

Desktop Vacuum Forming Machine

450DT



Installation, Operating and Service Manual

For Parts, Service & Technical Assistance

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Thank you for choosing Formech.

Please read and follow the below safety instructions before attempting to install or operate your machine.



- > Do not operate the machine until you have been trained and are fully conversant with it.
- > Read and understand all of this user manual.
- > This is a 'single person operating' machine.
- > Check your supply voltage and frequency. Make sure it is compatible with your machine. Your machine's electrical specification plate is next to the power inlet socket.
- > You must ensure that the machine is properly earthed and fused.
- > If your machine is not equipped with a moulded mains connector then note that:
 - The earth wire is GREEN with a YELLOW stripe. 
 - The live wire is BROWN 
 - The neutral wire is BLUE 
- > Only suitably qualified personnel should make electrical connections.
- > Turn off the machine and disconnect the power supply when the machine is not in use.
- > The heater and pump on this model are not intended to be left running indefinitely.
- > Never remove any panels unless the electrical supply has been isolated.
- > Always let the machine cool down before attempting to work on it. Some parts of the heater and heat shield become extremely hot during operation.
- > Note the safety warning labels situated on the panels. Never remove any warning labels from the machine.
- > Note the 'HOT SURFACES' safety labelling on the heater & heater guard. These areas can become VERY HOT.
- > Only use the machine for vacuum forming plastic. It is not intended for any other purpose.
- > Ensure that the area you are working in is properly ventilated and that you are aware of the potential hazards from the plastics you are forming. It is the responsibility of the owner or designated responsible person to assess the risks associated with any dangerous fumes given off and to determine any necessary precautions required such as fume extraction. Contact your plastics supplier to gain information regarding hazardous fumes.
- > There is a risk of being burnt when handling heated plastics. Always wear suitable personal protective equipment such as gloves.
- > Ensure that the area surrounding the machine is clean and frequently cleared of finished product and any scrap.
- > This machine is fitted with a dry running vacuum pump. Do not lubricate. Do not allow any liquid to enter the vacuum system. Ensure that moulds are properly sealed to prevent ingress of dust into the vacuum circuit. Severe damage may be caused if the above is not observed.
- > Daily repetitive use of this or any other machine may lead to a) fatigue and loss of concentration b) possible strains.
- > Operators should be trained in the use of correct lifting techniques.
- > Users of this machine should complete regular competence tests.



It is vital that any person using this machine and the person(s) responsible for the health & safety is made fully aware of the potential hazards that could arise from use and misuse.

These can be broadly categorised as: -

1. Electric Shock.

This machine uses Voltages up to 240Vac.



NEVER ATTEMPT ANY REPAIR UNLESS THE ELECTRICAL SUPPLY IS DISCONNECTED. ONLY SWITCH ON WHEN ALL COVERS HAVE BEEN REPLACED.

ONLY A QUALIFIED ELECTRICAL TECHNICIAN MAY WORK ON ANY PARTS CARRYING MAINS VOLTAGE AND SHOULD BE RESPONSIBLE FOR ENSURING THAT THE MACHINE IS IN A SAFE CONDITION BEFORE ALLOWING SERVICES TO BE RESTORED.

2. Burning.

Parts of this machine reach temperatures greater than 300°C over large areas.

WAIT UNTIL THE MACHINE HAS COOLED DOWN BEFORE SERVICE WORK COMMENCES.



SPECIAL PRECAUTIONS MUST BE TAKEN TO ENSURE THAT ONLY THE MACHINE OPERATOR IS IN THE OPERATING AREA DURING USE.

USE PERSONAL PROTECTIVE EQUIPMENT SUCH AS GLOVES WHEN TESTING THE HEATED PLASTIC, HANDLING HOT VACUUM FORMED PARTS, MANUALLY ASSISTING THE FORMING PROCESS AND TOUCHING HOT SURFACES.

INFRARED RADIATION IS EMITTED BY THE QUARTZ HEATERS, ENSURE THAT ANY EXPOSURE TO THIS TYPE OF RADIATION IS SHORT OR COMPLETELY AVOIDED.

3. Toxic Fume Inhalation.



When large sheets of plastic are heated fumes will be given off.

ENSURE THAT THE MACHINE IS POSITIONED IN AN ADEQUATELY VENTILATED PLACE. ASSESS THE RISKS OF THE MATERIALS TO BE FORMED PRIOR TO USE.

4. Fire.



RISK OF FIRE AS A RESULT OF HEAT AND PLASTICS PRESENTS AN EMERGENCY SITUATION. ENSURE FIRE SAFETY TRAINING IS PERFORMED & CONTROLLED.

IT IS ESSENTIAL TO HAVE FIREFIGHTING EQUIPMENT AVAILABLE AT OR NEAR THE MACHINE. USE DRY POWDER (BLUE) OR CARBON DIOXIDE (BLACK) FIRE EXTINGUISHERS.

5. Injury from Trapping.



There is a risk of trapping fingers and hands when loading mould tools. Ensure appropriate care is taken to prevent trapping and use suitable personal protection. Care is required when operating the clamping frame to ensure that fingers or hands are not trapped.

Keep hands clear of the heater rails when pulling the heater forwards.

6. Prohibited Uses.

DO NOT USE THIS MACHINE FOR ANY PURPOSES OTHER THAN THE VACUUM FORMING AND BLOW MOULDING OF PLASTICS SHEET.

DO NOT USE THE HEATER TO APPLY HEAT TO ANY MATERIAL OTHER THAN PLASTIC SHEET AS PART OF THE VACUUM FORMING PROCESS SUCH AS: FOOD PRODUCTS, ALL TYPES OF PARTICLES, POWDER, DUST, ALL TYPES OF LIQUID, WOOD, PAPER, METALS AND ANY FORMS OF COMBUSTABLE MATERIALS.

DO NOT USE THE TABLE MECHANISM TO CLAMP, COMPRESS, FOLD OR APPLY FORCE TO ANY ITEM UNDER ANY CIRCUMSTANCES.

DO NOT USE THE CLAMPING FRAME TO CLAMP COMPRESS, FOLD OR APPLY FORCE TO ANY ITEM OTHER THAN THE CLAMPING OF SHEET PLASTICS AS PART OF THE VACUUM FORMING PROCESS.

DO NOT USE THE TOP OF THE HEATER OR TOP OF THE HEATER GUARD TO STACK PLASTICS OR OTHER MATERIALS.

DO NOT USE THE MACHINE TO STACK OR LEAN ITEMS AGAINST THE SIDES.

DO NOT USE ANY OTHER PART OF THE HEATER TO MOVE THE HEATER FORWARDS AND BACKWARDS OTHER THAN THE HEATER HANDLE.

DO NOT USE OR MODIFY THE ELECTRICAL POWER IN THE INTERNAL WIRING TO SUPPLY ANY OTHER DEVICE OR TO APPLY MODIFICATIONS TO THE MACHINE OR ITS FUNCTIONS.

THIS IS NOT AN EXHAUSTIVE LIST OF THE POSSIBLE MISSUSE OF THIS MACHINERY.
THE USE OF THIS MACHINE MUST BE ASSESSED, MONITORED AND CONTROLLED BY THE PERSON
RESPONSIBLE FOR THE HEALTH AND SAFETY IN THE ORGANISATION THAT OWNS AND OPERATES THIS
MACHINE.

The Formech 450DT is a highly versatile, manually operated Vacuum Forming Machine that will produce high definition mouldings in up to 6mm thick material. These machines are intended for use only for the vacuum forming of plastics components and for the blow moulding of heated plastics. The 450DT is ideal for prototype development work whilst also quite capable of small and large production runs.

The Formech 450DT incorporates the following features:

- Reliable and robust PLC control system and easy to use graphical touch screen with single screen forming cycle operation and 20 memory storage facility.
- Powerful quartz heaters PLC controlled in 4 heating zones.
- Heater power level standby feature allowing energy saving when heater is in rear position.
- Heater safety shut-off after idle period.
- A powerful filtered diaphragm vacuum pump.
- Vacuum gauge indication.
- An air blow facility to release the moulding from the tool.
- An external pressurized air outlet port to allow air supply to external accessories.
- The machine has been designed to be highly adaptable and functions such as changing a mould, or fitting reducing windows (which allow smaller sheets to be used) can be carried out in the minimum amount of time.
- Optional reel feed system.
- Optional purpose built Trolley

This manual is the original user instructions for the Formech 450DT. It informs the user on aspects of machine safety, assembly, operation and maintenance. A more comprehensive guide to the vacuum forming process is available from Formech.

A transit screw is fitted to the rear of the machine to secure the heater and prevent damage during transportation.

Remove this screw when the machine has been appropriately positioned after unpackaging and before attempting to use. See next page for handling and positioning.



Your Formech Machine is supplied with:



1x Electrical cable



1x Installation / Operating
/ Repair Manual + EC
Certificate



1x Table Mesh



Assortment of 5
plastic sheets
(content may vary)

Transportation / Positioning

The 450DT is delivered in a dedicated packaging which includes a pallet, a cardboard box and protective foams. The machine may be unpacked and placed on a bench, table or 450DT trolley. Ensure that the structure, size and load bearing capacity of the bench or table is sufficient for the machine weight. A minimum of 2 persons are required to lift the machine. In the case of the 450DT trolley, ensure that the 2 machine retaining screws are fitted to the under-side of the trolley / machine.

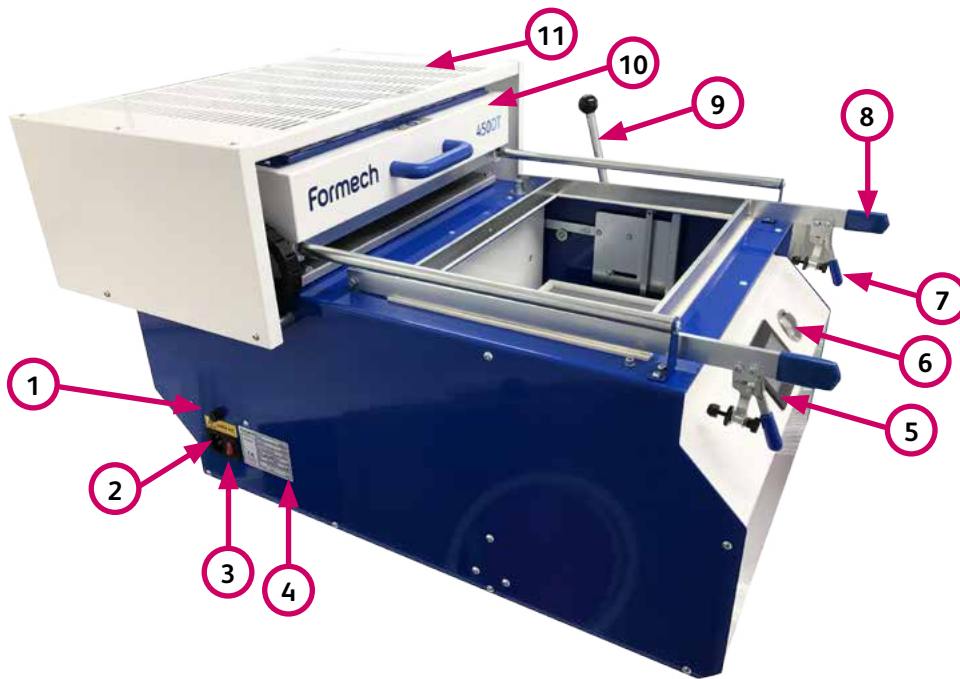
Ensure the machine and / or trolley is sited on a level surface in a draft free environment with a minimum of 40cm access around the machine. Ensure that the area on and around the machine is clear of all other stored items and materials. More access may be required for maintenance and this desktop machine may be easily moved if necessary.

