Operating & Maintenance Instructions 242 Vacuum Forming Machine

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1. Introduction

Your new 242 Vacuum Forming Machine has been designed to produce high quality vacuum formings on sheet sizes of up to 685mm x 660mm (27" x 26"), with a maximum moulding height of 300mm (11.8"). Changing the removable top plate, platen tray and clamp frame reduces the forming area. Reducing kits (Part No 242R) are available to order for this purpose.

The material is heated from above by 40 ceramic heater elements. The heaters are separated into 15 heating zones, allowing the operator full control over heat distribution. The heater zones are controlled from the machine's internal PLC (Programmable Logic Controller), and up to 40 different settings can be stored. The heater assembly slides on precision linear bearings to give smooth and maintenance-free service over many operations. Rodless pneumatic cylinders control the movement of the heater system.

While heating, a through-beam sensor constantly checks the level of the sheet. As the material softens and drops under its own weight, air pressure from the vacuum / pressure pump is injected into the mould cavity, supporting the sheet to assist in obtaining uniform heating.

Once heated, the heater system is moved to its rest position and the mould raised by a pair of pneumatic cylinders. Once the mould is in the raised position vacuum and release blow can be applied. A centrifugal fan blows cold air onto the moulding once it is formed to accelerate the cooling process.

All of the movements of the machine are also controlled by the PLC, which can store up to 40 different timer settings. Timer settings can be entered individually. They can also be obtained by running the machine manually and copying the times into the PLC memory upon completion of the cycle.

The operator is protected from moving parts by a light curtain across the front of the machine. This allows free access to the machine for material loading and adjustments.

The machine operates on a 400V 3 phase electrical supply, and consumes 9kW of power on full load. A compressed air supply of 5-8 bar pressure is also required.

The machine weighs 320kg and is mounted on heavy-duty castors for ease of location and movement.

242 Vacuum Forming Machine

2. Health & Safety Information

The 248 Vacuum Forming Machine utilises high power pneumatics to perform the forming process. Light guards are provided to prevent access to moving parts during operation. The machine must never be operated with these guards removed, damaged or malfunctioning in any way.

In common with all vacuum forming machines, the material being heated on the 242 is clamped around its perimeter while heat is applied. Due to the expansion of the material, the centre may distort during heating prior to softening. When running the first component in a new material, care must be taken that the material does not rise and contact the heating elements. Failure to observe this point could result in ignition of the material.

Should there be any specific queries regarding Health and Safety or any other aspects of the 242 Vacuum Forming machine please contact the manufacturer or their appointed local distributor.

3. Unpacking & Location

Your 242 Vacuum Forming Machine will reach you complete and ready to use. Upon receipt proceed as follows:

Unpack from wooden crate if necessary.

Check for any signs of transit damage. All damages must be reported within 3 days of receipt.

Position the machine as required. Should there be a need to lift the machine, use extended forks on a fork lift truck, ensuring that these extend underneath the machine and protrude through the opposite side. Ensure that the fork lift truck is capable of lifting the weight of the machine. Please note that the ends of the platen cylinders protrude beneath the base of the machine. Do not lift with the forks under the cylinders.

Note that access to either side of the machine should be allowed for maintenance operations. Also, ensure that the meshed areas are not restricted in any way, as these allow excess heat to escape from the heater system.

Lock the castors using the locking catches located on top of each wheel.

4. Electrical Supply & Connection

The electrical specification of your new machine is as follows:-

Voltage	400V 50Hz 3 Phase
Current (max per Phase)	20A
Watts (max)	9000W

The colour coding of the wires in this appliance are as follows:

L1	Red
L2	Yellow
L3	Blue
Earth	Yellow / Green

It is recommended that the machine be supplied from a dedicated 400V 3 Phase + Earth, 20A per phase power supply.

Phase Sequence

The 242 Vacuum Forming Machine incorporates a 3 phase motor for the vacuum / pressure pump, and therefore phase sequence is important to ensure that it rotates in the correct direction. To check this, place the machine in Manual Mode and switch on the cooling fan. The fan should rotate in the direction of the arrow marked on the fan housing.

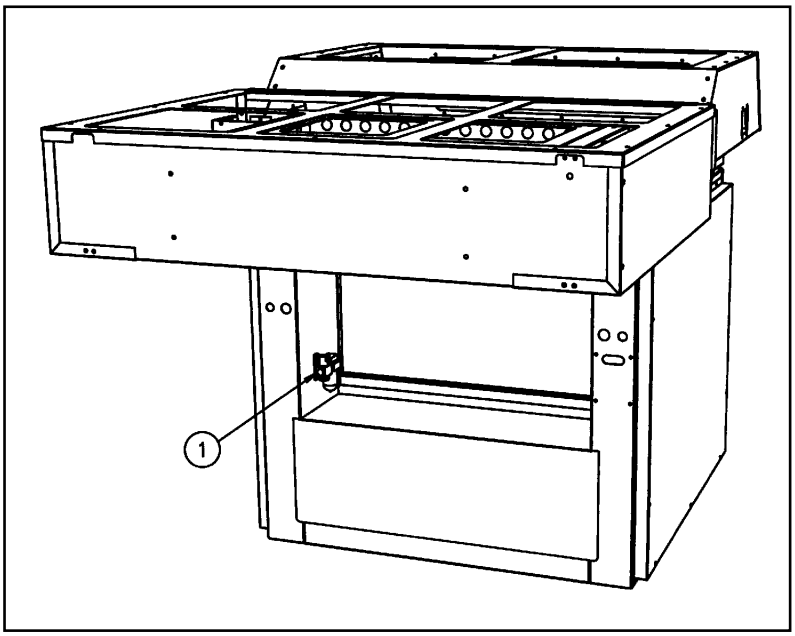
To correct rotation, disconnect the machine from the mains supply, disconnect the blue and the yellow. Connect Blue to L2 and Yellow to L3. Retest.

Should there be any queries regarding the electrical requirements of the 242 Vacuum Forming Machine please refer back to the manufacturer or their nominated distributor.

