PRE-PROJECT FEASIBILITY REPORT

for

STEEL & POWER PROJECT

Installation of 1000 TPD DRI Sponge Iron plant, 30 MW Power generation from WHRB, 660 TPD Steel Melt Shop, Rolling Mill for Rebar, Light Section, Strip, Medium Section, Galvanizing Unit for Tube & Sheet, Cold Drawing Line & Wire Mesh Unit, ERW Pipe Mill, PEB Shed & Roofing Manufacturing Unit.

At

Tanzania.

Project Proponent:

M/s Tanzania Steel Industry Limited.

(JULY 2025)

Consultant:

JKEC INDIA

JK ENGINEERING AND CONSULTANTS.

Introduction/Recommendation:

JK ENGINEERING AND CONSULTANTS.

Introduction:

We would like to introduce ourselves as **JK Engineering & Consultants**. We are an association of Qualified Engineers with decades of Engineering & Rolling Experiences to provide our services in Steel Industry.

Currently, we are engaged with dozens of Steel Rolling Groups for serving them our services as below:

- Plan philosophy for Steel Plants.
- Pre-Feasibility Reports of Steel Manufacturing Units.
- Up gradation of existing Project Setup.
- Engineering Services for Mechanical, Electrical & Civil.
- Supervision & Manpower Support for Erection & Commissioning.
- Mill Production support on Contract basis.

Since, Engineering excellence is our main business philosophy and prime area of interest, hence we target to provide complete dedication in relation to the services we deliver.

This furnished information listed below on the project is based on standard statistics & with current price specifications of Units. We trust that the enclosed report presents to you a complete picture of the project and meets your requirements.

We are sure that our report shall come to you as a most satisfactory one and it receives your consent. Moreover, our experience and capability in the concerned field shall leave no doubt in your mind to relate the projections of the desired Project.
However, if you require any clarification please do not hesitate to write / contact us back.

We assure you of our Level Best Services, Always.

Recommendation:

Looking in to the Technological and Financial Strength of the Promoters & Financial viability of the Project, we find the project worthy for promotion and implementation.

In view of these facts the Project is recommended from all angles. All concerned are requested to extend their whole-hearted support to the company.

Warm Regards,

(Engg. KP Singh)
Email: consultancy.jkec@gmail.com

(Engg. JK Swami)
Email: jkenggconsultants@gmail.com

LIST OF CONTENT

LIST OF FIGURES

Chapter-1.0
Executive Summary

1.1 Brief of Proposal:

M/s. Tanzania Steel Industry Limited, have proposed to setup the Integrated Steel & Power Plants at **KWALA Industrial Park, KIBAHA District, TANZANIA** in which company will install DRI Sponge Iron Plant, WHRB for heat recovery & Power Generation, Steel Melt Shop, Online Hot Charging Rolling Mill for TMT, Strip, Light & Medium Section, Galvanizing Unit for Angles/Tube/Sheets, Cold Drawing Line & Wire Mesh Unit, ERW Pipe Mill & PEB Shed Manufacturing Unit.

The brief description of the project includes:

1.1a. Project Details:

Project will be implemented in two (02) years and in Four (04) major Phases. Capacities/Phases of various plants are as follows against 330 Working days/Year:

Table I: Proposed Production/Capacity Detail:

Phase	Facility Name	Capacity
Ph.IV	DRI Sponge Iron plant (500 TPD x2 Kiln each)	330,000 TPY
	Power generation from WHRB (15 MW x 2 Nos.)	30 MW
Ph.III	Steel Melt Shop (Induction Furnace) (30 T x 3 Nos.)	356,053 TPY
	Rolling Mill for Rebar	338,250 TPY
	Rolling Mill for Light Section	
	Rolling Mill for Strip	
	Rolling Mill for Medium Section	
Ph.II	Galvanizing Unit for Tube & Sheet.	60,000 TPY
	Cold Drawing Line & Wire Mesh Unit	30,000 TPY
Ph.I	ERW Pipe Manufacturing Unit	96,000 TPY
	PEB Shed & Roofing Manufacturing Unit	49,200 TPY

The above facilities are planned with prime objective of:

- Recovering all sensible heat from the by-product flue gas from Sponge Iron Unit.
- Partial of the total power requirement will be generated by Company and the balance will be procured from State Grid for further value addition i.e. making Billet, Rebar, Strip, Section, Pipe, Galvanizing Unit & PEB Shed & Roofing Manufacturing Unit.

