

Aluminium Pressure Die Casting (Upto 0.75 kg)

PRODUCT CODE	: 335404006
QUALITY AND STANDARDS	: This Profile envisages the manufacture of pressure die cast components of Aluminium for engineering use required for automotives, defence and aeronautic space applications. The quality of the component is supposed to be good near net shape with high production, resulting into, low cost and conforming to standard specifications as laid down by Bureau of Indian Standard IS 11804:1986 code of Practice for Manufacture of Aluminium Alloy Pressure Die Castings.
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INTRODUCTION

Though tremendous technological advancements in the metal casting industry have taken place in recent years, the foundry industry faces increasing demands to achieve higher productivity at minimum cost, even while producing high quality cast components of intricate shapes. By proper selection of a casting technique with careful foundry and metallurgical controls, castings of high quality are being commercially manufactured. Amongst a large number of foundry techniques one is low and high pressure die-casting. It has been developed and industrially employed to produce castings of near-net shape components. The near net shape cast parts are famous

for their fine details, good surface conditions, complex shapes and economy. Under the present scenario of industrial development, metal casting has moved from an art and craft industry to the industry based on science and technology. The pressure die casting manufacturing processes have been systematically developed so that structure may be controlled and quality may be assured. Die casting provides the foundry man with one of the fastest means of producing castings with a much higher degree of accuracy than that normally obtained by conventional sand casting. In fact, this method is unexcelled for mass production work as numerous castings can be produced very rapidly at low cost. The castings can be made to very close tolerances and with a fine surface finish.

Pressure die casting in aluminium alloy offers means for very rapid production of engineering and other related components even or intricate design. The technique has obvious advantages when a component is required in large quantities. However, for engineering components such as those required for aeronautic space, defence and automotive applications, mechanical properties and durability are of primary importance. It is therefore essential that the best features of design should be employed and optimum casting technique with minimum cost be adopted. Pressure die cast products are used in the form of components of various electrical, electronic, mechanical instruments and appliances used in domestic as well as industrial fields.

MARKET POTENTIAL

The popularity of pressure die cast aluminium alloy components arises from the following advantages it offers as compared to other methods of castings:

- High Productivity
- Good as cast surface finish and appearance.
- Compact casting-sound strength.
- Do not require further machining.
- Can be cast within close dimensional tolerance.
- Very thin section, can be cast with ease.
- Metal wastage in the casting is low.
- Rejection due to casting defects is low.

Demand mainly arises from the sources like Defence, Telephone industry, Automobile components and fittings, Electrical appliances, Electronic

components, Builders hardwares and fittings etc. Demand in these areas again depends upon the primary market, replacement market and substitution market.

- The Primary Market is expected to continue as the leading market and, with the trend of demand growth, to cater to the requirement of more and more new industries coming up in the above areas of consumption. The replacement market is also likely to expand with more marketability of new products.
- There are very few units in the small scale sector producing pressure die cast components. Hence there is good scope for setting up this industry.

BASIS AND PRESUMPTIONS

1. The Scheme has been prepared on the basis of 75% efficiency on single shift basis of 8 hours' duration considering 25 working days in a month and a total of 300 working days in a year.
2. The rate of interest in the scheme has been worked out on the basis of 15% upon an average. However, this figure is likely to vary depending upon the financial outlay of the project as well as location of the unit.
3. The break-even point in the scheme has been calculated on the 80% capacity utilization basis.
4. The cost of machinery and equipment as indicated are approximate which are ruling locally at the time of preparation of the scheme. When a tailor cut

project is prepared, necessary changes are to be made.

5. The rates quoted in respect of salaries and wages for workers and others are the minimum rates in the state/neighbouring states.
6. Margin money required is minimum 30% of Projected investment i.e Rs. 16.75 lakhs. However, it may differ from Project to Project and type of entrepreneurs such as Women, SC/ST, Physically Handicapped etc.
7. Pay back period of the Project: After the initial gestation period of one and half years it will require approximately 5 years to pay back the loans.
8. Profile life is estimated to be 10 years. The project should be reviewed every 3 to 4 years for modernisation of the plant and machinery, technology etc. so that its life is prolonged.

