Hydro Pneumatic Press Systems
For ‘PET’ Stretch Blow Moulding Machines

Typical Automatic Stretch Blow Moulding Machine for ‘PET’ Bottles

- Hydro Pneumatic Mould Open-Close System with Deceleration Valve
- Neck Sealing Cylinder with Hollow Shaft
- Stretch Pin Cylinder
- Valve Regulator Assembly
- Cushion (Deceleration) Solenoid Valves
- Single & Dual Blow Solenoid Valves
General Layout of Pneumatic System for Stretch Blow Moulding

SERIES ‘F’ STANDARD PNEUMATIC CYLINDER FOR STRETCH PINS

SERIES ‘CH’ HOLLOW SHAFT PNEUMATIC CYLINDER FOR SEALING SMALL MOUTH CONTAINERS

CUSHION SOLENOID VALVE

SCREW WITH LOCKNUT TO ADJUST DECELERATION

SERIES ‘X’ HYDRO PNEUMATIC SYSTEM FOR MOULD OPEN CLOSE & LOCK

SERIES ‘Z’ HYDRO PNEUMATIC SYSTEM FOR SEALING WIDE MOUTH CONTAINERS

LOW PRESSURE REGULATOR SET TO 6 Kg/cm²

7 TO 9 Kg/cm²

35 TO 40 Kg/cm²

DUAL PRESSURE BLOW SOLENOID VALVE

HIGH PRESSURE REGULATOR SET 15 TO 30 Kg/cm²

NON RETURN VALVE
1. **General Description**

1.1 The general layout of major pneumatic components used in stretch blow moulding machines is given in Fig 1.

“MERCURY” Series “X” and Series “Z” Hydro Pneumatic Clamping Systems use low cost pneumatic elements to achieve the large forces associated with pure hydraulic systems, with 50% saving in energy and 100% increase in speed over an equivalent hydraulic system.

The system has three stages of operation:-

(a) Initial Low force, Large travel, Rapid Approach.

(b) High Force, Short travel (typically 3mm), Power Stroke.

(c) Low Force, Rapid Retraction.

The selection of the correct system is very important for efficient performance. General guidelines is given in the appropriate sections. Please feel free to contact us for further guidance if required.

1.2 **Sequence of Operation**

(a) The heated perform is placed in the mould and the machine cycle is initiated by pressing 2 Hand Safety Push Buttons.

(b) The Series “X” Clamp Cylinder closes the mould at High Speed with a low force (hence low compressed air consumption).

(c) Just 3 to 5mm before the two halves of the mould touch, the Cushion Solenoid Valve is switched “ON”. This Cushions the closing of the mould and avoids banging and machine vibration. The rate of declaration can be varied by adjusting screw on Cushion Solenoid Valve.

(d) After the mould closes completely the Power Stroke Solenoid Valve of Series “X” Cylinder is switched “ON”. This causes the clamping pressure to increase by 20 times the regulated air pressure to Power Stroke Solenoid Valve. The mould is now held in the closed position by a very large force.

(e) The Neck Sealing Cylinder now moves down and seals the neck and Stretch Pin Cylinder extends to stretch the preform to the desired length.

(f) The low pressure solenoid of Dual Pressure Blow Solenoid Valve is switched “ON”, causing initial stretch and blow at low force. After a delay the high pressure solenoid of a Dual Pressure Blow Solenoid Valve is switch “ON” for final blow and forming.

(g) After the set blow time, the air exhausts, and all cylinders retract rapidly.

**NOTE**: The ideal cycle time is 5 to 7 seconds. This can be achieved by proper selection and location of valves and pipe fittings and tubing. Please feel free to contact us with your machine details to enable us to guide you correctly.
Piping Layout (Series 'X')

