

ROTAIR S.p.A.

Operating manual
of the
electrocompressor
with electronic card
Airmaster S1

RVD

[]	RVD 40
[]	RVD 50

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-- 1) IDENTIFICATION DATA --

Here follows details of the information printed on the machine identification plate situated at the front of the machine.

MODEL: **RVD**

REGISTRATION NO.:

MASS (Kg):

AIR DELIVERY (litres per minute) * :

WORKING PRESSURE (bar):

YEAR OF CONSTRUCTION:

ACOUSTIC POWER dB(A) ** : < 100

(*)Measured in accordance with ISO 1217 standards ($\pm 5\%$).

(**)Measured in accordance with directive CEE 84/533, technical adaptation 85/406/CEE.

**CAUTION:**

The use of non-original ROTAIR S.p.A. spares will result in the immediate cancellation of the guarantee.

On requesting assistance or ordering of parts always cite the model number and registration number above.

-- 2) TECHNICAL DATA --

Model	Motor rated power HP	Motor rated power kW	Air output ISO 1217 lt/min.	Voltage V	Frequency Hz	Air connector 1" 1/2	Pressure bar	Pressure psi	Weight Kg
RVD 40-8	40	30	5100	400	50	1" 1/2	8	114	550
RVD 40-10	40	30	4400	400	50	1" 1/2	10	145	550
RVD 50-8	50	37	6400	400	50	1" 1/2	8	114	660
RVD 50-10	50	37	5500	400	50	1" 1/2	10	145	660

-- OIL SYSTEM CAPACITY: 12 litres

(*) Q8 SCARLATTI 46 oil is recommended.

Similar types permitted:

DICREA 46	AGIP
COMPRESSOR OIL 46API	
ENERGOL RC-R 46	BP.
COMPRESSOR 46	ERG.
RARUS 425	MOBIL.
LR CCW 46	ROLOIL.
CORENA D 46	SHELL
DACNIS VS 46	TOTAL.

MOTOR:

For all other information, regarding the motor, consult the use and maintenance booklet of the manufacturer itself, enclosed with this documentation.

COMPLETE MACHINE:

-- MAX. ENVIRONMENTAL TEMPERATURE: 40 °C
-- LENGTH : 1825 mm
-- WIDTH: 1044 mm
-- HEIGHT: 1185 mm

-- 3) THE PURPOSE OF THE MANUAL AND WHO IT IS TO BE CONSULTED BY -

The owner, user and maintenance technician must carefully study the manual to ensure that it is used for the purposes for which it has been designed and constructed.

It is essential that all the information contained in this manual are applied, in order to ensure optimum use of the machine under the safest conditions.

The correct and careful use of the machine in accordance with the instructions contained in this manual, will ensure the long life of the machine, and will also enable the personnel to prevent the risk of any accidents or injury during work.

This manual must be carefully conserved, in its special case, away from any humidity, heat and sun's rays, to ensure that it is ready for consultation at any time, both by the operational personnel and the maintenance staff.

It is important to ensure that the special maintenance operations in particular are undertaken by specialized personnel.

In the event of loss or damage of this manual, ROTAIR S.p.A. must be asked for a copy, citing the relative machine identification details as shown on the plate on the machine.

Should the plate become illegible, use the details quoted on the invoice on requesting a new manual.

Further information or instructions for use or relating to any further interventions necessary on the machine can be request ROTAIR S.p.A. directly, always citing the machine identification details.

This machine has been exclusively designed and **built to supply compressed air** in the conditions as envisaged by the manufacturer. Any other use not envisaged in this description will be considered as being "*non conforming*" and will release the manufacturer from any further responsibility which will fully that of the user itself.

"*Conforming use*" presupposes the observance of the following regulations concerning the use, maintenance and transport of the unit itself.

It is also necessary to ensure that all the accident prevention regulations hereby described are followed, also in accordance with general safety regulations as indicated in the current legislation.

The constructor declines any responsibility in the event of any modifications made to the machine without its authorization.

The machine is supplied complete with the following documents:

- 1) - General use and maintenance booklet;
- 2) - Motor use and maintenance booklet;
- 3) - Declaration of machine conformity to the R.E.S. of EEC directive 89/392;
- 4) - Conformity certificate of the oil separator tank;
- 7) - Certificate of conformity of the safety valves of the oil separator tank;
- 9) - Compressor guarantee certificate.

-- 4) ENVISAGED MACHINE USE --

The **RVD** compressor is a machine which generated a well-defined quantity of compressed air measures in litres per minute.

There are many field of application for the use of all those tools, accessories and implements which have a "**pneumatic**" function.

Each instrument has a compressed air consumption measured in litres per minute.

The best ratio between compressor and tool is when the compressed air consumption of this last does not exceed 85% of the air generated by the compressor (also bear in mind that the quantity of compressed air requested by the tool, will increase in proportion to the wear of the tool itself).

A correct compressor-tool ratio will ensure that the machine operates efficiently and will guarantee maximum performance.

If the tool is too big it will jeopardise the correct function of the machine, and its performance will be impaired, not having the necessary amount of compressed air.

This machine has been designed to work at an environmental temperature of between **-10** and **+40°C**.

serves to lubricate the bearings and to maintain a coating of oil between the rotors and the bearings themselves as well as the internal cylinder walls, thereby promoting compression resistance. Another important function of the oil injected between the rotors is that of absorbing the heat generated by the air compression.

The compressed air supplied by this compressor is free of any pulsations and compression comes about axially. A "regulator" unit is mounted on the compression unit, the purpose of which is to regulate the quantity of air taken in according to the amount of air consumed. A double-stage filter mounted on the top of this unit guarantees maximum purity of the suctioned air.

-- 5.4) OIL SEPARATOR TANK --

Consists of a pressurized container, and due to its construction features it is exempt from the annual I.S.P.E.L. inspection and is supplied with a conformity certificate issued by the manufacturer. The identification and inspection details are impressed on a plate which is welded to the machine.

The lid features the following elements: safety valve for overpressure, a thermal switch which intervenes if the temperature inside the tank exceeds 100°C and valves which regulate the maximum and minimum pressure of the machine.

-- 5.5) BELL AND FLEXIBLE COUPLING --

The engine and the compressor are interconnected by a bell which guarantees concentricity between the engine flywheel and the compressor shaft.

A large-size block joint with rubber pieces interspaced transmits power in a smooth and silent way without splitting.

The engine-compressor thus assembled is clamped to the frame with four flexible supports (silent-blocks) which completely absorb the vibrations it generates. A fan is splined to the engine shaft on the opposite side to the flywheel which generates large air displacement which cools the machine fluids and elements.

-- 5.6) ELECTRO-BLOWING FAN AND HEAT EXCHANGER --

The necessary cooling of the electrocompressor is guaranteed by the electro-blowing fan placed near the heat exchanger. The produced air flow, by going through the combined air-air and air-oil heat exchanger, cools both the outlet compressed air and the oil in the machine.