IMPLEMENTATION SCHEDULE

Sl. No.	Activity	Approx. Time	Cumulative Time
(i)	Preparation of Project Report	6 weeks	6 weeks
(ii)	Provisional Registration as SSI	2 weeks	8 weeks
(iii)	Financial Arrangement	12 weeks	20 weeks
(iv)	1. Construction/ Renovation of factory Shed/ Building	20 weeks	40 weeks
	2. Purchase and Procurement of Machinery and Equipments		
(v)	1. Installation of Machinery and Equipments	4 months	14 months
	2. Electrification		

3. Staff Recruitment

(vi)	N.O.C from Pollution Control Board	2 weeks	14 months and 2 weeks
(vii)	Arrangement of Utilities	6 weeks	1 year and 4 months
(viii)	Procurement of Raw Materials	1 month	1 year and 5 months
(ix)	Commissioning, Trial Runs and Commercial Production	1 month	1½ years

TECHNICAL ASPECTS

Process of Manufacture

Because of its high melting point, aluminium silicon alloy is die cast in cold chamber pressure die casting machine. In pressure die casting the molten metal is introduced under pressure into a metallic die and allowed to solidify to produce near-net-shapes. Two types of die casting machines known as cold chamber and hot chamber are usually used. The production rate depends on casting thickness, specified properties of the cast metal and the complexity of the cast shape. This technique produces castings of very good surface finish with high dimensional accuracy. The process provides high yield due to absence of riser and feeding system. Production rate is high and the casting generates more metallurgical integrity. Finer grains and absence of porosity make the casting mechanically compact. Casting size, weight, design and melting point of cast metal limit the use of the process. Cost of die confines the process only to relatively small parts.

The cold chamber machine is used for the alloy which has higher melting point than the zinc-alloy. Higher pressure is applied, so lower molten metal feeding temperature is used. Casting traps lesser

amount of air as compared to the air trapped in hot chamber machine. In pressure die casting, die temperature, molten metal pouring temperature, injection pressure and speed are optimised for a special casting.

Metal for a single shot is loaded into a cylindrical chamber through a pouring aperture. A piston then forces the metal into the die, the entire operation being completed in a few seconds, so that iron contamination is virtually eliminated. Using this technique much higher injection pressure in the range of 70–140 Mpa is feasible, enabling lower metal to be employed and greater intricacy achieved. The castings are less prone to entrapped air and a higher standard of soundness ensures from the smaller amount of liquid and solidification shrinkage occurring within the die.

In cold chamber operations the molten metals is usually maintained at constant temperature in an adjacent holding furnace, where transfer of successive shots to the machine chambers can be accomplished manually. Holding furnaces may be electrically heated types or the one using immersion heating types or the one using immersion heating device, which has a close control over the molten metal.

- The molten metal should be thoroughly degased by chlorine gas or hexachloroethane followed by modification with suitable modifier. For thinner sections the working temperature of the molten metal should be 680° C to 690° C and for thicker sections this should be between 650° C to 680°C.
- The die temperature should be maintained so that castings of good quality are produced.
- The die cast components are subjected to fettling operation for removal of getting system and fins, if any.

Quality Control and Standards

Alloys suitable for pressure die casting and their chemical composition are given below. Alloys 4420 or LM-24M, 4520 or LM-2M, 4600 or LM-20M are widely used alloys for general engineering work and are suitable for Pressure die-casting. These alloys have excellent fluidity good corrosion resistance, medium strength and can be cast in intricate shapes. The die cast component should be free from blowholes and Pinholes porosity, shrinkage, cold shut etc. They should be free from dimensional inaccuracies. No patching or welding shall be allowed to cancel or rectify any defects.

Chemical Compositions -% of

Grade	Cu	Si	Mg	Fe	Mn	Ni	Zn	Pb	Sn	Ti	Al
4420 or LM-24M	3.0–4.0	7.5–9.5	0.3	1.3	0.5	0.5	3.0	0.3	0.2	0.2	Balance Remainder
4520 or LM-2 M	0.7–2.5	9.0– 11.5	0.3	1.0	0.5	0.5	0.5	0.3	0.2	0.2	Balance Remainder
4600 or LM- 20M	0.4	10.0– 13.0	0.2	1.0	–	0.1	0.2	0.1	0.1	0.2	Balance Remainder

Production Capacity

Estimated production capacity-
9.5 MT per month.

