

# **PRESSURE DIE CASTINGS**



## **1. INTRODUCTION:**

Pressure die castings have gained popularity, due to several advantages like high productivity, better surface finish and appearance, less machining, close dimensional tolerance, very thin sections can be cast without any casting defects, very low metal wastage etc.

Aluminum zinc magnesium etc. alloys can be easily die cast and it plays a major role because of its intrinsic and versatile properties of lightness, strength to weight ratio, corrosion resistance, electrical and thermal conductivity, non-toxicity etc.

The molten metal is poured into a "cold chamber" through a port or pouring slot by a hand or automatic ladle. A hydraulically operated plunger, advancing forward, seals the port forcing metal into the locked die at high pressures.

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

Automobile components like car and bigger engine pistons, gear box housings, crank cases, clutch shoes, engine housing, hydraulic and pneumatic pump and valve bodies, in automobiles etc. are made by high pressure die casting. Most of the aerospace components are made from high strength aluminum titanium alloys with high pressure die casting process.

Also the kitchen and electrical home appliances, textile machine components, food industry, dairy and brewery machines and equipment, pharma machinery components etc. are mostly made from Aluminum alloy pressure castings.

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

The promoter with metallurgical engineering and experience in nonferrous/ Aluminum casting industry shall have better edge in managing the project well.

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

The automobile industry is highly dependent on the die-casting industry, as the auto industry is forced to seek higher fuel efficiencies and lower emissions by lowering weight of the vehicles. Aluminum and specifically aluminum pressure die-castings are now being used for power train and engine areas in new advanced vehicles. This is one of the major reasons for the predicted growth of the industry.

The global die casting market is forecasting indicates it will grow from USD 55.47 billion in 2015 to USD 80 billion by 2022. The market is poised to grow at a CAGR of over 6.60%. The end market for die-casting is quite huge dominated by auto and aerospace and other industrial requirements. The market for die-castings in industrial applications is expected to grow at a faster CAGR of 7.83% during the forecast period. Additionally, the die-casting market in the electrical and electronic applications is expected to witness a steady growth. This segment accounted for 11% of the global die-casting market share as of 2016. Pressure die-casting is the most preferred production process. The market for magnesium die-casting is expected to grow at a higher CAGR of 10.0% over the coming 5 years, while that of zinc is expected to grow at a slower pace.

As of today, India boasts of over 400 die casting companies, making it one of the major suppliers of die cast parts in the global market. Of these, over 25 units produce around 12,000 tons of die cast parts per year. While production of aluminum has touched 1.3 million tons of aluminum production, the Indian industry hardly consumes over 0.28 million tons of die-

castings. This indicates huge growth potential in coming years.

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

Asia-Pacific is the largest market for die-casting and globally accounted for over 70% share. The huge market in this region was mainly due to large-scale domestic production, government initiative and availability of resources. India is considered as an emerging hub for the pressure die cast automobile components, of aluminum, magnesium and zinc die cast parts.

The auto-component industry of India has expanded by 14.3 per cent because of strong growth in the spares or after-market sales to reach at a level of Rs 2.92 lakh crore (US\$ 44.90 billion) in the year 2017. The domestic demand is huge and steadily growing for auto components and it is likely to play very important role in expansion of pressure die casting industry not only for meeting the domestic demand but also for exports globally. Rockman Industries, Endurance Group, Super Auto India, Devilog Group, Spira Engineers are some of the local players who have successfully entered the global market with their product portfolio. There are global players like Cummins, Ford, General motors; John Deere, Mercedes Benz, Bosch, Toyota and Volkswagen sourcing the aluminum die casting parts from India.

The automobiles component and fittings, telephone industry, electrical appliances, electronic components and builder hardware & fittings etc. are the major markets that will also offer scope for export of Pressure Die Castings products. The requirement of defense, aeronautic and space is also likely to open up demand for domestic pressure die casting industry. Besides sectors like builder hardware, domestic appliances, electronic components, telephone industry etc. is growing demanding die cast parts. Make in India paving way for the global industry coming to our country.

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

The aluminum alloy groups are suitable for high pressure die casting: aluminum-silicon –alloys, aluminum-silicon-magnesium –alloys, aluminum-silicon-copper –alloys, and aluminum-

magnesium –alloys. The high pressure die cast able magnesium alloy groups are: – Magnesium-aluminum-manganese –alloys – Magnesium-aluminum-silicon –alloys – Magnesium-aluminum-zinc –alloys.

LM2, LM5, LM 6, LM 16, LM 24, LM 25, LM 31 etc. grade alloys are required for die casting. These alloys are standardized in the as cast condition, but it has been shown that the tensile properties may be substantially increased by appropriate heat treatment.

## **7. MANUFACTURING PROCESS:**

Pressure die casting also called cold chamber die casting is better suited for metals with high melting points such as aluminum. Metal is liquefied in a furnace alloyed and then ladled into a cold chamber where a hydraulically operated plunger pushes the metal into the die.

