**	**PB5**	Dew-point probe
BIAT	**AIn**	**PB2**	Air intake temperature probe
BOAT	**AOut**	**PB4**	Air outlet temperature probe

7.5 Unit start/stop

The unit can be started and stopped as follows:

- Using the keypad
- Using the clock (inactive function)
- Using a digital input configured as remote ON/OFF

7.5.1 Start-up using the keypad

With unit OFF (stand-by) press and release  to switch the unit on or off in chiller mode. With the unit on, the  LED is lit.

The instrument is in stand-by when  is off. Stand-by mode is set each time the unit is powered off from chiller operating mode. Also in stand-by the controller makes it possible to:

- Show the parameter readings on the display
- Manage alarm situations, displaying alarms and signalling them.

7.5.2 Start-up using time bands

This function is available if the controller features a clock.
Parameters ES01÷ES06 allow to set the time band start and end times
Parameters ES07÷ES13 allow to enable the time bands for each day of the week.

7.5.3 Start-up using digital input

Using a digital input configured as remote ON/OFF that depending on the polarity selected, active, activates operation in OFF:

- Assumes priority over the keypad
- From the keypad you can start and stop the unit only with the input disabled

With the input disabled, the instrument returns to the status prior to activation.

7.6 Setpoint

7.6.1 Displaying setpoint

To display the setpoint press and release  ; the icons identifying the circuits switch off and the working setpoint is displayed.

With the unit in stand-by, press  once to show **SetE** on the lower display.

When  button is pressed a second time, the lower display shows **Setr** indicating the real work setpoint (with dynamic setpoint active DDF).
The upper display will show the set value.

7.6.2 Changing setpoint

To change the unit working setpoint press  for at least 3 seconds and the working setpoint **SetE** will be displayed flashing.

The setpoint can be changed using  or  .

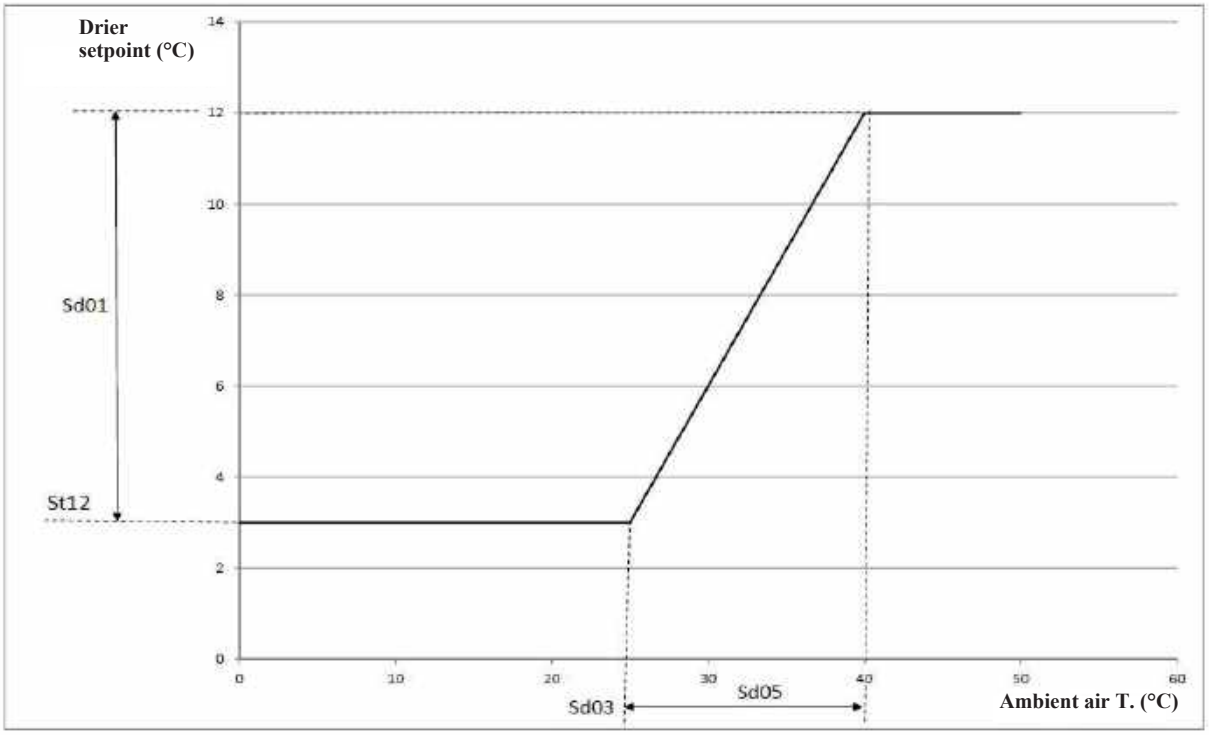
To save the new setpoint, press  or wait timeout to exit programming mode.

7.7 Dynamic setpoint function (DDF)

The controller enables modifications to the operating setpoint by adding or subtracting a value proportional to the temperature of the ambient air.
For industrial applications, the purpose of this function is to save energy.
The operating setpoint increases in proportion to the increase in ambient temperature, if Sd01 > 0°C.
The parameters below (modifiable) are set as follows:
Sd01: max. increment of dynamic setpoint in chiller mode = 0°C
Sd03: ambient air temperature setpoint and dynamic setpoint in chiller mode = 25°C
Sd05: differential of ambient air temperature setpoint in chiller mode = 15°C

NOTE
To able the DDF function, modify Sd01.

When Sd01 = 9°C, the setpoint changes as follows:
For example: with an ambient temperature of 30°C there would be an operating setpoint of 6°C.



7.8 How to visualize circuit internal values

NOTE
This chapter is not applicable to single circuit units.

In normal operating mode, circuit no. 1 is always visualized by default.

To switch from one circuit to another, use  or  to select an identification label within a circuit and press 

.

7.9 Functions menu button "Menu"

Entering the functions menu makes it possible to:

ALrM function	Display and reset active alarms.
ALOG function	Display and clear the alarms log (see 7.15.24).
UPL function	Upload instrument parameters to the smart key (see 7.17).
CrEn function	Enable / disable operation of a single circuit (see 7.9.1).
COEn function	Enable / disable operation of a single compressor (see 7.9.2).
COSn function	Display and reset the number of starts of each compressor (see 7.9.3).
Hour function	Display and reset the running hours of the controlled loads (see 7.9.4).
Cond function	Display the percentage of operation of the proportional outputs for control of the condensing fans speed (see 7.9.5).
POEn function	ENABLE or DISABLE the operation of a water pump using the key (see 7.9.6).
Pout function	Display the percentage of operation of the proportional outputs (see 7.9.7).

7.9.1 CrEn - Enabling or disabling the single circuit

Using the **CrEn** submenu the operation of a single circuit can be disabled for maintenance purposes or to isolate it in the event of faults.
Proceed as follows:

- Access the functions menu by pressing 
- Using  or  select function **CrEn** on the lower display;
- Press  . The lower display shows **Cr1E** while the upper display shows **En**;
- Use  or  to select the label **Cr1E** or **Cr2E**;
- Press  for 3 seconds in correspondence with label **Cr1E** or **Cr2E**. The upper display shows **En** in flashing mode;
- Use  or  to select label **diS** (circuit operation disabled) or **En** (circuit operation enabled);
- Press  to confirm the set function and proceed to the next circuit (only the loads associated with the circuit are disabled);

To exit the **CrEn** function and return to normal display mode press  or wait timeout.
During normal operation, if one of the circuits is set to **diS** the lower display shows a flashing label alternated with the parameter value shown at that time.
If circuit 1 is in **diS** mode the label shown on the lower display is **b1dS** = circuit 1 disabled.
If circuit 2 is in **diS** mode the label shown on the lower display is **b2dS** = circuit 2 disabled.

NOTE

Label **b2dS** *is present only on units with two refrigerant circuits.*

ATTENTION

*The **CrEn** function is enabled also on single circuit units. If you proceed to disable the only circuit present on these units, the unit will stop its entire cooling capacity.*

7.9.2 COEn - Enabling or disabling the single compressor

With the **COEn** submenu the operation of a single compressor within a circuit can be disabled for compressor maintenance purposes or to isolate it in the event of malfunctions.
The compressor status labels in the **COEn** function are:

- **CO1E** = operating status of compressor no. 1;
- **CO2E** = operating status of compressor no. 2;
- **CO3E** = operating status of compressor no. 3 (only two-circuit units);
- **CO4E** = operating status of compressor no. 4 (only two circuit units);

To enable or disable the compressors proceed as follows:

- Access the functions menu by pressing menu
- Using ▲ or ▼ select function **COEn**
- Press SET ; the lower display shows **CO1E** while the upper display shows **En**
- Press ▲ or ▼ to select the required label on the lower display. The upper display shows **En**
- Press SET for 3 seconds in correspondence with the label identifying the compressor to be disabled
- The upper display shows **En** flashing; use ▲ or ▼ to select function **diS** (compressor operation disabled) or **En** (compressor operation enabled)
- Press SET to confirm the selected function and proceed to the next compressor

To exit the **COEn** function and return to normal display mode press menu or wait timeout.

7.9.3 COSn - Displaying and resetting the number of compressor starts

The number of compressor starts can be visualized in the **COSn** submenu. The labels displayed are:

- **C1S** compressor 1 number of starts
- **C2S** compressor 2 number of starts
- **C3S** compressor 3 number of starts
- **C4S** compressor 4 number of starts

The number of starts is visualized in the lower display with a resolution of 10 starts. For example, if number 2 is displayed it means 20 compressor starts.
To display the number of starts proceed as follows:

- Open the functions menu by pressing the button menu
- Use ▲ or ▼ to select function **COSn**
- Press SET . The label of the single load **C1S** is shown on the upper display; the lower display shows the number of starts multiplied by 10.
- Display all the configured compressors by pressing ▲ or ▼.

To return to normal display mode press menu or wait timeout.
To reset the number of compressor starts proceed as follows:

- Access the functions menu by pressing menu
- When in **COSn** function, press ▲ or ▼ to select label **C1S**, **C2S**, **C3S** or **C4S**.
- Press SET for 3 seconds in correspondence with load **C1S**, **C2S**, **C3S** or **C4S**. The lower display now shows the number of starts flashing (reset in progress) and then the value "0" indicating that the number has been reset.
- At this point the starts of the next compressor are displayed.

To exit the reset function and return to normal display mode press menu or wait timeout.

7.9.4 Hour - Displaying and resetting the number of running hours of the associated loads

The Hour submenu displays the running hours of each compressor and also of the water pump. The labels displayed are:

- **CO1H** compressor 1 running hours
- **CO2H** compressor 2 running hours
- **CO3H** compressor 3 running hours
- **CO4H** compressor 4 running hours
- **EP1H** evaporator water pump running hours
- **EP2H** evaporator second water pump running hours

Like for the number of starts, the running hours are shown on the upper display with a resolution of 10 hours.
To view the running hours proceed as follows:

- Access the functions menu by pressing
- Press or to select the **Hour** function
- Press . The label of the single compressor is shown on the lower display; the upper display shows the number of running hours multiplied by 10. The icon will light up.
- Press or to display all the configured compressors.

To return to normal display mode press or wait timeout.
To view the number of running hours proceed as follows:

- Access the functions menu by pressing
- In the Hour function, press or to select label **CO1H**, **CO2H**, **CO3H**, **CO4H**, **EP1H** or **EP2H**
- Press for 3 seconds in correspondence with compressor label **CO1H**, **CO2H**, **CO3H**, **CO4H**, **EP1H** or **EP2H**; the upper display will show the number of running hours flashing (reset in progress) followed by 0 to confirm that the value has been reset, and then progresses to the next load.

To exit the reset function and return to normal display mode press or wait timeout.

7.9.5 Cond - Displaying of percentage / number of condensing steps

In the functions menu it is possible to visualize the work percentages of the fan proportional output.
Cnd1 Condensing fans management proportional output.
For visualization, proceed as follows:

- Access the functions menu by pressing
- Select the **Cond** function using or
- Press . The lower display shows **Cnd1**, the upper display shows the work percentage.

To return to normal display mode press or wait timeout.

In dual circuit units, to display the number of ventilation steps activated, access the functions menu by pressing :

- Select the **Cond** function using or
- Press . The lower display shows **Cnd1**, the upper display shows the number of steps activated.

Use or to select the label **Cnd1** or **Cnd2** on the lower display; the upper display shows the operating percentage.

To return to normal display mode press or wait timeout.

7.9.6 POEn - ENABLE or DISABLE the operation of a water pump using the key

Operation of a single pump can be disabled for servicing or to disconnect it from the circuit in the event of a malfunction.
In the functions menu it is displayed with the label **POEn**; inside the folder it is displayed as follows:
PE1E = evaporator no. 1 pump operating status
The labels which identify the individual pumps are only displayed in the POEn function for the pumps actually present.

Access the function menu key:

- use the or keys to scroll the list and select the "**POEn**" function
- press the key: the bottom display shows "**PE1E**" and the top display "**En**"
- select the pump for disabling by pressing the or keys (labels "**PE1E**", "**PE2E**" present depending on the unit's configuration)
- press the key for 3 seconds: the top display shows a flashing "**En**". Pressing the or keys alternates the contents of the top display between "**En**" and "**diS**"; pressing the key confirms the selected status (**En**= enabled, **diS**= disabled)

Press the key to quit the **POEn** menu; it will also be shut down after a time-out.

Display status of the DISABLED water pump
During normal operation, if one of the pumps is disabled, a flashing label **P1Ed**, **P2Ed**, (evaporator pumps 1 and 2)... appears on the bottom display, alternating with the parameter currently displayed.