1.1b. Land and Location Details:

The proposed project is proposed on land located in **Kwala Industrial Park, Opposite Kwala Dry Port, Kwala Village, Kibaha District, Tanzania** with total Area 397,167 sqm (approx. 40 ha).

1.1c. Power Requirement:

Total power requirement for the Project will be estimated to 70 MW.

Company's Own Source of Power Generation (MW) : 30.0

Balance (MW), will be procured from State Grid : 40.0

Note: Partial of the total power requirement will be generated by Company and the balance will be procured from State Grid.

Total Power required for proposed project is 70 MW and are as per below Table:

Table II: Power Requirement

Sl. No.	Facility Name	Proposed (MW)
1.	DRI Sponge Iron plant (500 TPD x2 Kiln each)	3.0
2.	Power generation from WHRB (15 MW x 2 Nos.)	
3.	Steel Melt Shop (Induction Furnace) (30 T x 3 Nos.)	45.0
4.	Rolling Mill for Rebar	4.0
5.	Rolling Mill for Light Section	3.0
6.	Rolling Mill for Strip	4.0
7.	Rolling Mill for Medium Section	3.0
8.	Galvanizing Unit for Tube & Sheet.	1.5
9.	Cold Drawing Line & Wire Mesh Unit	1.0
10.	ERW Pipe Manufacturing Unit	2.0
11.	PEB Shed & Roofing Manufacturing Unit	1.5
12.	Auxiliary & other loads	2.0
	Total ::	**70.0**
	Company's Own Source of Power Generation (MW):	**30.0**
	Balance (MW), will be procured from State Grid:	**40.0**

1.1d. Water Requirement:

The proposed project will require about 1183 KLD water out of which 44 KLD will be required for domestic usage and 1139 KLD will be required for industrial (Cooling purpose). Source of water will be Ground Water. Zero discharge will be maintained.

Table III: Water Requirement

Sl. No.	Description	Proposed (KLD)
1.	Iron Ore Beneficiation Plant	300
2.	DRI Unit	330
3.	WHRB	289
4.	SMS with Caster	100
5.	Rebar-Rolling Mill	30
6.	Light Section-Rolling Mill	20
7.	Strip Rolling Mill	20
8.	Medium Section-Rolling Mill	20
9.	Pipe galvanizing unit	10
10.	Cold Drawing Line & Wire Mesh Unit	0
11.	ERW pipe manufacturing unit	10
12.	PEB Shed & Roofing Manufacturing Unit	10
13.	Domestic demand	44
	Total ::	**1183**

1.1e. Air Pollution Control Equipment:

Particulate emission level will be kept within 30 mg/Nm3.

Table IV: Air Pollution Control Device

Sl. No.	Units	Name of APCD	Stack Height (mtr)	No. of Bag filters/ESP	Emission Design
1.	DRI Kiln	WHRB Boiler I & II (ESP)	70	2	<30mg/Nm^3
		Kiln discharge end (Dust extraction with Bag filter)	30	2	
		Coal Circuit, Iron ore circuit (Dust extraction with Bag filter)	30	2	
		Stock House (Dust extraction with Bag filter)	30	2	
		Cooler Discharge end (Dust extraction with Bag filter)	30	2	
		Product House & Product separation Bin (Dust extraction with Bag filter)	30	2	
		Coal Injection (Dust extraction with Bag filter)	30	2	
		Coal Handling (Dust extraction with Bag filter)	30	2	
3.	SMS	(Fume extraction with Bag filter)	30	1	<30mg/Nm^3
4.	Hot Rolling Mill	(Dust extraction with Bag filter)	30	1	<30mg/Nm^3
5.	Galvanizing Unit	(Dust extraction with Bag filter)	30	1	<30mg/Nm^3
		Pickling Line (Fume Extraction System)	30	1	

1.2 Salient Features of The Project:

1.2a Name of the Proposed Unit : **Tanzania Steel Industry Limited.**

1.2b Location : Kwala Industrial Park,
Kibaha District, Tanzania

1.2c Office (Regd.) : Plot #S19, Kwala Industrial Park, Kwala,
Kibaha District, Tanzania

1.2d No. of Working Days/Shifts : 330 Days/ 3 Shifts

1.2e Man Power Utilization :

