

# **GREY IRON CASTINGS**

## **1. INTRODUCTION:**

The Grey Iron Casting is a type of cast iron that has a graphitic micro structure. It is named after the gray color of the micro structure with free graphite flakes it forms. Gray iron is a common engineering alloy because of its relatively low cost and good machinability, which results from the graphite lubricating the cut and breaking up the chips. It also has good galling and wear resistance because the graphite flakes self-lubricate. The graphite also gives gray iron an excellent damping capacity because it absorbs the energy and converts it into heat. It is the most common cast iron and the most widely used cast material.

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

Cast iron's properties are changed by adding various alloying elements. Silicon is the most important alloy element because it helps in forming free graphite. A low percentage of silicon allows carbon to remain in solution forming iron carbide and the production of white cast iron. A high percentage of silicon forces carbon out of solution forming graphite and the production of Grey cast iron. Other alloying agents are manganese, chromium, molybdenum, titanium and vanadium etc. that counteracts silicon, promotes the retention of carbon, and the formation of carbides in micro structure, thereby improving tensile strength, impact strength, wear and heat resistance, corrosion resistance etc. Nickel and copper increase strength, and machinability, but do not change the amount of graphite formed.

It has a number of desirable characteristics not possessed by any other metal and yet is among the cheapest of ferrous materials available to the engineer. Gray iron castings are readily available in nearly all industrial areas and can be produced in foundries representing comparatively modest investments.

It is used for machinery body and rotating machine housings where the stiffness of the component is more important than its tensile strength. Alloy gray iron is very popular for internal combustion engine cylinder blocks, pump housings, valve bodies, machine tools, heavy earth movers and stationary machinery. In addition it is suitable for electrical boxes and decorative castings due to its properties/ Grey cast iron's high thermal conductivity and specific heat capacity are often exploited to make cast iron cookware and disc brake rotors.

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

Preferably metallurgical or mechanical engineer.

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

The Foundry industry in India comprises various large, medium and small companies that manufacture gray iron castings from small to very large castings used in machinery building. There are more than 5000 foundries in India. The foundries are distributed in geographical clusters. Some of the major foundry clusters are Belgaum, Batala/ Jalandhar, Coimbatore, Howrah, Kolhapur and Rajkot. Approx. 1500 units are having International Quality Accreditation. Several large foundries are very modern & globally competitive. Many foundries using cupolas are gradually shifting to Induction Melting.

The Indian foundry industry manufacturers are supplying cast components for most of the local demand in Auto, Tractor, Railways, Machine tools, Sanitary, Pipe Fittings, Defence, Aerospace, Earth Moving, Textile, Cement, Electrical, Power machinery, Pumps / Valves, Wind turbine generators etc.

A foundry has already invested in energy-efficient technologies and equipment and is also focusing on the installation of induction furnaces to reduce energy consumption. Besides, the metal compositions and metallurgical property enhancement technology upgrades are under way in foundries to improve value addition and increase production efficiency.

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

The Indian foundry industry produced over 120 lakh MT in recent years, of which the grey iron casting production has been over 80 lakh MT in the country. The foundry industry has exported over US\$ 25 million. The Indian casting production rate increased by 22% while worldwide casting production rate of increase is 13.7%. The market share of Indian foundry industry is approx. 10% of global market.

The main end user industry viz Capital Goods is likely to grow from USD 35 Bn to USD 115 Bn Industry by 2025 and the auto sector is likely to grow 3.5 to 4 times of the current value of USD 74 billion to USD 260 billion to 300 billion. Even if these forecast plans are realized by 75 %, it will augur well for the Indian Foundry Industry.

The foundry market in India and for exports will grow steadily with CAGR of over 10% by 2020 and the demand of Premium quality "Grey Iron Castings" is growing from domestic products and components such as auto sector, Industrial machines, industrial valves, valve actuators, pumps, turbines, etc.

Some of the alloy added Grey iron castings are very widely used in automotive and heavy machines. In view of the wide application in industry, a good unit will have very good scope of developing products for existing and new applications for the consumers of these castings.

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

Main raw materials are pig iron, cast iron scrap and metallurgical coke. Other materials are alloying additives and molding adhesives like molasses graphite and silicon, manganese etc.

## **7. MANUFACTURING PROCESS:**

Grey cast Iron castings are produced by melting pig iron and C.I. scrap in melting furnace. The molten metal is poured in dry sand molds. Castings are taken out of the mold after getting cooled. After breaking the runner and risers castings are fettled properly. Pattern design and

mold preparation is a very critical operation for gray iron casting and may have big impact on profitability of the project.

