

# **PNEUMATIC CYLINDERS & ALLIED COMPONENTS**

## **1. INTRODUCTION:**

Pneumatic engineering makes use of gas or pressurized air to carry out mechanical work and also help in controlling various motions in manufacturing operations. Pneumatic systems used in industry are commonly powered by compressed air as it is free to use and there is no major cost involved in case of leakage.

A centrally located and electrically powered compressor powers cylinders, air motors, and other pneumatic devices. A pneumatic system controlled through manual or automatic solenoid valves is selected as it provides a lower cost, more flexibility, or safer alternative to electric motors and actuators in work areas.

Pneumatic system also has applications variety of industrial machines, automobiles, railways and control systems. It has special place in dentistry, construction, mining, etc. due to its ease of use in remote areas and built in safety features

## **2. PRODUCT & ITS APPLICATION:**

Pneumatic technology has evolved in to preferred system for automation. With help of valves of various types, actuators like cylinders, air motors and bladder accumulators etc. have been useful operations of machines as well as in creating logic circuits for automation.

- A pneumatic motor or Air motor or compressed air engine is a type of motor which does mechanical work by expanding compressed air. Pneumatic motors are available in size from hand-held motors to engines of up to several hundred horsepower. Some types rely on pistons and cylinders; others on slotted rotors with vanes or turbines. Pneumatic motors are widely used in hand-held tools, impact wrenches, pulse tools, screwdrivers, nut runners, drills, grinders, sanders and so on.

- Pneumatic cylinders are made from metal tubes that withstand the operating pressures. The cylinder barrel is ground and/or honed internally for surface finish. The pistons move in the cylinder under air pressure and carry out the work. The cylinder consists of a cylinder barrel, in which a piston connected to a piston rod that moves back and forth. The piston has sliding rings and seals to prevent leakage. The cylinder head gland also has seals. Pneumatic Cylinders are mostly single acting and return of piston occurs through external force, internal retraction spring. Double acting cylinders are supplied with pressurized air for both the retraction and extension. Cylinders have mountings with various fixtures like flanges, trunnions, clevises, and lugs. The piston rod attachments are used to connect to the object or machine component that it is pushing or pulling. There are special construction of cylinders that have applications in machines and equipment. Viz. Telescopic cylinder, Plunger cylinder and Differential cylinder.
- Pneumatic circuit has various valves for like direction control valves, Pressure controller, flow control valves, and logic control valves like "AND" and "OR" valves. Directional control valves are one of the most fundamental parts in pneumatic system. They allow fluid flow into different paths from one or more sources. The spool (sliding type) consists of lands and grooves. The lands block oil flow through the valve body. The grooves allow air or gas to flow around the spool and through the valve body. Spool is of two types namely sliding and rotary. Sliding spool is cylindrical in cross section, and the lands and grooves are also cylindrical. Rotary valves have sphere-like lands and grooves in the form of holes drilled through them. The valves are operated either manually, mechanically hydraulically or through Solenoid.

Pneumatic logic is a reliable and functional control system for industrial processes. In recent years, these systems have largely been replaced by electronic control systems in new installations but Pneumatic devices are still favored for automation where safety factors dominate.

### **3. DESIRED QUALIFICATIONS FOR PROMOTER:**

Any ITI, Diploma or Graduate with some background in manufacturing or marketing.

#### **4. INDUSTRY OUTLOOK/TREND**

Pneumatic equipment is having demand in Oil & gas, mining, and chemicals sector contributing to almost 50 percent of the market size. The global pneumatic equipment market is valued at \$56.63 billion in 2016 and is expected to grow at a CAGR of 5.43 percent. The pneumatic equipment is cleaner and finds significant applications in the food processing industry. Additionally, pneumatic equipment like pneumatic actuators is increasingly being used for medical analysis and MRI-assisted surgery. During 2015, the pneumatic cylinders segment accounted for over 32% of the pneumatic equipment market and is likely to dominate owing to their low initial cost and durability. Pneumatic equipment is deployed in the industrial sector for impeccable repeatability and precise control. In automation and virtual reality, every aspect of motion is constantly changing for achieving real-time responses. This is achieved with faster computers, better software, and integrating the system with pneumatic components.

This global market is characterized by the presence of big international players and several regional pneumatic equipment manufacturers from developing countries and as a result appears fragmented. The international players offer a wide product portfolio and mainly offer services to meet the demand from major end users. Vendor competition is completely based on the ability to meet consumer preferences, such as safety, ease of operation, cost, sustainability, and reliability.