Noise Emissions

Noise emissions on the Formech 450DT are less than 70dB(A).

Machine Storage

The Formech 450DT must be stored in a dry environment. If the machine is not used for a long period of time, run the pump periodically (once a month).



1. Fuse holder 13A
 2. Power Inlet C20
 3. Power ON/OFF Switch
 4. Specification plate
 5. Touch screen HMI
 6. Vacuum gauge
 7. Material clamp
 8. Clamp frame
 9. Table lever
 10. Heater
 11. Safety labelling (hot surfaces)
- + air pressure outlet

Mechanical Specifications

Max Material Size:	450mm x 300mm
Max Forming Area:	430mm x 280mm
Max Depth of Draw:	160mm
Overall Width:	639mm
Overall Height:	525mm
Overall Length:	986mm
Weight:	75Kg

Electrical Specifications

Standard Voltage:	208V-240V ac
Frequency:	50-60Hz
Power:	2.3Kw

Machine Arrangement

1. Fuse Holder

The machine is protected with a 13A fuse accessible from the outside.

2. Power Inlet Receptacle C20

The machine has a C20 receptacle on the side. The power cable has a C19 Plug to fit this receptacle. If your machine is a special voltage or frequency then it may be supplied with a lead not terminated into a mains plug. See Safety section at the beginning of this manual. Note the safety labelling. Before commencing any repair work always remove the mains lead from the Power Inlet Receptacle.

3. Power Switch ON/OFF

This is the main power switch. Switch this 'ON' to provide power to the machine after connecting the power lead. When set 'OFF' there will be no power to the machine.

4. Specification Plate

This states the essential machine data & CE marking.

Machine Arrangement (continuation)

5. Touch screen HMI

The machine is operated through this HMI providing easy use through intuitive graphical software to operate the machine and adjust the settings.

6. Vacuum Gauge

This is situated on the top right hand side of the front panel and gives indication of the vacuum level achieved at the table mould area during moulding. It is usual to expect approx 22”Hg / -750mbar of vacuum.

7. Material Clamps

These clamps lock the Clamp Frame firmly down. After placing the plastic under the clamp frame the material clamp levers are pulled up to lock in place. Adjust the black nuts on the clamps to suit the thickness of the clamped plastic material or when a reducing window is fitted. Adjustment may only be carried out while not under pressure. The rear of the clamp frame is spring loaded and self-adjusting.

8. Clamp frame

This holds the plastic material in position during the forming and release processes.

9. Table Lever

When pulled towards you the table will rise to the upper limit. A further application of pressure will lock the table in this position. During forming the table complete with mould is lifted into the hot plastic and locked in place to ensure a good vacuum seal. At the end of the cycle the table is returned to the lower position by pushing the handle back and away.

NOTE: A mechanical interlock designed to prevent a mould being raised into the heating elements stops the table being raised unless the heater box is fully back

10. Heater Box

This carries the heating elements and is drawn forward by manually pulling the centrally mounted handle. The heating zone control system has built in safety features:

The manual mode ‘count up’ timer has a limit of 300 seconds after which the heater will turn off all power to the heating elements if the heater is still forwards.

When the timed program is loaded, if the heater is forward for more than 2 minutes after the timer has completed the set time the heater will switch to the standby setting. If the heater is not returned to the standby position after a further 2 minutes then the heater will turn off all power to the heating elements.

11. Safety Labelling

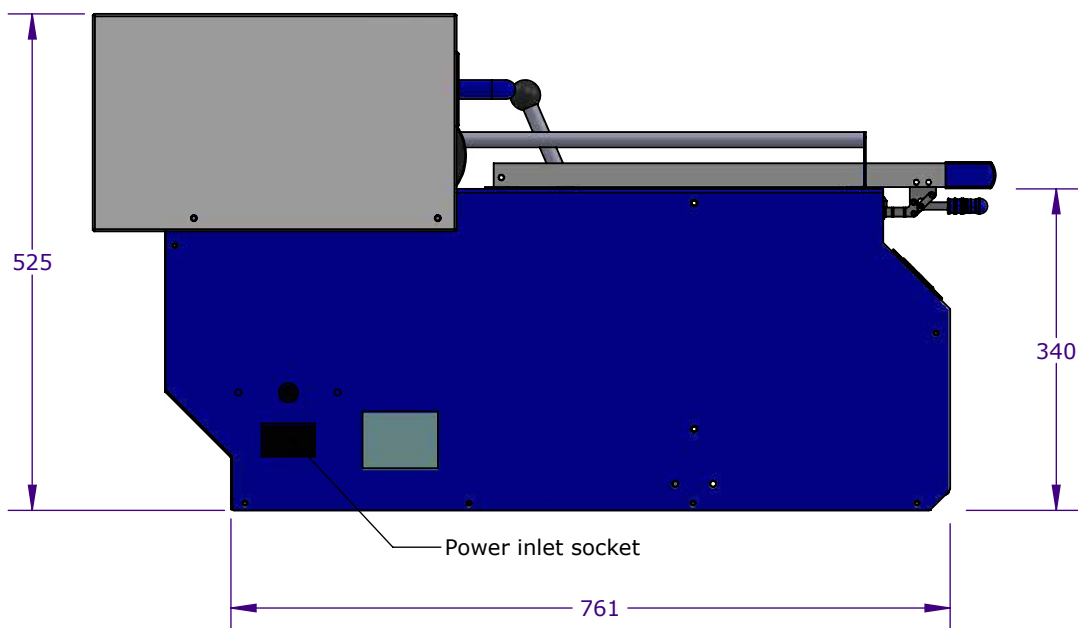
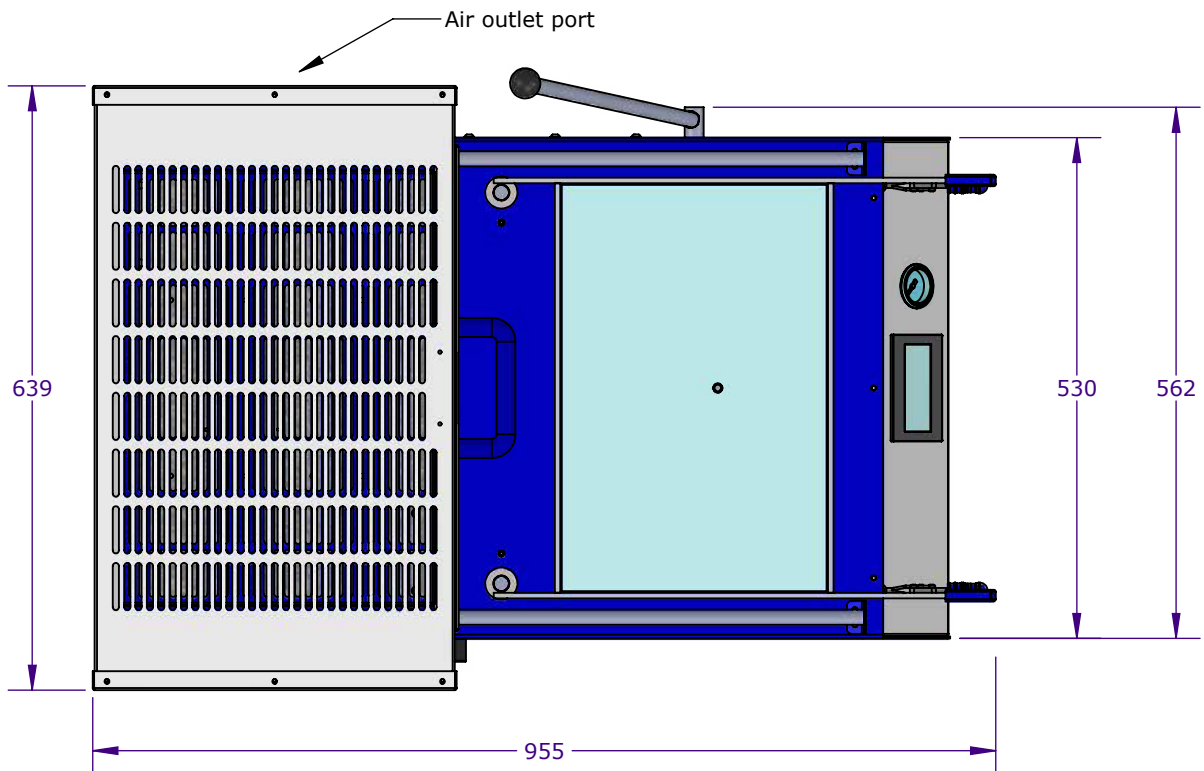
The heater and heater guard will have hot surfaces. Take note of the labelling in these areas.

+ Air pressure outlet (see footprint on page 10 for location)














When the vacuum pump is running, the pressure is diverted to this outlet. This can be used to supply or run other equipment when not being used for vacuum forming. Do not block this outlet or attempt to connect air supply. THIS MACHINE DOES NOT REQUIRE AIR SUPPLY.

Machine Footprint

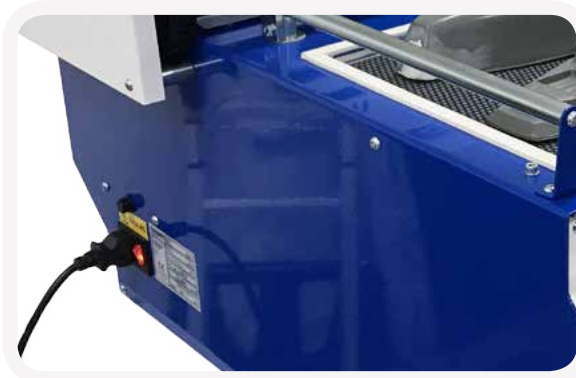
(Dimensions are in mm)



Introduction to the 450DT Control System - Operating Buttons and Icons

	<p>Heater Enable Enables the heaters on the main menu screen. Heaters will shut off after 40 minutes if the machine is unused.</p>
	<p>Start Opens the load options screen to allow selection of saved parameters or manual operation.</p>
	<p>Manual Operation Allows manual operating of the machine functions. Default heater settings are applied. Timer will count up.</p>
	<p>Load from Memory Allows previously saved operating parameters to be used.</p>
	<p>Settings This button provides access to the settings screen where the operating parameters may be adjusted and saved if required.</p>
	<p>Heater Power Setting Allows adjustment of the heat power for each zone. Adjustable in 1 % increments.</p>
	<p>Heater Standby Setting This feature allows reduction of the heater power level when the heater is in the rear position.</p>
	<p>Page Forward This operation will advance to the next page in the help screen and memory settings screens.</p>
	<p>Page Back This operation will return to the previous page or screen.</p>
	<p>Save Used to save operating parameter settings.</p>
	<p>Heater Timer Displays the heating time. The time will count up in manual mode. The set time and the count down time is shown in memory mode.</p>
	<p>Vacuum This operation will latch the pump and the vacuum valve ON to apply vacuum to the table vacuum port.</p>
	<p>Release This operation will apply compressed air to the table hole. This function does not latch but will unlatch the vacuum. Press & hold to run.</p>

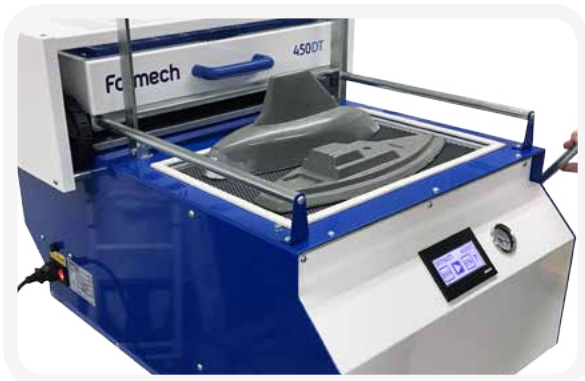
Initial Requirements 450DT



1. Ensure the machine is turned on.



2. With the heater fully back, raise the table to the top position by pulling the table lever closer to you.



3. Place your mould onto the table. A sheet of wire mesh is supplied with the machine to assist with Vacuum air flow under the mould tool.