-- 6. ELECTRONIC CARD DESCRIPTION --**6.1 General Operation**

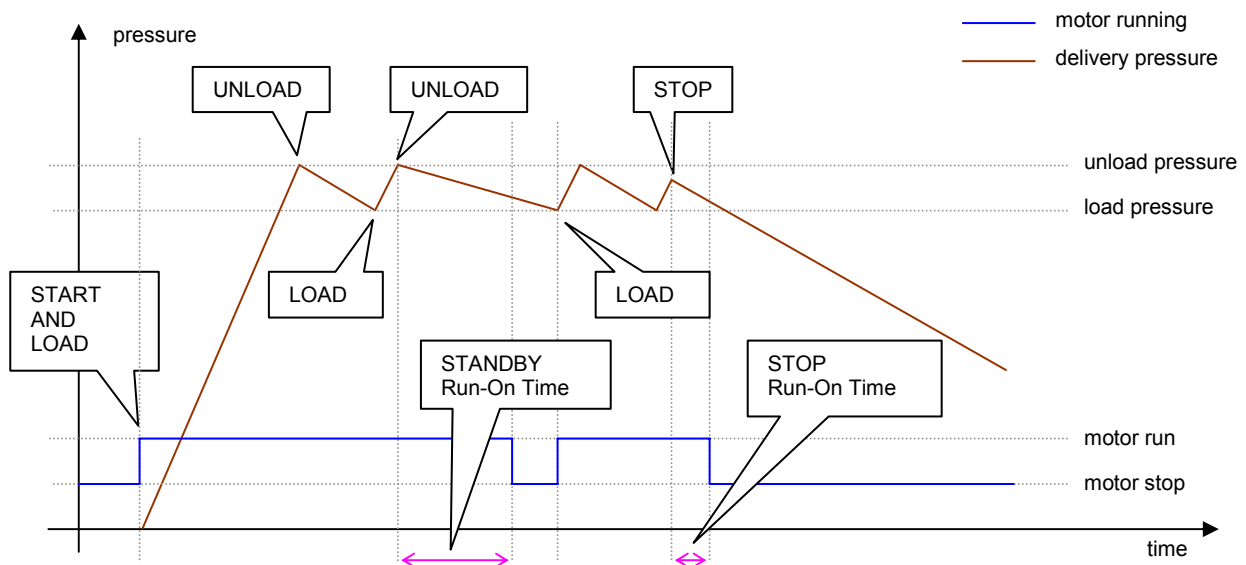
In normal operation, the detected delivery pressure controls regulation of the compressor once the compressor has been started by pushing the start button, or by a remote start command if enabled. The controller will perform safety checks and start the compressor if no inhibiting conditions are detected.

If a start inhibiting condition exists the compressor will not enter the started condition and a start inhibit message is displayed. If a run inhibiting condition exists the compressor will enter the started condition but a main motor start is inhibited; the compressor will remain in the standby condition and a run inhibit message is displayed. If a load request is present, in accordance with internal pressure settings or by remote command, the main motor is started in a star/delta sequence. When running in delta configuration, after the star/delta time (adjustable) has expired, the load delay time (adjustable) prevents loading for a period to allow motor speed to stabilise. The load delay time can be set to one second if required. When the load delay time has expired the load valve output is energised and the compressor will load. If the unload pressure setting is reached, or a remote unload command is received, the load valve output is de-energised and the compressor will run offload for the standby run on time (adjustable) before the main motor stops and the compressor enters Standby mode. The compressor will load again if pressure falls below the load setting before the standby run on time expires. If in Standby mode, a motor start sequence followed by the load delay time is executed before loading.

In the event of a motor stop, initiated by a stop command or when entering standby mode, a blow down timer (adjustable) is started. If a start request is made during the blow down time the compressor will enter standby mode until the blow down time expires. If already in standby mode, and a load request is present, the compressor will remain in standby mode until the blow down time has expired. For units with internal pressure detection enabled, a minimum internal re-start pressure can also be set to prevent a motor start sequence before internal pressure is vented. In the event internal pressure fails to fall below the set minimum re-start pressure within two minutes after the set blow down time has expired, a blow down fault is generated and the compressor will shutdown. After an unload event a re-load timer (adjustable) is initiated that will prevent re-loading, this time can be adjusted to a minimum of one second if required. Normal automated operation is ended by pushing the stop button, a remote stop command or in the event of a shutdown fault.

When stopped manually, or by a remote command, the load valve is de-energised and the main motor allowed to run-on for the stop run on time (adjustable).

This time can be adjusted to a minimum of one second if required. Safety checks are made continuously, if there is a condition detected that presents a hazardous or damaging situation an immediate stop is performed and the reason displayed as a shutdown error message. If a warning condition is detected an Alarm message is displayed and normal operation continues.



6.2 Machine State Diagram

Controller operational logic is shown in the machine state diagram as state blocks with an associating status block number. The state block determines the functionality of the controller at any given time. The controller can only be in one state at any given time. The controller will move from state to state in accordance with the defined exit and entry conditions of each state block and the defined connections between state blocks.

Definitions:

Fault:

A detected abnormal condition that must be indicated to operator personnel and that may require controller automated safety action, dependant on fault type and definition.

Start Inhibit Fault (S):

A start inhibit fault is a condition that may present a danger or cause damage to the compressor if started whilst the condition is present. Start inhibit faults are only triggered if a compressor start from the ready to start condition is attempted. Start inhibit faults are not triggered during an automated motor start sequence from the standby condition. Start inhibit faults are self-resetting. A start inhibit fault code is displayed when triggered but is not recorded in the fault log.

Run Inhibit Fault (R):

A run inhibit fault is a condition that may present a danger or cause damage to the compressor if the main motor is started whilst the condition is present. Run inhibit faults are only triggered if a motor start sequence is initiated. Run inhibit faults are self-resetting and do not prevent the compressor from entering a started condition. A Run inhibit will hold the compressor in a standby state and will allow a motor start sequence when the condition is no longer present. A Run inhibit fault code is displayed when triggered but is not recorded in the fault log.

Alarm Fault (A):

An alarm fault is a warning condition that does not present an immediate danger or potential damage to the compressor. An alarm state will not shutdown the compressor or affect normal operation. An alarm fault code is displayed that must be manually reset to clear once the condition has been resolved or no longer exists.

Shutdown Fault (E):

A shutdown fault is a condition that may present danger or potential damage to the compressor if the condition persists. A shutdown fault will cause the controller to stop the compressor. A shutdown fault code is displayed that must be manually reset to clear once the condition has been resolved or no longer exists. Two types of shutdown fault are definable a) non-emergency shutdown, an immediate controlled stop is executed, b) emergency shutdown, an instantaneous stop is executed.

Unload Pressure:

The unload pressure is the delivery pressure level (adjustable) at which the controller will de-energise the load solenoid output and the compressor will offload.

Load Pressure:

The load pressure is the delivery pressure level (adjustable) at which the compressor will energise the load solenoid output and the compressor will load. If in the standby state, an automated main motor start sequence is triggered prior to load.

Main Motor Start Sequence:

The controller will energise the Star contactor output followed by the Main contactor output 200ms later. After the Star/Delta timer (adjustable) expires the controller will execute an automated Star to Delta contactor output changeover with a 50ms star to delta transition time. If a Stop command is received during the start sequence the controller will continue to execute the start sequence before stopping. This action is intended to limit the break current of motor starter contactors.

Load Delay Timer:

The star to delta output transition is immediately followed by a load delay time (adjustable) that will inhibit the load solenoid output from energising until the load delay time expires. Intended to allow the main motor speed to stabilize and other pre-load functions to occur.

Reload Delay Timer:

The reload delay time (adjustable) is a period of time immediately following a load to unload event during which the load solenoid output is inhibited from energising.