7.9.7 Pout - Displaying the work percentage of the four proportional outputs

In the functions menu you can view the working percentages of the four proportional outputs.
Pou1 Proportional output for management of actuators / servomotors or to drive external relay no.1
Pou2 Proportional output for management of actuators / servomotors or to drive external relay no.2
Pou3 Proportional output for management of actuators / servomotors or to drive external relay no.3
Pou4 Proportional output for management of actuators / servomotors or to drive external relay no.4
To view the work percentages of an output, enter the functions menu:

- Use or to select the Pout function
- Press on the lower display to show **Pou1**, the upper display shows the work percentage
- Use or to select label **Pou1, Pou2, Pou3** or **Pou4** on the lower display, at this point the upper display shows the work percentage from 0% to 100%
- To return to normal display mode press or wait timeout.

NOTE
*Labels **Pou1… Pou4** are present only if the associated outputs are configured.*

ATTENTION

*If proportional outputs **Pou1 - Pou2 - Pou3 - Pou4** are configured to drive an external relay, the display in the functions menu will not be expressed as a percentage but as 100 with output enabled relay ON and 0 with output disabled relay OFF).*

7.10 Condensate drain

The electronic controller offers 2 selection modes for condensate drain relay control:

- Fixed (permanently energized);
- Timed.

The drain operating mode is set by setting parameter **Sc01**.

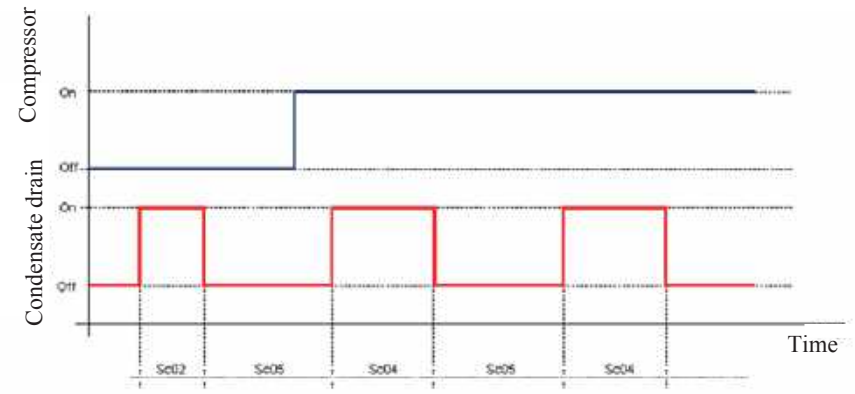
In both operating modes, when the condensate drain relay is energised the LED will light up.
Also during alarm events, the condensate drain relay continues to function according to setting.

7.10.1 Fixed (permanently energised)

For condensate drain relay permanently energised management logic, set parameter **Sc01**.
The relay remains permanently energised while the unit is powered.
This allows the smart drain installed on the unit to remain constantly powered..

7.10.2 Timed

For condensate drain relay timed management logic, set parameter **Sc01**.
The relay is energised cyclically with ON time and OFF time settable with parameters **Sc02÷Sc07**.
When the unit is started, the condensate drain relay ON time is reloaded at the value set with parameter **Sc04** and on the next start, the cycle always restarts with the valve ON.
The condensate drain relay timer controlled operating logic is illustrated in the figure:



7.10.3 Condensate drain operating test

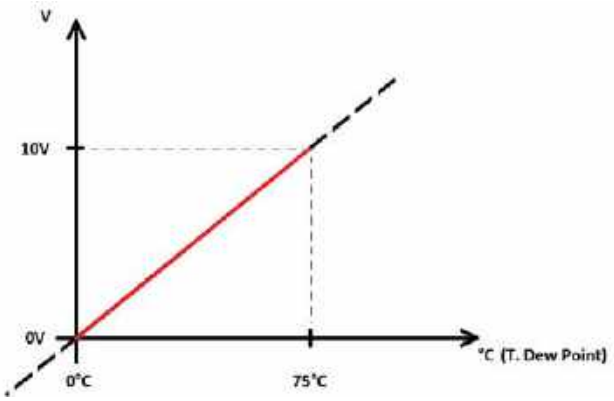
When the unit is powered, press  to energise the condensate drain relay; the corresponding icon will light to show the valve operating status.
This operation is possible only with timer-controlled management of the condensate drain relay to check it is functioning correctly.

7.11 Ready to start

Programming parameter **CF87** allows enabling or disabling this function.
The Ready To Start output closes whenever, following each system start via pushbutton, on/off using supervisor, or on/off using digital input, for the first time the system achieves complete compressor stopping due to temperature control, reaching of Chiller Setpoint (ST1).
No alarms originating from the probes on air side (inlet, outlet, dew point) affect the Ready To Start output. Reset occurs for the other unit blocking alarms and by setting the unit to OFF.

7.12 DW temperature signal

Function enabled when the analogue output is configured as Dew Point Temperature Probe.
The controller uses an analogue output to manage a 0-10V signal that is directly proportional to the value read by the DEW POINT probe. (Analogue output power supply separate from the controller power supply)
0V = 0°C (32°F)
10V = 75°C (167°F)



7.13 Energy saving value

Displays unit energy saving value as a percentage, this value is displayed by pressing SET + menu (see ch. 7.3.1 “Combined button functions”) and is addressed so it can be reached by the supervision system (e.g. Modbus). To show the energy saving percentage and the acronym ES (energy saving). In the event of an overload, OuLd is displayed in place of the value. The value is cleared from the display by pressing menu or after a 60s timeout.

7.14 Alarms

The electronic controller manages the display, reset and log of a large number of alarms.

7.15 Dryer probe alarms

Code on display	Meaning	Cause	Icon	Action	Reset
A01	Condensate drain alarm	Activation of condensate drain digital input	⚠	Activates alarm relay output. Compressor trip.	**Automatic** Automatic reset when fault is cleared
A02	Air intake probe low temperature pre-alarm	Activation when the air intake reading analogue input reads a temperature lower than Sc09. Deactivation when the air inlet reading analogue input detects a temperature higher than Sc09 + Sc10.	⚠	Activates alarm relay output. Warning only if number of trips / hour is less than Sc11, otherwise compressor trip. The condensate drain continues to function.	**Automatic** Switches to manual reset after Sc11 trips/hour. **Manual** Manual reset possible when emergency ceases.
A03	Air outlet probe low temperature pre-alarm	Activation when the air inlet reading analogue input detects a temperature lower than Sc12. Deactivation when the air inlet reading analogue input detects a temperature higher than Sc12 + Sc13.	⚠	Activates alarm relay output. Warning only if number of trips / hour is less than Sc14, otherwise compressor trip. The condensate drain continues to function.	**Automatic** Switches to manual reset after Sc14 trips/hour. **Manual** Manual reset possible when emergency ceases.
A04	Dew-point probe low temperature pre-alarm	Activation when dew-point probe analogue input detects a temperature lower than Sc15. Deactivation when dew-point probe analogue input detects a temperature higher than Sc15 + Sc16.	⚠	Activates alarm relay output. Warning only if number of trips / hour is less than Sc17, otherwise compressor trip. The condensate drain continues to function.	**Automatic** Switches to manual reset after Sc17 trips/hour. **Manual** Manual reset possible when emergency ceases.

Code on display	Meaning	Cause	Icon	Action	Reset
A05	Air intake probe low temperature alarm	Activation when the air inlet reading analogue input detects a temperature lower than Sc18. Deactivation when the air inlet reading analogue input detects a temperature higher than Sc18 + Sc19.	⚠	Activates alarm relay output. Compressor trip.	**Automatic** Switches to manual reset after Sc20 trips/hour. **Manual** Manual reset possible when emergency ceases.
A06	Air outlet probe low temperature alarm	Activation when the air outlet reading analogue input detects a temperature lower than Sc21. Deactivation when the air outlet reading analogue input detects a temperature higher than Sc21+Sc22.	⚠	Activates alarm relay output. Compressor trip.	**Automatic** Switches to manual reset after Sc23 trips/hour. **Manual** Manual reset possible when emergency ceases.
A07	Dew-point probe low temperature alarm	Activation when dew-point probe analogue input detects a temperature lower than Sc24. Deactivation when dew-point probe analogue input detects a temperature higher than Sc24 +Sc25.	⚠	Activates alarm relay output. Compressor trip.	**Automatic** Switches to manual reset after Sc26 trips/hour. **Manual** Manual reset possible when emergency ceases.
A08	Air intake probe high temperature alarm	Activation when the air intake reading analogue input detects a temperature higher than Sc27. Deactivation when the air intake reading analogue input detects a temperature lower than Sc27-Sc28.	⚠	Activates alarm relay output. Signalling only.	**Automatic** Automatic reset when fault is cleared.

Code on display	Meaning	Cause	Icon	Action	Reset
A09	Air outlet probe high temperature alarm	Activation when the air outlet reading analogue input detects a temperature higher than Sc29. Deactivation when the air outlet reading analogue input detects a temperature lower than Sc29-Sc30.	⚠	Activates alarm relay output. Signalling only.	**Automatic** Automatic reset when fault is cleared.
A10	Dew-point probe high temperature alarm	Activation when the evaporator outlet reading analogue input detects a temperature higher than Sc31. Deactivation when the evaporator outlet reading analogue input detects a temperature lower than Sc31-Sc32.	⚠	Activates alarm relay output. Signalling only.	**Automatic** Automatic reset when fault is cleared.

7.15.1 How to mute the buzzer

The controller emits an audible signal to alert the operator to the presence of alarms (buzzer).
The buzzer can be muted as follows:

- **Automatic muting:** the buzzer is muted when the situation that caused the alarm ceases.
- **Manual muting:** press and release one of the buttons; the buzzer will be muted even if the alarm condition persists.

7.15.2 General alarms list

Alarm codes and indications are composed of letters and numbers that identify different alarm types.
The first letter of the alarm label identifies the type, as follows:

- Letter **A** = unit alarm
- Letter **b** = circuit alarm
- Letter **C** = compressor alarm

The following tables contain a description of the alarms managed by the electronic circuit board. Some of the alarms mentioned may not be present on all unit models.

COD. alarm	Alarm Description	Alarm reset	Alarm Trip	Outputs block			
				Compressor	Pump	Fan	Heating elements
AP1	Probe **PB1** fault alarm	A	I	X		X	X (1)
AP2	Probe **PB2** fault alarm	A	I	X		X	X (1)
AP3	Probe **PB3** fault alarm	A	I	X		X	X (1)
AP4	Probe **PB4** fault alarm	A	I	X		X	X (1)
AP5	Probe **PB5** fault alarm	A	I	X		X	X (1)
AP6	Probe **PB6** fault alarm	A	I	X		X	X (1)
APE1	Probe **PB1**.. Probe **Pb8** of I/O expansion	A	I	X	X	X	
APE2	Probe **PB1**.. Probe **Pb8** of I/O expansion	A	I	X	X	X	
APE3	Probe **PB1**.. Probe **Pb8** of I/O expansion	A	I	X	X	X	

COD. alarm	Alarm Description	Alarm reset	Alarm Trip	Outputs block			
				Compressor	Pump	Fan	Heating elements
APE4	Probe **PB1**.. Probe **Pb8** of I/O expansion	A	I	X	X	X	
APE5	Probe **PB1**.. Probe **Pb8** of I/O expansion	A	I	X	X	X	
APE6	Probe **PB1**.. Probe **Pb8** of I/O expansion	A	I	X	X	X	
APE7	Probe **PB1**.. Probe **Pb8** of I/O expansion	A	I	X	X	X	
APE8	Probe **PB1**.. Probe **Pb8** of I/O expansion	A	I	X	X	X	
AEFL	Level sensor alarm	A/M	R	X	X (2)	X	X
AtE1	Evaporator water pump thermal cutout	M	I	X (3)	X	X	X (4)
AtE2	Evaporator second water pump thermal cutout	M	I	X (3)	X	X	X (4)
AEE	EEprom alarm	M	I	X	X	X	
ALSF	Phase sequence alarm (NOT USED)	A	I	X	X	X	X
ASLA	LAN communication with I/O expansion alarm	A	I	X	X	X	
ALc1	Phase monitor alarm	A/M	I	X	X	X	
AEUn	Evaporator inlet high temperature unloading indication	A	R				
ACF1	Configuration alarm	A	I	X	X	X	
b(n)HP	Circuit (n) high pressure switch	A/M	R	X		X	
b(n)HP	Circuit (n) high pressure switch and/or compressors (n) thermal overload alarm	A/M	R	X		X	
b(n)LP	Circuit (n) low pressure switch	A/M	R	X		X	
b(n)AC	Anti-freeze in chiller circuit (n)	A/M	R	X		X	
b(n)Ac	Signalling of anti-freeze in chiller circuit (n)	A/M	R				
b(n)hP	High condensing pressure transducer circuit (n)	M	I			X	
b(n)lP	Low condensing pressure - (evaporation with low pressure transducer) transducer circuit (n)	A/M	R	X			
AEht	Evaporator inlet water high temperature alarm	M	I	X		X	
b1tF	Circuit 1 fans thermal alarm	M	I	X			
b(n)rC	Circuit (n) recovery disabled signalling	A	I				
C(n)tr	Compressor (n) thermal alarm with AL47 = 0 – 1	M	I	X			

1= If probe configured for anti-freeze - water heater control and **Ar10** = 0.
2= With manual reset alarm.
3= Compressors stopped with only 1 water pump configured or with 2 water pumps configured and both in thermal alarm status.
4= Water heater elements off with only 1 water pump configured or with 2 water pumps configured and both in thermal alarm status (in this case the water heater elements are switched on only by the evaporator protection anti-freeze setpoint).
(n)= identifies circuit 1 or circuit 2
Key:
A= automatic
M= manual
R= delayed
I= instantaneous