5. Pneumatic Supply & Connection

Compressed air at a pressure of between 5.0 and 8.0bar (80-120psi) is required. The connection point is located at the rear of the machine (1) in the Diagram below, where an air filter, water separator and isolator switch are located. A push fit quick-connect coupling and hose clamp is supplied with the loose items and all that is required is a length of 6mm (1/4") inside diameter flexible air hose connected to a supply adjacent to the machine. The machine will consume approximately 0.01 cubic metres of compressed air per cycle.

The 242 can be isolated from the air supply by switching off at the isolator switch. This switch can be locked in the 'Off' position if required using a suitable padlock through the holes in the switch.



6. Overview of Heater System

The heaters on the 242 Vacuum Forming Machine are divided into 15 zones. For ease of identification, the heater system is laid out in a simple grid, as shown below.

Each heater zone is controlled by a separate relay, which is in turn controlled by the PLC. The zones are adjustable from 0% (off) to 100% (permanently on). In between these settings, any percentage can be selected between 5% and 95%. 1-4% and 96-99% have intentionally been omitted, as such a setting would cause the relays to operate too frequently, reducing relay life.

	A	B	C
5			
4			
3			
2			
1			

Front of Heater System

When setting the heaters, bear in mind that the heater zones around the edge of the material will also heat up the clamp frame and surrounding metalwork, reducing their effectiveness. Therefore, it is normal to increase the zone percentages in the outer areas. Towards the centre of the material, the elements are purely heating the material and are also shielded by the outer zones. Therefore, it is normal to decrease the zone percentages in the centre areas. Should a reducing plate be used, then it may be possible to switch off some of the outer zones, reducing power consumption.

When using moulds with sharp corners it may be found that excessive thinning of the material takes place during forming. It can be useful to turn down the zone heating the affected area, as it will reduce the stretch of that part of the sheet, spreading the thinning over the surrounding areas. Should it be difficult to find which zone is heating the part of the sheet you wish to alter, draw a grid on a pale coloured sheet of material with a marker pen, to represent the zones of the heaters. Form the sheet to determine which zone is responsible for heating the area concerned.

7. Overview of Platen System

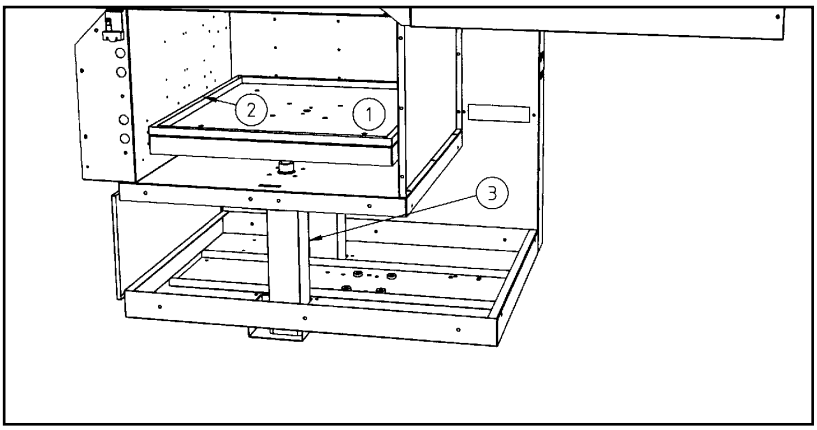
The platen of the 242 consists of a metal tray (1) with a foam rubber seal around the periphery (2). The seal is fitted into a channel for ease of changing (see Diagram below).

There is a mesh laid into the platen tray; this forms an air gap underneath the mould and allows air to flow during forming.

The mould should be attached to a baseboard of 645mm x 620mm (25.375" x 24.375"). The baseboard should be 12-20mm (0.50 - 0.75") in thickness. The mould and baseboard can then be placed on the platen. If required, the mould can be bolted down - there are M6 threaded inserts in the surface of the platen for this purpose.

The platen is raised and lowered by a pair of synchronised pneumatic cylinders (3). Reed switches mounted onto the cylinders inform the PLC when the platen is in the raised, lowered or half-stroke position.

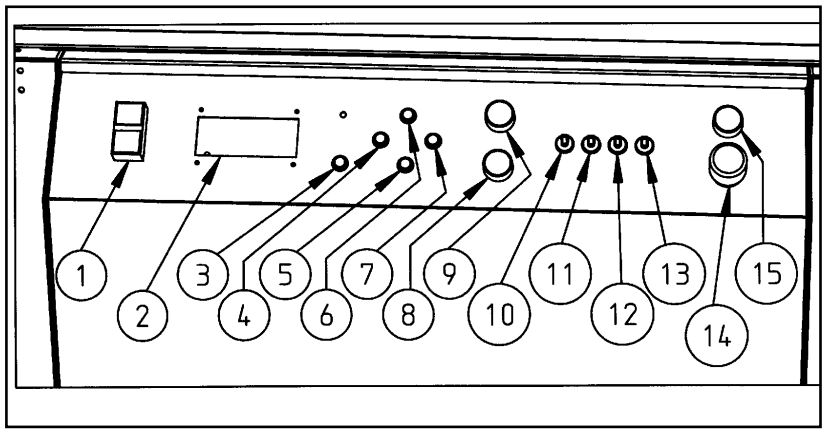
To retain the platen in the raised position (for mould changing, for example), enter Manual Mode, raise the platen using the Toggle Switch (Machine Controls (11) overleaf). When the platen is raised, press the Back/Home button (Machine Controls (4) overleaf) to switch off the vacuum pump. See Section 14 later for more information on using Manual Mode.



8. Machine Controls

All machine controls are located on the front control panel (see Diagram 2 below). Controls and their functions are as follows:

1.	I/O button.	Green I button switches machine on. Red O button switches machine off.
2.	LCD Display	Displays information regarding the current status of the machine.
3.	Shift button	Provides 2nd function to buttons 4-7
4.	Back/Home button	Cancel function as listed in Sections 11-16 below
5.	⇓	Scroll-Down function as listed in Sections 11-16 below
6.	⇑	Scroll-Up function as listed in Sections 11-16 below
7.	OK	Accept function as listed in Section 11-16 below
8.	Cancel	Cancels a cycle in Auto Mode
9.	Start	Initiates a cycle in Auto Mode
10.	Hood	Moves the Heater Hood in Manual Mode
11.	Platen	Raises and lowers the Platen in Manual Mode
12.	Fans	Turns the Cooling Fans on in Manual Mode
13.	Vacuum Pump	Up - Vacuum Centre - No flow Down - Blow
14.	Emergency Stop	Disables all machine functions.
15.	Platen Stroke	Out (Light Off) : 300mm (11.875″) Platen Stroke In (Light On) : 150mm (6″) Platen Stroke



9. Initial Start-up

Ensure that the machine is connected as detailed in Sections 4-6.