#### **5. MARKET POTENTIAL AND MARKETING ISSUES. IF ANY:**

Pneumatic cylinders, valves and other components are widely used in industrial machines. The top emerging trends driving the global pneumatics market for development of High-performance pneumatics, for use in aerospace and automobiles and food and pharma industry.

Demand for pneumatics is steadily growing across many industries. The growing use of more processed and packaged foods, is leading to accelerated investment in the food & beverage segment. Demand of pneumatic equipment is gradually acquiring significant application in food, pharma and dairy processing and medical applications as well. The recent FDA rules in the US demand pneumatics as part of the Food Safety Modernization Act, with stringent requirements for decontamination and hygiene and safety. The product segments are air motors, valves, cylinders, accumulators and filters, and accessories. In industrial sector the

rapid growth is witnessed in Machine tools, automotive, plastic processing, packaging, pharma industry, water and wastewater, hydraulic presses, renewable energy, food and beverage, entertainment and simulators, etc. They are also used in automatic door closures, lifts, elevators, and appliances.

The expanding population, increasing industrialization, and rapid urbanization in India will lead to the increasing demand for agricultural products, food, and chemicals, which use pneumatic equipment in their manufacturing plants. Moreover, the growth of the transportation sector in APAC will also fuel the demand for more oil and gas, which, in turn, will propel the demand for pneumatic equipment such as pneumatic pistons, motors, and cylinders.

One market research report estimates that this Asian region will account for more than 42% of the market share by 2020 and will also dominate the industry throughout the forecast period. Growth of all these sectors is fostering the growth of the pneumatic products market in India.

## **6. RAW MATERIAL REQUIREMENTS:**

Pneumatic cylinders are made from various materials and Selection of barrel materials is based on pressure and other duty conditions, ranging from aluminum extruded tubes, centrifugally cast irons and steels. Piston and rods are normally made from carbon / alloy steel round bars. Valves body is machined from cast parts or rods, and spools/ poppets are made from carbon and alloy steels. Other materials are seals and gaskets made from elastomers like nitrile, Viton, PTFE etc. and metal glands made from cast iron, bronze, stainless steel etc.

## **7. MANUFACTURING PROCESS:**

The process consists of manufacturing / pre-processing of components like cylinder tubes, pistons, piston rods and keeping them ready for further processing against orders. This production system is designed to meet the customers' requirements for product, optimization of operations and ensure short lead times. Besides the production equipment can be adapted to both long and short production runs.

- Pre-processing is done mostly for cylinder barrels, piston and piston rod by cutting blanks from tubes /rods followed by various stages of machining to semi-finished stage. These semi-finished parts are kept ready.

- Piston and piston rods may be hard chrome plated followed by finish lapping/ polishing. All other standard parts of cylinder, valves etc. are finished by chamfering, drilling, milling, tumbling, boring, turning, threading grinding, lapping on automates.
- As per customized requirements of customers' designs and duty conditions and quality, the cylinder barrels, piston and rod components are selected. Some components undergo welding with parts of the cylinder etc. These are then finished by machining, grinding, boring, honing, lapping to required tolerances and surface finish.
- All components are then washed and cleaned thoroughly to remove metal particles dust and moisture. The cleaned parts are then sent to "Clean Room" facility for assembly testing and packing.
- Painting of cylinders is carried out with High Gloss spray Painting to customer specified colors and paint specification.

Special purpose automates, turret lathes, CNC machine tools, Robotic Welding etc. are required for ensuring tight quality control and guaranteeing consistency and accuracy for volume product lines.

## 8. MANPOWER REQUIREMENT:

The unit shall require highly skilled persons. The unit can start from 16 employees initially and increase to 31 or more depending on business volume.

Sr No	Type of Employees	Monthly Salary	No of Employees				
			Year 1	Year 2	Year 3	Year 4	Year 5
1	Skilled Operators	20000	4	6	8	10	12
2	Semi-Skilled/ Helpers	9000	8	8	8	10	12
3	Supervisor/ Manager	30000	1	1	2	2	2
4	Accounts/ Marketing	20000	1	2	3	3	3
5	Other Staff	8000	2	2	2	2	2
	TOTAL		16	19	23	27	31

## 9. IMPLEMENTATION SCHEDULE:

The unit can be implemented within 6 months from the serious initiation of project work.