7.15.3 Indications table

Alarm CODE	Alarm Description	Comp.	Water heater Anti-freeze elements	Support elements	Evap pump Deliv. Fan	Cond. pump	Cond. fan Cir1 Cir2	Auxiliary relay
AEUn	Evaporator unloading indication							
b(n)Cu	Unloading indication from condensing press. temp. circuit (n)							
b(n)Eu	Unloading indication from evaporator low temp. circuit (n)							
C(n)Mn	Compressor (n) maintenance							
AEP1	Evaporator water pump maintenance							
noL	Indication of no communication between keyboard or controller 2 remote terminals configured with same address							
Atr(n)	Remote terminal alarm							

7.15.4 Probe faulty

Display labels meaning	**AP1** probe **PB1÷AP6** alarm, probe **PB6** alarm
Cause of trip	Probe configured and converted value off range
Reset	Probe not configured or converted value within range
Reset	Automatic
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.5 High pressure switch alarm

Display labels meaning	**b1HP** (circuit 1 high pressure digital input) **b2HP** (circuit 2 high pressure digital input)
Cause of trip	With the unit ON and circuit high pressure switch input active
Reset	Input inactive
Reset	Reset is always manual
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.6 High pressure switch and/or compressors thermal alarm

Display labels meaning	**C1HP** (high pressure switch alarm compressor no. 1) **C4HP** (high pressure switch alarm compressor no. 4)
Cause of trip	With unit in ON status and compressor high pressure switch input active
Reset	Input inactive
Reset	Reset changes to manual (reset procedure in functions menu)
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.7 Low pressure switch alarm

Display labels meaning	**b1LP** (circuit 1 low pressure digital input) **b2LP** (circuit 2 low pressure digital input)
Cause of trip	With low pressure switch input of active circuit The alarm is not signalled: 1. On compressor starting for time **AL01** 2. If time **AL64** from activation of the digital input has not elapsed
Reset	Input deactivation
Reset	Automatic - becomes manual after **AL05** trips/hour (reset procedure in functions menu)
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.8 High pressure

Display labels meaning	**b1hP** (circuit 1 high pressure analogue input) **b2hP** (circuit 2 high pressure analogue input)
Cause of trip	Condensing control probe detects value > set **AL09**
Reset	Condensing control probe detects value < set **AL09** - differential **AL10**
Reset	Reset is always automatic
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.9 Low pressure

Display labels meaning	**b1lP** (circuit 1 low pressure analogue input) **b2lP** (circuit 2 low pressure analogue input)
Cause of trip	The alarm is generated when the evaporation pressure probe reads a pressure value < set **AL03** When the compressor is started the alarm is not signalled for time **AL01**.
Reset	If the evaporation control probe measures pressure > set **AL03** + differential **AL04**
Reset	Automatic - becomes manual after **AL05** trips/hour (reset procedure in functions menu)
Icon	⚠ flashing
Action	Relay + buzzer activated

7.15.10 Anti-freeze alarm

The anti-freeze alarm is reset automatically. It changes to manual reset after 3 trips/hour.
With the machine on stand-by or OFF the anti-freeze alarm signal is activated with reference to the chiller thresholds.

7.15.11 Chiller mode anti-freeze alarm

Chiller Operation	
Display labels meaning	**b1AC** (chiller mode circuit 1 anti-freeze alarm) **b1Ac** (chiller mode circuit 1 anti-freeze alarm indication) With the alarm active and a dual circuit unit both labels are displayed (**b1AC-b2AC**/**b1Ac-b2Ac**).
Cause of trip	In operation and in stand-by remote OFF, if the anti-freeze control probe reads a temperature < set**AL26** for at least **AL28** seconds.
Reset	Anti-freeze control probe reads a temperature > set **A26**+ differential **AL27**.
Reset	Automatic - becomes manual after **AL29** trips/hour (reset procedure in functions menu).
Icon	⚠ flashing
Action	The compressors are stopped and the alarm label is displayed (**b1AC b2AC**); also the Alarm relay + buzzer are activated

7.15.12 Level sensor alarm

Each time the water pump starts, the level sensor alarm is overridden for **AL15** time to allow the hydraulic circuit to reach steady state conditions. In normal operating conditions, if the level sensor is in alarm status for **AL17** time, the compressor stops and label **AEFL** is displayed: the water pump continues to run for an additional **AL16** time after which, if the level sensor is still in alarm, the pump stops.
At this point, the alarm must be reset manually.
Parameter **AL18** is the period of time during which the level sensor must not be in alarm status in order to allow reset.

Display labels meaning	**AEFL** (level sensor alarm)
Cause of trip	The alarm is not acknowledged for time **AL15** after water pump starting. Alarm signalled if ID active for time **AL17**.
Reset	ID not active for time **AL18**
Reset	Automatic - becomes manual if ID active for time **AL16** counted at expiry of **AL17** (reset procedure in functions menu)
Icon	Flashing Flow!
Action	Alarm relay + buzzer activated only if the level sensor alarm is active during a normal operating stage.

ATTENTION

Activation of alarm relay + buzzer occurs only if the level sensor alarm is active during a normal operating cycle. Otherwise the alarm is signalled only by a flashing icon.

NOTE

The alarm is always automatic reset with the unit in stand-by or remote OFF (pump stopped).

Manual reset of level sensor alarm:
With alarms of the manual reset type, access the functions menu to reset (reset procedure in functions menu).

7.15.13 Compressors thermal overload protection alarm

Display labels meaning	**C1tr** (compressor 1 thermal overload protection alarm) -…**C4tr** (compressor 4 thermal overload protection alarm)
Cause of trip	With digital input active. The alarm is not acknowledged for **AL19** time after compressor start.
Reset	With ID inactive
Reset	Manual from menu **ALrM** with password demand
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.14 Fan thermal alarm

Display labels meaning	**b1tF** (circuit 1 condensing fan thermal protection alarm)
Cause of trip	With configured circuit digital input active
Reset	With digital input inactive.
Reset	Manual (reset procedure in functions menu)
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.15 High condensing pressure unloading indication in chiller mode operation

Display labels meaning	**b1Cu** (unloading indication from circuit 1 condenser coil) **b2Cu** (unloading indication from circuit 2 condenser coil)
Cause of trip	In operation if the probe configured as condensing pressure or temperature control detects a value > **CO44**
Reset	• if condensing pressure or temperature measures value < **CO44** - differential **CO45** • with unloading active, after time setting Par. **CO48**
Reset	Automatic
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.16 High condensing pressure recovery disabling indication in chiller mode (INACTIVE FUNCTION)

Display labels meaning	**b1rC** (circuit 1 recovery disabling signal) **b2rC** (circuit 2 recovery disabling signal)
Cause of trip	In operation if the probe configured as condensing pressure control detects a value > set **rC06**
Reset	• If condensing pressure or temperature measures value < set **rc06** - differential **rC07** • With recovery disabling function activated after time set in Par. **rC08**
Reset	Automatic
Icon	⚠ flashing
Action	Alarm relay + buzzer NOT activated

7.15.17 Indication of evaporator inlet high water temperature unloading

Display labels meaning	**AEun** (unloading from evaporator indication)
Cause of trip	operation if evaporator water inlet temperature measured is > set **CO40** for time set in Par.**CO42**
Reset	• If the measured water temperature is < set **CO40** - differential **CO41** • With unloading function active after time set in Par. **CO43**
Reset	Automatic
Action	Alarm relay + buzzer activated

7.15.18 Evaporator water pumping unit thermal overload protection alarm

Display labels meaning	**AtE1** (evaporator water pump thermal cutout) **AtE2** (evaporator second pump thermal cutout)
Cause of trip	ID configured as evaporator water pump thermal cutout active ID configured as evaporator second pump thermal cutout active
Reset	With ID inactive
Reset	Manual (reset procedure in functions menu)
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.19 Phase monitor alarm

Display labels meaning	**ALc1**
Cause of trip	Phase monitor alarm
Reset	Phase monitor alarm not active
Reset	Automatic - becomes manual after **AL42** trips / hour (reset procedure in functions menu). Recorded in alarms log exclusively with manual reset.
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.20 Compressors maintenance alarm

Display labels meaning	**C1Mn** (compressor 1 maintenance demand) **C2Mn** (compressor 2 maintenance demand) **C3Mn** (compressor 3 maintenance demand) **C4Mn** (compressor 4 maintenance demand)
Cause of trip	Compressor running hours > programmed hour meter setting
Reset	Running hours reset (in functions menu, "Hour" function, hold down "set" button for a few seconds)
Reset	Manual
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.21 Pumps maintenance alarm

Display labels meaning	**AEP1** (evaporator water pump maintenance demand) **AEP2** (evaporator second pump maintenance demand)
Cause of trip	Compressor running hours > programmed hour meter setting
Reset	Running hours reset (in functions menu, "Hour" function, hold down "set" button for a few seconds)
Reset	Manual
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

7.15.22 EEprom alarm

Display labels meaning	**AEE**
Cause of trip	Write to Eeprom failed
Reset	------
Reset	Manual
Icon	⚠ flashing
Action	Alarm relay + buzzer activated

NOTE

*For unit configuration alarms "***ACF1**÷**ACF9***" and "***AC10**÷**AC14***", contact technical service.*

7.15.23 Alarm relay / open - collector / buzzer notes

The unit features a general alarm relay that combines all alarms on a single output contact.
The relay is active with the following logic:

ON	With alarms not stopped With alarms not reset
OFF	With no alarms Unit power off

7.15.24 Display and delete the alarms log in the memory (ALOG function)

The alarm code display function is active only if alarms are actually present.

- Enter the functions menu by pressing 
- Select the **ALOG** function
- Press  .

  If no alarms are present, key  is not enabled.
- The lower display shows the label with the alarm code, while the upper display shows label "**n**" with a sequential number from 00 to 99.
- Scroll through all the alarms present with  or  .

To quit the **ALOG** function and return to normal display mode press  or wait timeout.
The memory can hold up to 99 alarms; all alarms detected above this number will automatically delete the oldest alarm from the memory (the alarms are displayed in incremental order from the oldest to most recent).

- To clear the alarms log, access the functions menu
- Use  or  to select the **ALOG** function on the lower display and press  .
- Scroll the alarm labels until finding **ArSt** in the lower display. The upper display shows **PASS**.
- Press  . Enter the password for deletion (the password value to reset the alarms log is **14**) and press  to confirm.
- If the password is correct, the label **ArSt** flashes for 5 seconds to confirm the deletion. After deleting the alarms log, the system exits the functions menu automatically and returns to normal display mode.
- If the password is incorrect, the message **PASS** appears again. If the correct password is not entered, it is anyway possible to scroll through the alarms in the memory with  or  .

To return to normal display mode press  or wait timeout.

7.16 Programming from keypad

The electronic controller parameters are divided into groups and subdivided into three levels, namely:

1. USER (**Pr1**);
2. SERVICE (**Pr2**).
3. MANUFACTURER (**Pr3**).

The USER level (**Pr1**) provides access exclusively to the user parameters, the SERVICE (**Pr2**) / MANUFACTURER (**Pr3**) level provides access to parameters concerning unit configuration.
The association of a given parameter with a given level is established in the design stage.

ATTENTION

All levels are password protected.

The USER password is 23.

The parameter families, which are classified under Labels, are subdivided as follows:

LABEL	ACTION
ALL	Show all parameters
St	Shows thermoregulation parameters only
dP	Shows Display presentation parameters only
CF	Shows configuration parameters only
Sd	Shows dynamic setpoint parameters only
ES	Shows only the energy saving and start up parameters (INACTIVE FUNCTION) Shows only the second setpoint parameters
Cr	Shows Compressor rack parameters only
CO	Shows Compressor parameters only
uS	Shows Auxiliary output parameters only
FA	Shows Fans parameters only
Ar	Shows anti-freeze heater parameters only
dF	Shows Defrost parameters only (INACTIVE FUNCTION)
rC	Shows Recovery parameters only
FS	Shows Domestic hot water parameters only (INACTIVE FUNCTION)
AL	Shows Alarm parameters only
Sc	Shows Dryer parameters only
Pr	Password

ATTENTION

*Configuration parameters "**CF**" are editable only with the unit in Stand-by.*

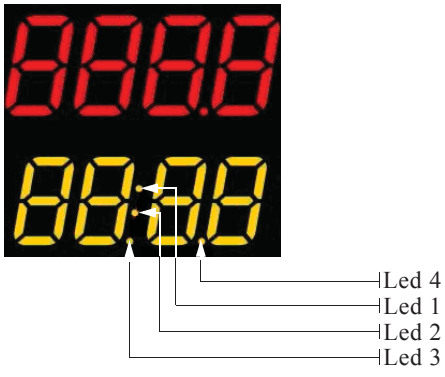
7.16.1 Access to parameters

To access the parameters menu "**Pr1**" (user level):

1. Press SET + ▽ for 3 seconds. The upper display shows the label "**PASS**", the lower display shows label "**Pr1**".
2. Press SET , "0" will appear blinking on the upper display
3. To enter the password, use △ or ▽ .
4. If the password entered is incorrect, you will be prompted to enter it again. If the password is correct, press SET to display the parameters. The first label "**ALL**" will appear on top of the display.
5. To select the labels, press △ or ▽ and then press SET . The lower display shows the label and the code of the first parameter it contains; the upper display shows the associated value.

ATTENTION

Certain parameters may be read-only. If a parameter is read-only, LEDs 1 and 2 will flash.



To exit the programming mode and return to normal display mode press SET + ▼.

7.16.2 How to change a parameter value

- Enter the programming mode;
- Press SET + ▼ simultaneously for 3 seconds
- Select the desired parameter.
- To change the value press SET .
- Change the value using key ▲ or ▼.
- Press SET to store the new value and move on to the code of the next parameter.

To exit, press SET + ▼ when a parameter is displayed, or wait 240 seconds without pressing any buttons.

NOTE

The new value set is stored also when exiting for time-out without pressing SET .

7.17 Use of the hot-key (UPL function)

7.17.1 Programming the board with the hot-key

With the instrument off:

- Insert the key.
- Switch on the instrument.
- Data download from the key to the instrument starts.