4. Fix the mould tool in place. Lower the table by pushing the table lever away from you.



5. Open the material clamps (see general arrangement) and raise the clamp frame. Place the plastic material over the aperture.



6. Pull the clamp frame down and close the two material clamps. The plastic should completely cover the white seals around the aperture. Adjust the toggle clamp screws to properly grip the plastic. ⁽¹⁾

⁽¹⁾ The rear of the clamp is spring loaded.

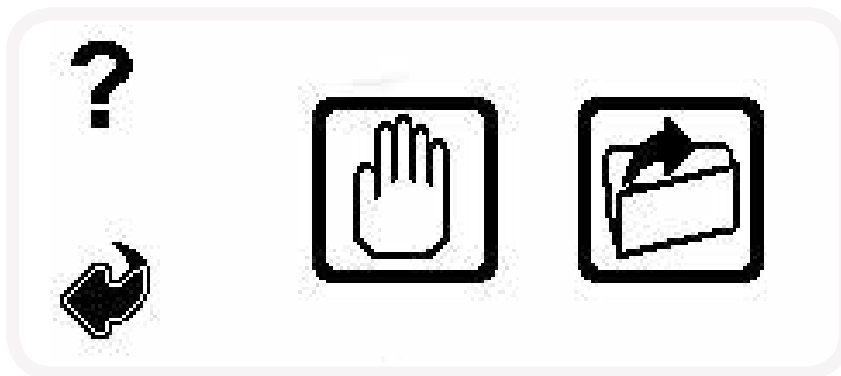
Main Menu



Press to turn ON the heaters. Allow 15 minutes for the machine to reach its operating temperature.

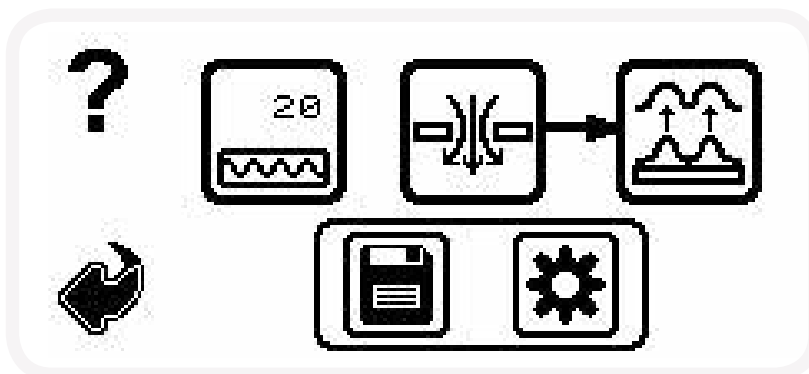
The 450DT has a 'HELP' feature accessible by pressing the '?' button on many of the user screens. Descriptions of the screen icons and buttons are shown on these screens in the language selected.

HELP screen language options are changed by pressing on the language button to select the language required. Press to open the Load Options screen:



Press to open the operating screen in manual mode.

450DT Basic Operation



The Manual Operation screen will open as shown.

The Heater timer value on the Heater button will count UP when the heater is pulled forwards and stop when pushed back. The Vacuum button will latch the vacuum ON when pressed. The Release button will momentarily activate the pump pressure when pressed.

Heater settings may be changed via the settings button. In manual mode the heaters are set to the default values. The Save button will use the settings of the timers shown and import them to the settings screen to edit and save as required.

The following section explains the 450DT vacuum forming process:




Pull the Heater forwards over the clamped plastic. As the plastic heats up it may begin to rise slightly. It will then soften and begin to drop back.




Push the heater back slightly to test the softness of the plastic manually or to observe its state. Continue heating until it is soft enough to form. When the plastic softness is correct push the heater fully back ⁽¹⁾.



Lift the table until it is fully raised. Then press the VACUUM button  to latch on the vacuum. The moulding will form around the tooling.



Once the plastic has cooled sufficiently the RELEASE button  may be pressed to blow the moulding off the mould.



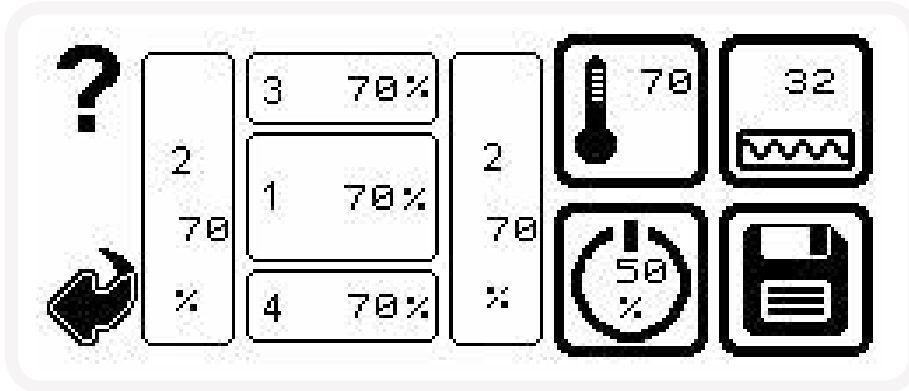
Once released the moulding is now complete and the table may be lowered. Release the clamp frame to remove the moulding for inspection.



Review the results and determine the parameters required to produce the forming. Use the save settings feature to set and record the values for later recall.

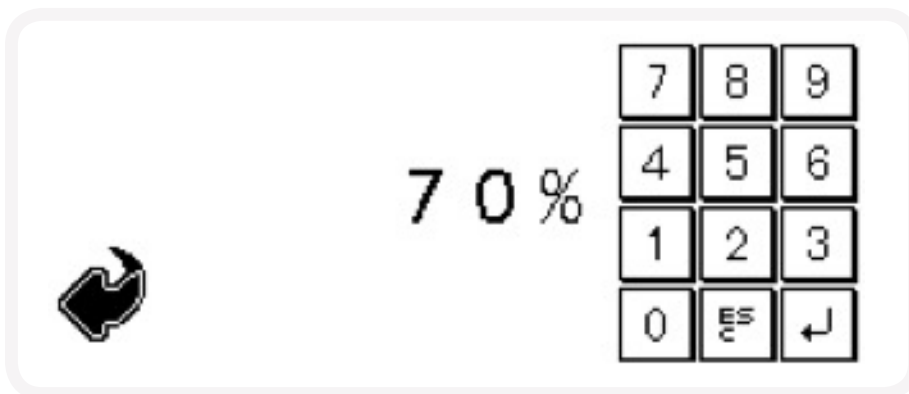
⁽¹⁾ When performing an initial forming it will be necessary to check the progress of heating as this will vary with plastic type, thickness and colour.

450DT Settings



This screen will open when the settings button on the operation screen is pressed. The Manual mode default heater settings are shown.

Heater power settings are adjusted by pressing on the heater button and changing the value using the pop-up keypad on the adjust screen.



Press on the value and the keypad will appear. Enter the new value. Press return. Press the back arrow to return to the settings screen.

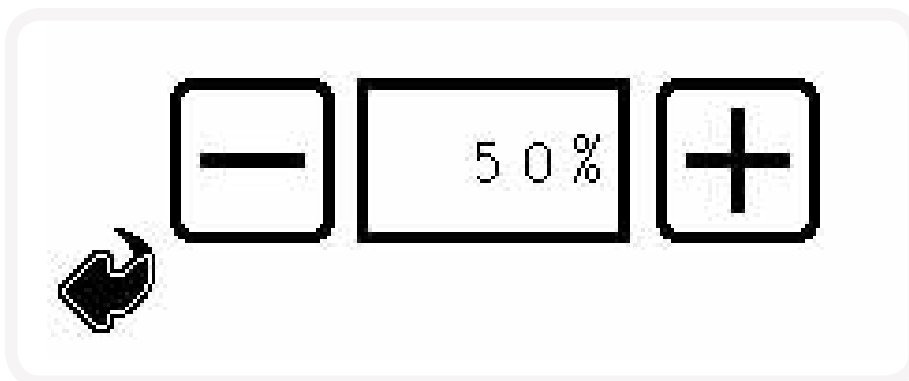
The Heater Timer value is changed in the same way.

Once set to a required value, press on a zone and the value will transfer to that zone. Repeat the process on the other zones to set the required heat power values.

Heat power may be set in 1 % increments to achieve the required heat profile.

The standby feature allows the Heater to idle at a lower heat power when in the rear position. The default level is 50% and is adjustable in 5 % increments.

Press on the standby button to adjust. The following screen will open:



Use the + & - buttons to adjust the standby level.

Press the back button to exit the settings screen and return to the operation screen.

The save button on the operation screen will also open the settings screen and will also bring the timer value from the manual operation across to the settings screen.

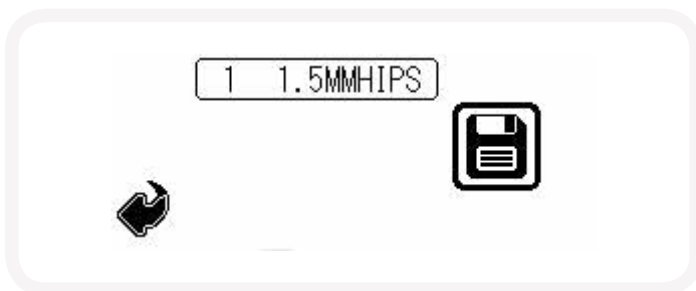
The heater power and timer parameters may be edited before saving into memory. The timer button will open an adjustment screen with a key-pad as described above. When complete, press the save button on the settings screen to select a memory slot to save.

There are 20 memory locations.

450DT Saving Parameters to Memory




When save is pressed on the settings screen the available memory slots are shown. Press the forward arrow to advance to memory positions 11-20. Press the Back arrow to return to the settings page if required. Press on a previously saved memory slot to change an existing record or select a new slot to save as required. When a memory position is selected the following screen will open.



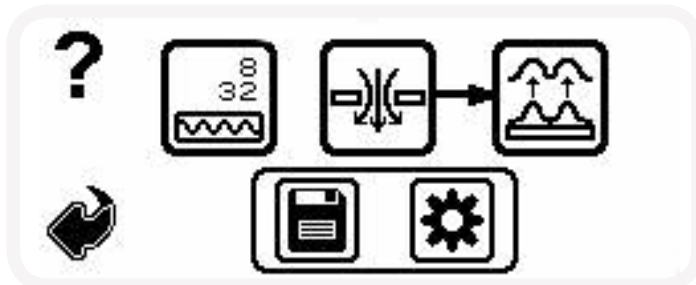
Press on the memory title to edit the title using the pop-up key pad as required. Press the save button when complete.

450DT Loading Previously Saved Parameters from Memory



Press the load button  on the load options screen to load previously saved parameters. The load select screen will open. The previously loaded memory slot will be remembered and a ✓ will show next to the slot. Use the forward arrow to scroll to memory slots 11-20 and select the memory parameters as required. The program memory operation screen will open. The following section explains the operating differences.

450DT Operating Using Saved Parameters



This operating screen will open. Two values will show in the heater timer button.

The lower value shows the timer parameter for the selected memory.

The top value shows the actual timer value. When the heater is pulled forwards the timer will count down.

When the timer reaches zero the timer buzzer will sound. The timer value will continue and show a negative value to indicate that's it has passed zero. All other buttons operate the same as previously described. Heater power settings can be adjusted as previously described using the settings button.

When the SAVE button is pressed the actual heat time, including its negative count, will be carried over to the settings screen for editing and saving as previously described.