Actuation of the injection piston forces the metal into the die—this is a single shot operation. This procedure minimizes the contact time between the hot metal and the injector components, which helps to extend their operating life. Injection pressures range from 3,000 to over 10,000 psi for both aluminum and magnesium alloys, and from 6,000 to over 15,000 psi for copper-based alloys.

Depending on machine capacity, the process may use Dies with single cavity, multiple cavity, and combination and “unit” die. Multiple cavity die has several cavities which are all identical. Die that has cavities of different shapes, it’s called a combination die. A combination die is used to produce several parts of single product for an assembly. Several parts for an assembly, or for different customers, might be cast at the same time with unit dies. One or more unit dies are assembled in a common holder and connected by runners to a common opening or sprue hole. This permits simultaneous filling of all cavities.

## **8. MANPOWER REQUIREMENT:**

The unit shall require highly skilled service persons. The unit can start from 11 employees initially and increase to 30 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     | 18000          | 3               | 4      | 4      | 6      | 6      |
| 2       | Semi-Skilled/ Helpers | 8000           | 6               | 12     | 12     | 18     | 18     |
| 3       | Supervisor/ Manager   | 30000          | 1               | 1      | 1      | 1      | 1      |
| 4       | Accounts/ Marketing   | 18000          | 0               | 0      | 1      | 2      | 2      |
| 5       | Other Staff           | 8000           | 1               | 1      | 1      | 1      | 1      |
|         | TOTAL                 |                | 11              | 18     | 19     | 28     | 28     |

## 9. IMPLEMENTATION SCHEDULE:

The unit can be implemented within 8 months from the serious initiation of project work.

| Sr. No. | Activities                                             | Time Required in Months |
|---------|--------------------------------------------------------|-------------------------|
| 1       | Acquisition of Premises                                | 1                       |
| 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                      | 2                       |
|         | Total Time Required (Some Activities run concurrently) | 8                       |

## 10. COST OF PROJECT:

The unit will require total project cost of Rs. 183.08 lakhs as shown below:

| Sr. No. | Particulars                                         | In Lakhs |
|---------|-----------------------------------------------------|----------|
| 1       | Land                                                | 25.00    |
| 2       | Building                                            | 40.00    |
| 3       | Plant and Machinery                                 | 66.45    |
| 4       | Fixtures and Electrical Installation                | 3.90     |
| 5       | Other Assets/ Preliminary and Preoperative Expenses | 1.80     |
| 6       | Margin for working Capital                          | 45.93    |
|         | TOTAL PROJECT COST                                  | 183.08   |

## 11. MEANS OF FINANCE:

The project will require promoter to invest about Rs 80.22 lakhs and seek bank loans of Rs 102.86 lakhs based on 70% loan on fixed assets.

| Sr. No. | Particulars            | In Lakhs |
|---------|------------------------|----------|
| 1       | Promoters Contribution | 80.22    |
| 2       | Loan Finance           | 102.86   |
|         | TOTAL :                | 183.08   |

## 12. WORKING CAPITAL REQUIREMENTS:

Working capital requirements are calculated as below:

| Sr. No. | Particulars | Gross Amount | Margin % | Margin Amount | Bank Finance |
|---------|-------------|--------------|----------|---------------|--------------|
| 1       | Inventories | 31.22        | 40       | 12.49         | 18.73        |
| 2       | Receivables | 36.53        | 50       | 18.27         | 18.27        |
| 3       | Overheads   | 2.69         | 100      | 2.69          | 0.00         |
| 4       | Creditors   | 31.22        | 40       | 12.49         | 18.73        |
|         | TOTAL       | 101.65       |          | 45.93         | 55.72        |

## 13. LIST OF MACHINERY REQUIRED:

| Sr. No. | Particulars                                            | UOM | Quantity | Rate    | Total Value |
|---------|--------------------------------------------------------|-----|----------|---------|-------------|
|         | Main Machines/ Equipment                               |     |          |         |             |
| 1       | 350 kg Melting Holding Furnace for Alloys              | Nos | 1        | 650000  | 650000      |
| 2       | 350 T High Pressure Die casting machine @ 3.1 kg/ shot | Nos | 1        | 3500000 | 3500000     |
|         | Automatic Ladling manipulator                          |     | 1        | 300000  | 300000      |
| 3       | Cooling Conveyor / Manipulator                         | Nos | 1        | 235000  | 235000      |
| 4       | Trimming Press 8T and 12T capacity                     | Nos | 2        | 40000   | 80000       |
| 5       | Reciprocating Mold spray unit                          | Nos | 1        | 140000  | 140000      |
| 6       | Surface treatment machine, Tumbling unit               | Nos | 3        | 90000   | 270000      |