Blow Down Timer:

The blow down time (adjustable) immediately follows a main motor stop event. During the blow down time a start request is recognised but is not initiated until the timer expires. If the optional internal pressure detection feature is enabled the restart inhibit is also dependant on internal pressure falling below the 'start inhibit pressure level' (adjustable). Failure of internal pressure to fall below the set pressure level for a period of two minutes after the set blow down timer expires will result in a blow down trip fault. The remaining time in seconds is show on the Information Item display.

Standby Run-On-Time:

When off load the standby run-on-timer will start. If the compressor remains in an off load condition and the timer expires the main motor will stop and the compressor will enter the Standby state. The compressor will automatically re-start and load as required. This function is intended to improve efficiency during low demand periods and to limit the number, and interval between, motor start events. The remaining time in seconds is show on the Information Item display.

Stop Run-On-Time:

When stopped (stop button, remote stop input or remote stop command) the compressor will unload and the main motor continue to run for the stop run-on-time before stopping. This function is intended to allow for internal pressure venting and to limit lubrication oil aeration prior to the main motor stopping. The remaining time in seconds is show on the Information Item display.

Started State:

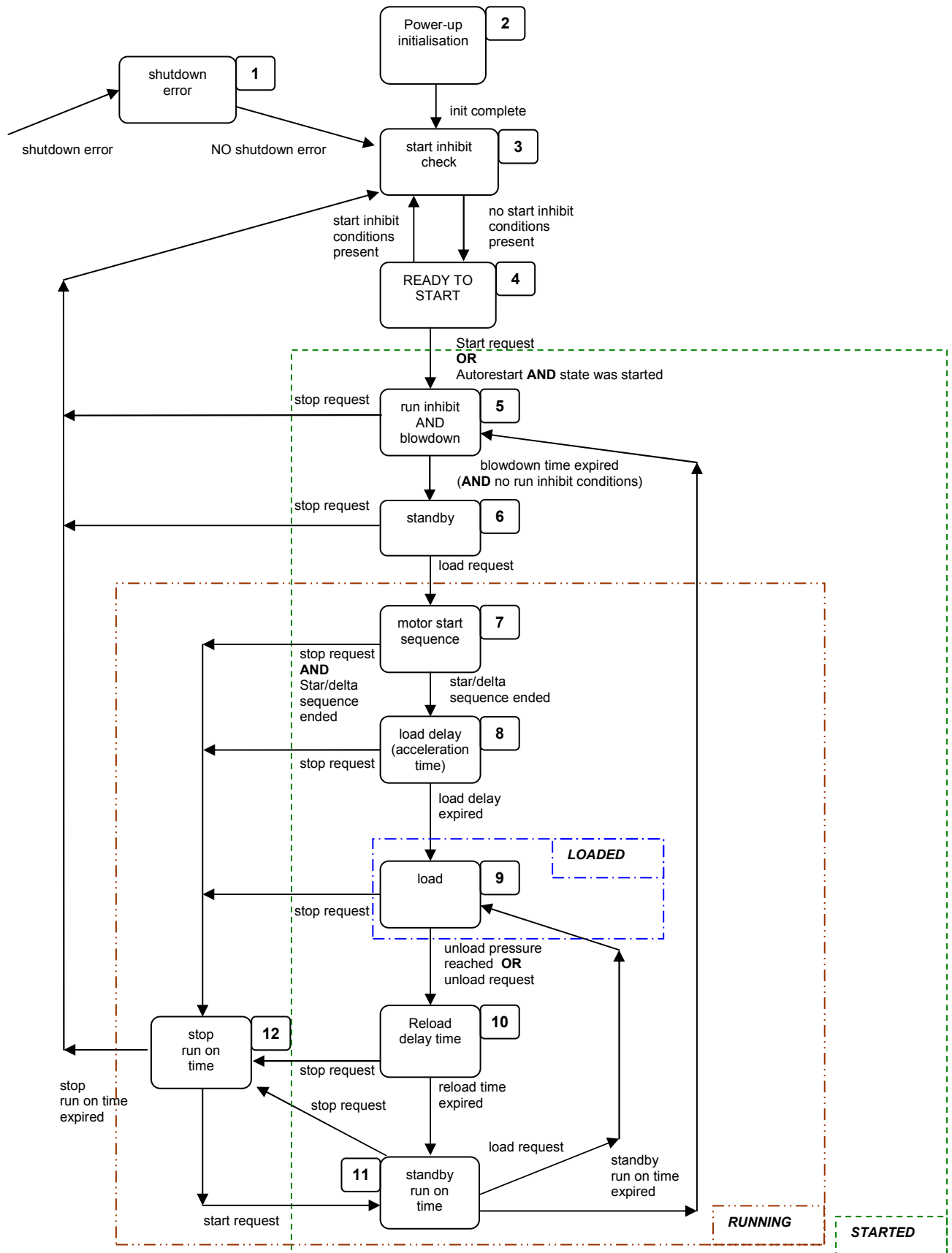
The unit has been started (start button, remote start input or remote start command) and is in an active condition ready to respond to changes in delivery pressure.

Running State:

The unit is in the Started state AND the main motor is running.

Loaded State:

The unit is in the Started state AND Running state AND the load solenoid output is energised.



7.0 User Interface



Display : Custom backlit LCD
Indicators : 2 x LED
Controls : 7 x Tactile push buttons

7.1 Keypad

START: Enter STARTED condition
STOP: Exit STARTED condition
RESET: Reset and clear fault conditions
ENTER: Confirm selection or value adjustments
MINUS/DOWN: Scroll down through menu, menu item options or decrement value
PLUS/UP: Scroll up through menu, menu item options or increment value
ESCAPE (C): Step back one menu navigation level

Start and Stop have one defined function and are not used for any other purpose.

Reset will initiate a display jump to the fault code item if a fault condition remains active or initiate a display jump to the information item if no active faults exist in normal display mode. If pressed and held for longer than two seconds in menu mode will exit menu mode to the normal operational display mode, page 00.

Enter will lock a selected value display preventing return, after a short delay, to the default Td value display. When locked the 'key' symbol will flash. To unlock press Escape.

Escape will initiate a display jump to the information item in normal display mode, page 00.

Plus, Minus, Enter and Escape are used to navigate menu mode and adjust menu parameters.

7.2 Led Indicators

STATUS: Green, adjacent to Start and Stop buttons

FAULT: Red, adjacent to Stop and Reset buttons

Indicator States:



ON: Illuminated continuously.

FF: Fast Flash: on/off four times per second.

SF: Slow Flash: on/off once per second.

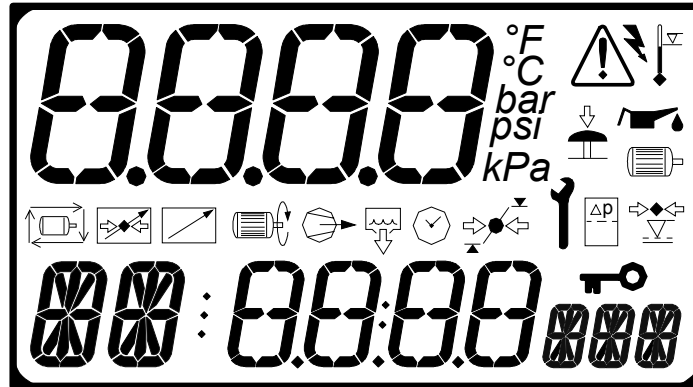
IF: Intermittent Flash: on/off every four seconds.

OFF: Extinguished continuously.