Heaters

The powerful quartz heaters are designed to heat the plastic rapidly without burning the surface. The time required to heat the plastic sheet remains fairly constant once the heaters have reached their operating temperature.

Heating cycle times vary according to a number of factors. With a little experience, timings may be easily estimated.

Some plastics such as styrene have a wide tolerance to heating times giving consistently good mouldings. Care must be taken with other materials such as ABS, as the surface will blister if the temperature limit is exceeded. Such plastics may also require drying prior to thermoforming.

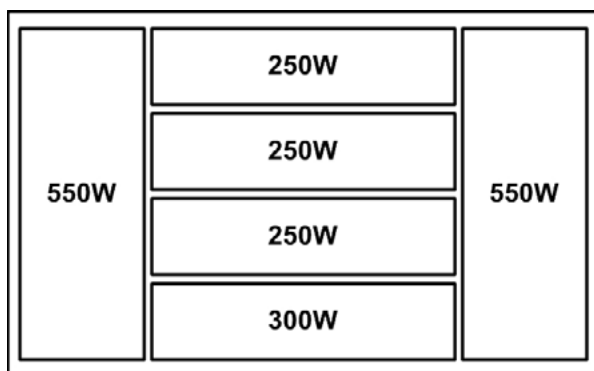
The moulding should be formed when the plastic is sufficiently relaxed to become indented by the blunt end of a pencil but not soft enough to sag.

A properly heated sheet will give an excellently defined moulding. If the sheet is not hot enough while forming the moulding will not pick up all the detail from the tool.

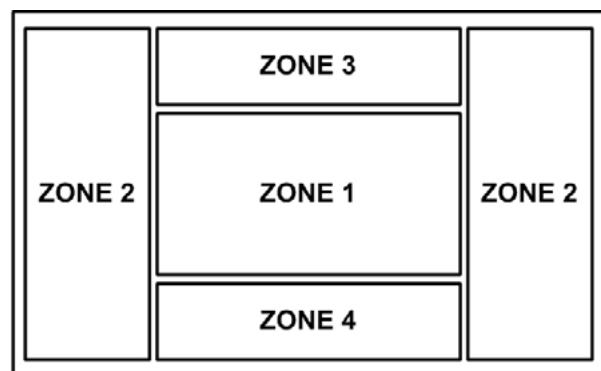
The times below were recorded using styrene at an ambient temperature of 20 degrees C With the machine at operating temperature. Please note that these times are a guide only. Various factors will affect the heating time including the colour and surface finish of the material.

- 1.5mm Thick = 60 seconds
- 2.0mm Thick = 95 seconds
- 4.0mm Thick = 240 seconds

The Heater elements are configured so that the front and side areas are slightly higher powered than the central and rear area. This is to provide more heat around the outside edges of the forming area which can be affected by environmental factors such as draughts. The element and zone layouts are shown below.



Front

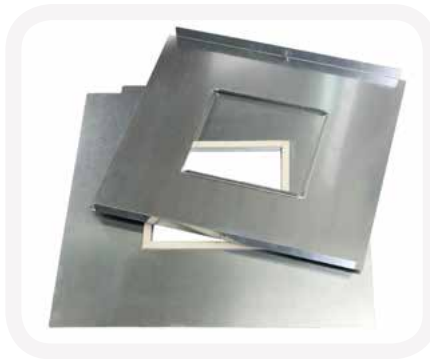


Front

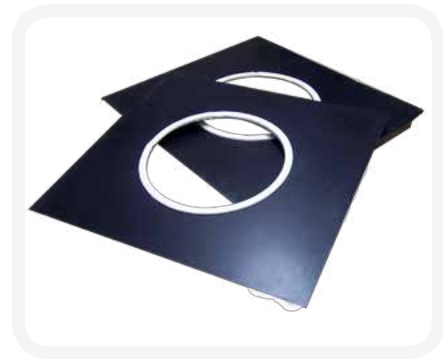
The following items can be purchased for your 450DT vacuum forming machine:



1. Service kit



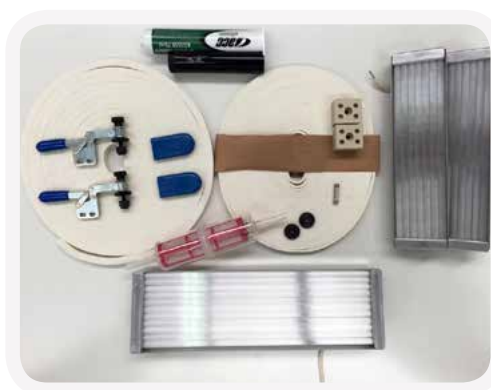
2. Reducing windows



3. Blow mould windows



4. 450DT Machine trolley



5. Spare parts kit

1. It is unlikely that you will need to service or repair your machine for many years provided you follow the maintenance information contained in this manual; however the table and clamp seals, which are considered to be consumable items, will need to be replaced depending on the usage of the machine. Therefore this kit contains the essential consumables (seals and pump filter) to ensure a good performance of your machine year on year.

2. The standard aperture size of the Formech 450DT reducing window is 228mm x 203mm, to use plastic size of 248mm x 223mm. Formech can also produce special size reducing windows. For more information please contact our sales department.

3. You can use your vacuum forming machine for blow moulding by fitting a special circular reducing window to your machine. The maximum diameter you will get on the 450DT is 270mm. For more information please contact our sales department.

4. The Formech machine trolley allows you to easily move your 450DT machine. The 2 locking castors assure the trolley remains in position all the time. Underneath there is also space to store plastic material and moulds. The trolley dimensions are: - Height: 720mm - Depth: 780mm - Width: 608mm

5. This is an essential selection of core consumable parts to minimise down time within the first two years. Spare parts kit contains: 1x Quartz element FSQ 250W, 1x Quartz element FSQ 300W, 1x Quartz element SSQ 550W, 2x Ceramic terminal blocks, 2x Clamp adjuster nuts, 2x Toggle clamps, 2x Clamp frame grips, 1x Seal kit, 1x In-line filter, 1x 13amp fuse.

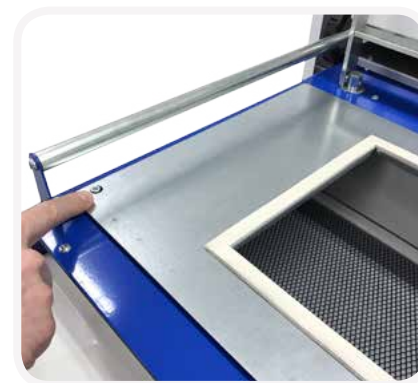
Reducing Windows - Fitting (optional)



1. Lift the clamp frame and place the lower reducing window.



2. The lower reducing window locates over the two cap head screws.



3. There is one cap head screw at the front and another one at the rear, opposite side.



4. Place the upper reducing window in the clamp frame at the rear.



5. Then locate it at the front of the clamp frame. The hole on the top plate of the reducing window needs to be at the front of the machine.



6. Close and lock the clamp frame. At this stage, you may have to adjust the toggle clamps.



7. Fit the bolt and the nut to secure the window to the clamp frame.



8. Reducing windows correctly fitted to the machine.

Trolley - Self Assembly Instructions (optional)

A. Parts supplied

Item	Qty	Fixing	Qty
Top Tray		M6 x 16 Setscrew & Washer (Security)	2
Corner Strut	4	M6 x 16 Button Head Screw	24
		M6 Plain washer	24
Storage Divider	3	M6 x 12 Button Head Screw	9
		M6 Full nut	9
75mm Swivel Castors	2	M10 x 25 Setscrew	2
		M10 Washer	2
		M10 Split Washer	2
75mm Locking Swivel Castors	2	M10 x 25 Setscrew	2
		M10 Washer	2
		M10 Split Washer	2

Before starting the assembly, prepare a clear area with suitable surface that will not scratch the painted surfaces of the trolley.

B. Tools required

- 10mm spanner for the dividers and machine security fixings.
- 13mm spanner for castor screws.
- 4mm Hex tool or screwdriver for button head screws.

C. Assembly

1. Start with the bottom tray that will need the four castors and the dividing panels for material storage to be secured in place.

- Ensure the two locking castors are fitted at the front of the lower tray.
- Fit castors using the M10 washers and M10 x 30mm setscrews pushing the fixing through the body of the castor and tightening securely into the threaded bush of the lower tray.
- It is easier to fit the dividing panels at this stage. Establish the desired position for the dividing panels and tighten securely with three M6 button head screws and nuts per divider.

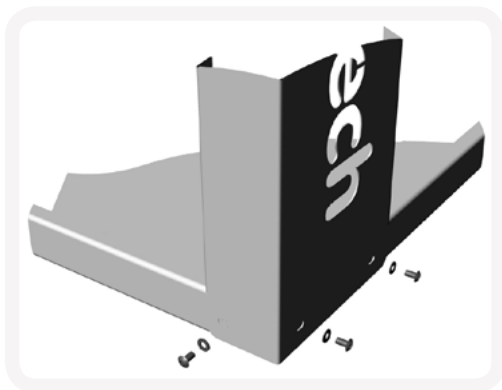
Position the completed lower tray to one side and begin the assembly of the top tray.



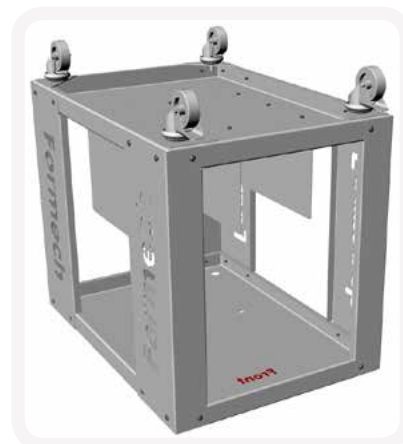
Trolley - Self Assembly Instructions (optional) (continuation)

2. Place the top tray (this has four 25mm holes to locate the rubber feet for the machine) upside down on the floor or a table to start the assembly process.

3. Take each of the four corner struts and secure the one end of each strut to the top tray with plain washers and M6 button head screws, making sure that they are only finger tight at this stage. There are three button screws per corner fixing. Ensure the corner struts are positioned as illustrated below:



4. Take the assembled bottom tray, turn it upside down and lower it until it rests onto the four corner struts. Fit the remaining fixings to the struts and lower tray with the remaining plain washers and M6 button head screws. Tighten all 24 strut fixings securely. Turn the assembly over so that the 4 casters are on the floor and check for stability.

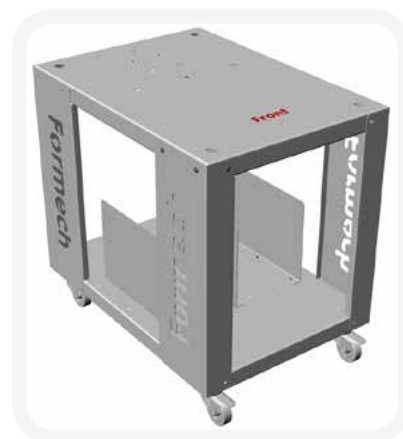


5. When locating the machine on the trolley ensure the machine rubber feet are located in the clearance holes of the trolley top. Ensure that local lifting and handling procedures are applied.

6. Trolley securing. The machine must be attached to the trolley by the securing screws and washers provided. The securing screws are fitted under the trolley top into the machine body. Ensure these fixings are tight and cannot become loose.

7. Once the trolley and machine have been placed in their ideal position, the two locking castors need to be depressed to prevent trolley movement.

ENSURE THAT LOCAL LIFTING AND HANDLING PROCEDURES ARE APPLIED AND MONITORED BY A PERSON RESPONSIBLE FOR HEALTH AND SAFETY.