Sr No	Activities	Time Required in Months
1	Acquisition of Premises	2
2	Construction (if Applicable)	2
3	Procurement and Installation of Plant and Machinery	3
4	Arrangement of Finance	2
5	Manpower Recruitment and start up	3
	Total Time Required (Some Activities run concurrently)	6

## 10. COST OF PROJECT:

The unit will require total project cost of Rs 149.80 lakhs as shown below:

Sr No	Particulars	In Lakhs
1	Land	25.00
2	Building	50.00
3	Plant and Machinery	60.00
4	Fixtures and Electrical Installation	4.85
5	<i>Other Assets/ Preliminary and Preoperative Expenses</i>	2.50
6	Margin for working Capital	7.45
	TOTAL PROJECT COST	149.80

## 11. MEANS OF FINANCE:

The project will require promoter to invest about Rs 43.04 lakhs and seek bank loans of Rs 106.76 lakhs based on 70% loan on fixed assets.

Sr No	Particulars	In Lakhs
1	Promoters Contribution	43.04
2	Loan Finance	106.76
	TOTAL:	149.80

## 12. WORKING CAPITAL REQUIREMENTS:

Working capital requirements are calculated as below:

Sr No	Particulars	Gross Amount	Margin %	Margin Amount	Bank Finance
1	Inventories	1.97	40	0.79	1.18
2	Receivables	6.62	50	3.31	3.31
3	Overheads	2.56	100	2.56	0.00
4	Creditors	1.97	40	0.79	1.18
	TOTAL	13.13		7.45	5.68

## 13. LIST OF MACHINERY REQUIRED:

Sr No	Particulars	UOM	Quantity	Rate	Total Value
	<b>Main Machines/ Equipment</b>				
1	Blank cutting machines	Nos	1	75000	75000
2	Precision Lathes	Nos	1	250000	250000
3	CNC Machining Center	Nos	1	900000	900000
4	CNC Turret Lathes	Nos	2	450000	900000
7	Milling Machine	Nos	1	300000	300000
8	Shot blasting/ Tumbling	Nos	1	150000	150000
9	Cylindrical Grinder	Nos	2	500000	1000000
11	Pillar Drilling Machine	Nos	1	150000	150000
12	On Line laser Measuring Machines	Nos	2	250000	500000
13	5 axis Measuring m/c CNC	Nos	1	650000	650000
14	Clean Room Air handling plant	LS	1	350000	350000
15	Air compressor Plant	Nos	1	250000	250000
14	MIG Welding Machine	Nos	1	75000	75000
	<u>Subtotal:</u>				<u>5550000</u>
	<b>Tools and Ancillaries</b>				
Sr No	Particulars	UOM	Quantity	Rate	Total Value
1	Die tools and gauges	LS	1	300000	300000
2	Misc. tools etc.	LS	1	150000	150000

	<u>Subtotal:</u>				<u>450000</u>
	<b>Fixtures and Elect Installation</b>				
	Storage racks and trolleys	LS	1	75000	75000
	Other Furniture	LS	1	50000	50000
	Telephones/ Computer	LS	1	60000	60000
	Electrical Installation	LS	1	300000	300000
	<u>Subtotal:</u>				<u>485000</u>
	Other Assets/ Preliminary and Preoperative Expenses	LS	1	250000	250000
	<b>TOTAL PLANT MACHINERY COST</b>				<b>6735000</b>

All the machines and equipment are available from local manufacturers. The entrepreneur needs to ensure proper selection of product mix and proper type of machines and tooling to have modern and flexible designs. It may be worthwhile to look at reconditioned imported machines, dies and tooling. Some of the machinery and dies and tooling suppliers are listed here below:

1. Techno Machines  
Chikkanahalli Road,  
Opp. Shahi Exports (Unit No 6),  
Near Annapoorneshwari Temple, Bommanahalli,  
BENGALURU-560 068, INDIA
2. S. S. Engineering Works  
Ajit Khanna(Proprietor)  
Plot No. 100, Sector 6 IMT Manesar, Gurgaon - 122050, Haryana, India
3. Taurus Private Ltd Co  
No. 24, D 2 / E 3, Kiab Industrial, Area At Pivele  
Kiab Industrial Area  
Bengaluru – 560100 Karnataka, India
4. Micro Engineering Works;



No. 6/140, Gandhi Nagar, Nallampalayam Road Nanjai Gounden, Pudur, G. N. Mills  
Post, Coimbatore - 641029, Tamil Nadu, India

5. S. G. Profile

Plot No. 201/1, Gala No. 56, Morya Industrial Estate, MIDC, Bhosari, Bhosari Midc,  
Pune-411026, Maharashtra, India