Machine State Number	Machine State	Status 	Fault 
1	Shutdown Error	OFF	FF
2	Startup Init	OFF	OFF **
3	Start Inhibit Check	OFF	OFF **
	Start inhibit condition		SF
4	Ready to Start	OFF	OFF **
5	Blowdown	if (load_request) FF else IF	OFF **
6	Standby	IF	OFF **
7	Start Motor in Star/Delta	if (load_request) FF else IF	OFF **
8	Load Delay	if (load_request) FF else IF	OFF **
9	Load	ON	OFF **
10	Reload Delay	if (load_request) FF else IF	OFF **
11	Standby Run on Time	IF	OFF **
12	Stop Run on Time	SF	OFF **

 ** SF for Alarm condition

7.3 Display



The display is divided in to 4 areas.

Top, Left: Display Field:-

4 character numeric display, with unit symbols, used to continuously show delivery pressure in normal operating mode or menu page number in menu mode.

Top, Right: Fault Symbol Field:-

Symbolic displays used to indicate common general fault conditions

Middle:

Symbolic displays used to reinforce meaning of selected item, fault condition.

Symbolic status information in normal operational mode 'Information Screen' item

Bottom:

Item and Value Field:-

Item identification: 2 character alphanumeric, 14 segment











Item Value: 4 character numeric, 7 segment

Item Unit: 3 character alphanumeric, 14 segment











Display Character Examples, Units:

BAR	bar	KPA	kPa	CFM	cfm	CFM	cfm
PSI	psi	Hh	hour	M3m	m ³ /min	m3	m ³ cubic metres
KW	kW KiloWatt	Mm	minute	FE3	ft ³ cubic feet	h/m	time hours/minutes
KV	kV KiloVolt	S	seconds	SPM	spm bearing monitoring	dmY	date day/month/year
RPM	rpm	mA	mA milliAmp	dBm	dBn spm unit	()	greater than less than
OC	°C	mV	mV milliVolt	+	+ positive	^ v	up down
O/O	% percent	OF	°F	--	- negative	^ Δ	star delta

Operational Display Symbols:

-  Motor Running
-  Loaded
-  Amount of time, timer
-  Filter, differential pressure
-  Pressure set point indication (upper and lower set point indicators displayed independently)
-  Condensate drain active (optional function)
-  Power failure autorestart enabled (optional function)
-  Remote load or remote pressure regulation active
-  Remote start/stop
-  Normal Operational: selected item locked as temporary default display
Menu Mode: page item locked (adjustment inhibited)

Fault Display Symbols:

- | | | | |
|---|-----------------------------|---|-------------------------------------|
|  | General fault |  | Lubrication, oil, oil level |
|  | Emergency stop |  | Dewpoint |
|  | Excess pressure |  | Motor |
|  | Power failure |  | Service due, maintenance |
|  | Above set temperature limit |  | Filter differential, filter service |

7.4 Display Structure and Menu Navigation

Display Item Structure:

All value, parameter or option selection displays are grouped into menu lists. Items are assigned to a list according to type and classification. Items that can be used to select options or modify functions are assigned to 'menu mode' lists. Items that an operator may require to view during routine operation, detected pressure or temperature values for example, are assigned to the normal operational mode list. Lists are identified by page number, the normal operational display list is page 0. All parameters and options are assigned to menu mode pages 1 or higher. All Page 0 items are view only and cannot be adjusted.

Normal Operational Mode (Page 0):

At controller initialisation, all display elements and LED indicators are switched on for three seconds, the display will then show the software version code for a further 3 seconds before initialisation is complete and the normal operating display (Page 0) is shown. In page 0 'normal operational display mode' the Display Field will show the final delivery pressure continuously and the Item and Value Fields will initially show the Information Item display for 35 seconds before reverting to the default temperature display item. All available Item and Value field option displays (temperatures, pressures, hours counters) can be selected using the Up or Down buttons at any time. The Item display will revert to the default item after 35 seconds if no further selection is made. Pressing the Enter button will lock any selected Item display and inhibit return to the default display. When an Item display is locked the lock key symbol will slow flash. To unlock an Item display press Up or Down to view an alternative Item display or press Reset or Escape. In page 0 Escape will select the Status Information Item display and Reset will select any active fault code display or the Status Information Item display if no faults are active. Unless a selected Item display is locked, the display will automatically jump to the Status Information Item display at key status change events. The timeout period before returning to the default Item display is modified in some instances to enable the full range of a set countdown timer to be shown. No Item values, options or parameters can be adjusted in page 0. If a fault condition occurs the fault code becomes the first list item and the display will automatically jump to display the fault code. More than one active fault code item can exist at any one time.

Access Code:

Access to page list displays higher than page 0 are restricted by access code. To access menu mode pages press UP and DOWN together, an access code entry display is shown and the first code character will flash. Use PLUS or MINUS to adjust the value of the first code character then press ENTER. The next code character will flash; use UP or DOWN to adjust then press ENTER. Repeat for all four code characters. If the code number is less than 1000 then the first code character will be 0(zero). To return to a previous code character press ESCAPE. When all four code characters have been set to an authorized code number press ENTER. Access to certain menu mode pages is dependent on authority level determined by the access code used. An invalid code will return the display to normal operational mode; page 0.

The following pages and access levels are used:

ACCESS LEVEL = USER (code = 9)	ACCESS LEVEL = SERVICE 1 (code = 100)
P00, P01, P02	P00, P01, P02, P08

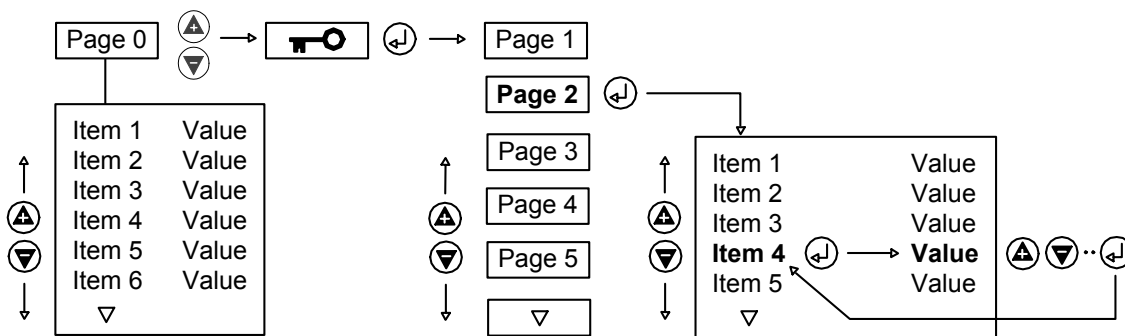
Access Code Timeouts:

When in menu mode, if no key activity is detected for a period of time the display will automatically reset to the normal operational display; Page 0. The timeout period is dependant on the access code used:

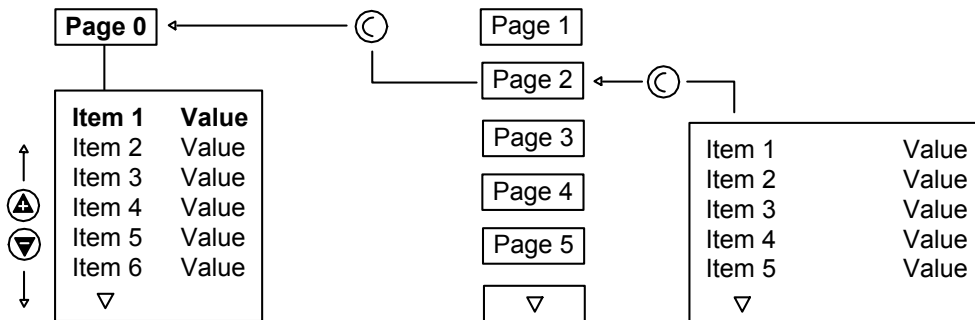
User: 1 minute

Menu Mode Navigation:


In menu mode the Display Field will flash and show the Page number. To select a page press UP or DOWN. For each page the Item and Value field will display the first Item of the page list. To view a page list press ENTER, the Page number will stop flashing and the Item display will flash. Press UP or DOWN to view the selected page list items. To select an Item value for modification press ENTER, the Item display will stop flashing and the Value display will flash. The value or option can now be modified by pressing UP(Plus) or DOWN(Minus). To enter a modified value or option in memory press ENTER; alternatively the modification can be abandoned, and the original setting maintained, by pressing ESCAPE.