Operation	LCD Display
Switch on the machine at the isolator switch located on the rear or side of the machine.	Press I Button To Start
Ensure that the Emergency Stop button (14) is released. Press the green I button (1). The main contactor will be heard to engage inside the machine.	MAIN MENU 1 HEATERS-BASIC 2 Heaters-Advanced
The Main Menu scrolls up and down using the Up and Down arrow buttons (5 & 6). The Menu options are: 1 Heaters - Basic 2 Heaters - Advanced 3 Timers 4 Manual Mode 5 Auto Mode 6 Configuration	
The currently selected option is displayed in CAPITAL letters.	
Pressing the OK button (7) takes you into the chosen option.	

10. Setting up Heaters - Basic Mode

From the Main Menu, select
Option 1 - HEATERS-BASIC

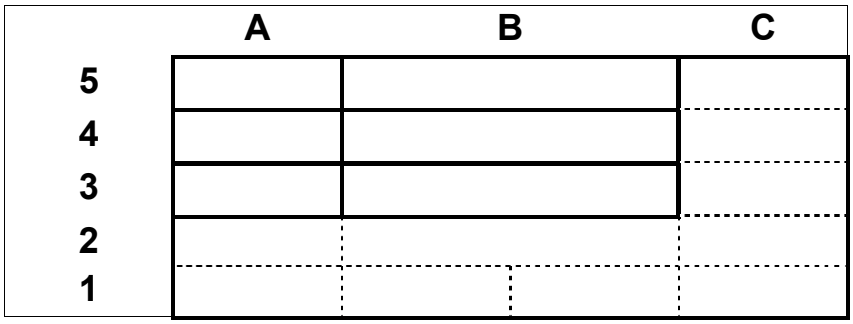
The Heater Setting screen is displayed. It shows:

Current Heater Setting Number
Grid Reference across machine (Letters)
Grid Reference front to back (Numbers)
Zone Percentages
Settings Flag (to right of Heater Setting):
0 = nothing stored
1 = settings stored ready for copy (see below)

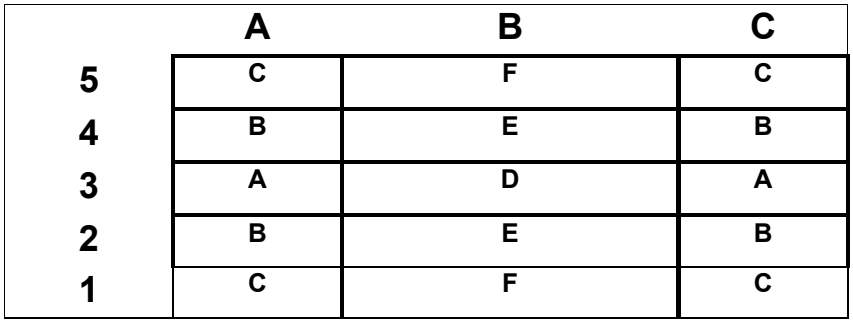
	MAIN MENU
1	HEATERS-BASIC
2	Heaters-Advanced

HEATER SETTING 1			0
	A	B	C
8	100	90	90
7	90	80	

In Basic Mode, only the rear left hand section of the heater system (i.e. A5 to B3) is adjustable. These settings are mirrored to the other three sectors when the Heater Settings are saved (see Diagrams below).



Heater Zones available in Heaters-Basic Mode



Mirroring Effect when saving Settings in Heaters-Basic Mode

10. Setting up Heaters-Basic Mode (cont)

In both the Heater and Timer Setting screens, the section enclosed in asterisks (*HEATER SETTING 1*) is the currently active parameter.

The options available in the Heater Set-up screen are as follows:

⇓ (5)	Navigates from Heater Setting to Line 8, and then down the Heater Zones.
⇑ (6)	Navigates up the Heater Zones, and then to the Heater Setting.
OK (7)	Navigates right across the Heater Zones
Cancel (8)	Navigates left across the Heater Zones
Shift (3) + ⇑ (6)	In Heater Zones - increases setting by 5%, up to a maximum of 100%. In Heater Settings - increments the Heater Setting, up to a maximum setting of 40.
Shift (3) + ⇓ (5)	In Heater Zones - decreases setting by 1%, down to a minimum of 0% In Heater Settings -decrements the Heater Setting, down to a minimum setting of 1
⇓ (5) + ⇑ (6)	When flag at top right of LCD display = 0: Copies the settings of the current Heater Setting to a temporary memory, which is cleared when returning to Main Menu. Sets flag to 1. When flag at top right of LCD display = 1: Pastes the stored settings into the current Heater Setting from the temporary memory. Resets flag to 0.
Shift (3) + Cancel (8)	Resets all Heater Settings to the values they had when entering Heaters-Basic Returns to Main Menu without altering the Heater Setting number
Shift (3) + OK (7)	Mirrors Heater Settings as shown above for selected Heater Setting only. Returns to Main Menu saving all Heater Settings to permanent memory and making the selected Heater Setting the current one

11. Setting up Heaters - Advanced Mode

From the Main Menu, select Option 2 - HEATERS ADVANCED

	MAIN MENU
1	Heaters-Basic
2	HEATERS-ADVANCED
3.	Timer Set-up

In the 'Heaters-Advanced' screen, there is access to all heating zones. This enables the fine-tuning of settings made in 'Heaters Basic'. For example, it is quite common to increase settings of the heater zones across the front of the machine, as this is the last area to be heated as the hood travels forward, and the first area to start cooling as it retracts. This adjustment would be made in 'Heaters Advanced'.

The options available are identical to those in 'Heaters Basic', with the obvious exceptions of the Mirroring facility upon saving and the ability to scroll to all heating zones.

