FOX AND OFFORD

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POLYLAB

UNIVERSAL MOULDING MACHINE

MK ~~IV~~ V MOTORIZED P L C CONTROLLED

MACHINE REF. NO.....

THIS MACHINE IS NOT TO BE USED FOR ANY OTHER PURPOSE OTHER THAN WHAT IT WAS DESIGNED FOR.

THE MACHINE IS NOT TO BE USED BY ANY UNTRAINED PERSONNEL.

ONLY QUALIFIED PEOPLE TO DO ANY CHANGES, MODIFICATIONS OR REPAIRS TO THIS MACHINE.

POLYLAB MK III PLC CONTROLLED

INDEX

MACHINE ASSEMBLIES (A)

Connecting The Electric Supply (110 Volts)

All cylinders and platens are controlled from the temperature control box mounted on the front of the machine. ~~Connect a 110 volt supply for 2.2 KVA load, via the transformer in the manner described below:~~

1) ~~Connect~~ the plug from the back of the machine to the ~~transformer~~.

2) Connect the ~~plug~~ from the transformer ~~to the~~ mains supply, making sure the supply is 240 volts. ~~Switch on the~~ mains supply.

3) Switch on main ~~machine~~ isolator ~~located at the~~ back right hand side of the machine. ~~The two~~ individual temperature control ~~zone lights~~ should now ~~light up~~. If either fail to do so, ~~switch off at the mains supply and~~ check all fuses and connections.

ALL CONNECTION SHOULD BE MADE BY AN ELECTRICAL COMPETENT PERSON.

1) CONNECT THE PLUG FROM THE BACK OF MACHINE TO MAINS. (MAKING SURE THE MAINS SUPPLY IS THE CORRECT VOLTAGE).

(2) SWITCH ON MAINS SUPPLY.

(3) SWITCH ON MAIN MACHINE ISOLATOR (LOCATED AT BACK RIGHT HAND SIDE OF THE MACHINE)
THE TWO INDIVIDUAL TEMPERATURE CONTROL ZONE LIGHTS SHOULD NOW BE LIGHT UP.
IF EITHER LIGHTS FAIL TO LIGHT UP, SWITCH OFF AT THE MAINS SUPPLY.
A ELECTRICAL COMPETENT PERSON SHOULD CHECK ALL FUSES AND CONNECTIONS.
IF ANY PARTS ARE FAULTY ONLY USE SPECIFIED REPLACEMENT PARTS.
DAMAGE TO THE EQUIPMENT MAY BE CAUSED IF ANY OTHER THAN SPECIFIED PARTS ARE USED.

MACHINE ASSEMBLIES (A)

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3) Switch on main machine isolator located at the back right hand side of the machine. The two individual temperature control zone lights should now light up. If either fail to do so, switch off at the mains supply and check all fuses and connections.

MACHINE ASSEMBLIES (B)

Setting Up The Machine

The Polylab Machine has been tested prior to delivery. However if at any time you need to exhaust any air in the hydraulic system (air in oil causes a gurgling sound which can easily be heard). Machine must be switched off at the mains, before doing any work. Loosen pipe connection on main Hydraulic Cylinder until oil flows through fitting and then re-tighten before starting machine.

Positioning Of The Hydraulic Cylinder Ram

The entrance to the hole in the ram should face the operator. If this is not the case, insert rod of approximately 8mm Dia and rotate the ram to its correct position.

To Operate Main Hydraulic Cylinder and Control of Heating

The temperatures and pressures are read into the PLC unit, which controls the valves and heaters.

The PLC is accessed by the operator by the interface. This allows temperature and pressure to set points to be adjusted and actual readings to be monitored. The main pump and automatic cycles are also started from the keypad.

Starting the Pump

The main isolator for the power must first be switched on. The unit goes through a self check. Once this is completed the display will cycle the following messages:-

System Ready
Temp 1 = XXX °C
Temp 2 = XXX °C

The pump can now be started using F1 and stopped using F0.

