Malleable Iron Casting

PRODUCT CODE	:	33111200
QUALITY AND STANDARDS	:	As per ISI Specifications
MONTH AND YEAR OF PREPARATION	:	January, 2003
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Introduction

The term Malleable Iron includes ferritic (or standard) malleable iron and pearlitic malleable iron. In commercial practice, the unqualified term *"malleable iron"* refers to the ferritic material. There are two types of ferritic malleable iron, namely, black heart and white heart. The black heart material has a matrix of ferrite with interspersed nodules of tempered carbon. The white heart type has a different form of tempered carbon and usually contains some combined carbon, because of its composition and method of manufacture. *"Cupola Malleable Iron"* is a ferritic grade produced by cupola melting for pipe fitting and similar thin section castings. Because of lower strength and ductility, cupola malleable usually is not specified for engineering castings. Pearlitic malleable iron is designed to have combined carbon in the matrix resulting in higher strength and hardness than is available in ferritic malleable iron.

Malleable cast iron is better suited for use in bridges, railways lamp-post bracket, motor trucks and lorry parts. Pipe-fittings like elbow tee, reducing socket, bush, plug, caps, cross, check nut, short bend, 3-way elbow, 4-way tee etc. are used at places where strength and malleability both are required. Unfortunately malleable casting is at a stage of infancy in our country. For example not even a single such unit exists in eastern UP. It has been observed that a large number of parts can be made of malleable iron, if readily available.

Market Potential

Malleable cast iron has been accepted by industries as reliable engineering material. Even though the use of malleable cast iron is limited to only a few industries like pipe fittings and auto parts in our country, it can be extended to even bicycle parts, sewing machines and other allied items in future. These industries are localized in Punjab, Haryana and around Delhi. The Eastern UP has around 50–60 running cupola furnaces. There are about 20–25 cupola furnaces around Varanasi alone. Hence,

at least 40% of these industries can be motivated to include malleabilising treatment too. Due to liberalized government policies malleable casting units has to grow rapidly. Keeping in view the future trend the demand for malleable cast iron is expected to rise in years to come.

BASIS AND PRESUMPTIONS

This project is made on the basis of the following presumptions:

1. It is assumed that the unit will be viable at 75% efficiency on single shift basis considering 6 working days per week.
2. The rate of interest in the scheme is taken at 14% for both fixed and working capital. Due to liberalization and competition among banks, lower rate of interest is possible in future.
3. The prices of machinery and equipments are approximate which are ruling locally at the time of preparation of the project. When a tailor-cut project is prepared the necessary changes are to be made at the local level.
4. The rates quoted in respect of salary and wages are minimum and may vary as per demand.
5. There is a 5% burning loss in the project.
6. BEP in the scheme has been calculated on the basis of full capacity utilization.
7. As per current UPFC policy, 40% of the project cost has to be provided by entrepreneur.

IMPLEMENTATION SCHEDULE

Project implementation will take a period of the months from the date of approval of scheme. Following is the schedule to commence commercial production:

Activity	*Period (in Month)*
1. Scheme preparation and approval	0–2
2. SSI registration	2–3
3. Sanction of loan	3–5
4. Clearance from Pollution Control Board and other relevant agencies	3–4
5. Placement of order for delivery of the machinery and equipment	4–6
6. Installation and procurement of machinery and equipments.	6–7
7. Power connection, Telephone connection and other formalities	7–8
8. The trial runs	8–9
9. Commencement of production from 9th month onwards	

TECHNICAL ASPECTS

Process of Manufacture

The project is envisaged to produce pearlitic malleable cast iron manufactured in oil fired rotary furnace. Cupola malleable, generally referred to as ferritic malleable iron, is not specified for engineering casting due to its lower strength and ductility. There are two stages of manufacturing malleable cast irons:

a) Manufacture of white cast iron,

b) Its subsequent heat treatment either in coke fired/oil fired or electrically heated furnace for malleabilising.

In pearlitic cast iron carbon is in combined form. The purpose of malleabilising treatment is to convert this into nodular form. It takes about 5–7 days of stage heating in order to achieve required microstructure. After heat treatment, the product is sent to machine shop for proper finishing, machining and threading etc. The product is despatched after galvanizing and painting as desired by buyers.

Quality Control and Standards

A fully annealed malleable casting contains 2.0 to 2.5 per cent graphite carbon which is equivalent to about 6 to 7.5% by volume. Because of graphite, the carbon contributes nothing to the strength of the casting, those with lesser amount of graphite are somewhat stronger and more ductile than those containing greater amount. The typical composition ranges for ferritic and pearlitic malleable irons analyzed in the white iron conditions are as follows:

Elements	Ferritic Malleable Iron Grade 3210%	Pearlitic Iron 35018%	Malleable % Iron
Total Carbon	2.30-2.65	2-2.45	2-2.65
Silicon	0.90-1.6	50.95-1.35	0.90-1.65
Manganese	0.25-0.5	50.25-0.55	0.25-1.25
Sulphur	0.05-0.18	0.05-0.18	0.05-0.18
Phosphorus	0.18 Max.	0.18 Max.	0.18 Max.