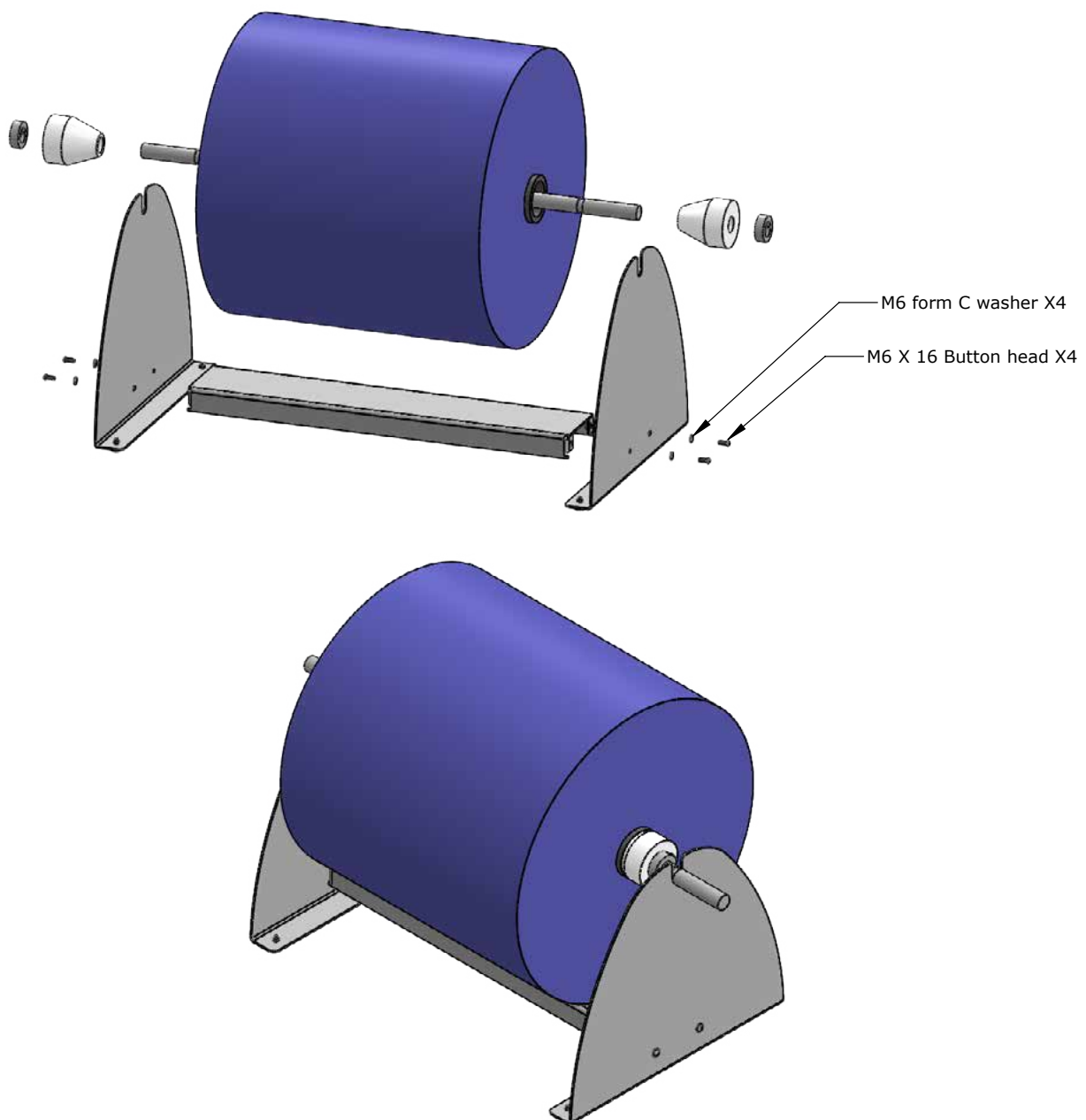


Reel Feed - Self Assembly Instructions (optional)

The 450DT can be used with a reel feed as an accessory. See assembly diagram below. Place the cones and locking collars either side of the reel. Then tighten the two collars to the central shaft so that the cones are locked in place. Now locate the shaft and the material on top of the reel feed stand.

TAKE CARE WHEN LIFTING HEAVY LOADS SUCH AS PLASTIC REELS FOR USE WITH THIS OPTION. ENSURE THAT LOCAL LIFTING AND HANDLING PROCEDURES ARE APPLIED AND MONITORED BY A PERSON RESPONSIBLE FOR HEALTH AND SAFETY.

USE MECHANICAL LIFTING METHODS OR EQUIPMENT WHERE POSSIBLE.



All tools should be mounted on a baseboard. They should not have undercuts and must be produced with slightly angular sides ('draft angle') to aid release. Vent holes are needed to allow the air to be evacuated from pockets and sharp angles on the tool. Providing these holes are kept small (1mm diameter or less) they will not leave marks on the surface of the finished moulding.

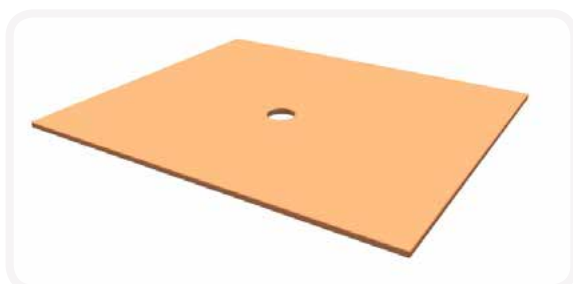
Tools made from wood or medium density fibreboard (MDF) are easily constructed and can give short runs of good quality mouldings at a low cost (see notes below). The use of close-grained wood will avoid grain patterns appearing on the mouldings.

Plaster of Paris may be used for one-offs but the plaster must be allowed to properly dry out. (See notes below)

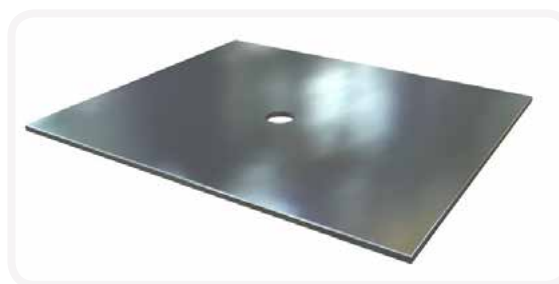
Aluminium tools have the advantages of carrying fine detail and being more resistant to both distortion and surface damage. Aluminium tools should be pre-heated before use. A cool metal mould will absorb some of the heat from the plastic sheet before it can take up the full definition.

Resin tools combine most of the advantages of metal moulds with relative ease of manufacture. Various resinous materials are commercially available especially for vacuum forming tool production.

Repairs to the vacuum circuit can be costly. The use of talc as a release agent is not recommended. It may clog the vacuum filter, valves and hoses.



MDF Baseboard



Aluminium Baseboard

NOTES:

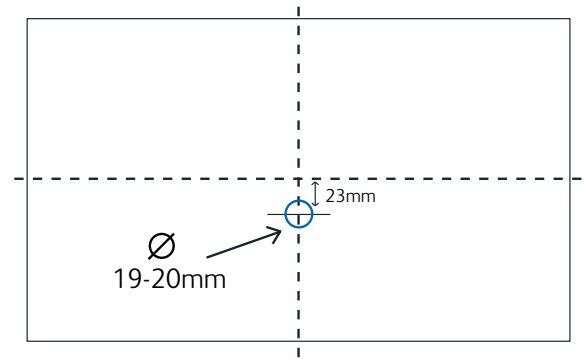
Porous mould materials such as wood and plaster should be properly sealed to prevent the vacuum pump from sucking out any moisture or sawdust, loose plaster etc. The vacuum circuit may quickly become blocked with dust or slurry if moulds are not properly sealed.

As the plastic cools after forming it will contract, gripping the tool tightly. If the tool has been made with sloping sides and has a good surface finish it will release more easily. Where the draft angle must be kept to a minimum a release agent may be used to assist release.

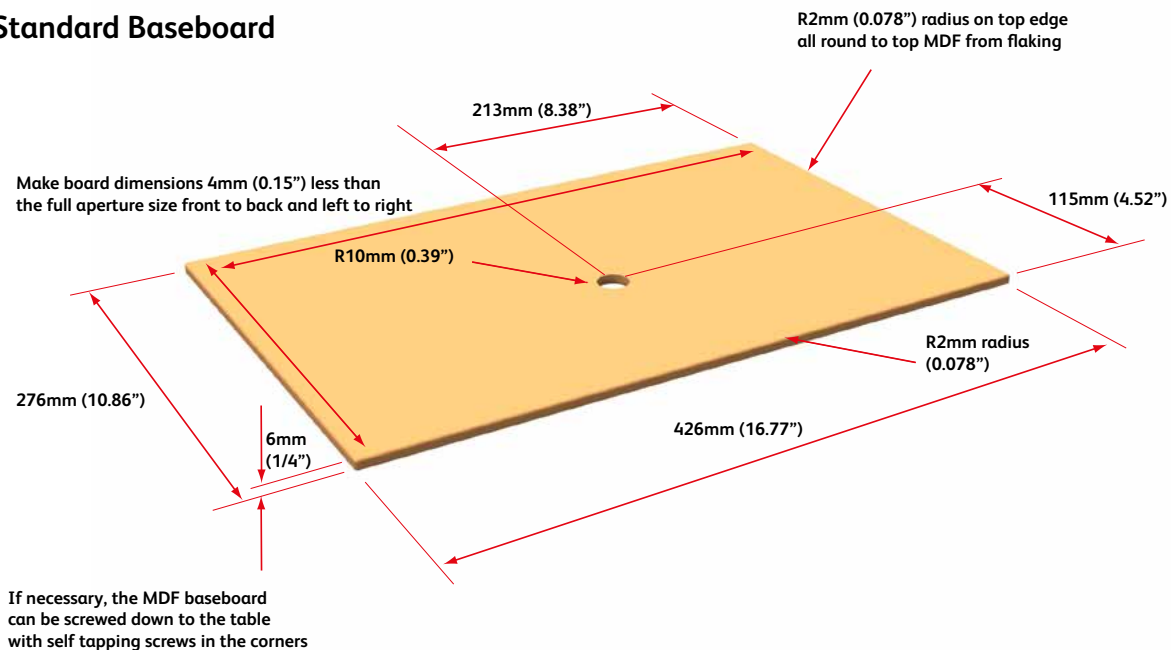
Sealed moulds will usually release more easily. Silicone based release agents may be used on more difficult moulds. Silicone based release agents are rapidly absorbed by porous (unsealed) moulds, rendering them ineffective.

The baseboard can be made from either MDF or aluminium and needs to be 6.00mm (1/4") thick. The vacuum hole can be 19.00 – 20.00mm (3/4") diameter and needs to be positioned 23mm forward of the centre of the table.

