# SPECIFICATION FOR HYDRAULIC & PNEUMATIC TRAINING SYSTEMS

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# 1 Pneumatic and Hydraulic Actuators

## 1.1 Basic Indicative Diagram

## 1.2 Hydraulic Actuators

1.2.1 Floor standing powder coated MS Structure with castor wheels with locking system, on which cylinder, power pack and piping are mounted. Seamless piping should be used to make a circuit such that Double Acting Cylinder operation can be demonstrated using Direction control valve. Oil tank to be mounted under the table top. All hose pipes should be provided with quick change coupling.

1.2.2 All valves and cylinders should be of reputed make like Bosch Rexroth, Eaton, Hydec, Parker, Yuken etc.

1.2.3 Power pack Unit: 1 No.

- 1.2.3.1 Electric Motor: 0.5 HP, Single Phase, flange mounted
- 1.2.3.2 Pressure: 70 Bar (max)
- 1.2.3.3 Operating Pressure: 35 bar
- 1.2.3.4 Tank: 10 liter capacity
- 1.2.3.5 Top mounted electrical motor design
- 1.2.3.6 Pressure relief valve, pressure gauge, level gauge
- 1.2.3.7 Hydraulic Oil
- 1.2.3.8 Gear Pump

1.2.4 Double Acting Cylinder: 2 No.

- 1.2.4.1 Bore: 40 mm X 18
- 1.2.4.2 Stroke: 100 mm
- 1.2.4.3 With mounting Bracket
- 1.2.4.4 1/4" BSP connectionnt
- 1.2.4.5 Operating pressure: 30 Bar

1.2.5 Valve

- 1.2.5.1 4/3 Hand-lever operated Valve, spring return centered with sub plate.

1.3 **Pneumatic Actuators**

1.3.1 Floor standing powder coated MS Structure on which cylinder, Pneumatic Compressor and with PVC piping Connected. PVC Piping should be used to make a circuit such that Double Acting Cylinder operation can be demonstrated using Direction control valve and Pressure Gauge Mounted.

1.3.2 All Valves & Cylinders should be of reputed make such as Bosch Rexroth, Festo, Janatics, SMC, Emerson etc

1.4 **Air Compressor Unit: 1 No.**

1.4.1

1.4.1.1 10 Bar gage & shut off valve with 8 mm Brass male connector hose
1.4.1.2 Displacement: 3 cfm or more
1.4.1.3 FRL unit
1.4.1.4 Working pressure: 7 $Kg/cm^2$ (7 Bar)
1.4.1.5 Electric Motor: 0.5HP or more, 1440 RPM, 230V, 50Hz, Single Phase
1.4.1.6 Safety Valve
1.4.1.7 Pressure Switch
1.4.1.8 Storage Tank: 35-50 liters
1.4.1.9 Pressure Gauge

1.4.2 Double Acting Cylinder: 2 No.

1.4.2.1 Bore: 32 mm
1.4.2.2 Stroke: 250 mm
1.4.2.3 With mounting Bracket

1.4.3 Valve

1.4.3.1 5/3 way directional control valve mid position closed, hand-lever operated

## 2 Hydraulic Training Work Bench

2.1 Basic Indicative Diagram

2.2 Use of anodized extruded aluminum profile (40 X 40 mm) table with shelves (3 Nos.) to store components when not in use Mounted on 4 Nos. of caster wheels for free movement. Work station with vertically mounted Frame unit (made of aluminum profiles).

| | | |
|---|---|---|
| 2.2.1 | Overall occupied Size (W x H x D): | 1000 mm X 1300 mm X 800 mm, |
| 2.2.2 | Working area Frame dimensions: | 1000 mm x 700 mm |
| 2.2.3 | Working area grid: | 50mm X 50 mm |
| 2.2.4 | Material: | SS, 5mm Diameter |

2.3 **Oil Collection Tray:** 2 Nos.+ (01no for hydraulic power pack of ss material) Mounted on the horizontal plane of the work station, Made of Stainless Steel, , 14 SWG with oil drain arrangement.