Important:

Once settings have been adjusted in 'Heaters Advanced', care should be taken not to overwrite the changes in 'Heaters Basic', by pressing Shift and OK with that Heater Setting selected.

12. Setting up Timers

From the Main Menu, select Option 3 - TIMER SETUP

The Timer Set-up screen is displayed, showing:

Current Timer Setting Number
Timer Description
Timer Setting
Settings Flag
(to right of Heater Setting):
0 = nothing stored
1 = settings stored ready for copy (see below)

	Main Menu
2	Heaters-Advanced
3	TIMER SETUP
4	Manual Mode

*TIMER SETTINGS 1*0	
HEATING TIME	00
FAN DELAY	00
VACUUM 1	00

All Timers are adjustable in 0.1 second increments. For speed of setting, the timers increment up in 1 second steps, and down in 0.1 second steps.

Heating Time	Adjusts the length of time that the Heater system dwells in its fully forward position.
Fan Delay	Sets the time interval between the platen reaching its upper position and the cooling fans switching on.
Vacuum 1…4	Sets the time for the vacuum cycles 1 - 4.
Blow 1…4	Sets the time for the blow cycles 1 - 4.

In both the Heater and Timer Setting screens, the section enclosed in asterisks (eg. *TIMER SETTING 1*) is the currently active parameter.

The options available in the Timer Set-up screen are as follows:

⇓ (5)	Navigates from Timer Setting to Heating Time, and then down through the Timers.
⇑ (6)	Navigates up through the Timers and then to the Timer Setting.
Shift (3)	In Timers - increases setting by 1 second.
+ ⇑ (6)	In Timer Settings - increments the Timer Setting, up to a maximum setting of 40.

12. Setting up Timers (cont...)

Shift (3) + ⇓ (5)	In Timers - decreases setting by 0.1 second, down to a minimum of 0 seconds. In Timer Settings decrements the Timer Setting, down to a minimum setting of 1.
⇓ (5) + ⇑ (6)	When flag at top right of LCD display = 0: Copies the settings of the current Timer Setting to a temporary memory, which is cleared when returning to Main Menu. Sets flag to 1. When flag at top right of LCD display = 1: Pastes the stored settings into the current Timer Setting from the temporary memory. Resets flag to 0.
Shift (3) + Cancel (8)	Resets all Timer Settings to the values that they had when entering Timer Settings. Leaves the current Timer Setting number as it was when entering Timer Settings. Returns to Main Menu.
Shift (3) + OK (7)	Saves all Timer Settings to permanent memory. Makes the selected Timer Setting the current one. Returns to Main Menu.

To set up the machine from scratch is time-consuming and also includes a lot of guesswork. To eliminate this, there is a facility to paste settings from a Manual Cycle. For information on storing these settings into temporary memory see Section 14 later. To copy these settings into a Timer Setting, proceed as follows:

Once the Timer Settings have been stored you will automatically enter the Timer Settings screen. The flag at the top right of the LCD display = 2, showing that manual times have been stored.

Select the Timer Setting you wish to use (using Shift + ⇑/⇓)

⇓ (5) + ⇑ (6)	When flag at top right of LCD display = 2: Pastes the stored settings into the current Timer Setting from the temporary memory. Resets flag to 0.

13. Manual Mode

From the Main Menu, select Option 4 - MANUAL MODE

In Manual Mode, all of the machine functions can be operated using the Toggle Switches (9 - 13).

The screen in Manual Mode gives the following information:

The total heating time.
The status of the platen (Up or Down)
The Heater Setting No. in use

	MAIN MENU
3	Timer Set-up
4	MANUAL MODE
5	Auto Mode

MANUAL OPERATION		
Heating	:	0.0
Platen	:	Down
Heating No	:	1

Formings can be produced in Manual Mode, in the same way as with a manual vacuum forming machine. There are electrical interlocks to prevent the following:

Heater Hood coming forward with Platen Raised
Platen raising with Heater Hood forward
Any movement being made with the Guard open

Should the heater be retracted to view the sheet and then brought forward again, the timer will continue counting. To reset all manual timers, return to the Main Menu using Cancel (8) and then re-enter Manual Mode.

When material is heated to its plastic state, as is usual for vacuum forming, it will tend to sag under its own weight. On a sheet size as large as the 242 this is undesirable, as it leads to uneven heating. To overcome this, a through-beam sensor has been positioned to monitor the sheet level. Once it drops more than 40mm or so, the blow valve is operated to support the sheet. This type of system is commonly known as Pressure Balancing. To enable the Pressure Balancing to operate the vacuum pump needs to be running, and it is therefore automatically started when the heater system comes forward.

Should the sensor be obstructed, i.e. by a tall mould or a dirty lens, the pressure balancing will be switched off for the duration of the heating cycle. The user will be informed by a message, which is displayed for 1 second before the heater system moves forward.

13. Manual Mode (cont...)

Pressure Balancing is not always desirable, and can be switched off in Configuration, see Section 16 below.

Switch Obstructed Pressure Balancing Disabled

Once a satisfactory forming has been produced, the times may be stored in temporary memory ready for copying to a Timer Setting:

⇓ (5) + ⇑ (6)	Copies the Timer settings into temporary memory. Display changes to Timer Settings, flag to 2. See above for how to copy settings into a Timer Setting.

Pressing Cancel (8) returns to the Main Menu

14. Auto Mode

From the Main Menu, select Option 5 - AUTO MODE

In Auto Mode, the machine operates in a fully automatic cycle, from the clamping to the unclamping of the material.

The screen in Auto Mode gives the following information:

The Heater Setting No in use
The Timer Setting No in use
The number of cycles performed

	MAIN MENU
4	Manual Mode
5	AUTO MODE
6	Configuration

AUTO MODE		
Heater No	:	1
Timer No	:	1
Part Count	:	0

The cycle can only be initiated when the light guard is clear. Pressure Balancing works in the same way as in Manual Mode (see Section 14 above).