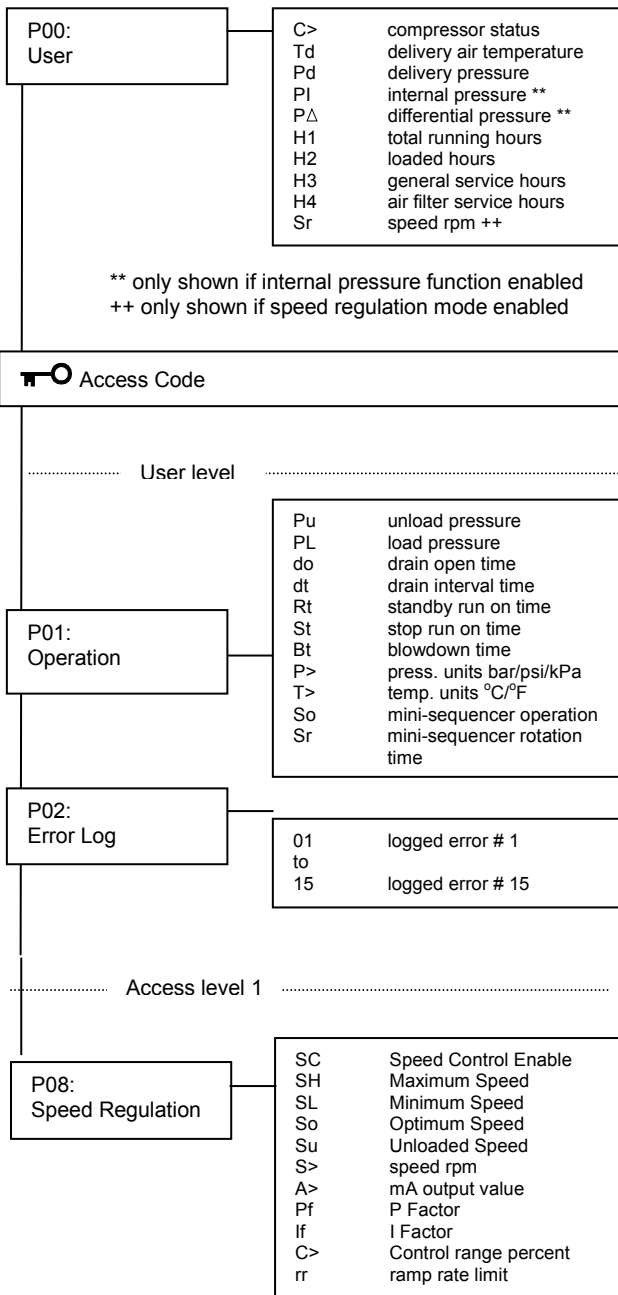
Press ESCAPE at any time in menu mode to step backwards one stage in the navigation process. Pressing ESCAPE when the page number is flashing will exit menu mode and return the display to normal operational mode; page 0.



Press and hold RESET for two seconds at any time to immediately exit menu mode and return to the normal operational mode display. Any value or option adjustment that has not been confirmed and entered into memory will be abandoned and the original setting maintained.

 A flashing Key symbol displayed with any Item indicates the Item is locked and cannot be modified. This will occur if the Item is view only (non adjustable) or in instances where the item cannot be adjusted while the compressor is in the operational STARTED state.

7.4.1 Menu Structure



7.4.2 P00 User Menu

The User menu shows normal operational values and information displays. This is the default display menu; no access code is required.

item#	description	units	step	min	max	default	display
1	information screen	---	no_edit	---	---	---	C>
2	delivery air temperature	°C/°F	no_edit	---	---	---	Td
3	delivery pressure	bar/psi	no_edit	---	---	---	Pd
6	running hours	h	no_edit	0	99999	---	H1 1430
7	loaded hours	h	no_edit	0	99999	---	H2 1275
8	general service hours	h	no_edit	-9999	9999	---	H3 0570
9	air filter service hours	h	no_edit	-9999	9999	---	H4 0080
109##	motor speed	rpm	no_edit	0	7200	---	Sr 3000 rpm
110##	percent speed	%	no_edit	0.0	100.0	---	SP 100.0 %

** only shown if internal pressure sensor function activated

only shown if variable speed regulation mode is activated (S1-20 only)

Status Information Item:

The page 0 'Status Information Item' provides a basic overview of status using symbols:



Main motor running



Compressor on load



Delivery pressure relative to pressure set points, not displayed when remote pressure control active.



Pressure equal to, or below, load pressure set point



Pressure equal to, or above, unload pressure set point



Pressure between load and unload pressure set points



Condensate drain valve output is energised (if function enabled)



Countdown timer function is occurring (Run-On-Time, Stop Run-On-Time, Blowdown Time). During a countdown time function the remaining time in seconds is displayed.

Hours Display Items:

Hours are displayed using the 'value and units' display fields together. This feature enables a maximum of 9999999 hours to be displayed.

H2: 123456 (Loaded Hours 'H2' = 123456 h)

Note: hour values less than 1000 are shown with leading zeros (10 hours = 0010)

7.4.3 P01 Operation Menu

Contains general operation parameters that may be modified by the User from time to time.

item#	description	units	step	min	max	default	display
1	unload pressure	bar/psi	0.1	PL+0.2	14.0	7.0	Pu 7.0 bar
2	load pressure	bar/psi	0.1	5.0	Pu-0.2	6.5	PL 6.5 bar
3	drain open time	s	1	1	30	5	do 5 s
4	drain interval time	s	1	30	3600	60	dt 60 s
5	standby run on time	s	1	1	3600	300	Rt 300 s
6	stop run on time	s	1	1	60	30	St 30 s
7	blowdown time	s	1	1	600	10	Bt 10 s
8	pressure units	---	1	0	2	0	P> 0 0=bar / 1=psi / 2=kPA
9	temperature units	---	1	0	1	0	T> 0 0= ⁰ C 1= ⁰ F
10	mini-sequencer operation	---	1	0	1	0	So 0 0=off / 1=on
11	mini-sequencer rotation time	hours	1	1	168	24	Sr 24 hrs

7.4.4 P02 Error Log Menu

Contains the last 15 fault states in chronological order. The most recent fault (alarm, start inhibit or shutdown) is stored as item 1. Each item consists of two values: the fault code number and the running hours when the fault occurred. The display will automatically alternate between these two values. All items are view only.