2.4 Quick release socket plug arrangement for building circuits, All hydraulic components are mounted using lever operated moulded adapters or hook-in type adapters for quick release & placement.

2.5 Industrial standard Valves and all components of reputed make like Bosch Rexroth, Eaton, Hydec, Parker, Yuken etc. should be used for the trainer kit.

2.6 All the components are fixed with QRC for easy and quick hydraulic connections.

2.7 All Quick Release Fittings used are with double check valve, ¼" BSP connection

2.8 Quick Release Male Adaptors as per the QRC required on the following components

2.9 Oil Distribution: Manifold: Sub plate (1 station manifold) with 4 ports: 2 Nos.

2.10 Pressure relief valve (sub plate mounted) with 40 Bar: 1 No.

2.11 Pressure relief valve (in-line type) with 40 Bar: 1 No.

2.12 Glycerine filled pressure gauge with facility to connect to A, B, P or T ports: 1 No.

2.13 Throttle cum check valve sub plate mounted: 1 No.

2.14 Throttle cum check valve in-line mounted: 1 No.

2.15 **Direction Control Element:**

- 2.15.1 4/2 way DC valve lever operated spring return, sub plate mounted: 2 Nos.
- 2.15.2 4/3 way DC valve, lever operated spring return, sub plate mounted: 1 No.
- 2.15.3 4/3 way DC valve lever operated detented, sub plate mounted: 1 No.
- 2.15.4 3/2 Stem actuated valve, sub plate mounted: 2 Nos.
- 2.15.5 4/2 way DC valve, 24VDC solenoid operated spring return: 1 No.
- 2.15.6 4/3 way DC valve, 24VDC, Spring Centered, Closed center, solenoid operated spring return: 1 No.
- 2.15.7 4/3 way DC valve, 24VDC, Spring Centered, Tandem Centre, solenoid operated spring return: 1 No.

2.16 **Actuating Devices (Output)**

2.16.1 Double acting cylinder 40mm X 150 mm stroke: 2 Nos.

2.16.2 Bi directional Hydraulic motor: 1 No.

2.17 **Pressure control and Other Valves**

2.17.1 Non Return Valve: 1 No.

2.17.2 Inline Type, Size ¼": 1 No

2.17.3 Non Return Valve: 1 No.

2.17.4 Sub-plate mounting type: 1 No

2.17.5 Pressure Sequence Valve, Max operating Pressure: 40 Bar, Sub-plate mounting type: 2 Nos.

2.17.6 Pressure Relief Valve, Max. Pressure 100 Bar, Knob/screw operated, Size: ¼", Inline type, with QRC, Vendor should be able to demonstrate the operation of this valve from 20 bar to 80 bar at different settings.