During this stage, every set-up is blocked and the lower display will show message "**doL**" flashing.
At the end of the procedure, one of the two following messages will be shown on the upper display:

- "**End**" if programming was successful (control starts after 30 seconds).
- "**Err**" if programming failed.

In the event of an error, the instrument must be switched off and then on again to repeat the operation or start with normal regulation (in this case the key must be unplugged when the instrument is off).

7.17.2 Hot-key programming

ATTENTION

Important: the hot-key saves the instrument parameters but it does not program them.

With the instrument switched on:

- Insert the key
- Access the functions menu
- Select the function **UPL** on the lower display

Press SET to start data download from instrument to key.
During this stage, the lower display shows message "**UPL**" flashing
At the end of the procedure, one of two messages will be shown on the upper display:

- "**End**" If programming was successful
- "**Err**" If programming failed.

To exit function **UPL**, press menu or wait time out (15 sec).

7.18 Unit adjustment and control

7.18.1 Compressors control

The electronic controller manages compressor start and stops, observing the minimum run times.
The following section describes the two control and rotation modes.

7.18.2 Choice of compressors control type

The controller features the facility to choose between two temperature control types:

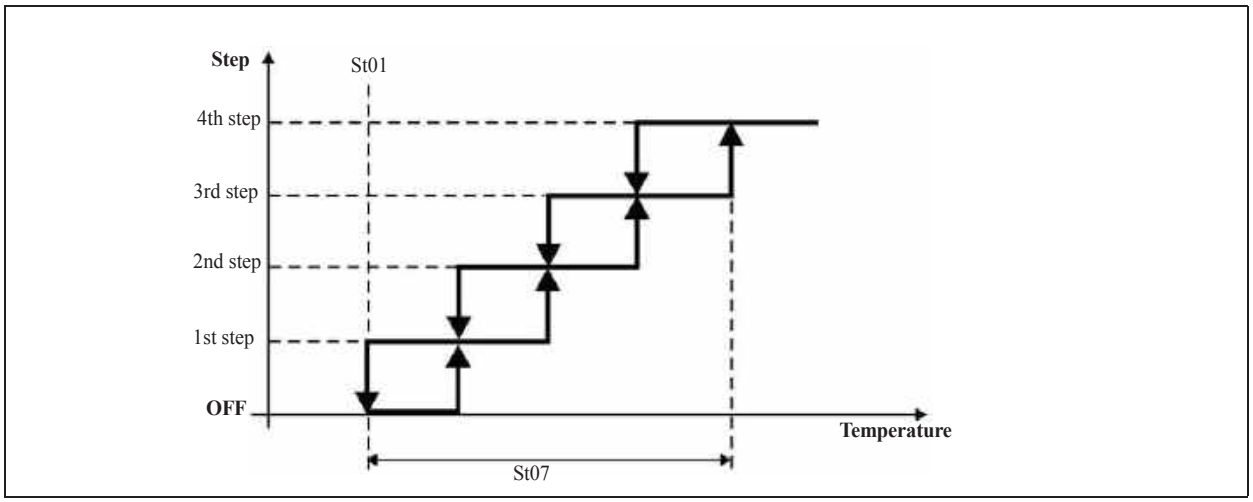
- Proportional
- Neutral Zone (factory setting)

7.18.3 Proportional regulation

Temperature setting (set-point) and temperature deviation value (differential) are used for chiller unit proportional regulation. When the measured temperature increases, the system progressively starts the compressors. When the temperature falls below the differential, the compressors stop progressively.

7.18.4 Compressors regulation diagram

Compressors controller operation diagram in chiller mode

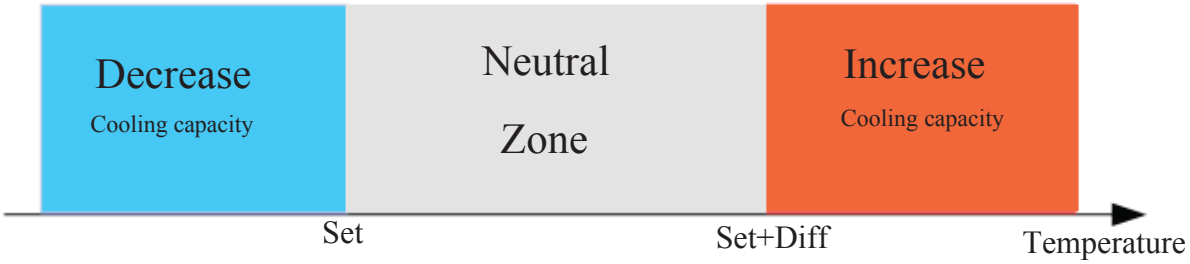


Neutral zone regulation (factory setting, only models RFE 190÷225) In chiller mode, if the reference temperature is > Setpoint+Differential, the unit's compressors are activated in sequence, according to the ON delay time outside the neutral zone **7.18.5**.

In contrast, if the reference temperature is ≤ Setpoint, the unit's compressors are stopped in sequence according to the OFF delay time outside the neutral zone.

Moreover, to obtain the temperature set-point and compressor rotation, if the reference temperature is within the neutral zone, the unit compressors start in sequence according to the switching-on delay in the neutral zone. Still within the neutral zone, after a programmable time interval the controller stops one compressor and, according to the programmed rotation, starts another. These events in the neutral zone occur only if at least one of the unit compressors is already running.

Compressors regulator operation diagram in chiller mode:



7.18.6 Compressors rotation

For correct operation of the compressors over time, the electronic controller manages rotation of compressor starts with different logic, selectable by means of a parameter.

The possible choices are:

- **Fixed sequence**: the first compressor to start is always the last one to stop.
- **Rotation by hours**: the first compressor to start is the one with the lowest number of running hours, while the first to stop is the one with the highest number of running hours.
- **Rotation by starts (factory setting)**: the compressor that starts will be the one with the lowest number of starts, while the first to stop will be the one with the highest number of starts.

In dual circuit units, it is also possible to choose whether to favour compressor saturation or balancing in each circuit.

7.18.7 Forced compressors rotation

For units that often operate at partial loads, the controller provides the facility to perform forced compressor rotation.

For circuits with more than one compressor, but only one is running, this compressor will stop and another compressor will be forced to start.after a programmable running time.

7.18.8 Compressors starting time limitation

If there are several compressors in a circuit but only one is running, after a programmable running time the compressor is stopped and another compressor is started (the first compressor available according to the number of running hours or of starts).

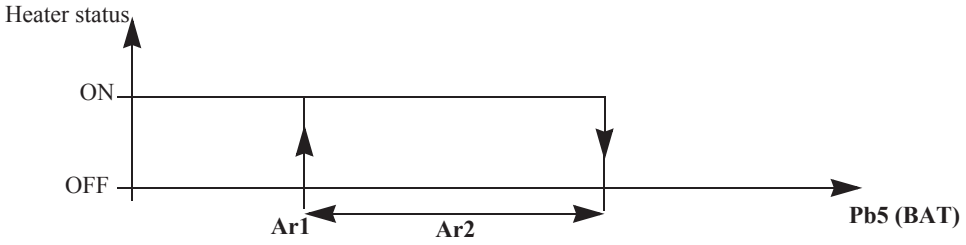
7.19 Unloading function

This function makes it possible to reduce the unit cooling capacity when required; it may affect the entire unit or a single circuit and it is achieved by stopping one or more compressors. The unloading types are as follows:

- **Unloading due to high temperature**: having defined a setting and an unloading differential, if the temperature measured by the probe remains above the setting for an activation time, one compressor is stopped in each circuit. If the temperature of the probe becomes lower than, or equal to, the unloading setting less the differential, or if the associated maximum duration has elapsed, the unloading function is deactivated and the compressors start again.
- **Unloading due to high pressure (if high pressure transducer is present)**: having defined a setting, a differential, and an unloading time, if the condensing pressure measured in a circuit is greater than or equal to the setting, the unloading function is activated in the circuit and one compressor is stopped only in the circuit involved. The unloading function is deactivated only if the condensing pressure drops and remains below the unloading setting for a pre-set time or if it falls below set - diff.

7.20 Anti-freeze heaters

The anti-freeze heating element is standard on the versions for minimum ambient temperatures of -5°C.
It ensures protection against the risk of freezing, when the ambient temperature drops.
The heating element is wrapped around the condensate separator, on the condensate drain and on the zone below the exchanger.
Activation of the heating elements is managed via the electronic controller, via an ambient temperature probe.
The heating element activation logic is described below.



7.21 Fans control

The fans can be controlled as follows (see chapter 4.5 “Fans (condensing section)”):

- ON/OFF
- by steps
- with speed control.

The selection is made on the basis of the unit configuration.

ATTENTION

Speed control is not present in dual frequency models.

7.21.1 Units configured with "STEP" control fans

These units are equipped with a pressure transducer located on the refrigerant compressor discharge line.
On the basis of the pressure read by the transducer, the electronic controller manages operation of the fans according to ON-OFF logic, i.e. switching the fans power supply on and off.

7.21.2 Units configured with fans speed control

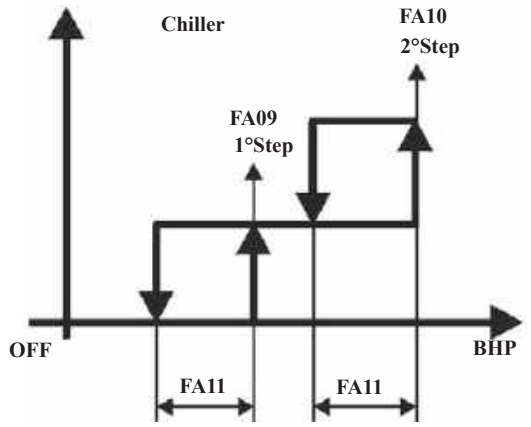
The units are equipped with speed controllers that keep the condensing pressure around a preset value.
These units are equipped with a pressure transducer located on the refrigerant compressor discharge line.
For example, if the temperature of the air conveyed to the condenser drops, the pressure transducer detects a drop in condensing pressure, which on sending the signal to the speed controller reduces the fans rpm thus decreasing the air flow through the condenser.
Similarly, in the case of an increase in the temperature of the air conveyed to the condenser, with a consequent increase in condensing pressure, the speed controller increases fan rotation speed to increase the air flow through the condenser

NOTE

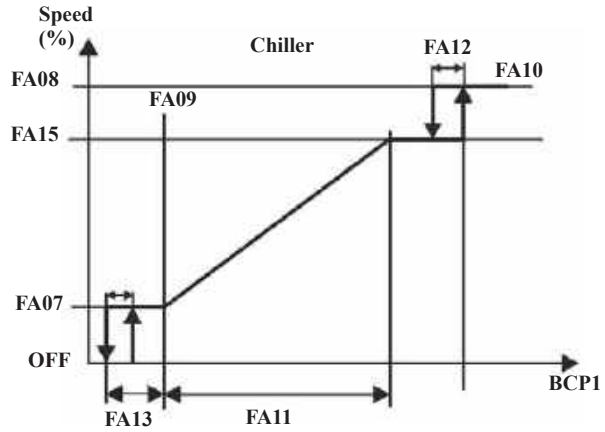
In high available pressure axial fans, the speed control is integrated in the fan motor.

7.21.3 Fan control diagrams

The following diagram illustrates the fans STEP control logic in accordance changes in condensing pressure.
STEP diagram:



Speed control diagram (high available pressure axial fans only):

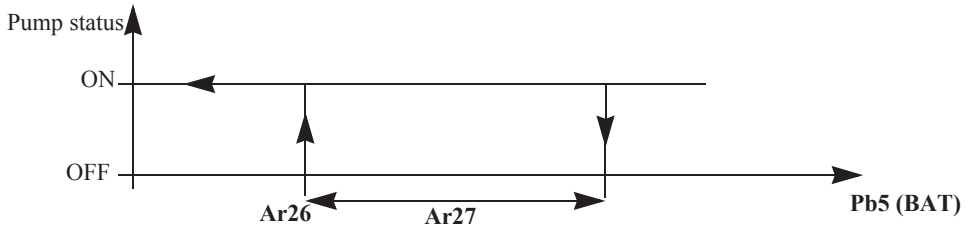


7.22 Hydraulic unit

There is one circulation pump installed (see chapter 4.8 “Pump serving the Thermal Mass circuit”).
When the unit is powered on, the pump starts and continues to run until the unit is set to OFF.

7.23 Anti-freeze pump management (if ambient probe is installed)

The pumps installed in the unit can be started in anti-freeze mode to prevent the formation of ice in the unit's hydraulic circuit. If the unit is powered off and the selected reference temperature is below the programmed setpoint, one of the pumps is started. The pump is stopped if the temperature increases above the set-point + differential, according to the following diagram:



7.24 ModBus

The supervision system provides the facility to monitor and act on certain of the unit's parameters by means of a remote device using the RS485 port. The MODBUS communication mode for the controller features the following characteristics:
Baud Rate = 9600 bps
Data Bit = 8 bit
Parity = None
Stop Bit = 1
Start/stop= 4milliseconds of silence (approximately 3 characters)
Minimum timeout = 500 ms
For further information, refer to the specific manual.

7.25 Automatic restart

In case of power failure, when power is restored the unit will be ON if it was ON at the time of power failure, and OFF if it was OFF.

7.26 Parameters description-settings

The following is a list of all the programmable parameters complete with their associated access levels.
U= user level

ATTENTION

Ensure these instructions are observed in full to avoid incorrect operation of the unit.