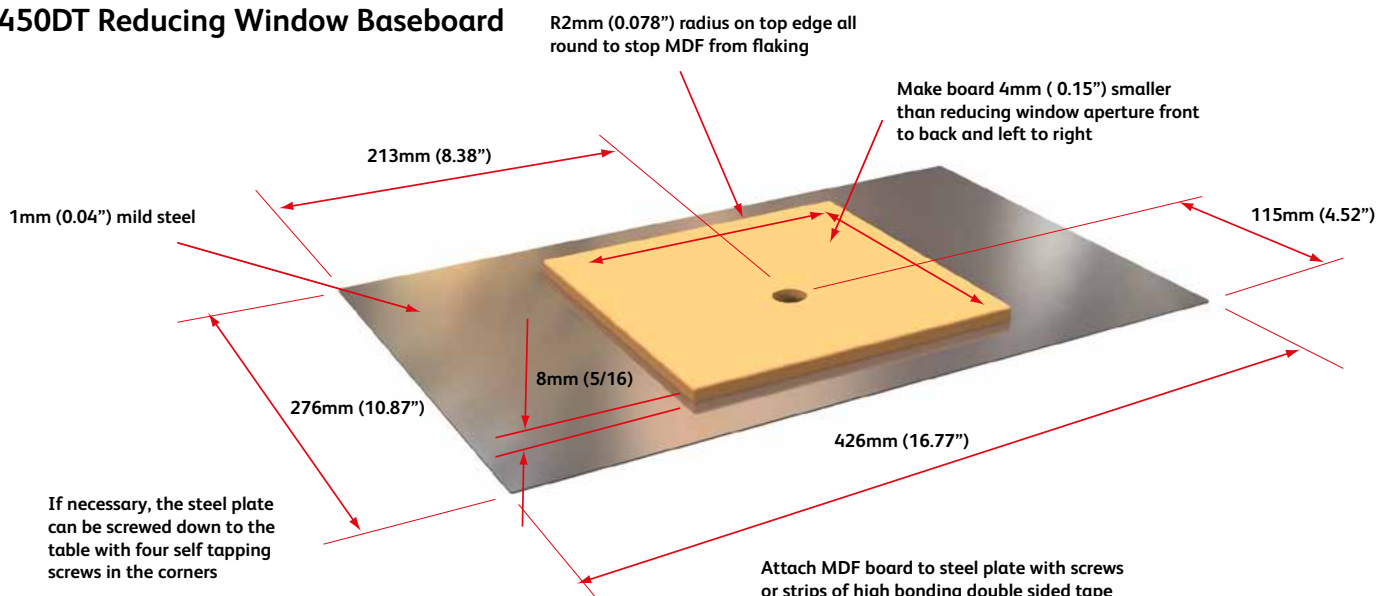
The baseboard has to be 4mm shorter in both directions than the forming aperture of the machine e.g. forming aperture = 280mm x 430mm > baseboard size = 276mm x 426mm.



450DT Standard Baseboard



450DT Reducing Window Baseboard



Plastic sheet is commercially available in a wide variety of grades, thickness and colours. Materials such as styrene and PVC are most suited to vacuum forming. Other materials such as acrylic, polypropylene and polycarbonate will mould but difficulties may be encountered.

It is not within the scope of this manual to attempt to list all the potential problems and their solutions. It is recommended that the newcomer to vacuum forming gains experience and confidence with easily formed materials before moving onto the more difficult materials.

Formech has available a Vacuum Forming Guide which will cover some of these topics in more details. Please contact Formech to gain access to this guide.

After Forming

After forming, most plastics can be subsequently heat formed to add such details as folds or clips. Although many plastics can be printed, and in some cases painted, the presence of release agent used to help free a tight moulding may make the surface resistant to further decoration.

Trimming

An ideal moulding will be ready for use when removed from the machine and requires no finishing. However, most mouldings do require trimming before they can be used.

There are numerous methods available for this process.

Thin materials can be trimmed with a sharp knife. Shaped cutting dies can be used to cut out intricate shapes. If no flange is required on the finished product then a trimming saw mounted in a pillar drill will cut the moulding in a horizontal plane to free it from the surrounding material.

In mass production environments the range of equipment available for this requirement encompasses clicking presses, roller presses, routers, horizontal band saws, water jet cutters, laser cutters and many others.

Formech has available a Vacuum Forming Guide which will cover some of these topics in more details. Please contact Formech to gain access to this guide.

Reliability and a long service life are synonymous with the Formech brand. However, as with any machinery, certain parts will require periodic replacement.

Seals

The silicone seals applied to the mould table and to the top aperture of the machine (clamp) are seen as being consumable parts, their service life will depend on how the machine is treated and how often it is used.

The table and clamp seals are not covered by our warranty.

Heating Elements

The Quartz infrared heating elements supplied with this machine are manufactured using quartz tube and therefore may break or crack with impact or physical shock.

The Quartz heating elements contain internal filaments, which become extremely hot when power is applied. The wire expands and contracts as it heats and cools.

Eventually, due to the continual expansion and contraction, the wire will fracture and a new element will be needed. This may take 10 years or more. Because of this we are unable to apply our standard warranty to Quartz heating elements. However our experience is that this form of infrared heating is durable, reliable and more resilient to shock and impact than similar ceramic products.

The heating elements are not covered by our warranty.

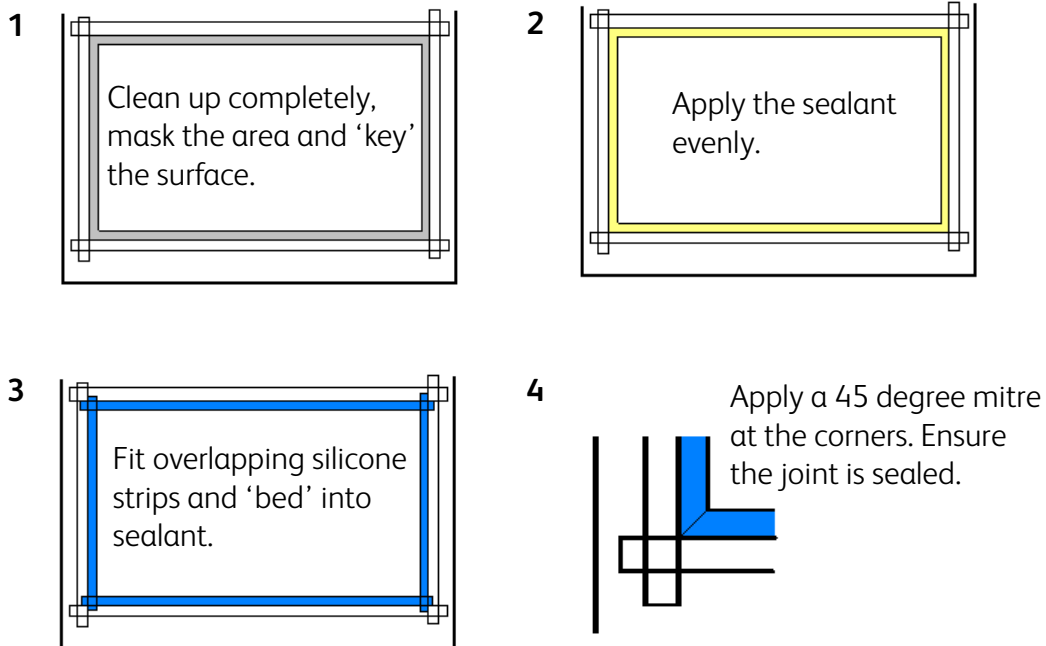
Vacuum System

The vacuum system on this machine is fairly simple but uses high quality components throughout. The life expectancy of the vacuum system will be compromised by the ingress of dirt, shavings, dust, liquid etc.



THE VACUUM CIRCUIT INCLUDING THE VACUUM PUMP WILL NOT BE COVERED BY OUR WARRANTY IF THEY ARE FOUND TO BE BLOCKED WITH FOREIGN MATTER OR CORRODED BY THE INGRESS OF LIQUID.

Replacing Seals



1. Remove all the existing seal and adhesive with a sharp blade. Mask off the sealing area with masking tape or similar (Mask the outside for top frames or reducing windows & the inside for table seals). Prepare the sealing area with emery cloth or similar to achieve a good surface for the new adhesive to key with. Ensure that the surface is clean from dust, dirt and grease.

2. Apply a generous bead of high modulus silicone sealant to the masked area and smooth down to give a consistent layer.

3. Cut the silicone strip in lengths long enough to overlap the corners. Do not stretch the seal strip when measuring or applying. Lay each strip on to the seal area overlapping at the corners. Ensure the seal strip is bedded down well by pressing firmly along the full length.

4. With a sharp blade cut a 45° mitre joint at all corners. Fill gaps in the joints with sealant. Remove the masking tape before the sealant has set. For best performance leave seal to set overnight.

Replacing a Heating Element



Before any maintenance work is carried out the electrical supply must be locked in the OFF position or the mains lead removed.

Only a qualified electrical technician may work on any parts carrying mains voltage and should be responsible for ensuring that the machine is in a safe condition before allowing services to be restored.

> How to check a heating element

If you notice there is a cold area on heated plastics, it may be that a heating zone or heating element is not working correctly. In either case the first step is to check the wiring at the terminal block. It is not always obvious that they are loose or disconnected.

1- First, set all the zones to 70 % and check for even heat and softening plastic when the heater is held over the forming area with plastic sheet fitted. Make a note of the area(s) where the plastic remains hard to determine if it is a single element of entire zone. Allow the heater to cool completely before performing any further checks.

2- If an entire zone is not functioning, then the first step is to check the wiring connections at the terminal blocks. Ensure the machine is disconnected. Remove the top cover and check that the wiring is not loose or has become disconnected for that particular zone. Remove the relevant terminal block covers to determine this. If you are a qualified electrical technician and conversant with electrical fault-finding techniques, then refer to the circuit information at the rear of this manual. If you are uncertain then contact Formech for service and advice.

3- Resistances for heating zones and individual elements are scheduled in the electrical trouble shooting section. Zones and elements can be verified safely by checking the expected resistances.

4- If an element is found to be broken or faulty using a resistance check and that corresponds with a cold area, then it will require replacement. Refer to the following procedure:



1. Unplug the machine from the mains. Bring the heater completely forward and remove the 4 screws retaining the cover on top of the heater.



2. Take the cover out.

Replacing a Heating Element (continuation)



3. At this stage check that all the element wires and interconnecting wires are fully tightened and that the fault was not merely a loose connection.



4. Remove the relevant terminal block cover(s).



5. Loosen and remove the element wires from the appropriate connector block.



6. Remove the nuts and washers holding the faulty element. Spanner key n°8



7. Remove element and fit the replacement new heating element ensuring the fixing screws are secured.



8. Ensure that the connections are correctly fitted and the connector block screws are fully tightened. Replace the connector cover and top heater cover. Finally test the heater.

Electrical Troubleshooting



Before any maintenance work is carried out, electrical supply must be locked in the OFF position or the mains lead removed.

Only a qualified electrical technician may work on any parts carrying mains voltage and should be responsible for ensuring that the machine is in a safe condition before allowing services to be restored.

Faults on electrical & electronic modules are rare but loose plugs and terminals are responsible for most electrically based failures. A logical approach to detecting the fault begins with a complete appraisal of the faults and symptoms.

Much time can be wasted looking in the wrong areas for a problem that, when found, was obvious. See also section dealing with Electrical circuit information.

If you are a qualified electrical technician and conversant with electrical fault-finding techniques, then refer to the circuit information at the rear of this manual. If you are uncertain then contact Formech for service and advice.

Quartz Heating element and heating zone resistances.

ZONE / ELEMENT TYPE	RESISTANCE +/- 5%
ZONE 1	108Ω
ZONE 2	50Ω
ZONE 3	215Ω
ZONE 4	178Ω
250W Quartz Element	215Ω
300W Quartz Element	178Ω
550W Quartz Element	100Ω

If zone 1 or 2 has a resistance measurement that is double that of the schedule above then it would imply that one of the 2 elements in that zone has failed, check the individual elements.

Equipment fusing – Fuses are a safety device. If a fuse fails then it is likely that there is a reason for the failure – overcurrent or short-circuit.

If the fuse protection continues to fail after replacement then the cause will need to be investigated by a qualified and competent person using a methodical approach to fault-finding diagnostics and referring to the circuit information contained in this user manual.

The same will apply to any non-functioning parts such as the vacuum pump, valve, heater zone outputs, PLC, HMI and any other malfunction of the control system.

Vacuum / Pressure Troubleshooting

If the vacuum or pressure appears to be weak or non-existent check the following.