Pump Start - F1
Pump Stop - F0

Programming/Start Up

Switch on isolator
To input press F1 (Start Pump)
Press 'MON' to access variables
Screen shows V--- V--- V---
Press 'VAR' then code
Press 'ENTER'
Press 'SET'
ie. Code 'V070' pressure '100'
Press Arrow → to move on next variable
Press CODE
Press ENTER
ie. Code 'V080' down time '100'
Press ARROW → to move to next variable
Press CODE
Press ENTER
ie. Code 'V090' up time '100'
Press ARROW ↓ to start cycle
On completion of cycle press arrow ↑ to reset

Adjustment of System Parameters

The following variables can be adjusted using the operator interface as above:-

V070 - Pressure (in bar)
V080 - Down time in 0.1 secs
V085 - Cure time in 0.1 secs
V090 - Up time in 0.1 secs)
V100 - Set point temperature 1 (Cast Element)
V110 - Set point temperature 2

Automatic Cycle

Once the pump is running, and down and up times have been set, the automatic cycle is started by pressing the down arrow key (↓). When the cycle is completed, to start a new cycle you must first press the up arrow key (↑) to reset the sequence, then press the down arrow key (↓) to start.

MACHINE ASSEMBLIES (D)

Heat Control

1) The control of the temperature of the cylinders and platens (after having ensured that all the electric connections have been made in accordance with the instructions on page A1), are as Page A2.

2) The moulds can be heated up by inserting them between vice clamps ensuring heaters and thermocouples are in place. The mould is in contact with the micro switch and thermocouple at the rear of the platen.

3) Machines of this type are generally used such that the plastic materials pass rather slowly through the cylinders. As overheating of plastics should be avoided it is advisable to use slightly lower temperatures than those recommended by plastic material manufacturers. A guide to moulding temperatures appears on 'moulding charts' page D3.

MACHINE ASSEMBLIES (E)

Fitting Platens

Turn machine off at main isolator (rear right hand side).
Allow machine to cool, if hot.

To fit the top platen 'PT' to the hydraulic cylinder, insert the spigot into the locating hole and secure in position by inserting the special retaining clip in hole 'X'.

To fit lower platen 'PB' in position, offer it between the pillars and locate spigot in position 'Y'.

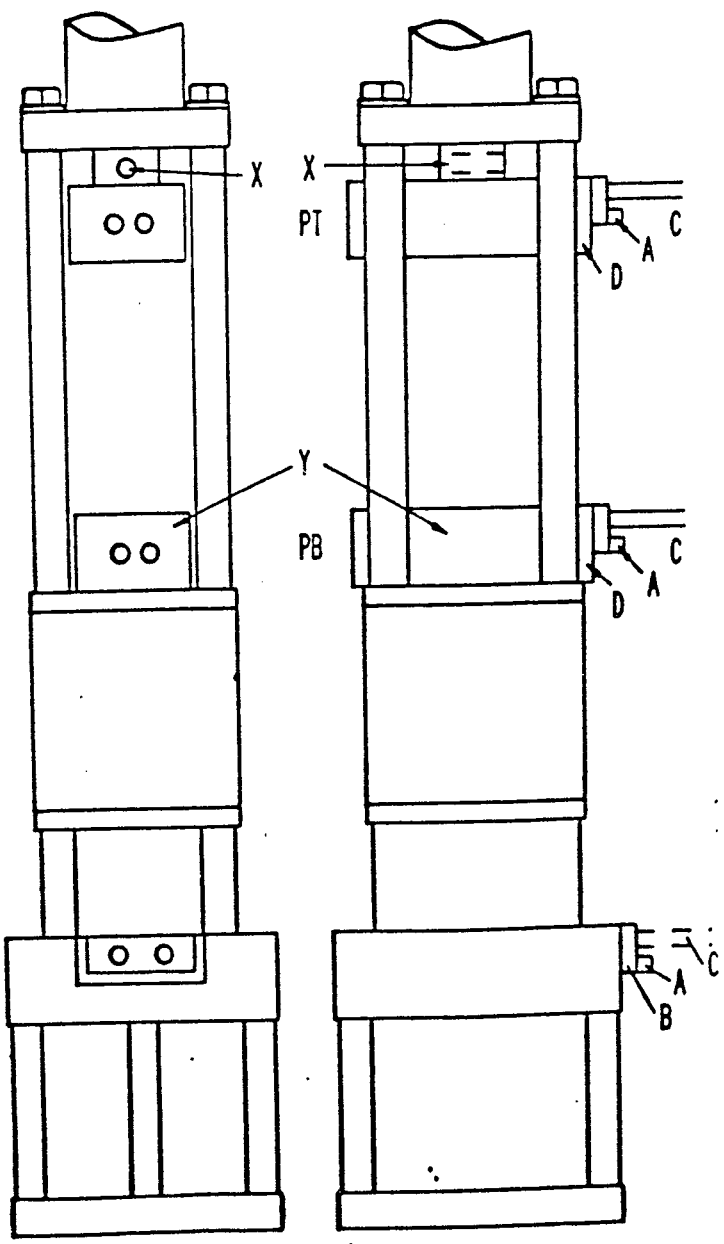
To fit heaters and thermocouple, first remove retaining screw 'A' and plate 'B'. Remove heater elements and fit one in each of the platens 'PB' and 'PT'.