The capacity utilisation will be 80%

Quantity (per annum) : 91 MT

Value : Rs. 1,45.6 Lakhs

Motive Power (per month)

Total motive power requirement =
4500 kW

Pollution Control

The industry does not create extensive pollution hazard. The workshop should be well ventilated, properly lighted and fitted with exhaust fans.

Energy Conservation

There is little scope for energy conservation in this industry except in the melting practice where the furnace should be properly insulated to reduce radiation loss and should be fitted with automatic pyrometric control to maintain the furnace at the proper temperature.

FINANCIAL ASPECTS

A. Fixed Capital (per month)

(i) Land and Building	Rent (Rs.)
Land and Built up area including workshop, office, store etc. Total covered area 300 sq. metres @ Rs. 25/-per sq. mtr. on rent with sufficient open space for storing of raw materials and creating greenaries for pollution abatement.	7,500

(ii) Machinery and Equipments

(a) Production Unit

Sl. No.	Description	Qty (No.)	Amount (In Rs.)
1.	Horizontal cold chamber pressure die casting machine with control panel of 60T capacity with 7.5 HP motor	1	13,00,000
2.	Electrical resistance furnace for melting Aluminium 100 kg capacity	1	1,00,000
3.	Centre lathe 900mm Heavy duty with 3 HP motor and accessories	1	40,000
4.	Shaping machine 600mm stroke with 3HP motor and accessories (Cone Pulley drive,all geared)	1	50,000
5.	Pillar Drilling machine complete with 1 HP motor	1	70,000
6.	Bench Grinder double ended with 1HP motor	1	20,000
7.	Pedestal Grinder with 2HP motor	1	30,000
8.	Trimming machine (bell Press) @ Rs. 10,000 each	3	30,000
9.	Vice,tables,fixtures,measuring instruments,gauges etc.	L.S.	75,000
	(a) Testing Equipments Laboratory comprising chemical testing and physical testing	L.S.	1,50,000
	(b) 1) Diesel Generation set 125 KW Cap.with standard accessories	1	1,25,000
	(c) Electrification and Installation @ 10% of above cost		1,99,000
	Total		21,89,000
	(d) Cost of moulds and fixture	L.S	1,50,000
	(e) Office Equipment, Furniture, typewriter, fan etc.	L.S	50,000
	Total		23,89,000

(iii) Pre-operative Expenses

Like legal expenses, establishment cost, travelling, start-up expenses, consultancy fee, estimate fee, interest during construction, trial run expenses etc.	1,00,000
Total	24,89,000

B. Working Capital (per month)

(i) Personnel	No.	Salary (Rs.)
1. Works Manager	1	6,000
2. Sales Executive	1	5,000
3. Supervisor	1	3,000
4. Chemist	1	3,000
5. Store Keeper-cum Accountant	1	2,500
6. Steno-Typist	1	3,000
7. Maintenance Fitter	1	2,500
8. Skilled Worker @ Rs. 2500	3	7,500
9. Semi-skilled Workers @ Rs. 2300	3	6,900
10. Unskilled Workers @Rs. 2150	4	8,600
11. Peon/Watchman @Rs. 2150	2	4,300
Total		52,300
Staff welfare @ Rs.15%		7,845
Total		60,145
Say		60,000

(ii) Raw Material Requirements (per month) (Rs.)

(a) Aluminium alloy ingot 10 MT @ Rs. 90 per kg	9,00,000
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(iii) Utilities and Other Contingent Expenses (per month) (Rs.)

1. Rent		7,500
2. Electric Power(4500 KWH) @ Rs 3.50 Per KWH		15,750
3. Water	LS	600
4. Postage and Stationery		1,000
5. Repair, Maintenance and Replacement		10,000
6. Consumable Stores like Fluxes, Degasser, Lubricants dies etc.		25,000
7. Transport Expenses		2,500
8. Misc. Expenses		5,000
9. Advertisement and Publicity		5,000
Total		72,350
Say		72,000

Total Recurring Expenses (Rs.)