| Sr. No. | Particulars                                         | UOM | Quantity | Rate   | Total Value |
|---------|-----------------------------------------------------|-----|----------|--------|-------------|
| 7       | Polishing Belt grinder                              | Nos | 5        | 15000  | 75000       |
| 8       | Heat Treatment furnace                              | Nos | 2        | 180000 | 360000      |
| 9       | Lathe machine                                       | Nos | 5        | 70000  | 350000      |
| 10      | Drilling machine                                    | Nos | 2        | 40000  | 80000       |
| 11      | Milling machine                                     | Nos | 1        | 140000 | 140000      |
| 12      | Air Compressor unit                                 | Nos | 1        | 80000  | 80000       |
|         | subtotal :                                          |     |          |        | 6260000     |
|         | Tools and Ancillaries                               |     |          |        |             |
| 1       | Die Repair tools and Grinders                       | LS  | 1        | 200000 | 200000      |
| 2       | Misc. tools Trolleys etc.                           | LS  | 1        | 140000 | 140000      |
| 3       | Hoist for Mold load/ unload                         | LS  | 1        | 20000  | 20000       |
| 4       | Air Handling unit                                   | LS  | 1        | 25000  | 25000       |
|         | subtotal :                                          |     |          |        | 385000      |
|         | Fixtures and Elect Installation                     |     |          |        |             |
|         | Storage racks                                       | LS  | 1        | 25000  | 25000       |
|         | Other Furniture                                     | LS  | 1        | 25000  | 25000       |
|         | Telephones/Computer                                 | LS  | 1        | 40000  | 40000       |
|         | Electrical Installation                             | LS  | 1        | 300000 | 300000      |
|         | subtotal :                                          |     |          |        | 390000      |
|         | Other Assets/ Preliminary and Preoperative Expenses | LS  | 1        | 180000 | 180000      |
|         | TOTAL PLANT MACHINERY COST                          |     |          |        | 7215000     |

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

Other well-known machine are ACME TOOLINGS, Ace Manufacturing Systems Ltd., Batliboi Ltd. Mumbai, Bharat Fritz Werner Ltd., HMT Machine Tools Ltd., Advani Oerlikon Ltd, Bombay, Lakshmi Machine Works Ltd., Lokesh Machines Ltd., Praga Tools Ltd., Toolcraft Systems Pvt. Ltd.

#### 14. PROFITABILITY CALCULATIONS:

| Sr. No. | Particulars                         | UOM      | Year Wise estimates |        |        |        |         |
|---------|-------------------------------------|----------|---------------------|--------|--------|--------|---------|
|         |                                     |          | Year 1              | Year 2 | Year 3 | Year 4 | Year 5  |
| 1       | Sales                               | Rs Lakhs | 438.38              | 563.63 | 751.50 | 876.75 | 1002.00 |
| 2       | Raw Materials & Other Direct Inputs | Rs Lakhs | 374.58              | 481.61 | 642.14 | 749.16 | 856.19  |



|   |                           |          |       |       |        |        |        |
|---|---------------------------|----------|-------|-------|--------|--------|--------|
| 3 | Gross Margin              | Rs Lakhs | 63.79 | 82.02 | 109.36 | 127.59 | 145.81 |
| 4 | Overheads Except Interest | Rs Lakhs | 17.89 | 17.89 | 17.89  | 17.89  | 17.89  |
| 5 | Interest                  | Rs Lakhs | 14.40 | 14.40 | 14.40  | 14.40  | 14.40  |
| 6 | Depreciation              | Rs Lakhs | 13.46 | 13.46 | 13.46  | 13.46  | 13.46  |
| 7 | Net Profit Before Tax     | Rs Lakhs | 18.05 | 36.27 | 63.61  | 81.84  | 100.07 |

The basis of profitability calculation:

The Unit will have capacity of 500 MT of gravity castings per year of assorted types/ designs. The sales prices of die cast parts range from Rs 150 to Rs 400 per kg or more depending on type, metal, alloy composition, and volumes. The raw material cost of is ranging from 120 to 350 per kg depending on alloy grades. The material requirements are considered with wastage/ scrap/burnouts etc. of 8 % of finished products as most of generated scrap is reused. The unusable scrap is sold at @ Rs 15 ~ 30 per Kg. and the income of same is added. Energy Costs are considered at Rs 7 per Kwh and fuel cost is considered at Rs. 65 per liter. 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 breakeven capacity at 25.10 % of the installed capacity as depicted here below:

| Sr. No | Particulars               | UOM                | Value   |
|--------|---------------------------|--------------------|---------|
| 1      | Sales at Full Capacity    | Rs Lakhs           | 1252.50 |
| 2      | Variable Costs            | Rs Lakhs           | 1070.23 |
| 3      | Fixed Cost incl. Interest | Rs Lakhs           | 45.74   |
| 4      | Break Even Capacity       | % of Inst Capacity | 25.10   |

## **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, safeties etc. are 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 other consumer and industrial parts/ components and parts. The unit can utilize the spare capacities of furnace and machining capabilities. 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 key product parameters in terms of dimensions, tolerances and geometric profiles along with final weights of products. The material selection, processes including heat treatment and achievement of final properties are key to quality and success of project.

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

There are no specific training centers for production technology. However foundry technology can be obtained by joining as apprentice in foundry units. The Prototype Development Centers can provide some assistance and for foundry technology, casting, machining, dies and Tools development, courses run by 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 all over India.

**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.