Remove thermocouple and fit to 'PT' platen. Connect second thermocouple to control box and fit to 'PB' platen.

Secure both platen heaters and thermocouple in position by using retainer 'D' and screw 'A'.

After checking that all has been assembled correctly and all heaters and thermocouples are plugged into control box, the machine is now ready for use.

System parameters have to be reset, as on Page A2.



MACHINE ASSEMBLIES (F)

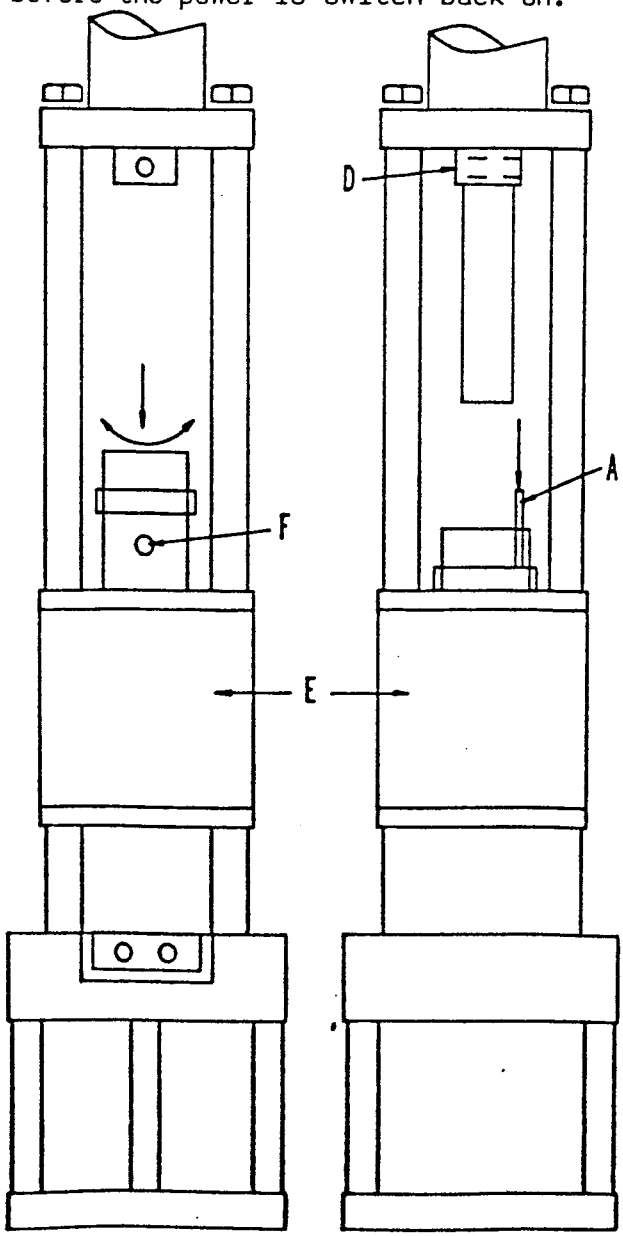
Fitting Cylinders

Ensure electrical supply is switched off by main isolator located at the back right hand side of the machine before fitting any cylinder to the machine.

