

HYDRAULIC CYLINDERS

1. INTRODUCTION:

Hydraulic system is one, where liquid is the powering medium. A fundamental feature of hydraulic systems is the ability to apply force or torque multiplication in an easy way, independent of the distance between the input and output, without the need for mechanical gears or levers, either by altering the effective areas in two connected cylinders or the effective displacement between a pump and motor.

In normal cases, hydraulic ratios are combined with a mechanical force or torque ratio for optimum machine designs. For the hydraulic fluid to do work it must flow to the actuator and/or motors and various types of valves to control flow, Pressure direction etc. are used. The path taken by hydraulic fluid is called a hydraulic circuit.

The popularity of hydraulic machinery is due to very large amount of power that can be transferred through small tubes and flexible hoses, high power density and wide array of actuators viz hydraulic cylinders that can make use of this power. The most common use for this is the classical hydraulic jack where a pumping cylinder with a small diameter is connected to the lifting cylinder with a large diameter.

2. PRODUCT & ITS APPLICATION:

A **hydraulic cylinder** also called a linear hydraulic motor is a mechanical actuator that is used to give a unidirectional force through a unidirectional stroke. It has many applications, notably in construction equipment, engineering vehicles, earth movers, mining, industrial machinery and plants, manufacturing machinery automation, robotics, appliances and civil engineering.

Hydraulic cylinders get their power from pressurized hydraulic fluid, mostly mineral oil, which

exerts pressure on piston and moves the piston rod. The piston rod connected to part/ lever of a machine and carries out work. The levers utilize the linear motion to convert in to rotary or oscillating motion through mechanisms.

The hydraulic cylinder consists of a cylinder barrel, in which a piston connected to a piston rod that moves back and forth. The piston divides the inside of the cylinder into two chambers, the bottom chamber (cap end) and the piston rod side chamber (rod end / head end). The piston has sliding rings and seals to prevent leakage. The cylinder head gland also has seals.

Hydraulic Cylinders are either single acting or double acting. In Single acting type fluid enters through a port at one end of the cylinder, and pushes the rod while return of piston occurs through external force, internal retraction spring or gravity. In double acting cylinders is supplied with hydraulic fluid for both the retraction and extension.

Cylinders are mounted with various fixtures like flanges, trunnions, clevises, and lugs are common mounting options. The piston rod also has mounting attachments to connect the cylinder to the object or machine component that it is pushing or pulling.

There are special construction of hydraulic cylinders that have applications in machines and equipment. Viz. Telescopic cylinder – compact construction with large stroke length, Plunger cylinder – without piston rod and Differential cylinder. Also a Position sensing “smart” hydraulic cylinder can be used in control circuits.

3. DESIRED QUALIFICATIONS FOR PROMOTER:

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

4. INDUSTRY OUTLOOK/TREND

The global hydraulic cylinders market has been estimated to be of \$9.8 billion in 2014 and is forecast to reach \$12.5 billion by 2020, representing a CAGR of 4.3% as per one report. The Asia-Pacific market is the third largest regional sub sector with an 18% market share. It is

expected to have the greatest rate of growth, over the period of 2014-2020. India, with skilled and low cost labor, will emerge as outsourcing hubs for some global hydraulic cylinder manufacturers.

Key factors driving growth are huge investment in infrastructure, construction, mining, aerospace & defense, railways auto etc. sectors. The surge in construction market will demand vehicles such as excavators, compactors, backhoe loaders, concrete and cement machines, drilling rigs, and wheel loaders etc. for various infrastructure projects such as roads, bridges, buildings or tunnels. The growth of aerospace, industrial machinery, oil and gas, and automotive industries will subsequently lead to the growth of the hydraulic equipment market.

The global hydraulic equipment market is highly competitive and has high growth potential. The competition in this market is expected to intensify further with the increase in product extensions and technological innovations. Leading vendors of Hydraulic equipment in this market are - Bosch Rexroth, Daikin Industries, Eaton, Kawasaki Heavy Industries, Parker etc. There are about 150 manufacturers in SME offering hydraulic, pneumatic and sealing products.

5. MARKET POTENTIAL AND MARKETING ISSUES. IF ANY:

Demand for hydraulics is steadily growing across many industries, of which the prominent sectors are Agriculture, Construction, Mining, Material-handling, Industrial equipment, Aerospace, marine industry, Defense sectors. The product segments are pumps, motors, valves, cylinders, transmission, accumulators and filters, and accessories. In industrial sector the rapid growth is witnessed in Machine tools, automotive, plastic processing, packaging, food industry, pharma industry, water and wastewater, hydraulic presses, renewable energy, food and beverage, entertainment and simulators, and others. Hydraulic cylinders are one of the critical components for a majority of the applications.

The rise in various construction activities in developing countries has led to high demand for hydraulic equipment. Various construction activities such as the construction of roads, railways, housing, infrastructure, and airports have contributed to the growing demand for earth-moving equipment such as excavators, loaders, bulldozers, and cranes.

The technology trend evolving is to build product with capabilities of Integration with electronics, miniaturization, compact, modular and intelligent hydraulic systems. The electro-hydraulic cylinders, also known as smart cylinders, incorporate electronic controls and servo valves such as transducers that provide electrically controlled valves and rod position feedback to ensure efficient operations.

Manufacturers are increasingly offering integrated hydraulic cylinder systems and solutions to differentiate themselves. This differentiation tactic allows manufacturers to add value by delivering systems or subsystems containing cylinders and ancillary products such as valves and pumps. For users, this translates into more efficient design, engineering and purchasing solutions, lower overall operational costs and lead times. Manufacturers that are horizontally integrated and have a complete hydraulic equipment product line are benefiting from this trend.