Functions in Auto Mode are as follows:

Start button (9).	The automatic cycle will commence. The display will then inform you of the progress of the automatic cycle.
Cancel button (4).	To cancel the cycle at any point.
⇓ (5) + ⇑ (6)	Reset the Parts Counter to 0.
Cancel (8)	Return to Main Menu

Difficult moulds may need to be manually released before lowering the platen at the end of the cycle. Placing the Platen switch (11) in the On position enables this function. The clamp frame lifts at the end of the cycle enabling the material to be removed. Pressing the Start button (9) completes the cycle by returning the platen to its lower position.

When forming shallow moulds, it may be preferable to leave the platen raised for the complete cycle. This can be achieved by placing the Hood switch (10) and Platen switch (11) both in the On position. The platen will then remain in the raised position at all times in Auto Mode.

15. Configuration

From the Main Menu, select Option 6 -
CONFIGURATION

To scroll up and down the Configuration Menu, use buttons ⇓ (5) and ⇑ (6). To return to the Main Menu press Cancel (8). Note that, unlike Timer and Heater Settings, changes to Configuration items are saved as they are made.

The Configuration screen gives the following information:

Pressure Balancing
When switched on, the pressure balancing will operate. When switched off, the pressure balancing will be inactive.

Shift + OK Switch On
Shift + Cancel Switch Off

Max Time
This is the maximum time that the Heater system will remain forward in Manual Mode. It is factory set to 200 seconds.

Shift + ⇑ Increases Max Time

Shift + ⇓ Decreases Max Time

PowerSave
The 242 software includes a facility to reduce the Heater Power by 50% when it is left idle for a period of time. This can be adjusted from 5 minutes to 30 minutes.

Shift + ⇑ Increases PowerSave Timer.

Shift + ⇓ Decreases PowerSave Timer.

The PowerSave timer can be cancelled and reset either by bringing the Heater Hood forward, or by pressing the Cycle Cancel Button (4).

When PowerSave is in operation, the display flashes a Warning message every 10 seconds.

Drape Timing
In normal operation (drape timing Off), the heating timer will start once the heater hood reaches its forward sensor. With Drape Timing switched On, the timer will not activate until the pressure balancing sensor has been broken for the first time. This can

improve accuracy when running the machine over a period of time, as it partially compensates for fluctuations in ambient and machine temperature.

When using Drape Timing, it should be noted that the actual heating time recorded in Timer Settings will be lower, as only the point from the sensor being broken to the end of the cycle is timed. It is therefore important to distinguish between settings made with Drape Timing and those without.

Shift + OK	Switch On
Shift + Cancel	Switch Off

Hood Ops
Plat Ops
These show the total number of hood and platen operations that have been performed by the machine.

Version No
This displays the software version that the machine is running.

16. Reducing Plates

The 242 Vacuum Forming Machine can be adapted to suit different sizes of sheet material. Reducing Plates (Part No 242R) are available for this purpose.

To fit a Reducing Plate, proceed as follows:

1. Isolate the machine from the electrical and compressed air supplies.
2. Unbolt the existing top plate.
3. Remove the large platen mesh from the platen
4. Lay the Reducing Tray into the Platen.
5. Bolt the new top plate onto the machine
6. Remove the two shoulder bolts which attach the rear of the clamp frame to its pivot points
7. Remove the two clips which secure the front of the clamp frame to the raising cylinders
8. Remove the clamp frame and fit the new size
9. Refit the shoulder bolts and securing clips

17. Maintenance

Your 242 Vacuum Forming Machine requires very little in the way of routine maintenance. The following checks should be made, to ensure that the machine continues to run correctly.

Service the vacuum pump in accordance with the Maintenance Schedule (see Appendix 1)

Should any circuits not function, check the circuit breakers located in the main switchgear enclosure (inside rear recess adjacent to mains isolator switch).

If there are any queries regarding specifications operation or maintenance of this machine, please contact the manufacturers or their appointed agent.

18. Appendix 1

Operating Instructions

CE

Rietschle Thomas
A Thomas Industries Company

Vacuum pumps

VC

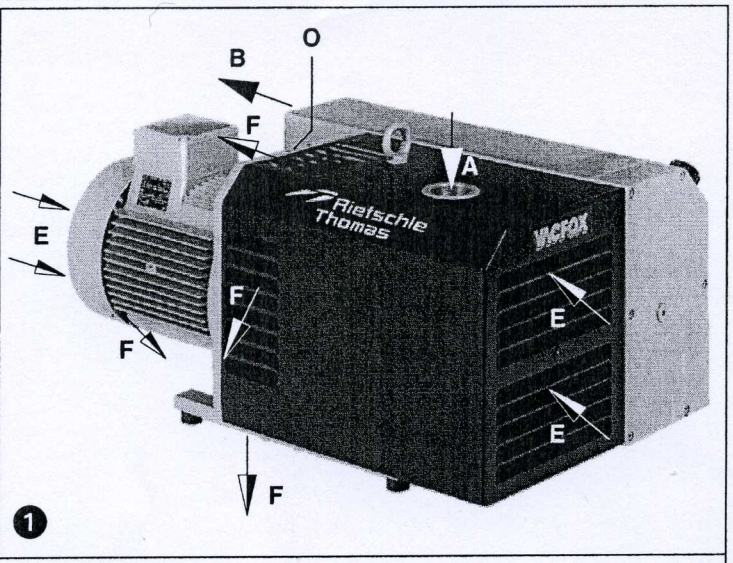
VACFOX

- VC 50
- VC 75
- VC 100
- VC 150

Pump ranges

These operating instructions apply to the following oil flooded rotary vane vacuum pumps: VC 50, VC 75, VC 100 and VC 150

The nominal vacuum capacities at atmosphere are 50, 70, 96 and 150 m^3/hr operating on 50 cycles. The pumping curves showing capacity against vacuum can be seen in data sheet D 231.



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Description

VC 50, VC 75, VC 100 and VC 150 vacuum pumps are fitted with a mesh filter on the pump inlet. The vacuum pump is enclosed in a sound box. On the exhaust side of the pump an oil mist eliminator is fitted which has the function of re-circulating oil back into the circulation system, as well as providing high efficiency separation on the pump exhaust. Situated between the pump housing and the motor, a high efficiency cooling fan pulls cooling air in through the fan cover, which results in the cooling of the re-circulating oil.