Remove thermocouple 'A' from top heat block 'E'. Place the selected cylinder into centre hole of top heat block 'E', slide down cylinder with location spigots 'F' at 45% until cylinder flange locates on top of top heat block 'E'. When this has been achieved turn cylinder 45% to locate spigots 'F' under top heater flange. You may now fit thermocouple 'A' by sliding it down cylinder slot provided until it reaches bottom of cylinder slot.

Once the cylinder is in position and with the cylinder ram in the upper position. Its plunger can be fitted in the hydraulic cylinder ram and secured by connecting pin 'D'.

It is very important when cylinders are removed or to be replaced, that the main electrical supply is switched off, and that thermocouple 'A' is refitted to top heat block 'E' before the power is switch back on.



MOULDING OPERATIONS (A)

Compression Moulding

The compression moulding of thermosetting materials is carried out by using the set-up with heated platens fitted into machine, as described on Page A5, also adding a dummy mould in the lower moulding position to activate the micro switch at the rear of platen.

Place the mould in the assemblies closed condition on the bottom platen. Switch on machine, by using the up - down buttons situated at the front right and left sides of machine. Move the top platen down until it contacts the top of the mould. No actual pressure should be exerted on the empty mould - at this point the mould is merely being heated up.

Set system parameters up as on Page A2.

When correct temperature has been reached, reverse the hydraulic pump and bring the top platen clear of the mould.

Using the heat insulated gloves, remove the top half of the mould and pour in the thermosetting powder (correct amount can be determined by weight).

Replace the top half of the mould.

Press 'F' to start cycle. Pressure up to 1.4 Kgm/SQ.mm (200 P.S.I) can be safetly applied.

The material will melt and flow into the form of the mould. It is then necessary to allow the material to chemically crosslink, and therefore, a curing time of about 2 or 3 minutes depending on mould thickness, must be allowed, with pressure still being applied to mould.

At the end of the cycle remove mould using heat insulated gloves, separate and remove the moulding.

Should the moulding not be satidfactory, refer to 'Fault Finding Chart' on Page D1.

Clean and replace mould for next cycle.

MOULDING OPERATIONS (B)

Injection Moulding

The injection moulding of thermoplastic materials is carried out by using the injection moulding cylinder fitted into the machine, as described on Page B1.

Charge the cylinder with plastic material to be used, by pouring into the top of the cylinder and then bring the cylinder up to the required temperature (see notes on heat control on Page A4 and also moulding chart on Page D3).

When the cylinder is at the required temperature, the mould can be inserted into the clamping area. The mould should be pushed forward until the end of the mould touches the stop plate (which will line up mould central to injection point). The mould should then be firmly locked in position by tightening the clamping screw. Allow to come up to temperature. Set system parameters and press 'F' to start cycle. Hold the pressure for approximately 5 seconds. At this point it is advisable to charge further material into cylinder in preparation for the next cycle.

The clamping screw on the mould can now be unscrewed, the mould removed (using heat insulated gloves), separated and the moulding extracted.

Should the moulding not be satisfactory, refer to 'Fault Finding Chart' on Page D2.

The mould can now be replaced in the clamping area and further mouldings produced.

MOULDING OPERATIONS (C)

Transfer Moulding

The transfer moulding of thermosetting materials is carried out by using transfer moulding cylinder fitted into the machine as described on Page A6.

Bring both the cylinder and the mould to the required temperatures (see note on heat control on Page A3 and also moulding chart on Page D3). During the warm up period, the plunger should be left in the cylinder so that both plunger and cylinder are at the same temperature. At this point NO material should be charged in the mould or cylinder. When the required temperatures have been reached the mould can be securely locked in position, as described in the injection moulding procedure on Page B2. Care must be taken however, as the mould is now too hot to handle without the use of heat insulated gloves. Bring the plunger well out of the cylinder and charge with material to be used. The correct amount of material can be determined by weight, always allowing 3 to 4 grams extra for this method of moulding.

Set system parameters and press 'F' to start cycle. A pressure of about 0.35 KG/SQmm (500 P.S.I) is required. As it is a thermosetting material 2 to 3 minutes cure time must be allowed to permit the material to cure. It is also essential that the plunger is left in the down position during this cure time as the surplus material left in the cylinder must be allowed to cure, so that it can clearly be withdrawn from the cylinder before commencing the next cycle.