Item#	description	units	step	min	max	default	display
1	logged error #1	---	no_edit	---	---	---	01 ... Er: 0010 E <> 12345 *
2 to 15	logged error #2 to error #15	---	no_edit	---	---	---	02 to 15

* example: last detected error = Emergency Stop shutdown (fault code 0010E) at 12345 running hours

7.4.5 P08 Speed Regulation Menu

The speed regulation function provides P&I loop control of a variable speed drive (using 4-20mA output 1) in order to maintain a steady target pressure level (load pressure).

Speed regulation is used to maintain delivery pressure at the load pressure set point. If pressure rises to the unload pressure set point the load solenoid output is de-energised and the compressor unloaded. While in the offload state the controller will maintain speed at the set offload speed setting. If pressure remains above the load pressure set point for longer than the set run-on-time the main motor will stop and the controller will enter the standby state. When pressure falls below the load pressure set point the motor is re-started, if in standby state, and the load solenoid output is energised. Full range speed regulation is then applied.

If connected to a CMC sequence controller system, and the system consists of more than one VSR (variable speed regulated) compressor, any VSR compressor assigned as base load will be biased to operate at the set optimum speed setting. Any VSR compressor assigned as top-up will use full range speed regulation. In addition, the target pressure of each VSR compressor is automatically referenced to the sequencer to maintain exact pressure control regardless of pressure differentials between compressors. In this manner up to 12 VSR compressors can be controlled as a single coherent system with full efficiency capacity matched management, sequence rotation and single pressure set point control.

item#	description	units	step	min	max	default	display
1	Speed regulation control mode	---	1	0	2	0	SC 0=disabled 1=fixed speed regulation 2=variable speed regulation
2	maximum speed	rpm	100	100	10000	3000	SH
3	minimum speed	rpm	100	0	9900	1500	SL
4	optimum speed	rpm	100	100	10000	2700	So
5	unload speed	rpm	100	0	9900	1800	Su
6	rpm actual	rpm	---	---	---	---	S> View only, for information
7	output actual	mA	---	---	---	---	A> View only, for information
8	P factor	---	1	0	100	40	Pf
9	I factor	---	1	0	100	10	If
10	Control range percent	%	---	---	---	---	C> View only, for information
11	Maximum ramp rate	%	1	5	100	10	rr

Speed regulation control mode:

To disable speed regulation control for a fixed speed motor, load/unload compressor; select mode '0'.

To operate at fixed speeds select mode '1'. The motor will operate at the set optimum speed while loaded, and at the set offload speed when unloaded. The transition in speed is determined by the max ramp rate.

To operate as a full range variable speed regulated compressor select mode '2'.

Maximum Speed set for motor speed at 20mA output

Minimum Speed set for motor speed at 4mA output

Optimum Speed optimum efficiency speed while loaded

Offload Speed motor speed when off load

P Factor P&I loop proportional factor

I Factor P&I loop integration factor

Max Ramp Rate maximum allowed rate of change expressed as % of full speed range per second (example: max 3000rpm, min 1500rpm, ramp rate 10% = 150rpm/second maximum)

Control Range Percent: Shows the percentage of speed range where set minimum speed is represented as 0% and maximum speed is 100%. This value is different from the percent speed show in menu page 0.

7.5 Fault Messages

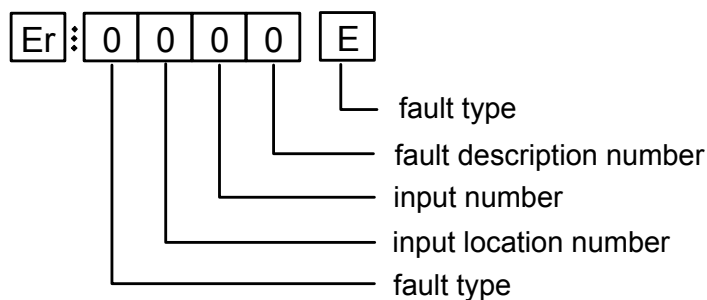
Faults are abnormal operating condition states. Alarms are fault states that indicate normal operating conditions have been exceeded but do not present an immediate hazard or potentially damaging condition. Alarms are intended as a warning only and will not stop the compressor or prevent the compressor from being started and run.

Start inhibits are fault states that prevent the compressor from initially being starting. Start inhibit faults are conditions that may present a hazard or damaging situation if the compressor was to be started. A start inhibit will self reset when the condition being monitored returns to normal operational levels. Start inhibit conditions are only checked during the initial start procedure and will not stop the compressor once started and in the 'started' state. Start inhibit conditions are not checked during an automated motor start from Standby.

Run inhibits are fault states that prevent the compressor from starting and running the main motor. Run inhibit faults are conditions that may present a hazard or damaging situation if the main motor is run. A run inhibit will self reset when the condition being monitored returns to normal operational levels and the compressor will then be allowed to exit the standby condition and run without further manual intervention. Run inhibit conditions are checked prior to a main motor start sequence and will not stop the compressor motor once started. Run inhibit conditions do not prevent the compressor from entering the 'started' state condition.

Shutdown trip errors are fault states that present a hazardous or damaging condition, the compressor is stopped immediately. The Shutdown trip error condition must be resolved, and the fault reset, before the compressor can be re-started.

The different fault state conditions are indicated on the screen with specific codes; the last character indicating the fault type: E = Shutdown Trip Error, A= Alarm, S = Start Inhibit, R = Run Inhibit. Shutdown trip errors are divided into two different categories: immediate shutdown errors and controlled stop errors. Immediate shutdown errors stop the compressor instantly (Emergency Stop button activated for example). Controlled stop errors stop the compressor in a controlled way using a normal Stop command; the motor will continue to run for the set stop run-on-time. Immediate shutdown errors have an error code where the first character is 0 (zero). Controlled stop faults have a "1" as the first character. Alarm faults are also divided into two different categories: alarms and service alarm messages. Alarms start with a "2", service alarm messages with a "4". Start Inhibit fault codes start with a "3".



fault description number	fault description
9	high level shutdown trip
8	high level alarm
7	high level start inhibit
6	special function
5	sensor error
4	timeout
3	low level start inhibit
2	low level alarm
1	low level shutdown trip
0	digital input

input number	input
#	Input number for controller input terminal/location

input location number	input location description
0	digital input
1	analogue input
2 to 7	<i>not used</i>
8	special functions
9	special functions slave unit

fault category number	fault category description
0	immediate shutdown trip error
1	controlled shutdown trip error
2	alarm
3	start or run inhibit
4	service

fault type	fault type description
E	shutdown trip error
A	alarm (or service message alarm)
S	start inhibit
R	run inhibit

-- 11) CHECKING AND MAINTENANCE --**-- 11.1) CHECKING COMPRESSOR OIL LEVEL --**

Every morning before starting the machine check the oil level in the compressor tank. The compressor oil level shall never fall below the minimum level notch and never exceed the maximum level either. It shall fall between the two notches of min. and max. level.

Oil level checks must be undertaken a few hours after having stopped the machine, in order to allow the oil to flow into the tank. In fact if the oil level is checked immediately after switching off the machine, a false reading is given which means that the user will top up with more oil than is necessary.

-- 11.2) CHANGING COMPRESSOR OIL --

The oil in the compressor shall be changed every 2000 hours' operation or at least once a year.

To change the oil proceed as follows:

1. Change the oil when the machine is hot
2. Unscrew the oil plug on the tank side.
3. Open the drain valve on the tank bottom.
4. After draining the oil replace the oil filter cartridge by unscrewing and removing it from its seat. Replace with a new one.
5. Fill with oil through the filler.