A standard built-in non return valve on the inlet of the pump seals the pump from the process when the pump is stopped. This prevents oil moving into the pumping cylinder when the pump is stationary. Excessive oil in the cylinder could cause a hydraulic lock when the pump is started and hence undue stress on the rotor blades.

The gas ballast valve which is fitted as standard avoids at its operating temperature any condensation of a small amount of water vapour inside the pump and hence emulsification of the oil. The gas ballast vapour handling capacity can be increased if required to tolerate higher vapour loads than normal.

All the pumps are driven by a direct flanged three phase, standard TEFV motor via a pin and bush coupling.

Optional extras: The following standard optional extras can be supplied if required: Vacuum regulating valve (ZRV), additional non return valve (ZRK), dust inlet filter (ZFP), high vacuum suction filter (ZVF), direct on line (DOL) motor starter (ZMS) and various vacuum gauges (ZVM).

Suitability

⚠ **The units VC are suitable for the use in the industrial field i.e. the protection equipments corresponds to DIN EN 294 table 4, for people aged 14 and above.**

These models can be used for the evacuation of a closed system or for a permanent vacuum from: 0.5 to 500 mbar (abs.) When these pumps are operated permanently outside the ranges listed above, there may be oil seepage at the exhaust port. For evacuation of closed system the volume to be evacuated can amount max. 2% to the nominal capacity of the vacuum pump.

For continuous operation > 100 mbar (abs.) we recommend the bigger motor size

⚠ **Amounts of water vapour may be handled. Water, other liquids, aggressive or inflammable gases and vapours may not be handled. For water vapour tolerance, see information I 200.**

Handling of inflammable or aggressive gases and vapours is only possible with special versions, if the safety instructions XE 2 are noted.

When handling oxygen, the saftey instruction sheet XE 3 should be noted.

⚠ **The ambient and suction temperatures must be between 12 and 40°C. For temperatures outside this range please contact your supplier.**

The standard versions may not be used in hazardous areas.

The back pressure on the exhaust port must not exceed + 0.1 bar.

⚠ **All applications where an unplanned shut down of the vacuum pump could possibly cause harm to persons or installations, then the corresponding safety backup system must be installed.**

BE 231

3.3.2004

Rietschle Thomas GmbH + Co. KG
Postfach 1260
79642 SCHOPFHEIM
GERMANY
Fon 07622/392-0
Fax 07622/392300
e-mail:
info.sch@rtpumps.com
www.rtpumps.com/sch

Rietschle Thomas UK
Bellingham Way
NEW HYTHE
KENT ME20 6XS
UNITED KINGDOM
Fon 01622/716816
Fax 01622/715115
e-mail:
ukinfo@rtpumps.com
http://www.rtpumps.co.uk

Handling and Setting up (pictures ❶, ❷ and ❸)

Pumps that have reached operating temperature may have a surface temperature at position (Q) of over 70°C.

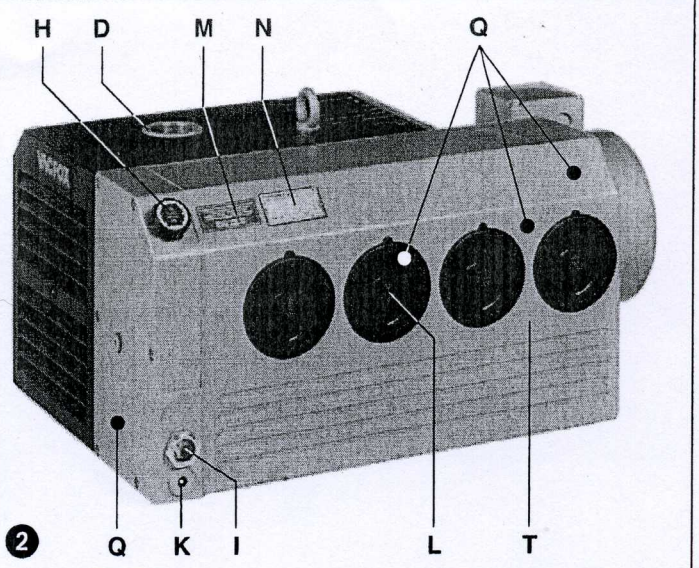
WARNING! Do Not Touch.

Suction flange (D), oil filler ports (H, H_1), oil sight glass (I), oil drain plugs (K), gas ballast (U) and oil separator housing (T) must all be easily accessible. The cooling air entries (E) and the cooling air exits (F) must be a minimum distance of 20 cm from any obstruction. The discharged cooling air must not be re-circulated. For maintenance purposes we recommend a space of 0.4 m.

The VC pumps can only be operated reliably if they are installed horizontally.

For installations that are higher than 1000 m above sea level there will be a loss in capacity. For further advice please contact your supplier.

When installed on a solid base, the pumps may be installed without fixing down. If the pumps are installed on a base plate we would recommend fitting anti vibration mounts. This range of vacuum pumps are almost vibration free in operation.



Installation (pictures ❶ and ❷)

For operating and installation follow any relevant national standards that are in operation.

1. The vacuum connection (A) is situated on the suction flange (D).
   The air handled can be emitted into the atmosphere through the exhaust port (B) or by utilising an exhaust pipe.
   Long and/or small bore pipework should be avoided as this tends to reduce the capacity of the pump.
   The exhaust port (B) must not be obstructed or partly obscured.
2. The lubricating oil (for recommended brands see under servicing) can be put into the pump at the oil filler port (H) of the oil separator housing, until the oil level shows at the upper mark of the oil sight glass (I). After filling, make sure the oil filler port is closed.
3. The electrical data can be found on the data plate (N) or the motor data plate. The motors correspond to DIN/VDE 0530 and have IP 54 protection and insulation class F. The connection diagram can be found in the terminal box on the motor (unless a special plug connection is fitted). Check the electrical data of the motor for compatibility with your available supply (voltage, frequency, permissible current etc.).
4. Connect the motor via a motor starter. It is advisable to use thermal overload motor starters to protect the motor and wiring. All cabling used on starters should be secured with good quality cable clamps.
   We recommend that motor starters should be used that are fitted with a time delayed trip resulting from running beyond the amperage setting. When the unit is started cold, overamperage may occur for a short time.

The electrical installation may only be made by a qualified electrician under the observance of EN 60204. The main switch must be provided by the operator.