The cull (the surplus material) can be pushed out from the dovetail form on the end of the plunger, using heat insulated gloves. The mould can be unlocked from the clamping area and removed from the machine.

The mould can now be opened and the moulding removed.

Clean the mould and re-position in machine for the next cycle.

Should the moulding not be satisfactory, refer to 'Fault Finding Chart' on Page D1.

NB During the process of transfer moulding always remember that the mould, the mould produced and the cylinder are always too hot to handle without heat insulated gloves.

MOULDING OPERATIONS (D)

Extrusion

The extrusion moulding of thermoplastics is carried out by using the extrusion cylinder fitted into the machine, as described on Page A6.

Before commencing moulding, if the blow moulded die is fitted, but not to be used, it is advisable to remove it by reversing the procedure detailed on Page B5. This will then give an unrestricted view of the operation.

To produce an extruded tube, process as follows:

Set system parameters.

With the plunger in the uppermost position charge the thermoplastic material into the top of the cylinder. Bring the cylinder up to the required temperature (see notes on heat control on Page A4 and fault finding chart on Page D3). Press 'F' to start cycle (adjust plunger speed 'flow' as described on Page A2) and thus, for an extrusion.

NB When blow moulding, this extrusion is know as a 'PARASON'.

To avoid 'curling' or 'sticking' the extruded section should always be cut clean at the nozzle of the cylinder before commencing the next cycle.

MOULDING OPERATION (E)

Blow Moulding

1) Mains supply must be off.

2) Open lower guard.

3) Remove platen from 'E' which will reveal hole for cylinder and bolt head 'A'.

4) Remove bolt 'A' and remove column 'C'.

5) Screw core spigot 'D' into tapped hole 'D'.

6) Insert blow mould die with 'neck' of the bottle facing downwards, and pass column 'C' through the pivot hole in the die.
Insert bolt 'A' through column 'C' but at this stage do not screw down tightly.

7) Carefully close the mould so that the cutting edge at the neck of the bottle locates around the core spigot 'D'.

8) Lock bolt 'A' firmly.

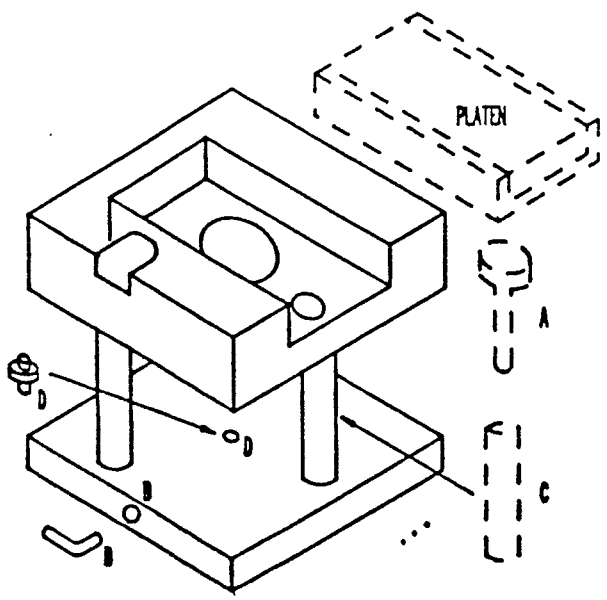
The blow moulding of the thermoplastic material is carried out by using the extrusion cylinder, fitted as Page A6. Turn on mains supply, allow cylinder to come up to temperature. Fit air supply to spigot 'D' (foot pump or regulated compressed air).

With the blow mould die open, produce a 'PARASON' (round tubular section) of sufficient length to locate well over the core spigot 'D' using the procedure as described under 'EXTRUSION' on Page B4. The mould should be firmly closed and clamped as quickly as possible, air pumped in (4 to 5 times on foot pump or 3 to 4 seconds of compressed air at approximately 27 P.S.I). The Parason will form into the shape of the cold mould and set.

At this stage it is most important that the Parason is cut cleanly flush with the cylinder nozzle to permit a clean start for the next cycle. The mould can now be opened and the moulding removed.

Remove the surplus 'Flash' top and bottom by hand.

Should the moulding be imperfect refer to Fault Finding Chart on Page D2.