2.17.7 Pressure Reducing Valve, Max operating Pressure: 40 bar, Sub-plate mounting type: 2 Nos.

2.17.8 Flow divider Valve, Threaded body, Pressure compensated spool, 50:50 ratio, Inlet flow 10 lpm (max): 1 No.

2.18 **Accessories**

2.18.1 Weight + Protection Hood, 10 kg, To suit hydraulic cylinder: 1 No.

2.18.2 Accumulator: 1 No.

2.18.2.1 Should be of reputed Make like Bosch Rexroth, Eaton, Hydec, Parker, Yuken etc.

2.18.2.2 Diaphragm type, Capacity: 1 liter

2.18.2.3 Working pressure: 20 kg/cm2

2.18.2.4 Pre-charge pressure: 35 kg/cm2, Nitrogen gas, With Safety Block With valve and QRC

2.19 **Connections**

2.19.1 Flexible hoses, R1 type ¼" ID with Quick release sockets on both ends

2.19.2 Length 1000 mm: 8 Nos.

2.19.3 Length 1500 mm: 2 Nos.

2.19.4 T-Connector with one Female QRC socket and two male QRC plugs: 2 Nos.

2.20 **Electrical Connection**

2.20.1 Mains cord for 230 VAC

2.20.2 Solenoid Cables: 5 Nos.

2.21 **Electronic Control Unit**

2.21.1 Should comprise of 24VDC power supply with current rating of minimum 4.5Amps, Distributor for 24V and GND (minimum 6 points each), 1 x toggle switch with 1 NO and 1 NC contacts, 3 X push button switch with 1 NO and 1 NC contacts, 2 X LED Indicators for connecting outputs of the circuit, 1 X buzzer for connecting outputs of the circuit, 5 X 3 change over relays, 1 X 1 change over relay, 1 X On delay timer with 1 NO and 1 NC contact, 1 X OFF delay timer with 1 NO and 1 NC contact.

2.22 **Power Generation**

2.22.1 Power pack (50 Bar) consist of

2.22.1.1 Variable Vane Pump with minimum 10 LPM

2.22.1.2 Relief valve.

2.22.1.3 Electric Motor: 1.0 HP 1440 RPM 230VAC

2.22.1.4 Cast Aluminium Tank: 40 liters

2.22.1.5 Oil Breather

2.22.1.6 Oil level indicator

2.22.1.7 Suction filter / Strainer
2.22.2 Variable Vane Pump & Relief valve

2.23 **Cut section components**

The cut section of following components should be supplied. All the components should be sectioned out of actual industrial components.

2.23.1 4/3 Way lever Operated 3 position Valve,
2.23.2 4/3 Solenoid Operated NG06/Cetop 3 valve
2.23.2.1 Closed Centered
2.23.2.2 Tandem Center
2.23.3 Non Return Valve
2.23.4 Pressure Relief Valve, sub plate mounted type with knob to set pressure
2.23.5 Shut off valve,
2.23.6 External Gear Pump
2.23.7 Diaphragm Accumulator: 1 liter
2.23.8 Flow control Valve
2.23.9 Line operated Check valve

2.24 **List of Experiments**

2.24.1 Study of Hydraulic Power Pack
2.24.2 Study of Pressure Relief valve
2.24.3 Study of Directional control valve
2.24.4 Study of D.A. Cylinder
2.24.5 Study of S.A. cylinder
2.24.6 Study of Meter in/out flow control
2.24.7 Study of Regenerative circuit
2.24.8 Study of Bleed of Circuit
2.24.9 Study of direct operated pressure relief valve

2.25 **Training Material**

2.25.1 Suitable Training Manual must be supplied

## 3 Pneumatic Training Work Bench

3.1 Basic Indicative Diagram

3.2 All valves and other components should be mounted on FRP/Plastic plate (of 80 mm X 130 mm size) fitted with plastic base (to avoid scratching on the Aluminum anodized work table) and with inbuilt button operated Push-to-lock/ unlock mechanism for easy clamping & unclamping with the work table

3.3 Should use actual new industrial standard valves and components like Air Distribution & Manual control, Control Element, Actuating devices, Logic Control, Flow control & Accessories should be of reputed make like Bosch Rexroth, Festo, SMC, Janatics, Emerson etc.

3.4 **Profile plate:** 1 No.

- 3.4.1 Work station with vertically mounted Frame unit (made of extruded aluminum profiles) with provision to work on both sides of the work station
- 3.4.2 Overall occupied Size (W x H x D): 800 mm X 1300 mm X 750 mm
- 3.4.3 Effective work area per side on the Frame unit: 800 mm X 700 mm
- 3.4.4 Profile groove width: 10.2 mm
- 3.4.5 Groove to groove distance: 20 mm
- 3.4.6 Material: Aluminium, anodized finish
- 3.4.7 Foot base: Wheel with locking arrangement

3.5 **Air distribution & manual control**

- 3.5.1 Flow & Pressure Regulator (FRL) unit with pressure gauge (10 bar), 1/4" 9BSP(F): 1 No.
- 3.5.2 Manifold 4 way, ¼" BSP (F) with 4 ball on/off valve: 1 No.
- 3.5.3 One-way flow control adjustable valve: 1 No.
- 3.5.4 Ball valve ¼" BSP for ON-OFF [M-F]: 1 No.
- 3.5.5 Silencer: 1 No.