Initial Operation (pictures ❶ and ❷)

1. Initially switch the pump on and off for a few seconds to check the direction of rotation against the direction arrow (O).
2. Connect the suction pipe at (A).
3. Run the pump for two minutes using the correct rotation. Stop pump and top up the oil using the oil filler port (H) to the correct level (see sight glass (I)). Repeat this process until the oil cooler is completely full.
   On no account open the oil filler port when the pump is operating.
4. Vacuum regulating valve (optional extra):
   The vacuum can be adjusted by turning the regulating valve according to the symbols as indicated on the top of the regulating valve.

Potential risks for operating personnel

1. Noise Emission: The worst noise levels considering direction and intensity measured according to DIN 45635 part 3 (as per 3. GSGV) are shown in the table at the back. When working permanently in the vicinity of an operating pump we recommend wearing ear protection to avoid any damage to hearing.
2. Oil mist in the Exhaust Stream: Even with the high efficiency oil mist eliminator the exhausted air could still contain extremely low amounts of oil mist which can occasionally be detected by smell. Permanent inhalation of these mists may result in health problems, therefore it is extremely important to make sure that the installation area is well ventilated.

Maintenance and Servicing

When maintaining these units and in situations where personnel could be injured by moving parts or by live electrical parts the pump must be isolated by totally disconnecting the electrical supply. It is imperative that the unit cannot be re-started during the maintenance operation.

Do not work on a pump that is at its normal operating temperature as there is a danger from hot parts or hot lubricant.

1. Air filtration

The capacity of the pump can become reduced if the air inlet filters are not maintained correctly.

Filters on the suction side (picture ❸):

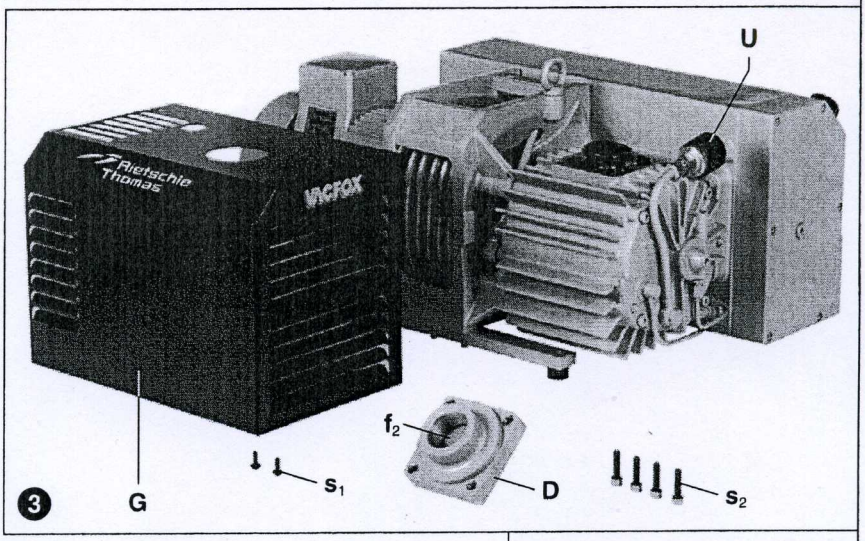
Mesh filter (f_2) must be cleaned regularly depending upon the amount of contamination. Cleaning can be carried out by washing out or by blowing out with compressed air. Replace filters if contaminated completely.

Dismantle cover (G) by removing screws (s_1) and the suction flange (D) can be dismantled by removing screws (s_2).

Filter for Gas ballast (picture ❸ and ❹):

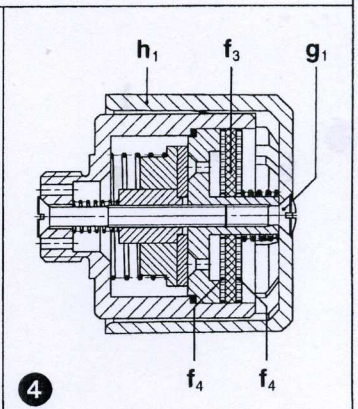
All pumps are equipped with a gas ballast valve (U).

The built in disc (f_3) and mesh discs (f_4) must be cleaned regularly depending upon the amount of contamination by blowing out with compressed air. Dismantle cover (G) by removing screws (s_1). By removing the screw (g_1) and plastic cap (h_1) the filter elements can be removed for cleaning. Re-assemble in reverse order.



Filter Cartridge (Optional Extras):

The filter cartridge of the vacuum tight suction filter (ZVF) or dust separator (ZFP) must be cleaned regularly again depending upon the amount of contamination. Cleaning can be achieved by washing or by blowing out with compressed air. Replace the filter cartridge if necessary. The cartridge can be removed completely by undoing the relevant retaining clips.



2. Lubrication (picture ❷)

Check the oil level regularly depending upon the operating hours. First oil change after 500 operating hours (see oil drain plug (K)). Further changes every 500-2000 operating hours. The oil change times should be reduced if the application is dusty.

Only oils corresponding to DIN 51506 group VC/VCL or a synthetic oil (obtainable from Rietschle) should be used. The viscosity must correspond to ISO-VG 100 according to DIN 51519.

The recommended Rietschle Oil types are: MULTI-LUBE 100 (mineral oil); SUPER-LUBE 100 (synthetic oil) (see oil type plate (M)).

When the oil is under a high thermal load, e.g. ambient or suction temperatures over 30°C, unfavourable cooling or operating with increased speed etc., the oil change time can be extended by using the recommended synthetic oil.

Old and used oil must be disposed of corresponding with the relevant health, safety and environmental laws.

If the oil brand is changed, the old oil must be drained completely from oil separator housing and the oil cooler.