The Bureau of Indian Standards has also brought out specifications for malleable iron as follows:

Malleable Pipefitting	BIS 1879:1975
White and Black	BIS 2107:1977
Malleable Iron Castings	BIS 2100:1977

Production Capacity

Estimated production per year : 500 MT
Value : Rs. 1,10,00,000.

Motive Power

Total requirement is about 30 H.P.

Pollution Control

Foundry industry has a share in the present environmental degradation and therefore No Objection Certificate (NOC) is required from State Pollution Control Board.

There are mainly two methods for pollution control in foundry industries:

i) By exploiting the meteorological and topographical conditions.

ii) By using various equipment for cleaning and dispersion of foundry emission.

Use of sophisticated pollution means are not feasible for small scale units, hence the exploitation of natural draughts and climatic conditions are the best and cheapest methods for desertion of chimney emission.

Energy Conservation

Use of optimum energy is the need of the hour for any enterprise. Hence conservation efforts are needed to decrease cost of the production and pollution too. Energy Audit should be integral part of activity of the management.

The factors which affect fuel economy in industrial furnaces may be stated as follows:

i) Complete combustion with minimum excess air.

ii) Proper heat distribution.

iii) Operation at the desired temperature.

iv) Reducing heat loss from openings.

v) Minimizing wall thickness.

vi) Waste heat recovery from fuel gas.

For electricity conservation machine tools should be individually motorized so that energy may be saved when machines are not in use. Use of lubrication and proper maintenance of machine will further save energy.

FINANCIAL ASPECTS

A. Fixed Capital

(i) Land and Building	
Rented	Rs. 21,000 (per month)
Covered area	4000 ft²@ Rs. 3.0 per ft² = 12,000
Uncovered area	6000 ft² @ Rs. 1.5 per ft² = 9,000
	Total Rs. 21,000

(ii) Machinery and Equipments

Description of Machine	**Quantity**	**Amount (In Rs.)**
(a) Production Unit		
i) Casting and Annealing Shop		
1. Rotary furnace of 1 MT capacity with 5HP motor	2	2,00,000
2. Core sand mixer, 100 kg capacity with 2 HP motor	1	35,000
3. Gyrator Sieve shaker of 24" width with 2 HP motors	1	40,000
4. Muller of 100 kg cap. with 2 HP motor	1	32,000
5. Moulding machine equipped with 3 HP motor.	4	1,50,000
6. Coal fired core backing oven of size 2m × 2m × 3.5m	1	25,000
7. Oil fired annealing furnace of size 2m × 4m × 3.5 with 5 HP and fan arrangement.	1	1,75,000
ii) Machine Shop		
8. 6" Lathe machine with 3 HP motor	1	40,000
9. 24" stroke shaper machine with 3 HP motor	1	55,000
10. 1" capacity drill machine with 1 HP motors	1	15,000
11. 8" capacity wheel double ended grinder with 2 HP motor	2	12,000
12. Flexible shaft grinder with 1 HP motors	1	7,000
	Total (i + ii)	**7,86,000**
(b) Testing Equipments		
13. Rockwell hardness testing machine	1	20,000
14. Weighing Scale	1	12,000
15. Thermocouple	LS	5,000
16. Chemical Testing Equipments	LS	50,000
	Total	**87,000**
c) Diesel generating set of 10 KVA		60,000
Total cost of plant and machinery		**9,33,000**
d) *Cost of electrification and installation @ 10% of plant and machinery*		93,300
e) Cost of dies, tool, pattern and fixture etc.	*LS*	50,000
f) Cost of moulding boxes, ladles and annealing pots etc.	*LS*	75,000
g) Office equipment, furniture etc.	*LS*	80,000
	Grand Total	**12,31,300**
iii) Pre-operative expenses like legal establishment Travelling, startup consultancy, telephone, electricity connection tariff etc.	*LS*	1,00,000
	Total	**13,31,300**

B. Working Capital (per month)

(i) Personnel

Designation	**No.**	**Salary (In Rs.)**	**Amount (In Rs.)**
a) Administration			
Manager Metallurgy	1	3,500	3,500
Sales Executive	1	3,000	3,000
Supervisor	2	2,500	5,000
Accountant–cum–Clerk	1	2,000	2,000

	Peon/Watchman	2	1,500	3,000
b)	*Workshop*			
	Core Maker	4	2,500	10,000
	Furnace Operator	2	2,200	4,400
	Moulder	6	2,000	12,000
	Machine Operator	4	1,800	7,200
	Fitter	1	1,800	1,800
	Helper	4	1,500	6,000
		Total		**57,900,**
Add: Perquisites @ 15% of above				8,685
		Total		**66,585**
		Say		**66,600**

(ii) Raw Materials (per month)	**(Rs.)**
Pig iron 30 MT @ 10,800/ MT	3,24,000
Steel scrap 20 MT @ Rs. 9,200/MT	1,84,000
Ferro Alloys, Fluxes, Limestone etc. LS	25,000
Total	**5,33,000**