-- 11.3) COOLING RADIATOR CLEANING --

The cooling liquids of the compressor and motor are cooled by a radiator which must therefore be kept clean to ensure that the ventilation air can easily pass through its honeycomb flaps.

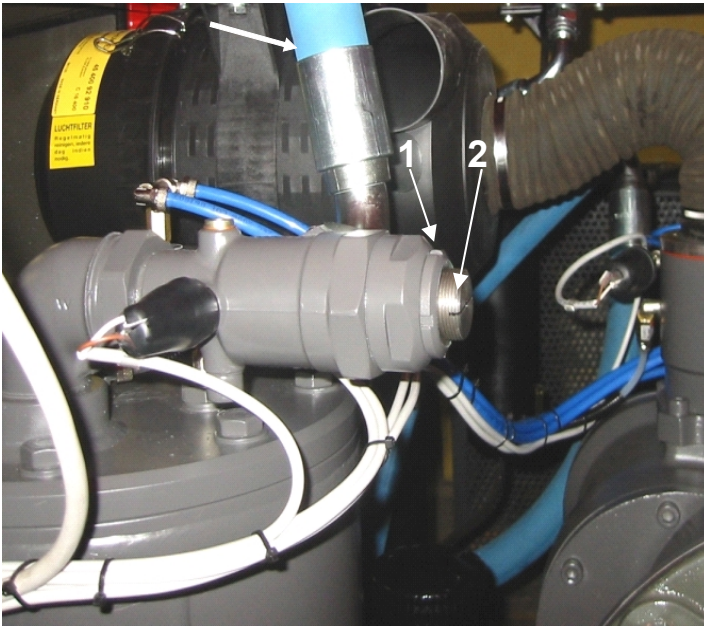
Should the flaps become clogged with dust or other particles, there is a risk of harmful overheating of the mechanical parts of the screw compressor, seriously jeopardising its function and duration. It is therefore advisable to check it regularly and clean it using compressed air or wash it using a pressurized water jet.

-- 11.4) MINIMUM PRESSURE CHECKING AND SETTING --

The purpose of this valve is to ensure that during operation the pressure in the oil separator tank does not drop under the minimum value, in order to ensure the necessary oil circulation.

CHECKING AND SETTING:

- 1) Start up the machine
- 2) With motor warm, at right temperature, gradually proceed to fully open the air cock the pressure of between 4.5 - 5 bar must appear on the gauge.



Should a different pressure appear than that indicated above, proceed with setting as follows (fig. 14):

- 3 Release the lock-nut (1) .
- 4 Tighten the regulation screw (2) to increase the pressure to the desired value.
- 5 Loosen the regulation screw (2) to reduce the pressure to the desired value
- 6 Tighten the lock nut (1) and close the cocks.
- 7 Slowly re-open the air cock and then close it again repeating the operations several times in order to permit the valve to settle into place.

Fig. 3

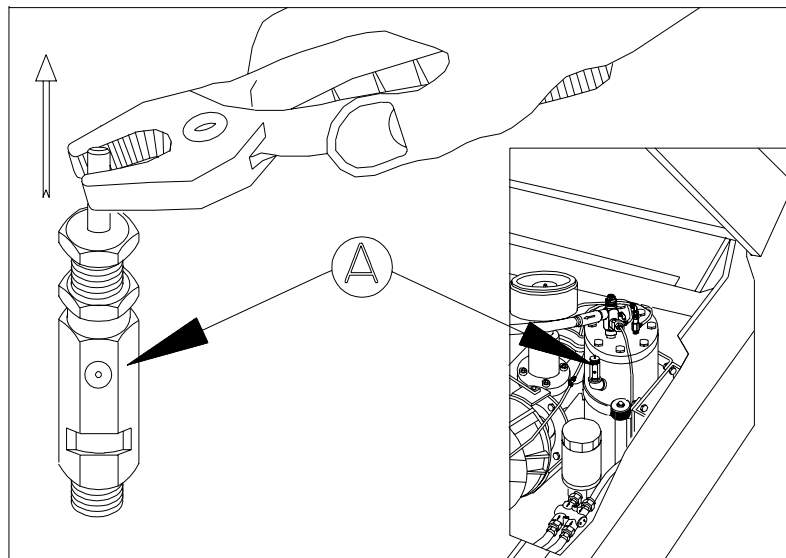
-- 11.5) SAFETY VALVE CHECK --

This valve is positioned on the oil separator tank and operates to discharge any accidental overpressure.

This valve is calibrated and checked at the factory, and cannot therefore be altered or tampered with for any reason.

Its efficiency can be checked periodically as follows:

1. Start up the machine
2. With cocks closed, lift the pin upwards using pliers, as indicated in fig. 18, and release as soon as the valve can be seen to discharge air.





WARNING: *The air which escapes from the valve during this checking operation is mixed with oil particles and therefore to avoid soiling the operator and the inside of the machine it is advisable to bind the valve with a cloth.*

If the pin fail to rise after being guided with the pliers, thereby preventing valve breathing, it must be replaced at once.

New replacement safety valves must be of the same type as the original and must be complete with conformity certificate issued by the manufacturer.

As this valve plays a vital role in preventing any dangerous overpressure which could cause the piping, or the oil separator tank to burst, it is important to request the original spare part from ROTAIR citing the machine serial number.

ROTAIR will not accept any responsibility in the event of the use of non-original and non-conforming valves.

-- 11.6) SUCTION FILTER AND ITS MAINTENANCE --

RVD compressors have been designed and made to operate in an environment at a max. temperature of 40°C;

should the machine be installed in a small ill-ventilated room because you have no other choice, it will be necessary to make a ventilation duct for air suction and a second duct for letting hot air out. Both ducts shall be connected with the outside and set in such a way as to prevent suction air from mixing with exhaust air. They shall have an adequate size with open-radius bends. An incorrect sizing would reduce ventilation and cause compressor overheating.

The room shall be well aired, clean and as close as possible to the distribution mains network. Should the compressor operate in a very dusty environment, clean air shall flow freely: this can be achieved by replacing the filter often enough (on the vent).

A dirty clogged filter reduces and slows down the quantity of air being sucked in necessary for ventilation with a consequent harmful overheating of the unit.

WARNING: *type, density and thickness of the filter have been designed and selected not to brake the sucked in air too much. Therefore the spares shall always be original ROTAIR spares. Should other materials be used the guarantee on the machine will become null and void.*

The machine shall be installed by leaving free space around it for ordinary and extraordinary maintenance operations.

METHOD TO MAKE SURE THE VENTILATION AIR FILTER IS NOT CLOGGED AND TO CHECK THE SIZING OF SUCTION AND EXHAUST AIR DUCTS.

On the rear side of the machine a device is installed to measure the vacuum generated inside the compressor.