Raise and lock the mould table in the up position



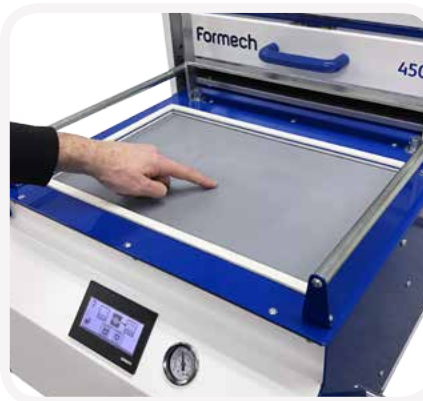
Turn your machine on and press the Start button



Press on the manual operation icon



Turn the vacuum on



Check the reading you get on the vacuum gauge



A vacuum gauge reading of 22”Hg or higher is normal. A lower reading indicates poor vacuum where attention is required

Vacuum / Pressure Troubleshooting (continuation)

The possible causes of poor vacuum are:

- The mould baseboard is restricting the vacuum hole in the table.
- NOTE: If the mould baseboard is too soft it may pull down under vacuum and block the vacuum hole.
- The mould is inadequately vented to allow trapped air to be evacuated.
- The table and clamp seals are in poor condition or the table is not locking properly at the top of its travel.
- There are holes drilled in the table.

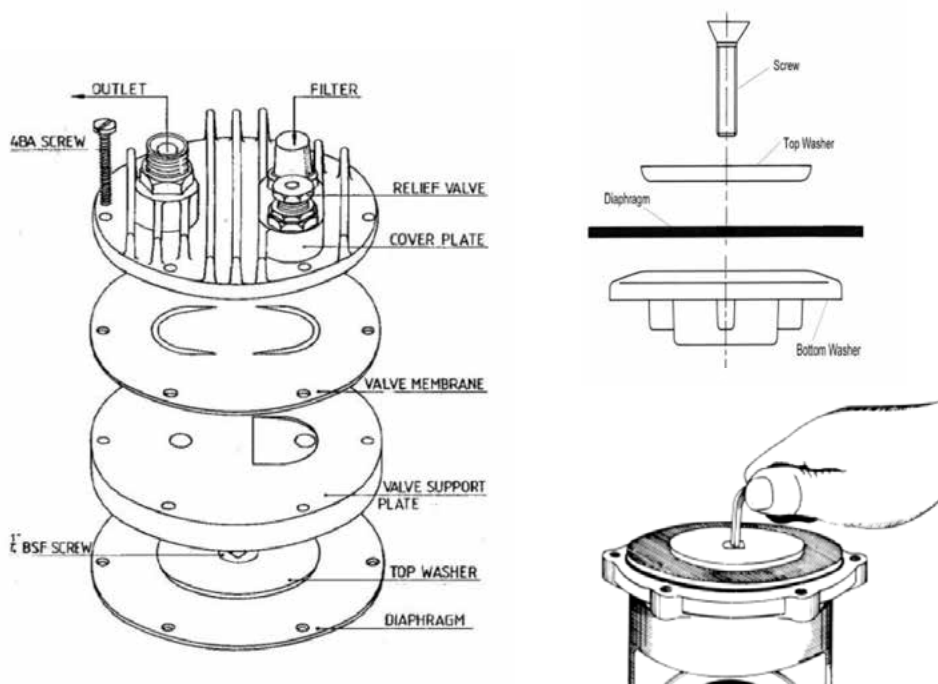
If all the above points are OK and you can hear the pump running when operated, then one of the following points may be the cause of the problem. If the pump does not run, refer to the Electrical trouble shooting section above.

- A pipe is loose, disconnected, damaged or blocked.
- The pump filter is blocked.
- The vacuum valve is blocked or not operating.
- The vacuum pump is blocked or faulty.

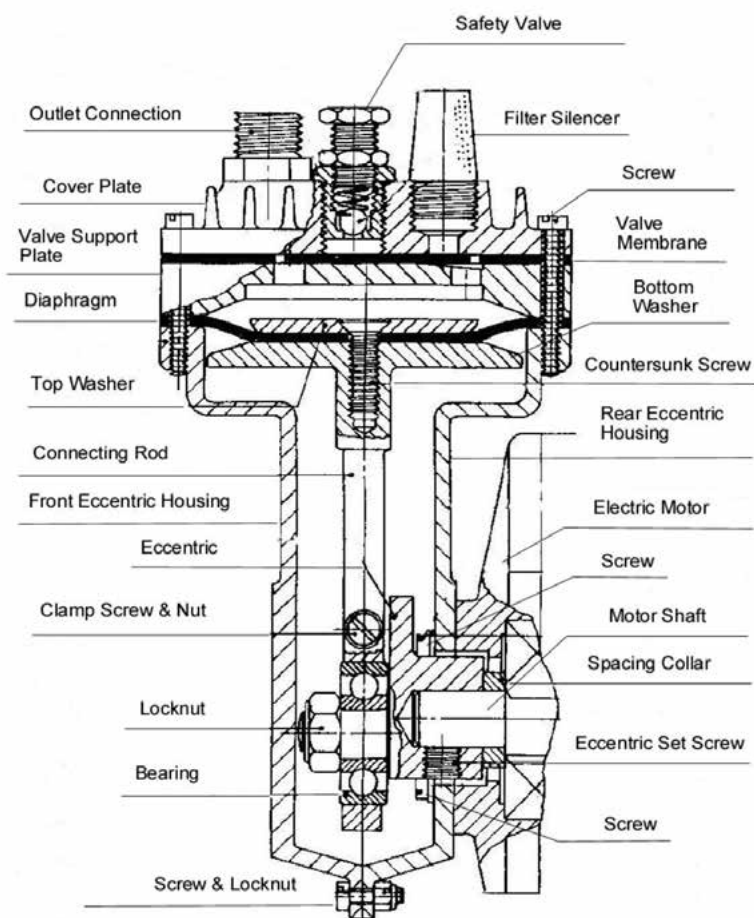
If the heater has been left in the forward position, with no plastic in the clamp frame, the table will start to overheat. The pipe attached to the back of the table will shrink and constrict the passage of air. Pipes become less flexible over time and may loosen or crack.

If the Vacuum pump is running but there is no vacuum or very poor vacuum measured at the pump then it may require maintenance. The Pump is a twin head diaphragm type. Each head consists of a diaphragm valve configuration operated by the motor. After considerable use the valve membranes and top washer may become worn or damaged. Access to these parts is by disassembly of the pump heads.

The following provides drawings and parts data to assist with the maintenance and repair of the diaphragm pump. Simply disassemble, inspect, replace parts if required and reassemble.



Vacuum / Pressure Troubleshooting (continuation)

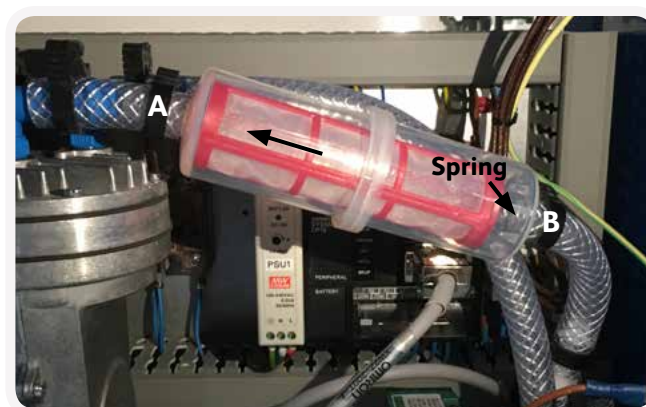


Qty	Description	Part N°
1	Vacuum Pump	PAP02
1	Diaphragm Seal Set, one side only	PAP03
1	Top Washer	PAP32

Replacing the Filter

Disconnect the electrical supply to the machine. Remove the five screws retaining the rear panel. The filter is connected to the pump as shown in the picture above.

Remove the pipe clips A & B. Remove the filter. Fit the new filter ensuring that the arrow embossed on the filter is pointing to the pump with the internal spring on the right-hand side. Replace pipe clips A&B. Replace the rear panel and test.



Cleaning

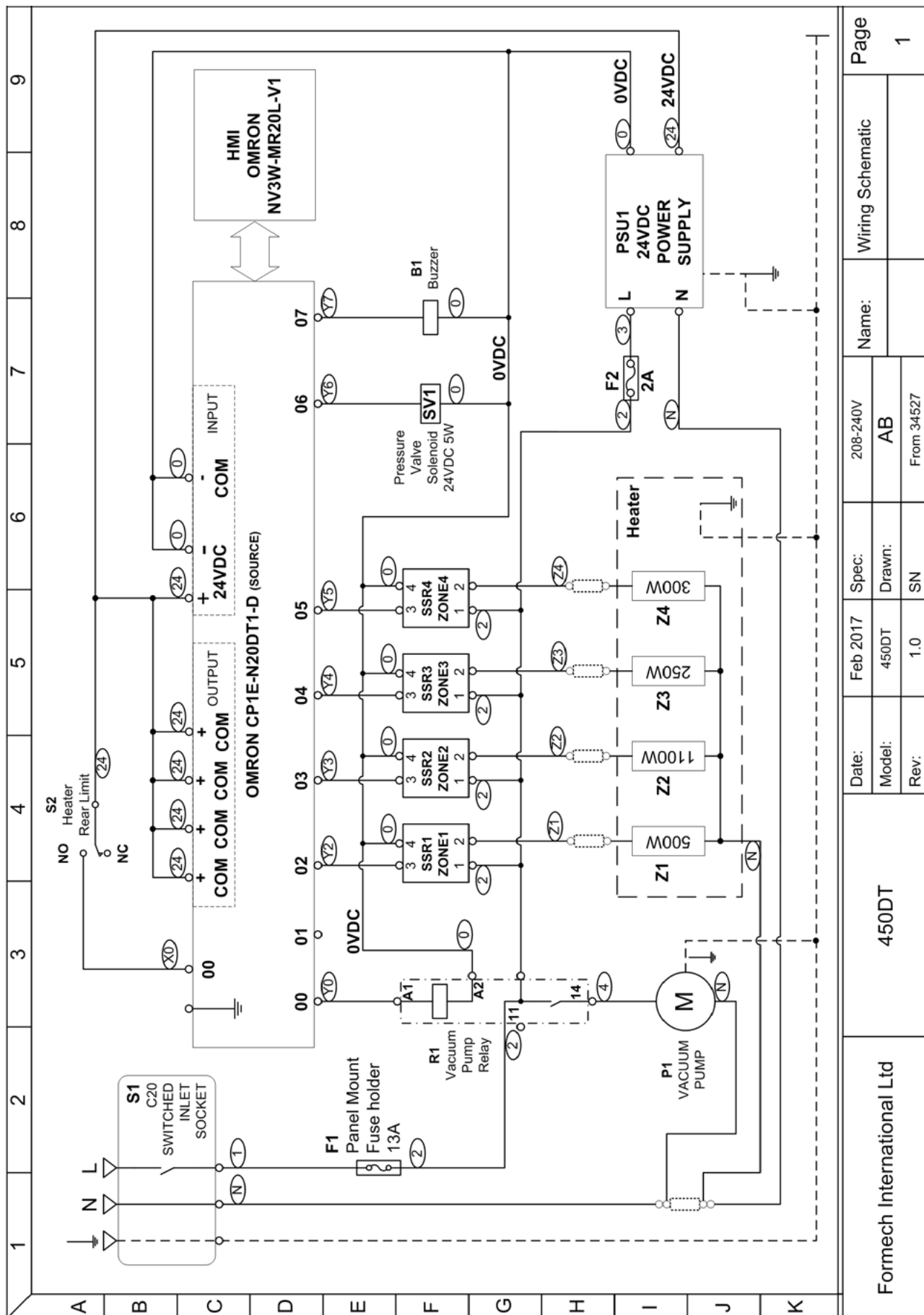
Ensure the inside of the machine and the heater tray is cleared of dust, dirt and debris. Do not allow dirt and loose particles to build up, particularly on the heater tray.