7.26.1 Parameters description

Parameter	Level	Description	Min.	Max.	Udm	Resolution	Value
Thermoregulator							
ST12	U	Dew-point setting (use SET key) Enables the dryer's working setpoint to be defined	ST02	ST03	°C °F	Dec Int	3 37.4
Pr1	U	User password	0	999			23
Display presentation							
dP01	U	Upper display default visualization: 0= no data displayed 3= common evaporator outlet probe 8= ambient air temperature probe for dynamic setpoint 16= air intake probe 17= air outlet probe 18= dew point probe 19= circuit condensing temperature probe 20= dry	0	20			18
dP02	U	Lower display default presentation: 0= no data displayed 3= common evaporator outlet probe 8= ambient air temperature probe for dynamic setpoint 16= air intake probe 17= air outlet probe 18= dew point probe 20= dry 21= energy saving 22= circuit condensing pressure probe 25= time display	0	25			16
Forced display visualization							
Remote terminals forced display presentation							
Display visualization in STD-BY							
Pr1	U	User password	0	999			23

Parameter	Level	Description	Min.	Max.	Udm	Resolution	Value
Unit							
Compressors							
Analogue inputs							
Probes offset							
Digital inputs							
Relay outputs							
Condensing proportional outputs							
Modulating outputs							
Remote terminal							
CF54	U	Configuration of remote terminal no. 1: 0= Absent 1= On board NTC probe 2= Without on board NTC probe	0	2			0
Operating logic							
Chiller / heat pump mode selection							
Automatic change-over							
Unit of measurement selection							
Net frequency selection							
Serial address							
CF64	U	Serial address.	1	247			1
Temperature control of compressors with different cooling capacity							
Compressors operation enabling							
Enabling of units with hybrid exchangers							
Buzzer enabling							
Chiller mode							
I/O expansion enabling							
Electronic expansion valve driver enabling							
Curve Enabling							
Unit Type							
I/O expansion configuration							
I/O expansion probes offset							
I/O expansion digital inputs							
I/O expansion relay inputs							
I/O expansion proportional outputs							
Modulating outputs							
Pr1	U	User password	0	999			23
Dynamic setpoint							
Sd01	U	Dynamic setpoint max increase in chiller mode Establishes the maximum variation of the working setpoint in chiller mode.	-30.0 -54	30.0 54	°C °F	Dec Int	0 32
Sd03	U	Dynamic setpoint ambient air temperature setting in chiller mode.	-50.0 -58	110.0 230	°C °F	Dec Int	25 77
Sd05	U	Dynamic setpoint ambient air temperature differential in chiller mode.	-30.0 -54	30.0 54	°C °F	Dec Int	15 27
Pr1	U	User password	0	999			23
Energy saving							
Pr1	U	User password	0	999			23
Compressors plant							
Compressor							
Capacity controls (INACTIVE FUNCTION)							
Compressor starting							
Compressors rotation - balancing - temperature control							
Evaporator water pump							
CO19	U	No. of hours for forced rotation of evaporator pumps.	0	999	10 Hours	10 Hours	4

Parameter	Level	Description	Min.	Max.	Udm	Resolution	Value
Condenser water pump							
Maintenance of loads							
Pump-down							
Evaporator unloading							
Condenser unloading							
Compressors liquid injection function							
Management of resources in neutral zone operation							
Evaporator water low temperature unloading							
Time controlled pump-down							
Compressor with modulating control							
Compressor forced rotation function							
Maintenance of loads							
Unit capacity control							
Pr1	U	User password	0	999			23
Circuit 1 auxiliary relay							
Circuit 2 auxiliary relay							
Auxiliary 0÷10V proportional output 1							
Auxiliary 0÷10V proportional output 2							
Modulating output minimum value							
Modulating evaporator pump							
Auxiliary outputs enabling							
Pr1	U	User password	0	999			23
Condensing fans							
Operation in chiller mode							
Operation in heat pump mode							
Hot start							
3-4 Fans step (chiller mode operation)							
3-4 Fans step (heat pump mode operation)							
Pre-ventilation in heat pump mode							
Pr1	U	User password	0	999			23
Anti-freeze - support - water heater							
Water heater function							
Water heater operation in chiller mode							
Water heater operation in heat pump mode							
Anti-freeze alarm							
Evaporator water pump operation with anti-freeze alarm							
Pr1	U	User password	0	999			23
Defrost (INACTIVE FUNCTION)							
Forced defrost (INACTIVE FUNCTION)							
Defrost mode (INACTIVE FUNCTION)							
Defrost start end from analogue input (INACTIVE FUNCTION)							
Delivery fan operation in defrost (INACTIVE FUNCTION)							
Defrost with condensing fans (INACTIVE FUNCTION)							
Hybrid exchangers							
Dynamic setpoint in defrosting (INACTIVE FUNCTION)							
Pr1	U	User password	0	999			23
Heat recovery							
Pr1	U	User password	0	999			23
Domestic hot water							
Pr1	U	User password	0	999			23

Parameter	Level	Description	Min.	Max.	Udm	Resolution	Value
Alarms							
Low alarms							
High alarm							
Compressor oil alarm							
Condenser flow switch operation							
Level sensor/evaporator flow switch alarm							
Compressors thermal alarm							
Pump-down alarm							
Anti-freeze alarm in chiller mode							
AL26	U	Chiller anti-freeze alarm set, provides facility to set a temperature value below which the anti-freeze, low ambient air temperature (air/air unit), low air outlet temperature (air/air unit) alarm is tripped (from **AL24** to **AL25**).	**AL24**	**AL25**	°C °F	Dec Int	-5 23
Anti-freeze alarm in heat pump mode							
Compressors discharge high temperature							
Generic unit shut-down alarm							
Alarms relay							
Alarms log - compressors thermal alarm reset password							
Compressor oil alarm management							
Unit generic block / signalling alarm no. 2							
High pressure alarm reset							
Condenser side water pump flow switch alarm							
Evaporator water inlet high temperature alarm							
Domestic hot water pump flow switch alarm							
Solar panels water pump flow switch alarm							
Domestic hot water heater thermal alarm							
Selection of anti-freeze alarm reset type							
Domestic hot water pump thermal alarm							
Compressor oil alarm							
Compressor thermal alarm							
FC pump pressure switch alarm							
Pressure switch alarm reset type							
Dryer							
Sc01	U	Operation of condensate drain valve: 0= Always on 1= Timer controlled	0	1			See Table 1
Sc02	U	Condensate drain ON time with compressor stopped (if parameter **Sc01**=1)	1	180	Sec		See Table 1
Sc03	U	Condensate drain ON time with two (three/four) compressors stopped (if parameter **Sc01**=1 and two (three/four) compressors configured)	1	180	Sec		See Table 1
Sc04	U	Condensate drain ON time with compressors running (if parameter **Sc01**=1)	1	180	Sec		See Table 1
Sc05	U	Condensate drain valve OFF time (if parameter **Sc01**=1)	1	600	Sec		60
Sc06	U	Condensate drain ON time (if parameter **Sc08**=2 and unit OFF/Stand-by)	1	60	Min		1
Sc07	U	Condensate drain valve OFF time (if parameter **Sc08**=2) and unit OFF	1	120	Min		30
Sc08	U	Condensate drain: 0= Always active (with unit OFF, compressors OFF times) 1= Active only with unit ON 2= Active with unit OFF with times Sc06 and **Sc07** (with unit ON as **SC08**=1 “Active”)	0	2			0
Sc09	U	Air intake probe low temperature setpoint	-50.0 -58	110 230	°C °F	Dec Int	0 32

Parameter	Level	Description	Min.	Max.	Udm	Resolution	Value
Sc10	U	Air intake probe low temperature pre-alarm differential	0.1 0	25.0 45	°C °F	Dec Int	5 9
Sc11	U	Maximum number of trips per hour of air intake probe low temperature pre-alarm	0	16			16
Sc12	U	Air intake probe low temperature pre-alarm setpoint	-50.0 -58	110 230	°C °F	Dec Int	0 32
Sc13	U	Air outlet probe low temperature pre-alarm setpoint	0.1 0	25.0 45	°C °F	Dec Int	5 9
Sc14	U	Maximum number of trips per hour of air outlet probe low temperature probe	0	16			16
Sc15	U	Dew-point probe low temperature pre-alarm setpoint	-50.0 -58	110 230	°C °F	Dec Int	-3 26.6
Sc16	U	Dew-point probe low temperature pre-alarm differential	0.1 0	25.0 45	°C °F	Dec Int	3 5.4
Sc17	U	Maximum number of trips per hour of dew-point probe low temperature pre-alarm	0	16			16
Sc18	U	Air intake probe low temperature alarm setpoint	-50.0 -58	110 230	°C °F	Dec Int	-15 5
Sc19	U	Air intake probe low temperature alarm differential	0.1 0	25.0 45	°C °F	Dec Int	5 9
Sc20	U	Maximum number of trips per hour of air intake probe low temperature alarm	0	16			5
Sc21	U	Air outlet probe low temperature alarm setpoint	-50.0 -58	110 230	°C °F	Dec Int	-15 5
Sc22	U	Air outlet probe low temperature alarm differential	0.1 0	25.0 45	°C °F	Dec Int	5 9
Sc23	U	Maximum number of trips per hour of air outlet probe low temperature alarm	0	16			5
Sc24	U	Dew-point probe low temperature alarm setpoint	-50.0 -58	110 230	°C °F	Dec Int	-5 5
Sc25	U	Dew-point probe low temperature alarm differential	0.1 0	25.0 45	°C °F	Dec Int	5 9
Sc26	U	Maximum number of trips per hour of dew-point probe low temperature alarm	0	16			5
Sc27	U	Air intake probe high temperature alarm setpoint	-50.0 -58	110 230	°C °F	Dec Int	65 149
Sc28	U	Air intake probe high temperature alarm differential	0.1 0	25.0 45	°C °F	Dec Int	5 9
Sc29	U	Air outlet probe high temperature alarm setpoint	-50.0 -58	110 230	°C °F	Dec Int	65 149
Sc30	U	Air outlet probe high temperature alarm differential	0.1 0	25.0 45	°C °F	Dec Int	5 9
Pr1	U	User password	0	999			23

	Condensate drain	
	Timed	**ID (Fixed)**
Sc01	1	0
Sc02	**RFE 032÷052:** 2 **RFE 060:** 3 **RFE 077÷090:** 4 **RFE 110:** 5 **RFE 130:** 3 **RFE 150÷190:** 4 **RFE 225:** 5	1
Sc03	**RFE 032÷150:** 1 **RFE 190÷225:** 3	1
Sc04	**RFE 032÷037:** 3 **RFE 045÷052:** 4 **RFE 060:** 5 **RFE 077÷090:** 6 **RFE 110:** 7 **RFE 130:** 5 **RFE 150÷190:** 6 **RFE 225:** 7	1

Table 1

CHAPTER 8

OTHER COMPONENTS

8.1 Compressor motor protection

The unit is equipped with an internal motor protection system by means of a power circuit breaker.

8.2 Refrigerant high and low pressure switches

The units are equipped with the following pressure switches:

1. **low pressure switch (LP)**
   This monitors refrigerant compressor suction pressure and will trip to protect the compressor if the pressure falls to potentially hazardous values that could harm the compressor. The pressure switch is of the "automatic reset" type. Alarm **b1LP** or **b2LP** (see chapter "7.15.7 Low pressure switch alarm"), generated by tripping of this pressure switch, can be delayed with respect to start-up of the compressor, to prevent temporary fluctuations in suction pressure or false alarms from interfering with correct operation of the unit. Once the preset time interval has elapsed tripping of this pressure switch will be detected by the electronic control unit, which will display alarm signal **b1LP** or **b2LP** (see chapter "7.15.7 Low pressure switch alarm") and shut down the compressor(s), while the pump will continue to run. After the alarm has tripped if the compressor suction pressure increases and exceeds the reset value the pressure switch will reset. The unit can be restarted by following the alarms reset procedure described in Chapter 7 "Electronic controller". If the cause of the pressure switch trip has not been remedied this cycle will be repeated continuously.
2. **high pressure switch (HP)**
   This monitors the refrigerant compressor discharge pressure and prevents it increasing to potentially hazardous values that could harm the compressor and people within the vicinity. The pressure switch is of the "automatic reset" type. Tripping of this pressure switch is read by the electronic controller, which opens the compressor power feeding circuit and displays alarm signal **b1HP** or **b2HP** (see section "7.15.6 High pressure switch and/or compressors thermal alarm").
   When the compressor discharge pressure decreases and falls below the reset point, the pressure switch resets automatically.
   The unit can then be restarted according to the alarm reset procedure described in Chapter 7 "Electronic controller".
   If the cause of pressure switch activation is not eliminated, this cycle may be repeated continuously.

The LP and HP pressure switches are connected to the refrigerant circuit pipes by means of SCHRAEDER valves (with needle) that prevent the refrigerant from escaping if the pressure switches are to be replaced.
The TRIP and RESET values of the pressure switches depend on the type of refrigerant and are shown in the following table:

Pressure switch	Refrigerant gases	TRIP		RESET	
		barg	°C	barg	°C
HP (RFE 032÷052, 090÷225)	R410A	41	64.7	33	55.0
HP (RFE 060÷077)		42	65.2	34	55.8
LP		2.5	-23.8	4	-14

8.3 Fan pressure switches

With fan speed control in ON/OFF mode these units are equipped with a Pressure switch (**FP**) that monitors the refrigerant compressor discharge pressure and is responsible for controlling operation of the fans in ON-OFF mode, i.e. connecting or disconnecting the fans electrical power supply.
The FP pressure switch is connected to the refrigerant circuit pipes by means of SCHRAEDER valves (with needle) that prevent refrigerant from escaping if the pressure switch is to be replaced.
The TRIP and RESET values of the pressure switch depend on the type of refrigerant and are shown in the following table:

Pressure switch	Refrigerant gases	TRIP		RESET	
		barg	°C	barg	°C
Axial Fans **FP**	R410A	27	46.1	21	36.1

With these values it is possible to check the condensation and the fan tripping.