Sand casting, uses sand, clay and binder mix to prepare mold for casting, various types of processes are available for sand mold preparation depending on the design and shape of casting, intricacy of shape and volume of production of the parts to be produced. Green Sand casting and shell casting technology are two most popular sand casting processes. Green sand molding is the most economical method of producing castings and large castings of up to 500 kg per piece can be made in green sand. For the larger castings, the mold surfaces are sometimes sprayed with a graphite mix and skin is dried to produce a cleaner surface on the casting. This procedure is often used on engine blocks. To withstand the higher electrostatic pressures developed in pouring larger castings; dry sand molds are often used.

The shell molding process is also used for it has ability to get hard mold or core, improving the accuracy and finish of the casting. Centrifugal casting of gray iron in water-cooled metal molds is widely used by the cast iron pipe industry as well as for some other applications. These castings may be machined for semi-finished component supply to customer.

## **8. MANPOWER REQUIREMENT:**

The unit shall require highly skilled service persons. The unit can start from 19 employees initially and increase to 49 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	4	6	8	10	12
2	Semi-Skilled/ Helpers	7000	12	16	20	24	30
3	Supervisor/ Manager	30000	1	1	1	2	2
4	Accounts/ Marketing	16000	1	2	2	3	3
5	Other Staff	7000	1	1	2	2	2
	TOTAL		19	26	33	41	49

## 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	2
4	Arrangement of Finance	2
5	Manpower Recruitment and start up	2
	Total Time Required (Activities run concurrently)	6

## 10. COST OF PROJECT:

The unit will require total project cost of Rs 148.69 lakhs as shown below:

Sr No	Particulars	In Lakhs
1	Land	15.00
2	Building	25.00
3	Plant and Machinery	36.59
4	Fixtures and Electrical Installation	4.80
5	Other Assets/ Preliminary and Preoperative Expenses	2.00
6	Margin for working Capital	65.30
	TOTAL PROJECT COST	148.69

## 11. MEANS OF FINANCE:

The project will require promoter to invest about Rs 86.14 lakhs and seek bank loans of Rs 62.54 lakhs based on 70% loan on fixed assets.

Sr No	Particulars	In Lakhs
1	Promoters Contribution	86.14
2	Loan Finance	62.54
	TOTAL:	148.69

## 12. WORKING CAPITAL REQUIREMENTS:

Working capital requirements are calculated as below:

Sr No	Particulars	Gross Amount	Margin %	Margin Amount	Bank Finance
1	Inventories	46.42	40	18.57	27.85
2	Receivables	50.49	50	25.25	25.25
3	Overheads	2.92	100	2.92	0.00
4	Creditors	46.42	40	18.57	27.85
	TOTAL	146.24		65.30	80.95

## 13. LIST OF MACHINERY REQUIRED:

Sr. No	Particulars	UOM	Quantity	Rate	Total Value
	<b>Main Machines/ Equipment</b>				
1	Induction Furnace 1000 kg, 500 kg	Nos	2	750000	1500000
2	Molding Machines	Nos	6	100000	600000
3	Sand mixer, sieves etc.	Nos	1	80000	80000
4	Core molding Machine	Nos	2	40000	80000
5	Sand reclamation System	Nos	1	130000	130000
6	Core Baking oven	Nos	1	75000	75000
7	Ladle with heating system	Nos	2	30000	60000
8	Jib Crane	Nos	1	130000	130000
9	Shot blasting machine	Nos	1	175000	175000
10	Lathe Machine	Nos	3	75000	225000
11	Drilling Machine	Nos	1	50000	50000
12	Milling Machine	Nos	1	200000	200000
13	Mold Boxes and tools	LS	1	100000	100000
14	Bench/ Flexible shaft grinders	Nos	3	8000	24000
15	Metallurgical Microscope	Nos	1	80000	80000