MOULDING OPERATION (F)

Vacuum Forming

1) Bring hydraulic ram to the top of its stroke.

2) Fit the vacuum pump assembly between columns with the air connector passing through the hole of top heat block (refer to fitting cylinders on Page A6 to complete process).

3) Connect the plunger of the assembly to the hydraulic ram with connecting clip and pin.

4) Stand the vacuum forming mould assembly on the insulated working surface at the front of the machine base panel and connect the air connector 'C' to the spigot on vacuum forming mould.

5) Fit cartridge heaters to the hot plate in the same manner as described for fitting cartridge heaters to the plate on Page A5. Rest the hot plate downwards on the insulated working surface, adjacent to the mould. Heat up to around 250°C, then adjust up or down for the best heat setting for different materials or thickness of material.

6) Bring the plunger down to its lowest position.

7) Remove clamping plate. This will reveal the mould cavity and loose base plate, making sure that the air evacuation channels are not blocked. Place the plastic material to be used across the vacuum forming die and position the clamping plate on top.

8) Using insulated gloves, place the hot plate on top of the mould assembly, by locating over the two guide dowels.

9) Observe the reaction of heat on the plastic materials to be formed (this will normally rise, wrinkle and then sag). At the moment of sagging return the plunger continuously to the top of its stroke; this creates a vacuum in the mould and the material will form into the mould cavity.

NB A little practise will be needed to obtain the best moulding conditions to suit different moulding materials and thickness.

10) Immediately on completing forming, as described in (9) above, remove the hot plate and place it face downwards on the insulated working surface, adjacent to the mould assembly.

11) Remove the clamping plate and then the moulding.

12) Return the plunger to its lowest position before loading the mould in readiness for the next cycle.

NB During the process of vacuum forming remember that the mould and hot plate are always too hot to handle without heat insulated gloves.

PLASTIC MATERIAL PHYSICAL COMPARISON (A)

Tensile

Power supply off.

Remove all moulding cylinders and moulds and clean.

The specimen to be tested is clamped on the ends in the clamping units 'N' and 'O' as shown. It is important that the socket cap screws are tightened evenly, keeping the bars parallel in order to achieve maximum grip.

Switch on machine.

Turn heat off by using the toggle switches at each side of the control panel, (this disconnects the power supply to the elements).

Place bottom clamp on top of heat block 'E' and locate spigots at 45° to lock under flange. Bring down the hydraulic ram and connect top bridge 'M'. Then insert retaining pin 'S'.

The assembly is now suspended from the hydraulic cylinder.

Insert pointer 'I' into 'N' holder.

Attach a 300 mm rule by magnet 'Q' in position.

Slowly bring the hydraulic cylinder up and zero pointer 'I' on rule.

By slowly bringing the hydraulic cylinder up until specimen breaks; Elongation, Breaking point can be noted.

PLASTIC MATERIAL PHYSICAL COMPARISONS

Crossbreak

Power supply off.

Remove all moulding cylinders and moulds and clean.

Fit anvil 'A' into hydraulic cylinder ram, insert pin 'D'.

Place plastic specimen centrally on tool support nibs.

Place gently in position in Polylab press, locating on to block 'E', checking for specimen movement.

Turn heat off by using the toggle switches at each side of the control panel, (this disconnects the power supply to the element).

Bring ram down slowly until anvil just touches specimen. Continue to bring ram down and observe the reading on ram down pressure gauge, until such time as the specimen either breaks or cannot bend any further.

PLASTIC MATERIAL PHYSICAL COMPARISONS (C)

Shear

Power supply off.

Remove all moulding cylinders and moulds and clean.

Assemble platens as referred to on Page A5, BUT DO NOT FIT EITHER THERMOCOUPLE OR CARTRIDGE HEATERS.

Switch on power supply.

Turn heat off by using the toggle switches at each side of the control panel, (this disconnects the power supply to the elements).

The standard 'Polylab' shear comparison test uses 25 mm (1.0") Dia. specimens of thickness up to 7 mm ($\frac{1}{4}$").

The method of mounting specimen

Remove shear punch 'A', remove the two screens 'B' and then die 'C'. Drop specimen into tool and re-assemble, with screw 'B' just nipped up tight.