Pressure transd ucers 8.4

Some models (RFE 090 ÷ 150 with centrifugal fans and RFE 190 ÷ 225 with high-head fans) are equipped with a high
. pressure transducer in the cooling circuit
The transducers detect the compressors discharge pressure values and control unit operation on the basis of the pressure setpoints set on the electronic controller.
Through the values read by the pressure transducers, it is possible to control condensing and unit fan activation.

8.5 Level sensor

All units are equipped with a level sensor. The level sensor is mounted in the tank where it is responsible for signalling low water level conditions. If this problem is detected the sensor sends an alarm signal to the control unit resulting in an immediate shutdown of the chiller.

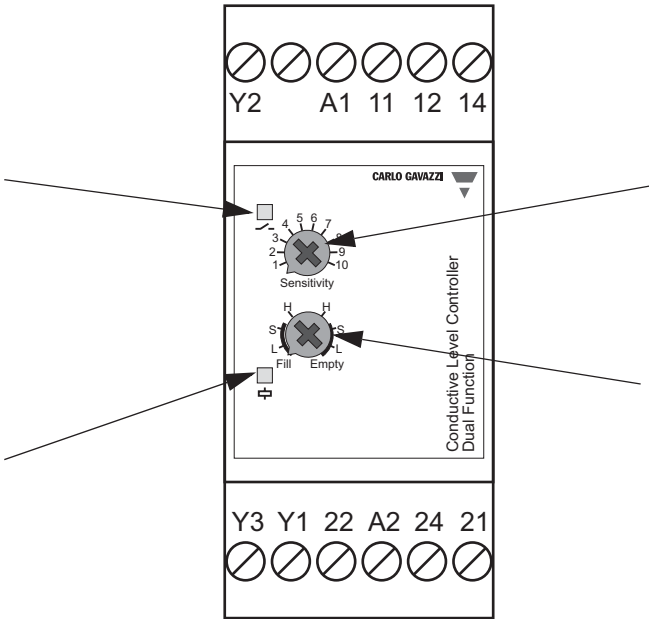
ATTENTION

Adopt all the possible precautions in order to prevent accidental contact with electrically live parts.

The voltage present in the electrical cabinet can reach values that are potentially fatal for humans.

The Amber LED switches on in the presence of water (in normal operating mode) and switches off in the absence of water.

Power on the system; the green LED will switch steady on.



A Sensitivity adjustment

B Sensitivity adjustment range

Adjusting potentiometer **B** changes the sensitivity range of potentiometer **A**

B	**A**
L	250 Ω ÷ 5 KΩ
S	5 KΩ ÷ 100 KΩ
H	50 KΩ÷ 500 KΩ

ATTENTION

The level sensor has been calibrated to function with 250kOhm sensitivity (position **A***=5,* **B***=H on the "Empty" side).*

Calibration of the level sensor is performed by the manufacturer so it must not be altered.

ATTENTION

There is an anti-tamper sticker over the adjustment potentiometers (A and B).

Damaging this sticker, even partially, will automatically invalidate the warranty.

CHAPTER 9

DRAIN SYSTEM

The unit is furnished with a condensate drain system which can be timed or the capacitive type. The type of drain system will be decided in offer phase.
The timed drain system is automatically controlled by the electronic controller which fixes the condensate drain intervals (see Chapter 7 “Electronic controller”).
The capacitive drain system features an electronic condensate level control system with a two-level capacitive sensor.
The electronic controller of the drain system continuously detects the signal from the capacitive sensor. See paragraph 9.2 “Capacitive condensate drain system”.

9.1 Timed condensate drain system

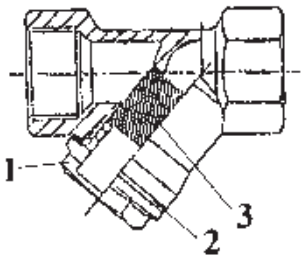
The timed condensate drain system must be carefully checked and serviced in order to prevent the separated condensate from being entrained with the flow of compressed air into the distribution system.

9.1.1 Filter cleaning

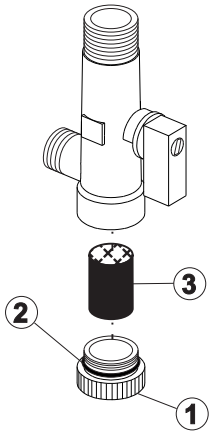
When a dryer is installed for the first time, it is common for particles of rust, pipe scale, metal filings etc. to find their way into the separator and then into the filter.
It should therefore be cleaned about a month after installation.Thereafter it should be cleaned once every 3 months.
In some installations, even more frequent cleaning may be required.
Depending on the type of machine, a normal mechanical filter or a condensate drain strainer with incorporated strainer (see figure on side) may be installed

- To remove the strainer mesh [3] close the on/off valve upline from the dryer.
- If the timed condensate drain is fitted with a Filterstop tap, just close the tap.
- Press the manual condensate drain button  to check that the filter is not pressurised.
- Open the IG main switch to disconnect the power supply to the dryer.
- Carefully unscrew the filter cap [1] retaining the sealing gasket [2] and remove the strainer mesh [3].
- Once cleaned, re-insert the mesh making sure it is home and square and tighten cap [1].
- Replace the sealing gasket [2] if it is damaged.
- After re-opening the on/off valve or the Filterstop tap, switch on IG again and re-start the unit.

Mechanical condensate filter



Condensate drain strainer



1. Filter cap
2. Sealing gasket
3. Strainer

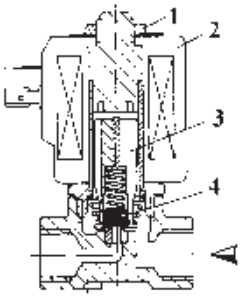
9.1.2 Solenoid valve maintenance

The solenoid valve must always be protected by an appropriate filter to prevent solid particles preventing it from opening and closing correctly.

However, if these particles manage to cross the filter and cause the valve to malfunction, all its internal components must be cleaned.
Proceed as follows:

- isolate and depressurise the dryer;
- open the main switch IG to turn off power to the dryer;
- unscrew the nut fixing the cap for the valve power supply;
- 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 the tie-rod [3];
- unscrew the tie-rod from the valve seat; check the condition of the O-ring seal [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 arrow pointing in the right direction.

Condensate drain solenoid valve



1. Fixing Nut
2. Solenoid
3. Rod
4. O-ring

ATTENTION

Do not tighten the nut [1] excessively as this could cause the valve to open and close incorrectly.

9.2 Capacitive condensate drain system

The capacitive condensate drain system CDE 2050 has been designed to discharge condensate without compressed air escaping; all impurities are held by a large surface stainless steed filter.

9.2.1 Description

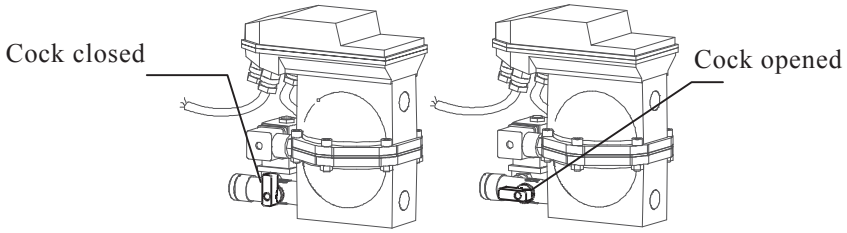
The drain system's body is constructed of two die-cast aluminium half-shells (1), see “Fig.1 Drain system” and “Fig.2 Drain system exploded view”, and a NBR gasket in between (6). A capacitive level sensor (2) is connected to the electronic controller that is protected by a plastic container (3) fixed on the top of the drain system.
There are 3 LEDs on the outside of the plastic box: LD1 (yellow) signals that the drain system is correctly supplied, LD2 (green) signals that the solenoid valve is open, and LD3 (red) indicates that an alarm situation has occurred. The  button permits the manual drain of condensate.
Inside the Filterstop cock (10) there is a large surface stainless steel filter (4). A solenoid valve directly controls the discharge of condensate (5); the valve is made of a brass body and stainless steel internal parts.
There are two 1/2" pipe connections.

9.2.2 Operation

The drain system has an electronic condensate level control system with capacitive sensor working on two levels.
The electronic controller reads the signal from the capacitive sensor (2) continuously.
When the condensate's level reaches the sensor's top limit L2 the solenoid valve (5) is energized and condensate is discharged (see “Fig. 3 Drain system operating logic”). When the condensate's level reaches the sensor's lower limit L1 (2) the solenoid valve (5) is de-energized and the condensate discharging is stopped.

9.2.3 Precautions during the use

During normal operation be sure that the Filterstop cock (10) level (8) is in the open position (see figure below and “Fig.2 Drain system exploded view”).



9.2.4 Condensate alarm

If the discharge operation is irregular (i.e. because of an excessive quantity of condensate or drain line is obstructed) and the condensate's level remains greater than L2 water level for more than 60 seconds, the alarm will trip and the red LD3 LED will light up (see “Fig.1 Drain system”). When the alarm is active the solenoid valve will stay open for 4 minutes and then will work in a cyclical way by closing the electronic contacts for 6 seconds every 2 minutes. The condensate drain alarm also trips, blocking the compressor (see chap. 7.15 “Dryer probe alarms”). This procedure will continue until the cause of the problem is eliminated and the drain system starts working normally.

9.2.5 Maintenance precautions

Before operating, make sure that all the pressurised parts of the drain system are at atmospheric pressure.
If replacement parts are needed use only original spares.

Fig.1 DRAIN SYSTEM

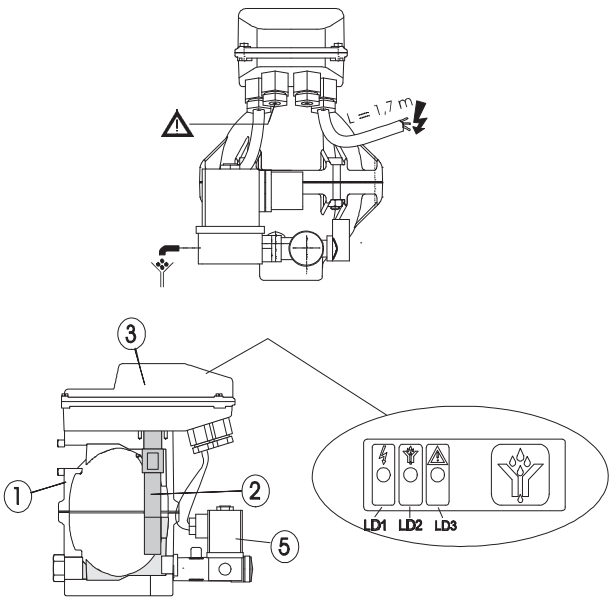


Fig.2 DRAIN SYSTEM EXPLODED VIEW

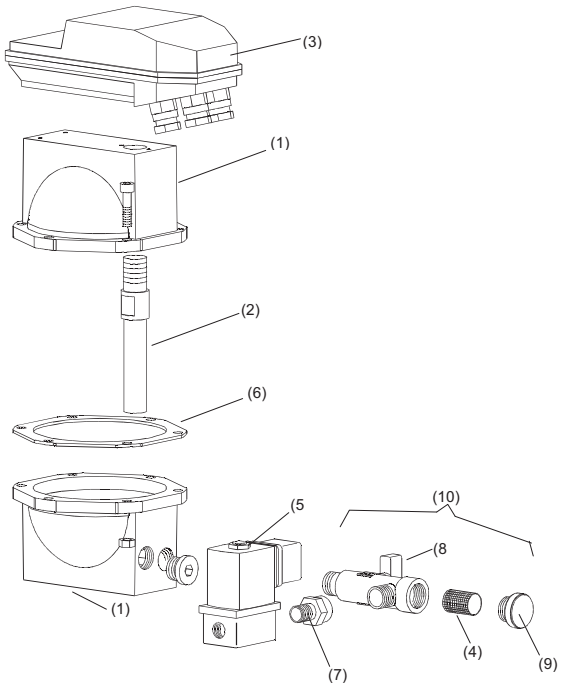
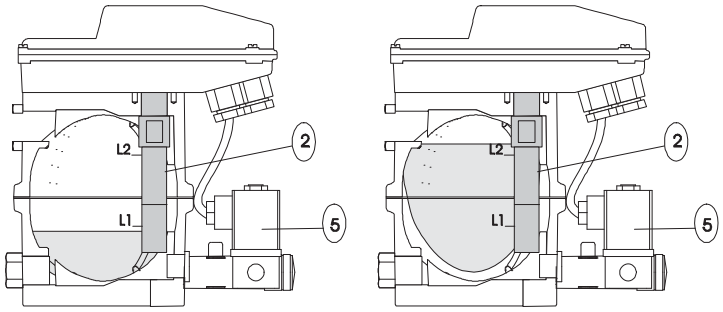


Fig. 3 DRAIN SYSTEM OPERATING LOGIC



OPERATION AND MAINTENANCE

10.1 Operation

Do not turn off the dryer if there is no compressed air flow for brief periods. The dryer has an adjustment system which adapts its cooling capacity to the real demand. If the thermal load due to the compressed air flow is between 0% and 100% of the available cooling capacity, the control system ensures a nearly constant dew point (approx. 3°C/37.4°F); if the thermal load is greater than 100% of the available cooling capacity the dew-point increases as a result.
It is advisable to switch off the dryer when the flow of compressed air is suspended for long periods (e.g. at weekends). **In this case, remember to turn on the dryer at least 10-15 minutes before the air compressor.**

ATTENTION

If the system is to be shut down for long periods of time, the condensation should be drained from the discharge line (by holding down the manual discharge key for a few minutes).
Failure to perform this drainage procedure may cause damage (ice and/or dirt in drain lines).