Sr. No	Particulars	UOM	Quantity	Rate	Total Value
16	Physical testing Lab	LS	1	150000	150000
17	Chemical Test Lab equipments	LS	1	80000	80000
	Subtotal:				3429000
	<b>Tools and Ancillaries</b>				
1	Patterns tools and gauges	LS	1	150000	150000
2	Misc. tools etc.	LS	1	80000	80000
	Subtotal:				230000
	<b>Fixtures and Elect Installation</b>				
	Storage racks and trolleys	LS	1	30000	30000
	Other Furniture	LS	1	40000	40000
	Telephones/Computer	LS	1	150000	150000
	Electrical Installation	LS	1	260000	260000
	Subtotal:				480000
	Other Assets/ Preliminary and Preoperative Expenses	LS	1	200000	200000
	<b>TOTAL PLANT MACHINERY COST</b>				<b>4339000</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 dies 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. Electrotherm India Ltd.,  
Survey No. 72, Village Palodia,  
Taluka Kalol Via Thaltej  
Ahmedabad- 382115,  
Gujarat, India General Electric

Other well-known machine are Acme Toolings, Ace manufacturing systems, Batliboi Ltd., Bharat Fritz Werner, HMT Machine Tools Ltd., Advani Oerlikon Ltd, Lakshmi Machine Works Ltd., Lokesh Machines Ltd., Praga Tools Ltd., Toolcraft Systems Pvt. Ltd. Etc.

### 13. PROFITABILITY CALCULATIONS:

Sr. No	Particulars	UOM	Year Wise estimates				
			Year 1	Year 2	Year 3	Year 4	Year 5
1	Capacity Utilization	%	40	50	60	70	80
2	Sales	Rs Lakhs	605.94	757.42	908.90	1060.39	1211.87
3	Raw Materials & Other Direct Inputs	Rs Lakhs	557.01	696.26	835.51	974.77	1114.02
4	Gross Margin	Rs Lakhs	48.93	61.16	73.39	85.62	97.85



5	Overheads Except Interest	Rs Lakhs	26.23	26.23	26.23	26.23	26.23
6	Interest	Rs Lakhs	8.76	8.76	8.76	8.76	8.76
7	Depreciation	Rs Lakhs	6.84	6.84	6.84	6.84	6.84
8	Net Profit Before Tax	Rs Lakhs	7.11	19.34	31.57	43.80	56.03

The Unit will have capacity of 3500 MT per year of Grey iron Cast products/ components of different grades/ types. The bulk sale/ distribution sales prices of castings ranges from Rs 30 per Kg for simple products to Rs 300 per kg for intricate and critical metal alloy and metallurgical properties requiring heat treatment etc. for high end products, as well as depending on type, size/ rating and volumes.

The raw material cost ranges from Rs 20 to 40 per kg for graded cast iron scrap and foundry grade pig iron. The metal alloy and melt additive cost ranges from Rs 60 to 260 per Kg. The material requirements are considered with wastage/ scrap etc. of 8 ~ 12 % of finished products. The unusable scrap is sold at @ Rs 18 ~ 20 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.

#### **14. BREAK EVEN ANALYSIS**

The project is can reach break-even capacity at 42.02 % of the installed capacity as depicted here below:

Sr. No	Particulars	UOM	Value
1	Sales at Full Capacity	Rs Lakhs	1514.84
2	Variable Costs	Rs Lakhs	1392.52
3	Fixed Cost incl. Interest	Rs Lakhs	41.82
4	Break Even Capacity	% of Inst Capacity	34.19

#### **15. STATUTORY/ GOVERNMENT APPROVALS**

The unit shall have to get state industrial unit registration from DIC, IEC Code for Export and local authority clearance. Depending on structure of finance the company shall need to register company with registrar of companies. The registration and approval for factory plan, safety for Fire etc. requirement, registration as per Labour laws ESI, PF etc. shall be required as per rules and applicability. 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 requirements, except installation of chimney/ blowers for heat treatment furnace / pickling line and ensure safe environment as per rules of factory safety. Solid waste disposal shall have to meet the required norms. Entrepreneur may contact State Pollution Control Board where ever it is applicable.

## **16. BACKWARD AND FORWARD INTEGRATION**

The machines and equipment offer scope for diversification in to producing variety of cast products for import substitution. The unit can also offer other consumer and industrial products / components etc. by using the spare capacities and machine capabilities. As such there is not much scope for organic backward or forward integration.

## **17. TRAINING CENTERS/COURSES**

There are no specific training centers for wire drawing technology. There are training for dies and tools development run by several centers of excellence viz Indo German Tool Room at Ahmedabad, Rajkot, Chennai, and CTTC Bhubaneswaretc. shall be helpful.

The most important scope of learning is in new product design and development by associating with institutes like NID etc. Entrepreneur may also study the new product designs, product range, features and specifications of leading Brands / competitors across the world by scanning the Internet and downloading data. 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.