**14. PROFITABILITY CALCULATIONS:**

Sr No	Particulars	UOM	Year Wise estimates				
			Year 1	Year 2	Year 3	Year 4	Year 5
1	Capacity Utilization	%	30	40	50	55	60
2	Sales	Rs Lakhs	79.48	105.97	132.47	145.71	158.96
3	Raw Materials & Other Direct Inputs	Rs Lakhs	23.67	31.55	39.44	43.39	47.33
4	Gross Margin	Rs Lakhs	55.82	74.42	93.03	102.33	111.63
5	Overheads Except Interest	Rs Lakhs	15.81	15.81	15.81	15.81	15.81
6	Interest	Rs Lakhs	14.95	14.95	14.95	14.95	14.95
7	Depreciation	Rs Lakhs	14.08	14.08	14.08	14.08	14.08
8	Net Profit Before Tax	Rs Lakhs	10.98	29.58	48.19	57.49	66.79

The basis of profitability calculation:

Unit will have capacity of 20,000 no's per year consisting of mix of pneumatic cylinders, valves, connectors etc. Depending on the type/ size of cylinders, valves and other components being high precision components, average sales price varies. The bulk price range is taken up to Rs. 200 per pc for simple items like connectors while price ranges from Rs 800 to Rs 5000 per pc for cylinders. Normally supply of complete system/ solution is offered to customers.

The material requirements are high Carbon alloy steel, and HCHCr etc. special alloys etc. for connectors and valve poppets, body etc. They cost in range of Rs 75 per Kg to Rs 180 per kg. The cost of Seamless tubes ranges from Rs 60 per kg to Rs 450 per kg. Seals and gaskets cost ranges from Rs 30 to Rs 500 or more per set for cylinders and valves. The unit may generate scrap which is to be sold at @ Rs 20 ~ 80 per Kg depending on type. The income of same is added. Consumables costs also considered based on prevailing rate. Energy Costs are

considered at Rs 7 per Kwh. The depreciation of plant is taken at 10 % and Interest costs are taken at 14 -15 % depending on type of industry.

## **15. BREAK EVEN ANALYSIS:**

The project is can reach break-even capacity at 24.10 % of the installed capacity as depicted here below:

Sr No	Particulars	UOM	Value
1	Sales at Full Capacity	Rs Lakhs	264.94
2	Variable Costs	Rs Lakhs	78.89
3	Fixed Cost incl. Interest	Rs Lakhs	44.84
4	Break Even Capacity	% of Inst Capacity	24.10

## **16. STATUTORY/ GOVERNMENT APPROVALS**

The unit will require state industry unit registration with District Industry center. No other procedures are involved. For export, IEC Code and local authority clearances. The industry registration and approval for factory plan, safety etc. is required as per factory inspectorate and labor laws. Other registration are as per Labor laws are ESI, PF etc. Before starting the unit will also need GST registration for procurement of materials as also for sale of goods. As such there is no pollution control registration requirement, however the unit will have to ensure safe environment through installation of chimney etc. as per rules. Solid waste disposal shall have to meet the required norms. Entrepreneur may contact State Pollution Control Board where ever it is applicable.

## **17. BACKWARD AND FORWARD INTEGRATION**

The machines and equipment offer scope for diversification in to producing several industrial parts/ components and parts of hydraulic systems and auto components. The unit can utilize the spare capacities. As such there is not much scope for organic backward or forward integration. The entrepreneur needs to ensure proper selection of product mix and also be careful in maintaining product parameters in terms of dimensions, tolerances and geometric

profiles along with final weights of products.

The workshop business needs building up reputation, ensuring reliability and quality of services rendered. Also personal rapport of key persons can generate good business volumes from OEM units and ancillary component unit. The location with good catchment area ensures good market potential to new business units.

## **18. TRAINING CENTERS/COURSES**

There are no specific training centers for production technology. The Prototype Development Centers can provide some assistance for precision machining, Tools development, etc. Other centers of excellence viz Indo German Tool Room at Ahmedabad, Rajkot, Chennai, etc. shall be helpful. The most important scope of learning is in new product design and development by study of the new product designs, product range, features and specifications of leading Brands / competitors across the world by scanning the Internet and downloading data from websites of Viz. North American, Europe, China etc. markets.

Udyamimitra portal (link: [www.udyamimitra.in](http://www.udyamimitra.in)) can also be accessed for hand-holding services viz. application filling / project report preparation, EDP, financial Training, Skill Development, mentoring etc.

Entrepreneurship program helps to run business successfully is also available from Institutes like Entrepreneurship Development Institute of India (EDII) and its affiliates.

### **Disclaimer:**

Only few machine manufacturers are mentioned in the profile, although many machine manufacturers are available in the market. The addresses given for machinery manufacturers have been taken from reliable sources, to the best of knowledge and contacts. However, no responsibility is admitted, in case any inadvertent error or incorrectness is noticed therein. Further the same have been given by way of information only and do not carry any recommendation.