Lubrication

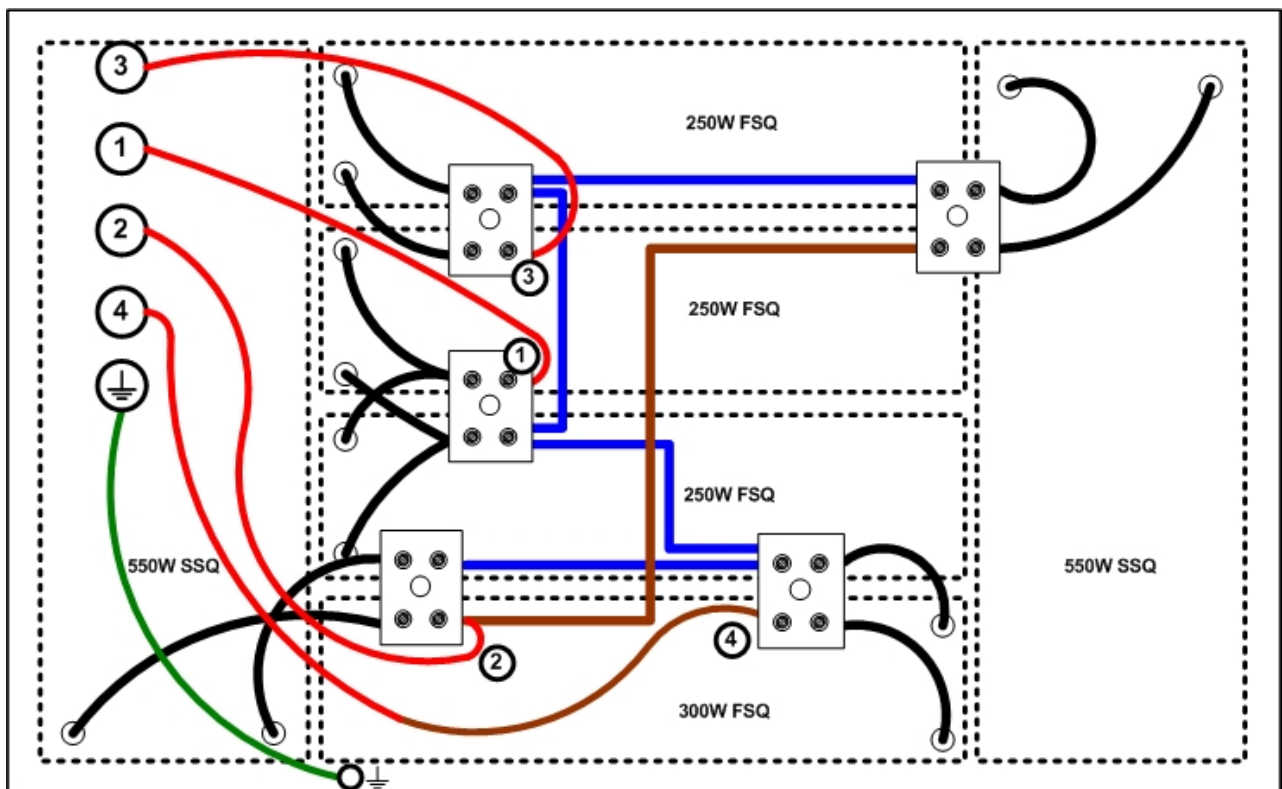
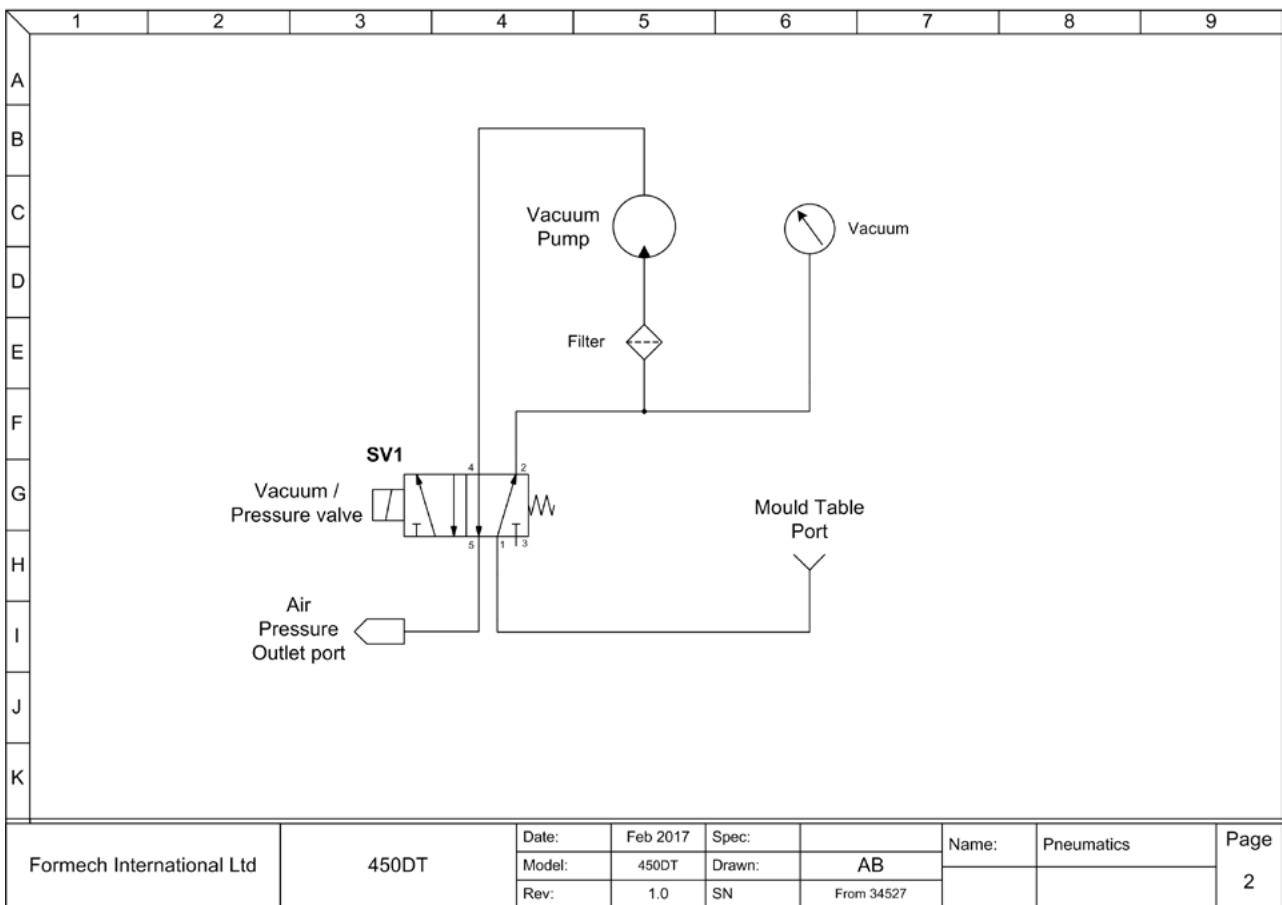
The 450DT requires minimum lubrication.

Apply general purpose grease to the table guide bars when required to assist with table movement.

Apply a small amount of fine silicone oil or fine oil to the heater slide bars when required to assist free movement of the heater.



Formech International Ltd	450DT			Date:	Feb 2017	Spec:	208-240V	Name:	Wiring Schematic	Page	1
				Model:	450DT	Drawn:	AB				
				Rev:	1.0	SN	From 34527				



Front Top wiring view

Quantity	Description	Part No
2	Quartz Element 550W SSQ 230V	HEQ01
3	Quartz Element 250W FSQ 230V	HEQ04
1	Quartz Element 300W FSQ 230V	HEQ05
1	Heatproof Cable 1.63mm Dia (solid)	EE39
1	Heatproof Cable 1.5mm SiFGL	EE41
1	Heatproof Cable 1.0mm SiFGL	EE40
1	Glassfibre Sleeving V111	EE38
5	Ceramic Terminal Block	MPP14
1	Cable Chain	EE70
1	Cable Chain End Bracket Set	EE71
1	Large Blue Heater Handle	GH02
2	Toggle Clamp Complete, Small Blue	MPP19
2	Small Clamp Upper Adjuster Nut Steel M5	MPP27
2	Small Clamp Lower Adjuster Nut Plastic M5	MPP24
2	450DT Clamp Frame Grip, Blue	GH23
1	Black Crank Handle Knob	GH25
1	Interlock Spring	GH40
4	Machine Rubber Mounting Foot	GH41
1	450DT Table Mesh	MPP44
1	5M Seal kit, 5M Top Seal, 3m Table Seal, Sealant (Seal kit A)	SK02
1	10M Seal kit, 10M Top Seal, 3m Table Seal, Sealant (Seal kit B)	SK03
1	Silicone Sealant Cartridge 85ml	MPP01
1	5/2 Valve 24Vdc 6W	P30
1	Vacuum Pump	PAP02
1	Diaphragm Seal Set, one side only	PAP03
1	Top Washer	PAP32
1	40mm Vacuum Panel Mount Gauge	P31
1	Large Inline Vacuum Filter	PAP05
1	1/4" Bore PVC Reinforced Hose	P13
1	3/8" Bore PVC Reinforced Hose	P14
1	1/4" BSPT to 10mm Hose Tail Elbow	P34
4	1/4" BSPT to 10mm Hose Tail Straight	P36
2	Pipe Clip - Small plastic, Type C, 1/4" Tube	P18
2	Pipe Clip - Small plastic, Type F, 3/8" Tube	P37
1	HMI	EE114
1	PLC	EE115
1	Communications Cable PLC-HMI	EE116
1	24VDC Power Supply, 1A	EE01
1	Relay, single pole, 6A, 24VDC	EE92

Quantity	Description	Part No
4	Solid State Relay (SSR) 250V 10A	EE93
1	C20 Panel Mount Socket & Switch	EE49
1	Panel Mount Fuse holder, 25mm	EE50
1	25mm 13A Ceramic Fuse, BS1362, 240V	EE51
1	Microswitch, Hi temp	EE34
1	Buzzer 12-24VDC	EE96
1	BS1363/A 3Pin Plug to C19 Power Lead, 13A	EE57
1	EU(Shuko) Plug to C19 Power Lead, 16A	EE56
1	NEMA6/15(N America) Plug to C19 Power Lead, 15A	EE74

EC Machinery Directive
2006/42/EC

Declaration of Conformity

We hereby certify that the machinery stipulated below complies with all the relevant provisions of the EC Machinery Directive and the National Laws and regulations adopting this Directive. Modifications to this machinery without prior approval from the undersigned will render this declaration null and void.

Machine Description: Vacuum Forming Machine
Machine Function: Thermoforming of Plastic Sheet
Model/Type: 450DT
Serial Number:
Date of Manufacture:

Is in conformity with the provisions of the following other EC Directives:


2004 / 108/EC - EMC
2006 / 95/EC - LVD

Technical File Compiled by: Andrew Berry at address below

.....
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Hertfordshire AL5 3NS, United Kingdom
.....

Significant harmonised standards applied:

EN ISO 12100:2010
EN 60204-1:2006+A1:2009
EN 12409:2008+A1:2011

Signed: 

Date:
Name: Paul Vukovich
Position: Managing Director
Being the responsible person appointed by the manufacturer

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