1. Raw Materials	9,00,000
2. Salaries and Wages	60,000

3. Other Expenses	72,000
Total	10,32,000

C. Total Capital Investment

1. Machinery and Equipments and Pre-operative Expenses	Rs. 24,89,000
2. Working capital for 3 months	Rs. 30,96,000
Total	Rs. 55,85,000
Say	Rs. 55,85,000

FINANCIAL ANALYSIS**(1) Cost of Production (per annum) (Rs.)**

1. Raw Materials	1,08,00,000
2. Staff and Labour	7,20,000
3. Other Expenses	8,64,000
4. Depreciation on furnace @ 20%	20,000
5. Depreciation on Machinery and Equipment @ 10%	1,89,000
6. Depreciation on office Equipment @ 20%	10,000
7. Depreciation on moulds Fixture @ 25%	37,500
8. Interest on total Capital Investment @ 15%	8,37,750
Total	1,34,78,250
Say	1,34,79,000

(2) Turnover (per annum) (Rs.)

1. 91 MT Aluminium alloy Pressure Die cast components @ Rs 1,60,000 per MT	1,45,60,000
2. Aluminium alloy scrap 0.30 Tons @ 50,000 per MT	15,000
Total	1,45,75,000

(3) Net Profit (per year)

$$\begin{aligned}
 &= \text{Sales} - \text{Production Cost} \\
 &= 1,45,75,000 - 1,34,79,000 \\
 &= \mathbf{Rs. 10,96,000}
 \end{aligned}$$

(4) Net Profit Ratio(on Sale)

$$\begin{aligned}
 &= \frac{\text{Net Profit} \times 100}{\text{Turnover per year}} \\
 &= \frac{0,96,000 \times 100}{1,45,75,000} \\
 &= \mathbf{7.52\%}
 \end{aligned}$$

(5) Rate of Return

$$= \frac{\text{Net Profit per year} \times 100}{\text{Total Investment}}$$

$$= \frac{10,96,000 \times 100}{55,85,000}$$

$$= 19.62\%$$

(6) Break-even Point

Fixed Cost (per annum)	(Rs.)
(a) 40% of Salary and Wages	2,88,000
(b) 40% of Other Expenses	3,45,600
(c) Dep. on Furnace and Moulds @ 20%	57,500
(d) Dep. on Machinery and Equipments	1,89,000
(e) Interest on Total Capital	8,37,750
(f) Depreciation on Office Equipments	10,000
Total	17,27,850
Say	17,28,000

$$\text{B.E.P.} = \frac{\text{Fixed Cost} \times 100}{\text{Fixed Cost} + \text{Profit}}$$

$$= \frac{17,28,000 \times 100}{17,28,000 + 10,96,000}$$

$$= 61.18\%$$

Addresses of Machinery and Equipment Suppliers

1. M/s. HMT Ltd.
31, Chowringhee Road,
Kolkata—700071
2. M/s. Indo Japanese Proto Type
Training Centre
Baltikuri, Dasnagar,
Howrah, Kolkata.

3. M/s. Hindustan Machine Tools
Jeevan Tara Building,
Parliament Street,
New Delhi-110001
4. M/s. Wesman Engineering Co. (P)
Ltd.
B-99 Mayapuri Indl. Area,
New Delhi
5. M/s. Batliboy and Co. Ltd.
Jeevan Vihar,
Parliament Street,
New Delhi-110001
6. M/s. Perfect Machine Tools,
44E, Connaught Circus,
New Delhi-110001.
7. M/s. Pioneer Equipment Co. (P)
Ltd.
36/8 Nizammudin West,
New Delhi.

Addresses of Raw Material Suppliers

1. M/s. Hindustan Aluminium Co.
United Commercial Bank
Building,
Parliament Street,
New Delhi-110001
2. M/s. Indian Aluminium Co.
Bank Building,
Parliament Street,
New Delhi-110001
3. Local Market.