When re-fitting shear punch 'A' ensure that it slides freely in housing 'D'.

Position punch 'A' so that it is just resting on specimen. With the upper platen in its uppermost position, position the shear comparison tool centrally on the lower platen. Bring upper platen slowly downwards until it is just touching the shear punch 'A', continue to bring ram down and observe the readings on the ram down pressure gauge.

MOULDING AIDS (A)

Fault Finding Chart - Thermosetting Materials

POSSIBLE CAUSE:	POSSIBLE FAULT COMPRESSION						POSSIBLE FAULT TRANSFER					
	Rough 'Cokey' Finish	Blisters	Large Bursting Blisters	Uncured Mouldings	Sticking in Mould	Short Mouldings	Short Mouldings	'Cokey' Mouldings	Uncured Mouldings	Failure to Mould	Blisters	Flash on Moulding
Insufficient Material	X						X	X				
Insufficient Pressure	X						X	X		X		
Insufficient Cure Time		X		X	X				X		X	
Moisture Content Too High		X	X								X	
Mould Too Hot		X	X									
Mould Too Cold	X			X	X			X	X			
Old Material				X				X	X			
Trapped Gases		X	X							X		
Poor Mould Design					X						X	
Dirty					X					X		
Incorrect Cylinder Temperature							X	X		X		
Wrong Material							X	X		X		
Transferring at Wrong Time							X	X		X		
Insufficient Mould Lock												X

MOULDING AIDS (B)

Fault Finding Chart - Thermoplastic Materials

POSSIBLE CAUSE:	POSSIBLE FAULT INJECTION										POSSIBLE FAULT BLOW MOULDING				
	Short Mouldings	Weld & Flow Lines	Rough Surface	Bubbles in Moulding	Poor But Shiny Surface	Sink Marks	Burns on Moulding	Flashes on Moulding	Warping or Buckling	Material Sets up in gate	Bubbles in Moulding	Excessive Flash	Poorly Formed Mouldings	Sink Marks	Poor Surface Finish
Injection Pressure Too Low	X	X	X			X				X					X
Injection Pressure Too High				X			X	X	X		X				
Cylinder Temp. Too Low	X	X	X							X		X			X
Cylinder Temp. Too High				X	X	X	X	X	X		X		X	X	
Venting Required	X			X			X								
Gate Too Small	X						X			X					
Mould Temp. Too Low		X	X							X					
Mould Temp. Too High					X	X									
Moisture Content Too High		X							X		X				X
Insufficient Hold on Time						X			X				X	X	X
Insufficient Mould Lock								X				X			
Insufficient Material	X	X													
Material Gelling Before Mould is Closed									X			X			
Poor Mould Design			X						X	X		X	X		X
Insufficient Air Pressure													X		X
Incorrect Material			X	X					X	X	X		X	X	X

MOULDINGS AIDS (C)

Moulding Chart showing popular used Materials

When referring to the following charts it should be remembered that many materials can be processed by different techniques, but when selecting the material, the correct grade of material must be used, as each type of material is specially mixed for the moulding application for which it is intended, i.e. Polypropylene injection moulding grade for injection moulding - Polypropylene blow moulding grade for blow moulding, etc.

Material	Cyl. Temp.	Mould Temp. °C	Notes
INJECTION MOULDING			
Polythene	120/150	Cold	Moulds easily at lower pressures.
Polypropylene	160/180	Cold	Moulds easily at average pressures.
Nylon	180/220	65	Tends to dribble from nozzle. Burns if moist or too hot.
Polystyrene	180/200	Cold	Inject fast at high pressures.
Polymethyl methacrylate	180/240	65	Inject fast, purge slightly if necessary.
Cellulose Acetate	155/165	30/40	Moulds easily at average pressures.
BLOW MOULDING			
Polythene	135/150	Cold	Parason extrudes very easily and can be blown at low pressures.
Polypropylene	170/190	Cold	
TRANSFER MOULDING			
Phenol Formal-dehyde	110	150	Carefully note the optimum time at which to transfer.
Rubber	100/110	140/150	Transfer very easily but do not overcure.
COMPRESSION MOULDING			
Phenol Formal-dehyde		140/150	
Rubber		140/150	Do not overcure.