A clogged filter or incorrectly dimensioned ducts create abnormal ventilation of the unit that can be checked with the vacuum meter (5mm)

-- 11.7) AIR FILTER MAINTENANCE --

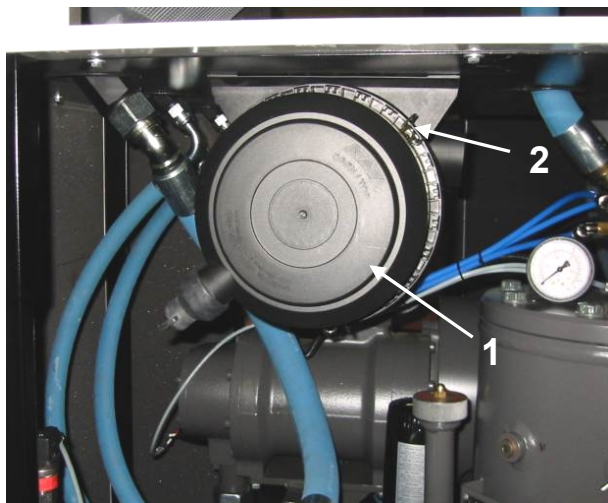


FIG. 16

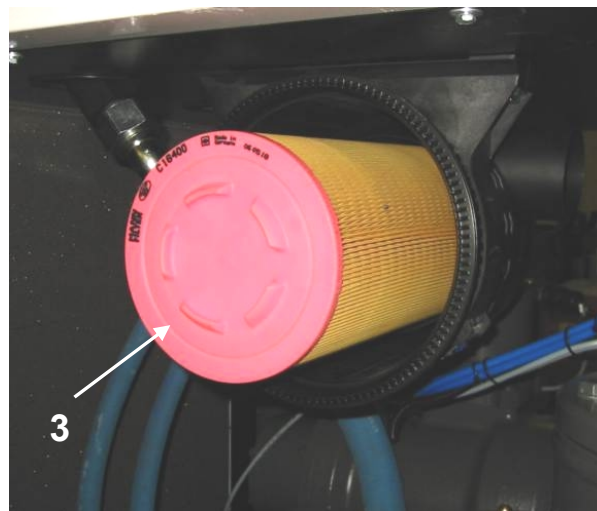


FIG. 16A

This check must be undertaken periodically after every 100 working hours, however should the machine operate in particularly dusty environments it may be necessary even daily.

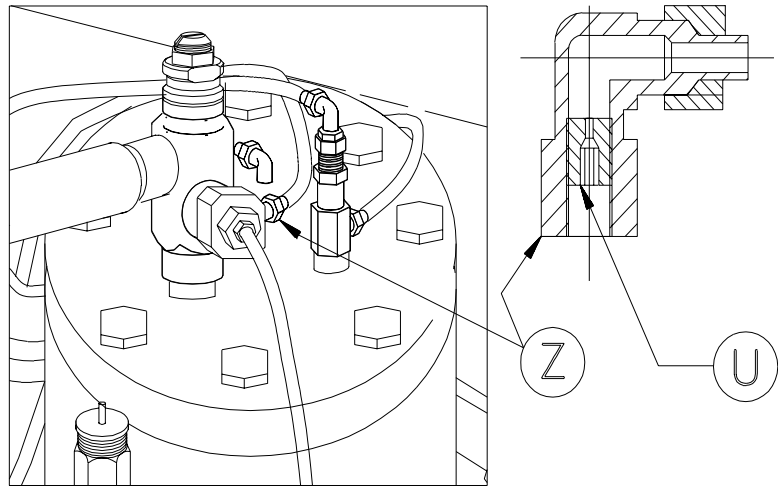
The filtering cartridge may be cleaned a few times using jets of compressed air, but never washed. They must however be replaced every 500 working hours.

To replace the air filter, take the cap (part 1 picture 16) away by releasing the three hooks (part 2 picture 16). Then take the filter (part 3 drawing 16A) away by rotating and drawing it outside. Put the new filter and close the cap again.

-- 10.8) OIL RECOVERY NOZZLE CHECKING AND CLEANING --

This must be undertaken in the event of any leakage of nebulized oil mixed with compressed air, as follows (fig. 5):

- Unscrew the connection (Z) positioned at the centre of the tank.
- Inside the connection (Z) is a nozzle (U); ensure that its gauged hole is not clogged (blow with a jet of compressed air).
- Re-assemble.

**FIG. 5**

WARNING: During the regular function of the compressor it is normal to note a certain amount of oil flow out of the transparent piping which starts from the connection (Z), towards the compressor head.

-- 10.9) OIL SEPARATOR ELEMENT --**-- 10.9.1) CHECKING OF OIL SEPARATOR ELEMENT --**

This operation is reserved for specialised and qualified personnel.

The frequency is usually estimated as being of about every 2000 working hours, but it strictly depends on the observance of all the maintenance regulations indicated in this manual.

Insufficient oil in the tank, failure to comply with the lubricant replacement frequency indications or use of the machine with clogged cooling radiator, may all result in **serious damage** to the separator filter.

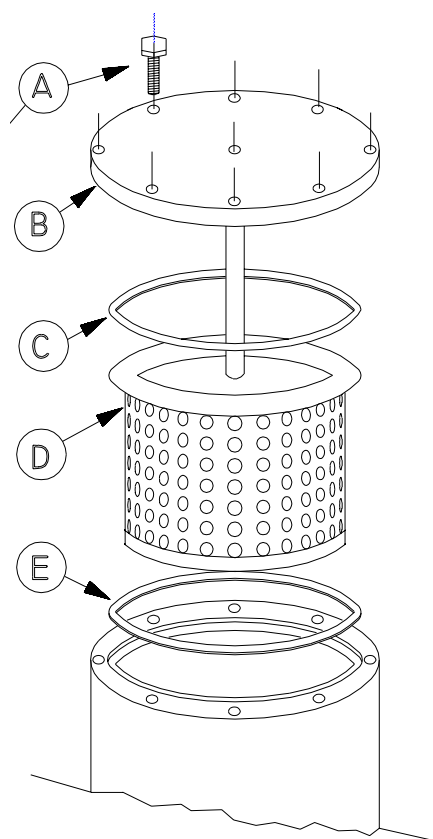
Therefore after having checked the condition of the recovery nozzle (operation described in paragraph 10.8) and having made sure of the correct oil level in tank, should there be any further traces of oil in the compressed air, it is necessary to replace the oil separator filter (fig. 6).

To find out the degree of blockage of the oil separator filter proceed as follows:

- Start up the machine
- Partially open the delivery piping until the control panel gauge indicates the working pressure.
- Read the pressure on the gauge positioned at the top of the oil separator and compare the two values: should a difference of over 1 bar be found, it is a clear indication that the filter is blocked and it must be neither cleaned or washed, but replaced.

-- 10.9.2) INSTRUCTIONS FOR THE REPLACEMENT OF THE OIL SEPARATOR ELEMENT --

1. The operation must be undertaken with machine off and no pressure in the oil separator tank.
2. Disconnect all the pipes from the connections positioned on the closure flange of the separator tank, marking them so there is no problem on re-assembly.
3. Loosen the screws (fig. 6, part A) and remove the flange (B).
4. Extract the filtering element (D) together with the seals (C) and (E).
5. Assemble the new seal (E) in the relative slot which has been previously cleaned. Endure that a metallic insert has been clipped to the seal in order to avoid the isolation of the filter and the accumulation of static electricity. Otherwise there is a risk of the separator filter catching fire.
6. Insert the new separator element correctly positioning it into the relative slot.
7. Assemble the second seal (C) with the same precautions as above.
8. Reassemble the flange (B) in the pre-assembly position.
9. Tighten the bolts, (A), with a tightening torque of 80 Nm.
10. Re-connect all the pipes to the respective fittings.
11. Start up the machine ensuring there is no leakage between the cap and the tank.
12. Allow the machine to operate for 10-15 minutes with closed cocks
13. Stop the machine with tank depressurized to 0 bar, re-check the screw tightening (A).

**FIG. 6**