OIL RESERVOIR TO BE MOUNTED ABOVE LEVEL OF CYLINDER
LOW PRESSURE WIRE BRAIDED HYDRAULIC HOSE
CUSHION SOLENOID VALVE
SERIES 'X' HYDRO PNEUMATIC CYLINDER FOR MOULD OPEN - CLOSE & LOCK
PU TUBING (6 I.D. FOR 2T & 4T)
(10 I.D. FOR 8T)
(12 I.D. FOR 15T & 30T)
FLOW CONTROL VALVE 'F' FOR FORWARD SPEED CONTROL
5/2 SOL.-SPRING VALVE FOR RAPID MOULD OPEN - CLOSE
3/2 SOL.-SPRING VALVE WITH EXTERNAL PILOT FOR POWER STROKE MOULD LOCK
EXHAUST SILENCER
AIR PRESSURE REGULATOR 'R'
(SET MAX. 6 Kg/cm²)
3/2 HAND SLIDE VALVE
AIR INLET (MAX. 8 Kg/cm²)

Pneumatic Circuit Diagram (Series 'X')

SERIES 'X' HYDRO PNEUMATIC CYLINDER FOR MOULD OPEN - CLOSE & LOCK
FLOW CONTROL VALVE 'F' FOR FORWARD SPEED CONTROL
5/2 SOL.-SPRING VALVE FOR RAPID MOULD OPEN - CLOSE
EXHAUST SILENCER
3/2 HAND SLIDE VALVE TO SHUT / OPEN AIR SUPPLY
FILTER, REGULATOR & LUBRICATOR SET (NOT SUPPLIED BY US)
REGULATOR 'R' FOR TONNAGE ADJUSTMENT

FIG. 2
FIG. 3
2. Series “X” Hydro Pneumatic Press System

The Series “X” System has been developed for applications where the cylinder has to be mounted horizontally.

Refer to Fig. 2 for Piping Layout, Fig. 3 for Pneumatic Circuit and Fig. 4 for overall dimensions and Fig. 6 for cut section details and spare parts list.

The system consists of a Hydraulic Cylinder and an Air to Oil Intensifier unit assembled as an integral unit. The Oil Reservoir is mounted vertically and coupled to the hydraulic cylinder through a suitable low pressure hydraulic hose. Alternatively, to achieve high speed and less heating of oil, the reservoir can be mounted vertically and Port “X” through a suitable connector.

An optional Cushion Solenoid Valve can be fitted in the oil line between the Reservoir and the Hydraulic Cylinder Port “X” to decelerate and close the moulds without jerks and vibration.

2.1 Sequence of Operation

(a) When the Approach Solenoid Valve is switched “ON”, air is admitted to Port ‘A’ and exhausted from ‘C’ and port ‘D’. The Output Shaft extends rapidly, with a low force, due to air pressure acting on reservoir piston through port ‘A’.

(b) When the two halves of the mould are about to close, the Cushion Solenoid Valve is switched “ON”. This cause the main oil flow from Reservoir to the Hydraulic Cylinder to shut and the oil is made to flow slowly through an adjustable Flow Control Valve incorporated in the Cushion Solenoid Valve. The Cylinder movement is thus decelerated and the mould closes slowly without a bang.

(c) When the moulds close fully, the Power Stroke Solenoid Valve is switched “ON”. This causes regulated air to be admitted to port ‘B’. The Intensifier Piston now moves forward and oil pressure in the Hydraulic Cylinder is increased by 20 times the regulated air pressure. This high pressure oil now acts on the large diameter Hydraulic Cylinder to give the large clamping force. The clamping force can be varied by adjusting Air Pressure Regulated ‘R’.

(d) After the machine cycle is over all the Solenoid Valves are switched “OFF”, causing air to be admitted to Port ‘C’ and Port ‘D’ and exhausted from port ‘A’ and port ‘B’. The Cylinder retracts rapidly.

(e) To avoid vibration during mould opening, the Cushion Solenoid Valve can be switched “ON” just before the mould opens fully.
**Reservoir**

\[ \text{N} \text{ (B.S.P. AIR PORTS)} \]
\[ \text{X} \text{ (B.S.P. OIL PORT)} \]