3.6 **Control Element**

- 3.6.1 3/2 way directly actuated valve with push button, M5, 1/8 or 1/4 " BSP (F)
- 3.6.2 3/2 way single pilot valve, M5, 1/8 or ¼" BSP (F)
- 3.6.3 5/2 way valve with roller lever valve, M5, 1/8 or ¼" BSP (F)
- 3.6.4 5/2 way pilot operated spring return valve, M5, 1/8 or ¼" BSP (F)

3.6.5 5/3 way double pilot valve (with manual override), M5, 1/8 or ¼" BSP (F)
3.6.6 3/2 way roller lever valve, M5, 1/8 or ¼" BSP (F)
3.6.7 3/2 way directional control valve with 24V DC operated.
3.6.8 5/3 way directional control valve mid position closed, hand-lever operated
3.6.9 5/2 way directional control valve, hand-lever operated
3.6.10 5/2 way directional control valve with 24V DC operated, spring return

3.7 **Actuating Devices (O/P)**
3.7.1 Single acting cylinder - Bore 25 mm, Stroke 100mm: 1 No.
3.7.2 Double acting cylinder Bore 25 mm, Stroke 150mm: 1 No.
3.7.3 Pneumatic motor: The component should be an application of pneumatic motor in an industry, Maximum pressure – 10 Bar: 1 No.

3.8 **Logic Control**
3.8.1 OR gate / shuttle valve 1/8" BSP (F): 1 No.
3.8.2 AND gate 1/8" BSP (F): 1 No.

3.9 **Flow Control**
3.9.1 One way flow control valve, inline type: 2 Nos.
3.9.2 Non return valve, Brass/Aluminium body: 1 No.

3.10 **Accessories.**
3.10.1 Pneumatic Counter Balance Valve, The counterbalance valve will hold a load in position until pressure is applied to move the load, Turning the adjusting screw clockwise will increase the load carrying capacity of the valve, Pressure Range: 1 to 8 bar, Max. Pilot Pressure: 7 bar: 1 No.
3.10.2 Weight + Protection Hood, To suit double acting pneumatic cylinder, With weight, 5 Kg.: 1 No.
3.10.3 PU tube, Red Blue and Yellow colour, 20 meter each
3.10.4 T-Connector: 2 Nos.
3.10.5 Pneumatic Quick change couplers (one touch fittings) mounted on each pneumatic component. The fittings should be suitable for 4 mm/ **suitable** OD PU tube

3.11 **Electrical connections**
3.11.1 Mains cord with stackable connection

3.12 **Air Compressor**
3.12.1 Air Compressors Displacement: 3 cfm or more
3.12.2 Working Pressure: 7 kg/cm$^2$ (7 Bar)
3.12.3 Electric Motor: 0.5 HP or more, 1440 RPM, 230 V/ 50Hz, Single Phase
3.12.4 10 Bar gage & shut off valve with 8 mm Brass male connector hose
3.12.5 Safety Valve
3.12.6 Pressure Switch
3.12.7 Storage Tank: 35-50 liter

3.13 **Cut section components**
The cut section of following components should be supplied. All the components should be sectioned out of actual industrial components.
3.13.1 5/2 way Hand Lever Operated Valve
3.13.2 3/2 way Roller Lever Actuated Valve
3.13.3 5/2 way Solenoid Operated Spring Return
3.13.4 5/2 way Double pilot Valve
3.13.5 Quick Exhaust Valve
3.13.6 One-Way Flow Control Adjustable Valve
3.13.7 OR Function valve