6. RAW MATERIAL REQUIREMENTS:

Main raw material used for hydraulic cylinder barrels is seam less steel tubes of carbon steel to alloy steel as per duty conditions. Piston rods are made from carbon steel rods. Seals of various types are used in combination made from elastomers like nitrile rubber, Viton PTFE etc. Wear bands are made from cast iron, bronze and fiber filled plastics. All the materials can be procured locally.

7. MANUFACTURING PROCESS:

The process consists of manufacturing of pre-processing of components like cylinder tubes, pistons, piston rods and keeping them ready for further processing. 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 and rods followed by various stages of machining to semi-finished

stage. These semi-finished parts that are controlled and kept ready.

- Piston and piston rods may be hard chrome plated followed by finish lapping/ polishing.
- All other standard parts of cylinder are finished by chamfering, drilling, milling, tumbling, boring, turning, threading grinding, lapping on automates.
- As per customized requirements of customers' viz seal designs, 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. These 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 service persons. The unit can start from 13 employees initially and increase to 27 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	10
2	Semi-Skilled/ Helpers	9000	6	8	10	12	12
3	Supervisor/ Manager	30000	1	1	1	1	1
4	Accounts/ Marketing	20000	1	2	2	3	3
5	Other Staff	8000	1	1	1	1	1
	TOTAL		13	18	22	27	27

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 150.03 lakhs as shown below:

Sr No	Particulars	In Lakhs
1	Land	25.00
2	Building	50.00
3	Plant and Machinery	59.25
4	Fixtures and Electrical Installation	4.85
5	<i>Other Assets/ Preliminary and Preoperative Expenses</i>	2.50
6	Margin for working Capital	9.13
	TOTAL PROJECT COST	150.73

11. MEANS OF FINANCE:

The project will require promoter to invest about Rs 44.53 lakhs and seek bank loans of Rs 106.20 lakhs based on 70% loan on fixed assets.

Sr No	Particulars	In Lakhs
1	Promoters Contribution	44.53
2	Loan Finance	106.20
	TOTAL:	150.73

12. WORKING CAPITAL REQUIREMENTS:

Working capital requirements are calculated as below:

Sr No	Particulars	Gross Amount	Margin %	Margin Amount	Bank Finance
1	Inventories	3.08	40	1.23	1.85
2	Receivables	7.56	50	3.78	3.78
3	Overheads	2.89	100	2.89	0.00
4	Creditors	3.08	40	1.23	1.85
	TOTAL	16.61		9.13	7.48

13. LIST OF MACHINERY REQUIRED:

Sr No	Particulars	UOM	Quantity	Rate	Total Value
	Main Machines/ Equipment				
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	1	650000	650000
5	Honing Machine	Nos	1	250000	250000
6	Heavy Duty Milling Machine	Nos	1	350000	350000

Sr No	Particulars	UOM	Quantity	Rate	Total Value
7	Burnishing machine	Nos	1	250000	250000
8	Cylindrical Grinder	Nos	1	700000	700000
9	Burnishing/ Lapping Machine	Nos	1	350000	350000
10	Radial & Pillar Drilling Machine	Nos	1	300000	300000
11	5 axis Measuring m/c CNC	LS	1	650000	650000
12	Clean Room Air handling plant	LS	1	350000	350000
13	Air compressor Plant	Nos	1	250000	250000
14	MIG Welding Machine	Nos	1	150000	150000
	<u>Subtotal:</u>				5475000
	Tools and Ancillaries				
1	Die tools and gauges	LS	1	300000	300000
2	Misc. tools etc.	LS	1	150000	150000
	<u>Subtotal:</u>				450000
	Fixtures and Elect Installation				
	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>				485000
	Other Assets/ Preliminary and Preoperative Expenses	LS	1	250000	250000
	TOTAL PLANT MACHINERY COST				6660000

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	90.75	121.00	151.25	166.37	181.50
3	Raw Materials & Other Direct Inputs	Rs Lakhs	36.94	49.26	61.57	67.73	73.89
4	Gross Margin	Rs Lakhs	53.80	71.74	89.67	98.64	107.61
5	Overheads Except Interest	Rs Lakhs	19.76	19.76	19.76	19.76	19.76
6	Interest	Rs Lakhs	14.87	14.87	14.87	14.87	14.87
7	Depreciation	Rs Lakhs	13.99	13.99	13.99	13.99	13.99
8	Net Profit Before Tax	Rs Lakhs	5.18	23.12	41.05	50.02	58.98

The basis of profitability calculation:

Unit will have capacity of 10,000 nos per year of hydraulic cylinders, connectors etc. Depending on the type/ size of cylinders, and other components the price range is taken from Rs. 900 per pc to Rs 8000 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. They cost in range of Rs 60 per Kg to Rs 200 per kg. The cost of Seamless tubes ranges from Rs 60 per kg to Rs 600 per kg. Seals and gaskets cost ranges from Rs 30 to Rs 1200 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 27.11 % of the installed capacity as depicted here below:

Sr No	Particulars	UOM	Value
1	Sales at Full Capacity	Rs Lakhs	302.50
2	Variable Costs	Rs Lakhs	123.15
3	Fixed Cost incl. Interest	Rs Lakhs	48.62
4	Break Even Capacity	% of Inst Capacity	27.11

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) 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.