**Cylinder - Intensifier Unit**

```
<table>
<thead>
<tr>
<th>MODEL No.</th>
<th>TON</th>
<th>TOTAL STROKE</th>
<th>POWER STROKE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J1</th>
<th>K1</th>
<th>L</th>
<th>L1</th>
<th>M</th>
<th>N</th>
<th>X</th>
<th>FREE AIR CONSUMED / CYCLE IN L.S.</th>
<th>SEAL KIT</th>
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<td>PQ20X-100</td>
<td>2</td>
<td>100</td>
<td></td>
<td>3</td>
<td>381</td>
<td>15</td>
<td>150</td>
<td>210</td>
<td>4</td>
<td>19</td>
<td>30</td>
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<td>M12x1.75</td>
<td>M8x1.25</td>
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<td></td>
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<td>431</td>
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<td>200</td>
<td>260</td>
<td>4</td>
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<td>30</td>
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<td>78</td>
<td>65</td>
<td>55</td>
<td>52</td>
<td>M12x1.75</td>
<td>M8x1.25</td>
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<td>30</td>
<td>M20x1.5</td>
<td>25.40</td>
<td>45</td>
<td>78</td>
<td>65</td>
<td>55</td>
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<td>M12x1.75</td>
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<td>3</td>
<td>531</td>
<td>15</td>
<td>300</td>
<td>360</td>
<td>4</td>
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<td>55</td>
<td>52</td>
<td>M12x1.75</td>
<td>M8x1.25</td>
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</table>

**Flexible Coupling**

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Flexible Coupling

\[ \text{F THD'S x J DEEP} \]

2 Nos.

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**To calculate the horse power of compressor required**:

\[ 1 \text{HP} = 120 \text{ LITRES OF FREE AIR (NL) PER MINUTE AT 5 Kg/Cm}^2 \]

\[ Q = \text{FREE AIR CONSUMED PER CYCLE (FROM CHART) IN NORMAL LITRES (NL)} \]

\[ \text{POWER REQUIRED} = \frac{Q \times N}{120} \text{ (H.P.) OR} \frac{Q \times N}{120 \times 0.746} \text{ (KW)} \]

| TON | A | B | C | D | D1 | E | D1 | E1 | F | G | H | J | K | L | M | N | P | R | S |
|-----|---|---|---|---|----|---|----|----|---|---|---|---|---|----|---|---|---|---|---|---|
| 2   | 14.8| 15 | 25 | 58 | 43.8| 44 | 37.8| 38 | 38 | M20x1.5 | 10 | M8x1 | 35 | 44 | 62 | 8.5 | 13.5 | 12 | 125 | 35 |
| 4   | 14.8| 15 | 30 | 71 | 57.8| 58 | 44.8| 45 | 45 | M24x2 | 10 | M8x1 | 40 | 52 | 75 | 8.5 | 13.5 | 15 | 275 | 42 |
| 8   | 14.8| 15 | 30 | 78 | 63.8| 64 | 49.8| 50 | 50 | M36x2 | 10 | M8x1 | 40 | 58 | 78 | 10.5| 16.5 | 15 | 375 | 46 |
| 15  | 14.8| 15 | 30 | 98 | 78.8| 88 | 64.8| 65 | 65 | M40x2 | 15 | M8x1.25 | 40 | 72 | 88 | 12.5| 19 | 15 | 600 | 60 |
| 30  | 19.8| 20 | 40 | 134| 87.8| 88 | 74.8| 75 | 75 | M48x3 | 15 | M8x1.25 | 45 | 80 | 105 | 12.5| 19 | 15 | 775 | 70 |
Hollow Shaft Neck Sealing Cylinders (Series CH)
Piston dia 50, 80 and 125mm

Salient Features
- Extra long guided piston, with low friction ‘U’ seals.
- Precision honed barrel.
- Specially compounded rod wiper seal.
- Piston rod centreless ground and hard chrome plated.
- All mountings can be attached without dismantling the cylinder.

Operating Conditions
Media: Air (filtered 40μ & lubricated)
Temperature Range: +5°C to +50°C
Pressure Range: Port ‘A’ 0.5 to 10 bar and Port ‘B’ 0.5 to 40 bar
Leakage: Bubble Tight

Mechanical Characteristic
Barrel: Ø50 & 100 Aluminium alloy IS 63400 (6063T6)
Ø125 Seamless Steel
Piston Rod: Carbon steel IS 5517 - C35
End Caps: Aluminium alloy IS 63400 (6063T6)
Seals: Nitrile rubber, polyurethane (Viton for high temp. on request)

Basic Dimensions

<table>
<thead>
<tr>
<th>MODEL No.</th>
<th>PISTON Ø (mm)</th>
<th>A</th>
<th>ØB</th>
<th>ØC1</th>
<th>ØC2</th>
<th>D (P.C.D.)</th>
<th>E (B.S.P.)</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>KK</th>
<th>M</th>
<th>N</th>
<th>SW1</th>
<th>SW2</th>
<th>V</th>
<th>W</th>
<th>Z</th>
<th>SEAL KIT No.</th>
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<td>50</td>
<td>15</td>
<td>40</td>
<td>25</td>
<td>20</td>
<td>68</td>
<td>69</td>
<td>1/4”</td>
<td>48</td>
<td>M6</td>