3.14 **List of Experiments**

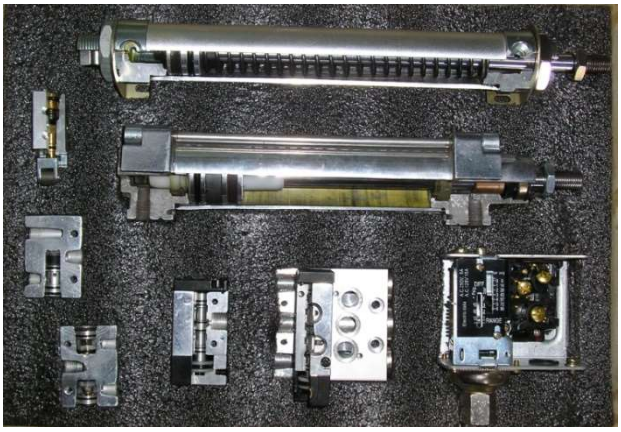
3.14.1 Working of Air filter, Lubricator & Regulator
3.14.2 Use of manifold block
3.14.3 Working of Single acting cylinder
3.14.4 Working of Double acting cylinder
3.14.5 Working of 5/2 way valve
3.14.6 Working of 5/3 way mid position closed
3.14.7 Working of 5/2 way double pilot valve air operated with manual override
3.14.8 Working of one way flow control valve
3.14.9 Working of 5/2 way valve solenoid operated
3.14.10 Working of OR gate / Shuttle valve
3.14.11 Working of & gate
3.14.12 Working of counter balance circuit
3.14.13 Working of silencer
3.14.14 Working of Indirectly actuation of single acting single

3.15 **Manual**

3.15.1 Instructional Manuals and an Exercise Manual should be provided with each system. Detailed theory and practical exercises should be included in the Exercise Manual.

## 4 Cut Section Model - Pneumatic Valves

4.1 Basic Indicative Diagram

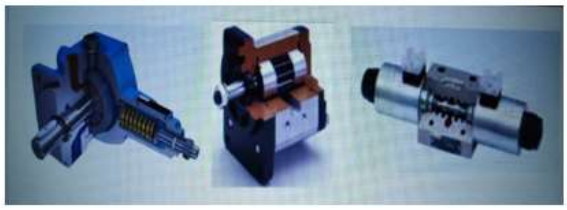


4.2 The cut section of following components should be supplied. All the components should be sectioned out of actual industrial components.

- 4.2.1 5/2 way Hand Lever Operated Valve
- 4.2.2 3/2 way Roller Lever Actuated Valve
- 4.2.3 5/2 way Solenoid Operated Spring Return
- 4.2.4 5/2 way Double pilot Valve
- 4.2.5 Quick Exhaust Valve
- 4.2.6 One-Way Flow Control Adjustable Valve
- 4.2.7 OR Function valve
- 4.2.8 FRL Unit
- 4.2.9 Single acting Cylinder
- 4.2.10 Double acting Cylinder
- 4.2.11 Quick change couplings

## 5 Cut Section Model - Hydraulic Valves

5.1 Basic Indicative Diagram




5.2 The cut section of following components should be supplied. All the components should be sectioned out of actual industrial components.

5.2.1 4/3 Way lever Operated 3 position Valve,
5.2.2 4/3 Solenoid Operated NG06/Cetop3 valve
5.2.3 Closed Centred
5.2.4 Tandem Center
5.2.5 Non Return Valve
5.2.6 Pressure Relief Valve, sub plate mounted type with knob to set pressure
5.2.7 Shut off valve,
5.2.8 External Gear Pump
5.2.9 Diaphragm Accumulator (1 Lit)
5.2.10 Flow control Valve
5.2.11 Line operated Check valve
5.2.12 Single acting Cylinder
5.2.13 Double acting Cylinder
4.2.11 Quick change couplings
4.2.12 Pressure gauge
4.2.13 Vane Pump