10.2 Maintenance

ATTENTION

Before installing or operating these units, ensure that all personnel involved have read and understood Chapter 2 "Safety"

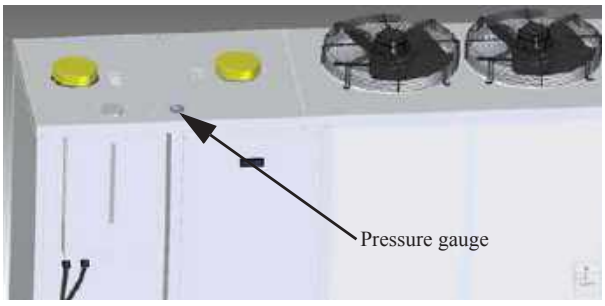
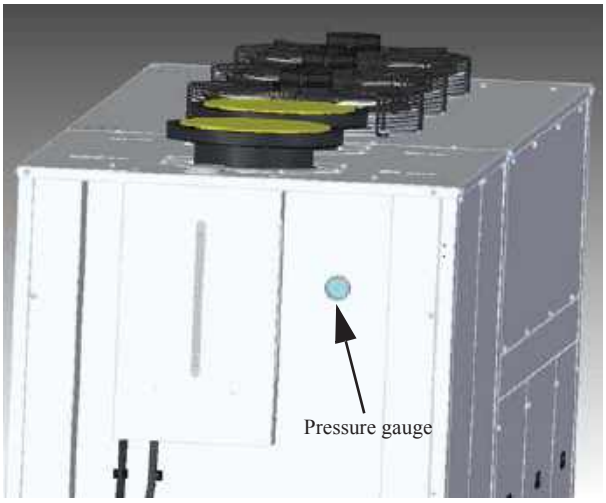
These dryers will give many years of trouble-free service if they are properly maintained and serviced.

10.3 Access to the unit

ATTENTION

Do not perform any type of maintenance or repairs on pressurised parts.

To ensure the compressed air circuit is depressurised, check the pressure gauge fitted on all unit models as indicated in the figures below.
In the case of leaks in the compressed air circuit, shut off the compressed air flow immediately.
Install adequate safety devices in compliance with statutory legislation governing the operation of pressure equipment in the country of use.

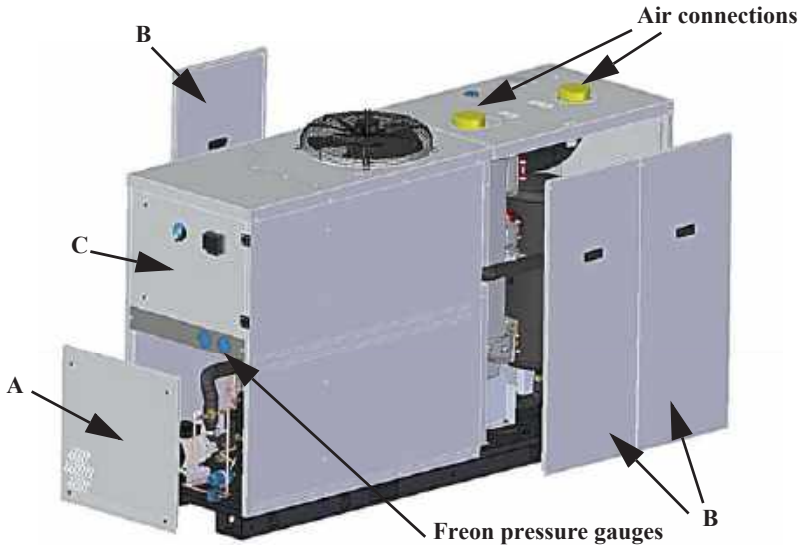
RFE 032÷110	RFE 130÷225
	

ATTENTION

Any task that requires the panelling to be opened must be performed only with the unit powered off and disconnected from the electrical supply.

: RFE 032÷077

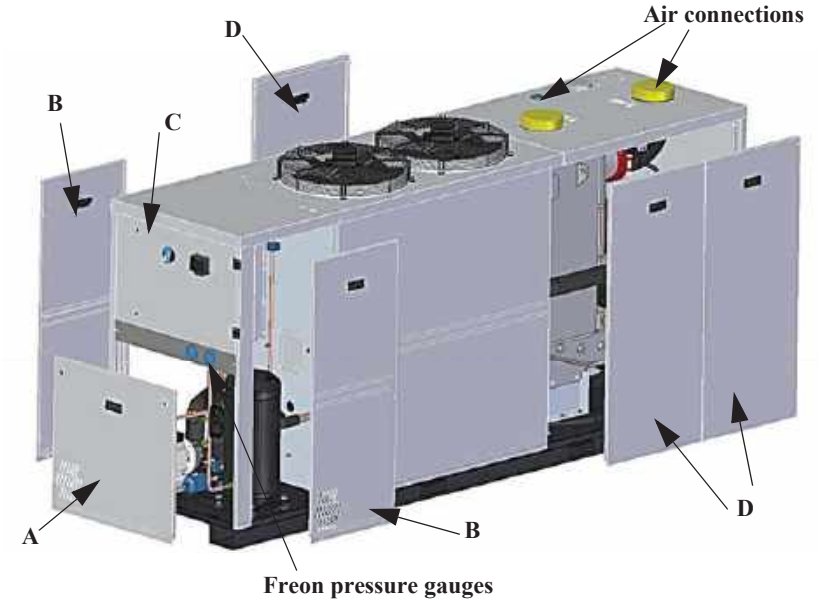
To access the refrigerant circuit components and the pump use the wrench supplied with the unit and open the latches securing front panel (**A**).
To access the air circuit components use a screwdriver to undo the screws fixing the panels (**B**).
To access the electrical circuit components remove front panel (**C**).



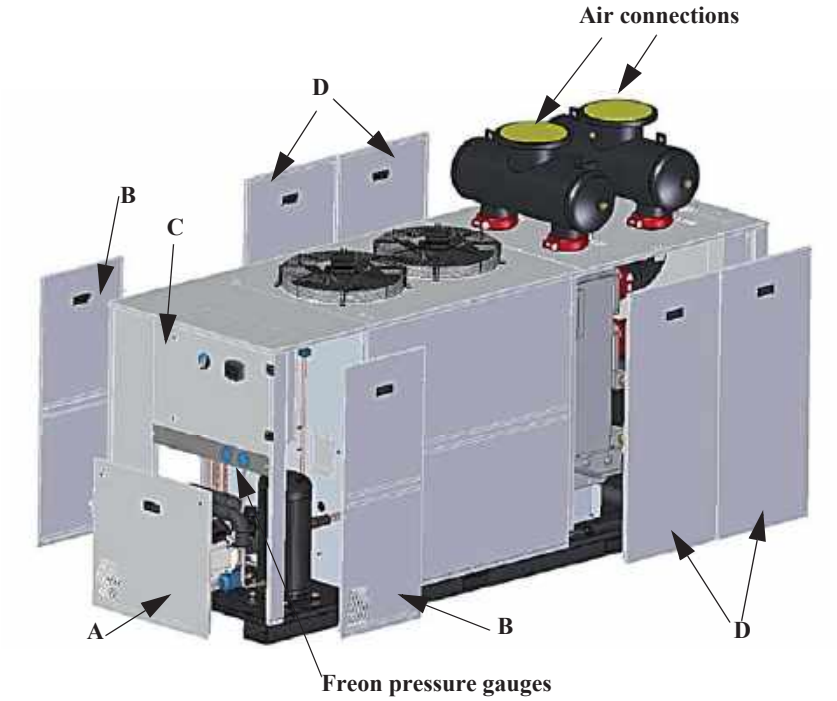
RFE 090÷150

To access the components of the refrigerant circuit and the pump open the latches securing panel (**A**). You can also access the refrigerant circuit components by removing the side panels (**B**).
To access the electrical circuit components remove front panel (**C**).
To access the air circuit components use a screwdriver to undo the screws fixing the panels (**D**).

RFE 090÷110



RFE 130÷150



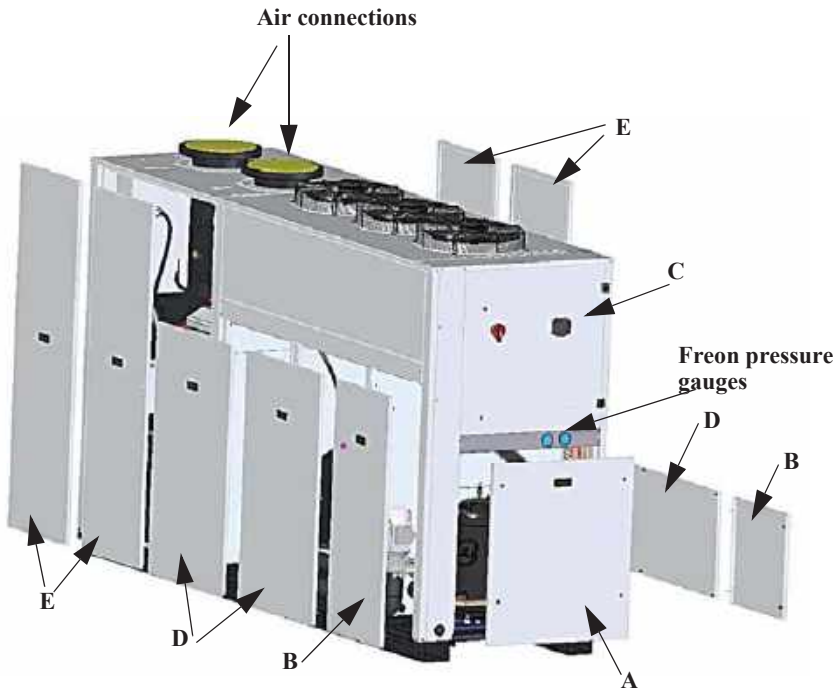
RFE 190÷225

To access the components of the refrigerant circuit and the pump open the latches securing panel (**A**). You can also access the refrigerant circuit components by removing the side panels (**B**).

To access the electrical circuit components remove front panel (**C**).

To access the evaporator and the hydraulic circuit components remove the side panels (**D**)

To access the air circuit components use a screwdriver to undo the screws fixing the panels (**E**).



10.4 Maintenance Schedule

OPERATION	1 day	1 month	6 months	Yearly
Check control panel display for any alarm signals.	◊			
Check reading of dew-point indicator. Check that, with the passage of compressed air, the temperature indicated by the electronic controller is between 0 °C (32 °F) and 4 °C (39 °F); These values may be exceeded for brief periods of time if there are oscillations in the compressed air flow, without, however, compromising the operation of the dryer.	◊			
Push the drain solenoid valve manual override button and check that the valve opens correctly.	◊			
Check compressed air inlet temperature is below limit for which dryer was selected (normally 35-40 °C / 95-104 °C). **(*)**		◊		
Check that the current absorbed by the dryer is within the data plate limits. **(*)**			◊	
Remove clean and replace the condensate filter. If the filter is always clogged with matter it may be necessary to dismantle and clean the solenoid valve.			◊	
Carry out visual inspection of refrigerant circuit, looking out for any deterioration of the piping or any traces of oil which might indicate a refrigerant leak.			◊	
Check the condition and security of piping connections.			◊	
Check the condition and security of wiring and electrical connections.			◊	
Using a spanner, check that the connections to the refrigerant compressor have not slackened.			◊	
Check that the ambient cooling air temperature is below the limit used for selection of the dryer (normally 25-30 °C / 77-86 °F). Check unit room is well ventilated.		◊		
Check that the fan unit is switched on automatically by the fan pressure switch. Check that fan operation is not noisy. Thoroughly clean the fins of the condenser with soft brush and/or jet of clean compressed air. Check that the grilles of the dryer are free from dirt and any other obstructions.			◊	
Clean condenser fins with a mild detergent.				◊

(*) For this purpose use specific test meters.

ATTENTION

The above maintenance schedule is based on average operating conditions.

In some installations it may be necessary to increase the frequency of maintenance.
Remove and clean condensate filter mesh within 1 month of installation.

CHAPTER 11

TROUBLESHOOTING

PROBLEM	CAUSE	SYMPTOM	REMEDY
A Tank water outlet temperature **BTWOT** higher than prescribed value.	**A1** Thermal load too high.	**A1.1** **BTWOT** temperature higher than prescribed value.	Restore thermal load to within prescribed limits.
	A2 Ambient temperature too high.	**A2.1** See A1.1.	If the unit is installed in an enclosed place, reduce ambient temperature to within the prescribed limits, for example by increasing room ventilation.
	A3 Condenser fins fouled.	**A3.1** See A1.1.	Clean the condenser fins.
	A4 Front surface of condenser blocked.	**A4.1** See A1.1.	Remove the obstruction from the front surface of the compressor.
	A5 No refrigerant fluid in the circuit.	**A5.1** • See A1.1; • Low evaporation pressure; • Check for the presence of a large number of air bubbles on the liquid sight glass.	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Have the circuit charged by a qualified refrigeration engineer.
	A6 Compressor protection trips.	**A6.1** • The head and the body of the compressor are very hot; • The compressor stops and attempts to restart after a short time (even few seconds).	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Have the circuit charged by a qualified refrigeration engineer.
B Dew-point temperature higher than expected.	**B1** Compressed air to be dried temperature too high.	**B1.1** • Dew-point and compressed air inlet temperatures higher than expected; • The alarm signal relative to the problem is displayed on the electronic controller; • Main alarm relay tripped (see Chapter 7 “Electronic controller”).	Reduce the compressed air inlet temperature within design limits.
	B2 Compressed air flow to be dried too high.		Take steps to reduce the compressed air flow rate within the design limits.
	B3 Compressed air pressure to be dried too low.		Take steps to restore the air working pressure within the design limits.
	B4 Ambient air temperature too high.		If the unit is installed indoors, reduce ambient temperature to within rated limits, e.g. installing fans to extract the air.
	B5 Dirty condenser fins.		Clean the condenser fins.
	B6 Front surface of the condenser obstructed.		Remove the obstruction from the front surface of the compressor.
	B7 The fan rotates in reverse.		Invert the position of two of the three phases of the power supply.