<td>17</td>
<td>30</td>
<td>12</td>
<td>M24x1.5</td>
<td>5</td>
<td>106</td>
<td>19</td>
<td>22</td>
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<td>64</td>
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<td>CH80-50HP(12)</td>
<td>80</td>
<td>15</td>
<td>48</td>
<td>32</td>
<td>25</td>
<td>100</td>
<td>98</td>
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<td>70</td>
<td>M8</td>
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<td>30</td>
<td>12</td>
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<td>22</td>
<td>28</td>
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<td>62</td>
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<td>CH80-50HP(14)</td>
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<td>15</td>
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<td>25</td>
<td>100</td>
<td>98</td>
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<td>M8</td>
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<td>-</td>
<td>28</td>
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<td>11</td>
<td>48</td>
<td>32</td>
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<td>90</td>
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<td>1/4”</td>
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<td>M10</td>
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<td>1/2”</td>
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<td>M16</td>
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<td>124</td>
<td>-</td>
<td>45</td>
<td>10</td>
<td>75</td>
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</tbody>
</table>

4.1 The Series “CH” Double Acting, Hollow Through Rod Pneumatic Cylinders have been developed for sealing small neck diameter containers (upto 35 mm dia.). The piston rod has a through hole with replaceable bearing bushes to accommodate different sizes of stretch pins.

4.2 Salient features of the Cylinder are:
   (i) Light weight, aluminium alloy barrel, end covers and piston. The barrel is precision honed.
   (ii) Bronze filled teflon wear strip on the piston and Gun Metal bearing bushes in the end covers, to accommodate eccentric loads on the shaft.
   (iii) Special profile ‘U’ Cup Seals for low friction and bubble tight sealing.
   (iv) Mountings as per ISO6431 Standards or as per customer specifications.

4.3 In addition to the cylinders listed in this manual, we are in position to develop special cylinders as per customer specifications.

4.4 Please specify Seal Kit No. While ordering spare seals.
Salient Features
- Extra long guided piston, with low friction ‘U’ seals and unbreakable rubber magnet for reed switch actuation.
- International standard ‘T’ slots for reed switch.
- Precision honed barrel.
- Fine control cushion screw with lock at rear end, to prevent accidental removal.
- Specially compounded rod wiper seal.
- All mountings can be attached without dismantling the cylinder.

Operating Conditions
- Media: Air (filtered 40μ & lubricated)
- Temperature Range: +5° to +50°C
- Pressure Range: 0.5 to 10 bar
- Leakage: Bubble Tight

Mechanical Characteristics
- Barrel: Aluminium alloy IS 63400 (6063T6)
- Piston Rod: Carbon steel IS 5517 - C35
- End Caps: Aluminium alloy IS 63400 (6063T6)
- Seals: Nitrile rubber, polyurethane (Viton for high temp. on request)

Basic Dimensions

5.1 The Series “PL” Double Acting Pneumatic Cylinders are manufactured as per IS 6431 Standards. In this Series, we manufacture the full range from 32 mm bore to 200 mm. The models included in this manual are supplied to the Stretch Blow Moulding Machine manufacturers for operation of the stretch pin.

5.2 Salient features of the Cylinders are:
(i) Light weight, aluminium alloy barrel, end covers and piston. The barrel is precision honed for low friction and long life of seals.
(ii) Bronze filled teflon wear strip on the piston and Gun Metal bearing brushes in the end covers, to accommodate eccentric loads on the shaft.
(iii) Special profile ‘U’ Cup Seals for low friction and bubble tight sealing.
(iv) Built in permanent magnet in piston as standard. Reed Switches can be mounted on the barrel for sensing the motion of the cylinder.