3. Oil separation (picture ❷, ❺, ❻ and ❼)

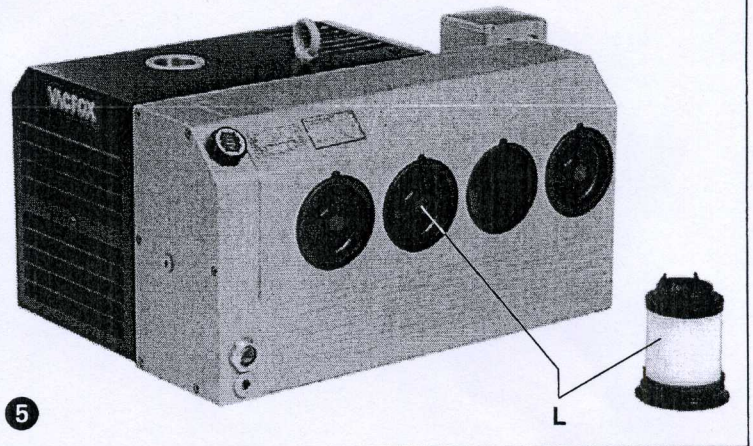
Extremely blocked filter elements will result in increased pump temperature and will cause discolouration of the lubricant.

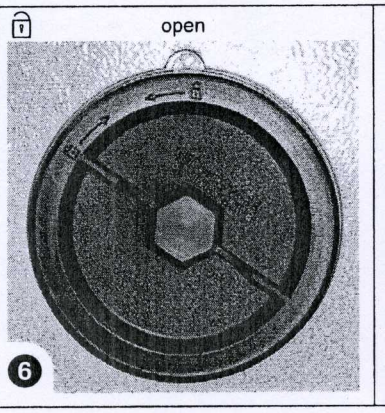
The oil separator elements (VC 50/75 → 3x, VC 100/150 → 4x) may become contaminated after a long period of operation which can result in high pump temperature and motor overload. We therefore recommend changing the filter elements (L) every 2000 operating hours or when the filter back pressure is in excess of 0.7 bar (see back pressure gauge → optional extra). It is not possible to clean these elements.

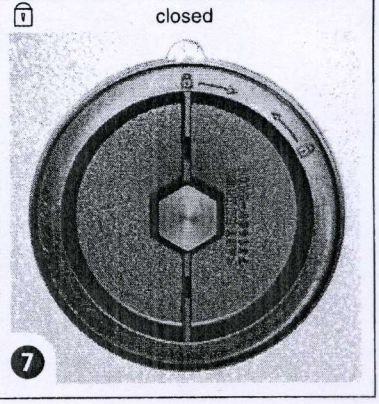
To change filters: Remove filter elements (L) with a ring spanner (spanner size 19 mm or $^3/_4$") turning to the left.

Put in new oil separator elements with open lock symbol (see picture ❻) at arrow ▼ on insert and fix by turning to the right (up to clicking into place).

Oiling the O-Rings of the oil separator elements makes the screw in easier.







Trouble Shooting

1. Motor starter cuts out vacuum pump:

1.1 Check that the incoming voltage and frequency corresponds with the motor data plate.
1.2 Check the connections on the motor terminal block.
1.3 Incorrect setting on the motor starter.
1.4 Motor starter trips too fast.
Solution: Use a motor starter with a time delay trip (version as per IEC 947-4).
1.5 The vacuum pump or the lubricating oil is too cold.
1.6 The viscosity of lubricant is too high.
1.7 Oil mist eliminator elements are blocked or contaminated.
1.8 Back pressure on the exhaust pipework is excessive.
1.8 Continuous operation > 200 mbar (abs.) Solution: Use a bigger motor size.

2. Insufficient suction capacity:

2.1 Inlet filters or meshes are obscured.
2.2 Suction pipe work is too long or too small.

3. Vacuum pump does not reach ultimate vacuum:

3.1 Check for leaks on the suction side of the pump or on the system.
3.2 Viscosity of lubricant incorrect.

4. Vacuum pump operates at an abnormally high temperature:

4.1 Ambient or suction temperature too high.
4.2 Cooling air flow is restricted.
4.3 Problem as per 1.6, 1.7 and 1.8.

5. Exhausted air contains visible oil mist:

5.1 Oil separator elements are fitted incorrectly.
5.2 Incorrect oil brand is used.
5.3 Problem as per 1.7, 1.8, 4.1 and 4.2.

6. Unit emits abnormal noise:

Note: A knocking noise from the rotor blades is normal when starting from cold, as long as it disappears within two minutes with increasing operating temperature.
6.1 The pump cylinder is worn.
Solution: send your complete unit off for repair to the supplier or approved service agent.
6.2 The vacuum regulating valve is noisy.
Solution: replace valve.
6.3 Blades are damaged.
6.4 Problem as per 1.5 and 1.6.

7. Water in lubricant i.e. Emulsification:

7.1 Pump pulls in water because of the application.
Solution: Fit water separators on to the vacuum side.
7.2 Unit handles more water vapour than the gas ballast is designed for.
Solution: Consult supplier for the provision of an increased gas ballast capability.
7.3 Pump operates only for a short time and does not reach normal operating temperature.
Solution: Run the pump with closed suction until the oil has been cleaned.

Appendix:

Repair on Site: For all repairs on site an electrician must disconnect the motor so that an accidental start of the unit cannot happen.
All engineers are recommended to consult the original manufacturer or one of the subsidiaries, agents or service agents. The address of the nearest repair workshop can be obtained from the manufacturer on application.
After a repair or before re-installation, follow the instructions as shown under the headings "Installation and Initial Operation".

Lifting and Transport: To lift and transport the vacuum pump the eye bolts on the pump and motor must be used. If an eye bolt is missing use suitably rated strops. The weight of the pumps is shown in the accompanying table.

Storage: VC units must be stored in dry ambient conditions with normal humidity. If a pump needs to be stocked for a period longer than 3 months we would recommend using an anticorrosion oil rather than the normal lubricant.

Disposal: The wearing parts (as listed in the spare parts lists) should be disposed of with due regard to health and safety regulations.

Spare parts lists:
E 231 → VC 50 - VC 150

VC			50	75	100	150
Noise level (max.)	dB(A)	50 Hz	66	66	70	72
		60 Hz	70	70	72	74
Weight (max.)	kg	50 Hz	57	59	88	89
		60 Hz	57	59	90	98
Length	mm	50 Hz	585,5	639,5	707	707
		60 Hz	585,5	639,5	707	724
Width		mm	316,5	316,5	406	406
Height	mm	50 Hz	267	267	300	300
		60 Hz	267	267	300	315
Oil capacity		l	3	3	4	4