(iii) Utilities	**(Rs.)**
a. Hard coke 4 MT @ Rs. 4,800/MT	19,200
b. Steam coal 8 MT @ Rs. 2,800/MT	22,400
c. Furnace oil -2000 Lts @ Rs. 20/Ltr.	40,000
d. Electric power 3000 KWH Rs. 3 KWH	9,000
e. Water and Other Utilities LS	200
Total	**90,800**

(iv) Other Contingent Expenses (per month)	**(Rs.)**
a. Rent	21,000
b. Transport and Telephone	2,000
c. Stationery, Postage, Fax etc.	500
d. Insurance and Tax	1,000
e. Repair, Maintenance and Replacement	5,000
f. Consumable, stores	1,000
g. Advertisement and publicity	1,000
Total	**31,500**

Total Recurring Expenditure (per month) (i+ii+iii+iv) Rs. 7,21,900

C. Total Capital Investment

i. Fixed Capital	Rs. 13,31,300
ii. Working Capital for 3 months	Rs. 21,65,700
Total	**Rs. 34,97,000**

MACHINERY UTILISATION

75% machinery utilization is considered for achieving the projected capacity of finished products. The bottleneck is on machining and heat treatment of casted parts. Melting will be performed 2–3 days per week as per the requirements of market.

FINANCIAL ANALYSIS

(1) Cost of Production (per year)	**(Rs.)**
Total Recurring Cost	86,62,800
Depreciation on Machinery and Equipments @10%	53,300
Depreciation on Furnace @ 25%	1,00,000
Depreciation on Dies, Moulds and Fixture @ 20%	25,000
Depreciation on Office Equipments @ 20%	16,000
Interest on Total Capital Investment @ 14%	4,89,580
Total	**93,46,680**

(2)Turnover (per year)

Item	**Qty./ Ton**	**Rate (In Rs.)**	**Amount (In Rs.)**
Finished Malleable iron parts	500 M/T	22,000	1,10,00,000
Without galvanising Scrap	20 M/T	8,500	1,70,000
	Total		**1,11,70,000**

(3)Net Profit (per year) *(Before Income Tax)*

Turnover – Cost of Production
Rs. 1,11,70,000 – 93,46,680 = **Rs. 18,23,320**

(4) Net Profit Ratio = $\frac{\text{Net Profit} \times 100}{\text{Turnover}}$

= $\frac{18,23,320 \times 100}{1,11,70,0000}$

= **16.3%**

(5) Rate of Return = $\frac{\text{Net profit per year} \times 100}{\text{Total capital Investment}}$

= $\frac{18,23,320 \times 100}{34,97,000}$

= **52%**

(6) Break-even Point

Fixed Cost	(Rs.)
Rent	2,52,000
Interest on total capital	4,89,580
Insurance	12,000
40% of Salary and Wages	3,19,600
40% of Other Contingent Expenses	45,600
Depreciation on Furnace	1,00,000
Depreciation on dies, fixture, and moulding boxes	25,000
Depreciation on Office Equipments	16,000
Depreciation on Other Machinery and Equipments	53,300
Total	**13,13,080**

B.E.P.

$$= \frac{\text{Fixed Cost} \times 100}{\text{Fixed Cost} + \text{Profit}}$$

$$= \frac{13,13,080 \times 100}{13,13,080 + 18,23,320}$$

= **42%**

Addresses of Machinery and Equipment Suppliers

1. M/s. Doeba Electric Welding Works
   185 Phase I, Block C,
   Naraina Industrial Estate,
   New Delhi
2. M/s. Pioneer Equipments
   Company Pvt. Ltd.
   432-Padra Road,
   Baroda
3. M/s. Kulkani Foundry
   E-209, Naraina Ind. Area,
   New Delhi.
4. M/s. Wesman Eng. Company Pvt. Ltd.
   7, Ganesh Chandra Avenue,
   Kolkata-13
5. M/s. Foundry Accessories
   7-Omprakash,
   90-Kazi Sayed Street,
   Mumbai-3.
6. M/s. Inspection Instruments Corpn.
   7, Sheriff Dovji Zakaria Bldg,
   Mumbai-3.
7. M/s. Engineering and Industrial Foundry Company, Ram Nagar,
   Coimbatore-641009.
8. M/s. National Mechanical Works
   72-A, M.M. Road,
   Paharganj,
   Delhi.
9. M/s. Ashoka Machine Tools Corporation
   Mayapuri Industrial Estate,
   New Delhi-64.
10. M/s. Toshniwal Brothers
    3E/8, Jhandewalan Extension,
    New Delhi-110005
11. M/s. Chola Ram Om Prakash
    578 Ishwar Chavan,
    Khari Bawli,
    Delhi-6
12. M/s. Greaves Cotton amd Co. Ltd.
    201, Nirmal Tower,
    26 Barakhamba Road,
    New Delhi-110001
13. M/s. Machinery Pattern and Foundry India Ltd.,
    Shed No. 12,
    Noida, (U.P.)

Raw Material will be procured from IOC, BPCL, SAIL and open market.