(v) Long length cushioning with a fine thread adjustment screw for guaranteed declaration at high speeds.

5.3 Please specify Seal Kit No. While ordering spare seals.
6.0 Cushion Solenoid Valves

6.1 These valves are fitted on our Series “X” Hydro Pneumatic Clamping Cylinders in the oil line between the Oil Reservoir and the Main Cylinder. The purpose of these valves is to avoid banging and vibration during mould opening and closing, when the machine is operated at high speed.

6.2 The valves consists of a 2 Way (2/2) Normally Open Solenoid Valve with a bypass Flow Control Valve. Just before the mould fully closes or fully opens, the Solenoid is switched “ON”. This shuts the rapid flow of oil from Reservoir to the Cylinder. The oil is now made to flow through a built in bypass Flow Control Valve to adjust the rate of deceleration, thus providing a smooth, cushioned mould closing and opening, which eliminates vibration and extends the life of the mould.

6.3 Refer to Section 2 on page 2.06/13 for construction details and dimensions.
7.0 High & Dual Pressure Blow Solenoid Valves

7.1 The blowing pressure for PET is generally in the range of 15 to 25 Kg/cm². We have developed two types of 1/2” 3/2 Poppet type Solenoid Valves with external pilot for this application.

The Single Solenoid Valve feeds blow pressure when the coil is switched “ON” and exhausts air when the coil is switched “OFF”.

The Dual Pressure Double Solenoid Valve first feeds low pressure (Max. 7 Kg/cm²) and when the preform is fully stretched, the high pressure solenoid is switched “ON” to provide final blow (Max. 30 Kg/cm²) for uniform forming. When both solenoids are switched “OFF” the blow air exhausts through the valve.

7.2 Refer to Section 2 on page 2.06/11 & 2.06/12 for construction details and dimensions.

7.3 We do not recommend that these valves be serviced in the field. In case of failure, replace the valve and send it for repairs to our factory or nearest service centre. Always specify the model no. and nature of complaint while sending the valve for service.
8.0 Solenoid Valve - Regulator Assembly

1/4” & 1/2” BSP Valve-Regulator Assembly

STANDARD VRA2 & VRA4

SERIES ‘X’ & ‘Z’
MODEL VRA2Z & VRA4Z

8.1 For efficient operation of our Series ‘X’ and Series ‘Z’ Hydro Pneumatic Systems, we have developed a compact Valve-Regulator Assembly.

The Approach Solenoid Valve, Power Stroke Solenoid Valve and the Tonnage Regulator are Sub-base mounted on a special manifold block. In case of valve failure, they can be replaced quickly without opening any pipe fittings. This reduces down time considerably and eliminates the chances of wrong fitment of pipes and connectors during maintenance. There is also saving in piping cost and air consumption.

8.2 Refer to Section 2 on page 2.06/4 & 2.06/5 for layout details and dimensions.

8.3 We do not recommend that our valves be serviced in the fields. In case of failure, replace the valves and send it for repairs to our factory or nearest service centre. Always specify the Model No. and nature of complaint while sending the valve for service.
9.0 High Pressure Regulator

1/2” BSP High Pressure Regulator

9.1 Our High Pressure Regulator Model RH4 is a piston type regulator that has been developed to overcome the failure of diaphragm type regulators under high pressure.

The salient features are:

(i) Compact and light weight

(ii) Well proportioned piston to spring ratio for fine control of output pressure.

(iii) Few moving parts for easy servicing

9.2 Refer to Section 2 on page 2.06/14 for technical specifications.

The regulator is a simple device and can be serviced in the field. Individual spare parts can be supplied. Please specify the Part No. while ordering.

10.0 Non Return Valve

1/2” BSP Non-return Valve

10.1 When our Dual Pressure Blow Solenoid Valve is used, our 1/2” Non Return Valve Model NR4 has to be fitted in the pipeline between the Low Pressure inlet of Dual pressure Blow Solenoid Valve and the Outlet of Low Pressure regulator. Refer to Section 2 on page 2.05/2 for construction details and dimensions.