PROBLEM	CAUSE	SYMPTOM	REMEDY
	B8 No refrigerant fluid in the circuit.	**B8.1** • Compressor doesn't stop even if there is a little air flow; • The head of the refrigerant compressor is very hot; • there is ice downline of the thermostat; • Power absorption lower than expected; • Also see B1.1	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Have the circuit charged by a qualified refrigeration engineer.
C Excessive air pressure drop.	**C1** See B2 and B3.	**C1.1** • Dew-point temperature increased (see B1.1); • Pressure downstream of the dryer lower than expected.	Restore the compressed air pressure and flow within the design limits.
	C2 There is an increase in the pressure drop and the dryer freezes.	**C2.1** See point D.	See point D.
	C3 Exchangers obstructed by dirt entrained by the compressed air.	**C3.1** Pressure down-line from the dryer lower than envisaged value.	Clean the exchangers by running a detergent solution, not aggressive for steel, copper and aluminium, through it. Install a filter up-line from the dryer. Eventually replace the obstructed module/s
D The dryer is obstructed and the air does not flow.	**D1** Incorrect position of temperature probe **BTWOT** 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)	**D1.1** The value measured by the probe remains above the value envisaged, even if the compressor runs for long intervals (eg. for more than 10-15 minutes) without air transit.	Correct the position of the probe in the socket by inserting it correctly.
	D2 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”) will cause ice formation.	**D2.1** 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”). If this doesn’t solve the problem, renew the control board.
	D3 Temperature probe **BTWOT** not calibrated.	**D3.1** 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
E Presence of water downstream from dryer.	**E1** The piping of the distribution line is located in a cold environment (temperature lower than the dew-point under pressure of the compressed air) and is not insulated. In this case, condensation forms on the internal surfaces of the piping.	**E1.1** Dryer runs normally. Problems are caused by external factors.	Insulate the piping exposed to low ambient temperatures.
	E2 The compressed air flow and/or the pressure are out of their rated limits. Also see B2 and B3.	**E2.1** • Dew-point and compressed air inlet temperatures higher than expected; • The alarm signal relative to the problem is displayed on the electronic controller; • Main alarm relay tripped (see Chapter 7 “Electronic controller”).	Restore the compressed air pressure and flow within the design limits. If necessary, position the dryer upstream from the air receiver or increase the capacity of the air receiver.
F Presence of condensate downstream from dryer (units with timed drain system).	**F1** Condensate drain solenoid valve coil burnt out.	**F1.1** The condensate and/or compressed air are not discharged when the manual check button is pressed.	Replace the condensate drain solenoid valve coil.
	F2 Blocked strainer upstream from the solenoid valve.	**F2.1** Very little condensate is discharged when the valve opens.	Remove and clean the strainer (see Chapter 9 “Drain system”).
	F3 Solenoid valve opening time too short.	**F3.1** The condensate continues to flow when the manual check button is pressed after a programmed discharge.	Increase the solenoid valve opening time (see Chapter 9 “Drain system”).
	F4 (if an electronic controller has been installed (see Chapter 7 “Electronic controller”)). The solenoid valve closing time set is too long.		Reduce the solenoid valve closing time (if the installed electronic controller allows (see Chapter 7 “Electronic controller”)).
	F5 Solenoid valve orifice blocked.	**F5.1** 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 Chapter 9 “Drain system”).
	F6 The electronic controller 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 drain button is pressed. If the relay doesn't work, replace the electronic controller.

PROBLEM	CAUSE	SYMPTOM	REMEDY
G Presence of condensate downstream from the dryer (units with capacitive drain system).	**G1** Condensate drain system fault.	**G1.1** The condensate and/or compressed air are not discharged when the manual check button is pressed.	Repair or replace the condensate drain system.
	G2 Condensate drain solenoid valve coil burnt out.	**G2.1** The condensate and/or compressed air are not discharged when the manual check button is pressed.	Replace the condensate drain solenoid valve coil.
	G3 Blocked strainer upstream from the solenoid valve.	**G3.1** Very little condensate is discharged when the valve opens.	Remove and clean the strainer (see Chapter 9 “Drain system”).
	G4 Solenoid valve orifice blocked.	**G4.1** The condensate and/or compressed air are not discharged when the manual check button is pressed.	Isolate the drain system from the compressed air net, dismantle the solenoid valve, clean the components and re-assemble the solenoid valve (see Chapter 9 “Drain system”).
H Insufficient pressure head (water pressure) at the pump outlet.	**H1** Excessively high water flow rate. The pump is running outside its operating limits (high flow rate, low pressure head, high power consumption).	**H1.1** • Possible increase in outlet temperature **BTOWT** (See A1.1); • With pump installed on unit: pump running - pump stopped pressure difference read on unit pressure gauge is too low; • Possible pump thermal trip.	Restore flow rate to within prescribed limits, for example by partially closing a pump outlet cock. Reset pump thermal cutout and check electrical power consumption.
	H2 See point I.	**H2.1** See point I.	See point I.
	H3 Evaporator clogged by impurities conveyed by the user circuit water.	**H3.1** High temperature difference between water inlet and outlet.	In relation to the type of fouling: • Clean the evaporator by flushing it with a mild detergent suitable for steel, aluminium and copper; • Supply a high flow rate of water in countercurrent conditions. Install a filter upline from the unit.
	H4 The pump does not work or rotates in the opposite direction (three-phase power supply).	**H4.1** • See H1.1; • General alarm relay trip.	Check the pump electrical supply and, if necessary, invert two of the phases. Perform the alarm reset procedure to restart the unit (see Chapter 7 “Electronic controller”).

PROBLEM	CAUSE	SYMPTOM	REMEDY
I The alarm FLOW of level sensor trips. Alarm displayed: **AEFL**	**I1** Unit upline filter, if present, is clogged.	**I1.1** • Display shows code **AEFL**; • General alarm relay trip.	Clean the filter upline from the unit, if installed. Perform the alarm reset procedure to restart the unit (see Chapter 7 “Electronic controller”).
	I2 Storage tank not bled correctly.	**I2.1** • See I1.1; • General alarm relay trip.	Bleed the storage tank via the relative bleed valve.
	I3 Water inlet-outlet inverted (units without hydraulic kit).	**I3.1** • See I1.1; • General alarm relay trip.	Invert water inlet and outlet. Perform the alarm reset procedure to restart the unit (see Chapter 7 “Electronic controller”).
J High pressure switch (HP) trip Alarm displayed: **b(n)HP**	**J1** The fan doesn’t work.	**J1.1** • Refrigerant compressor stops; • Display shows code **b(n)HP** alternating with value of **BTOWT**; • General alarm relay trip;	Repair or replace the fan. Where fitted, check the circuit breaker of the fan. Perform the alarm reset procedure to restart the unit (see Chapter 7 “Electronic controller”). Check the fan speed control system.
	J2 Ambient air temperature too high.	**J2.1** • Ambient air temperature higher than maximum permitted value; • See J1.1.	If the unit is installed in an enclosed place, reduce ambient temperature to within the prescribed limits, for example by increasing room ventilation. Perform the alarm reset procedure to restart the unit (see Chapter 7 “Electronic controller”).
	J3 Recirculation of warm air due to incorrect installation.	**J3.1** • Condenser cooling air temperature higher than maximum permitted value; • See J1.1.	Change the position of the unit or the position of any nearby obstructions in order to prevent recirculation. Perform the alarm reset procedure to restart the unit (see Chapter 7 “Electronic controller”).
	J4 See A3.	**J4.1** See J1.1.	Clean the condenser fins. Perform the alarm reset procedure to restart the unit (see Chapter 7 “Electronic controller”).
	J5 See A4.	**J5.1** See J1.1.	Remove the obstruction from the front surface of the compressor. Perform the alarm reset procedure to restart the unit (see Chapter 7 “Electronic controller”).
	J6 Thermal load too high.	**J6.1** • Water outlet temperature too high; • Refrigerant compressor stops; • General alarm relay trip.	Restore thermal load to within prescribed limits if possible. Perform the alarm reset procedure to restart the unit (see Chapter 7 “Electronic controller”).

PROBLEM	CAUSE	SYMPTOM	REMEDY
	J7 Thermal load too high with insufficient refrigerant charge in circuit (see also A5).	**J7.1** • The head and the body of the compressor are very hot; • The compressor stops and attempts to restart after a short time (even few seconds). • Compressor thermal protection trips • Display shows message **C(n)tr** • LED of general alarm icon ⚠ illuminates.	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Have the circuit charged by a qualified refrigeration engineer.
	J8 Compressed air flow or temperature too high combined with high ambient temperatures.	**J8.1** • 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”).	Reduce the compressed air flow and temperature to within rated limits. Restart the unit.
K Low pressure switch (LP) trips Alarm displayed: **b(n)HP**	**K1** No refrigerant fluid in the circuit (see also A5).	**K1.1** • Refrigerant compressor stops; • Display shows code **b(n)LP** alternating with value of **BTOWT** probe; • General alarm relay trip.	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Have the circuit charged by a qualified refrigeration engineer.
	K2 Unit upline filter, if present, is fouled	**K2.1** See K1.1.	Clean or renew the water inlet filter, if installed.
L Compressor protection trips Alarm displayed: **C(n)tr**	**L1** Thermal load too high with insufficient refrigerant charge in circuit (see also A5).	**L1.1** • The head and the body of the compressor are very hot; • The compressor stops and attempts to restart after a short time (even few seconds); • Compressor thermal protection trips; • Display shows message **C(n)tr**; • LED of general alarm icon ⚠ illuminates.	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.
	L2 Incorrect rotation direction of scroll compressor (three-phase units only).	**L2.1** Refrigerant is not compressed and the unit is unable to provide cooling action.	Invert the position of two phase wires of the power supply.

PROBLEM	CAUSE	SYMPTOM	REMEDY
M Display blank and all LEDs switched off with main switch P1 set to ON (I).	**M1** Control circuit fuse has blown.	**M1.1** Using a tester, no voltage reading is obtained on the transformer secondary winding terminals.	Check the possible causes for blowing of the fuse. Change the fuse.
	M2 Abnormal power consumption by one or more of the control board components.	**M2.1** Despite the presence of power on the board terminals the display remains blank and the LEDs remain off.	Try powering off the unit and then powering it on again. If this fails to solve the problem contact an authorised service centre.
N Alarm displayed: **AP1÷AP6**	**N1** Probes damaged.	**N1.1** • See problem; • General alarm relay trip.	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.
O Alarm displayed: **b(n)Ac**	**O1** Low water outlet temperature. The value set in the relative parameter is lower than the value measured by the probe.	**O1.1** • See problem; • Compressor stops and then restarts; • General alarm relay trip; • LED of general alarm icon ⚠ illuminates.	Identify and remedy the problem that caused **BEWOT** temperature to fall to a value below **AL26**.
	O2 Water flow rate too low.	**O2.1** • See problem; • Compressor stops and then restarts; • General alarm relay trip.	Increase the water flow rate.
P Alarm displayed: **AtE1/AtE2** pump thermal cutout.	**P1** The pump thermal cutout has tripped because the water flow rate was too high.	**P1.1** • See problem; • General alarm relay trip; • Refrigerant compressor and pump stop; • The display shows the message **AtE1/AtE2** alternating with the value of the **BTWOT** probe; • Pressure difference read on the pressure gauge with pump running and pump stopped is lower than the available pressure head with pump maximum flow rate.	Reset thermal cutout. Increase hydraulic circuit pressure drop by partially closing, for example, a pump outlet cock.
	P2 The grille through which the pump cooling air flows is obstructed.	**P2.1** • See problem; • General alarm relay trip; • Refrigerant compressor and pump stop.	Reset thermal cutout. Remove obstruction from grille.
	P3 Pump malfunctioning.	**P3.1** • See problem; • General alarm relay trip; • Refrigerant compressor and pump stop; • Pump current input higher than nominal value; • Pump noise levels may be anomalous.	Reset thermal cutout. Renew pump.

PROBLEM	CAUSE	SYMPTOM	REMEDY
Q Alarm **ACFx**	**Q1** Configuration error.	**Q1.1** Code **ACFx** flashing on display and unit shuts down.	Power off the unit and then power it on again. If this doesn't solve the problem, contact the nearest service centre.
R Alarm **AEE**	**R1** Processor is not saving data correctly.	**R1.1** • Unit not working; • Code **AEE** flashing on display; • LED of general alarm icon ⚠ illuminates.	Power off the unit and then power it on again. If this doesn't solve the problem, contact the nearest service centre.

CHAPTER 12

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 10 “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 10 “Operation and maintenance”.
4. Risk of cutting or detachment due to fan blades / pump impeller.	Risk of cutting or detachment.	Strictly observe all manual instructions. Chapter 1 “General information”; Chapter 2 “Safety” and Chapter 10 “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. 5.4 “Piping” 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 10 “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 10 “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 10 “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. 5.5 “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. 5.5 “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. 5.4 “Piping”
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. 5.4 “Piping”
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. 5.2 “Location” and Chap. 5.4 “Piping”
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 9 “Drain system” and Chapter 10 “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 10 “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. 5.5 “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 Chap. 5.5 “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. 5.5 “Electrical connections” and Chapter 6 “Starting”
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. 5.5 “Electrical connections” and Chapter 10 “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 “Starting”
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. 5.4 “Piping”; Chapter 9 “Drain system” and Chapter 10 “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 10 “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. 5.2 “Location”; Chap. 5.4 “Piping” and Chapter 6 “Starting”
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. 5.2 “Location”; Chap. 5.4 “Piping”; Chapter 6 “Starting” and Chapter 10 “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. 5.5 “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 9 “Drain system”; Chapter 10 “Operation and maintenance”