Table V: Manpower Requirement

Srl.	Description	Unit Capacity	Proposed Manpower
1.	DRI Sponge Iron plant (500 TPD x2 Kiln each)	330,000 TPY	280
2.	Power generation from WHRB (15 MW x 2 Nos.)	30 MW	100
3.	Steel Melt Shop (Induction Furnace) (30 T x 3 Nos.)	356,053 TPY	160
4.	Rolling Mill for Rebar	338250 TPY	100
5.	Rolling Mill for Light Section		50
6.	Rolling Mill for Strip		80
7.	Rolling Mill for Medium Section		50
8.	Galvanizing Unit for Tube & Sheet.	60,000 TPY	20
9.	Cold Drawing Line & Wire Mesh Unit	30,000 TPY	20
10.	ERW Pipe Manufacturing Unit	96,000 TPY	80
11.	PEB Shed & Roofing Manufacturing Unit	49,200 TPY	40
12.	Admin Staff	-	30
	Total Operational Manpower Required		**1010**

The project proponents have decided to give employment to local people within the plant, and outside the plant in direct and indirect employments. 1010 people will be employed and the company would be employing more than 70% people from local area.

The following facilities will be provided for the employees in the plant premises:

1. Administrative building and technical office
2. Construction office and store
3. Time and security office
4. First aid and rest room
5. Canteen and welfare center
6. Toilet and changing Room
7. Parking area

1.2f Cost of Project:

Description		Total (USD)
Land Procurement		11,120,676.00
Boundary & Site Development		1,500,000.00
Building and Civil Work		357,000.00
Plant & Machinery & Other Equipment	**Capacity**	
DRI Sponge Iron plant (500 TPD x2 Kiln each)	330,000 TPY	29,406,000.00
Power generation from WHRB (15 MW x 2 Nos.)	30 MW	20,124,000.00
Steel Melt Shop (Induction Furnace) (30 T x 3 Nos.)	356,053 TPY	19,350,500.00
Rolling Mill for Rebar Rolling Mill for Light Section Rolling Mill for Strip Rolling Mill for Medium Section	338,250 TPY	23,991,500.00
Galvanizing Unit for Tube & Sheet.	60,000 TPY	2,380,000.00
Cold Drawing Line & Wire Mesh Unit	30,000 TPY	3,000,000.00
ERW Pipe Manufacturing Unit	96,000 TPY	5,061,000.00
PEB Shed & Roofing Manufacturing Unit	49,200 TPY	3,613,750.00
Electrical Installations – Sub Station & Transformer.		595,000.00
Misc. Fixed Assets – Office, Weigh Bridge etc.		598,000.00
	TOTAL ::	**121,097,426.00**

Means of Finance		
Equity -Equity & reserve and surplus		**20%**
DEBT - Term Loan from Bank		**80%**
	TOTAL ::	**100%**

Chapter 2.0

Introduction of the Project/Background information

2.1a Identification of Project:

Name of The Unit	:	M/s Tanzania Steel Industry Limited.
Regd. Office	:	Plot #S19, Kwala Industrial Park, Kwala, Kibaha District, Tanzania
Plant Location	:	Kwala Industrial Park, Opposite Kwala Dry Port, Kwala Village, Kibaha District, Tanzania
Contact Person	:	Mr. Pawan Mundra (Director)
Partners	:	M/s Shree Shayam Holding Company LLC Mr. Pawan Mundra Mr. Madhu Raj Jat
E Mail	:	mundrapk@gmail.com
Existing Capacity	:	NA
Proposed Capacity		• 1000 TPD DRI Sponge Iron plant (500 TPD x2 each) • 30 MW Power generation from WHRB (15MW x 2 each) • 660 TPD Steel Melt Shop (30 TPH x 3 each) • 600 TPD Rolling Mill for Rebar x 1 • 400 TPD Rolling Mill for Light Section x 1 • 600 TPD Rolling Mill for Strip x 1 • 400 TPD Rolling Mill for Medium Section x 1 • Galvanizing Unit x 1 • Cold Drawing Line & Wire Mesh Unit x 1 • ERW Pipe Mill x 3 • PEB Shed & Roofing Manufacturing Unit x 1
Land Area	:	397,167 sqm
Manpower	:	1010.
Water Requirement	:	1183 KLD.
Power Requirement	:	Total power requirement for the Project will be estimated to 70 MW. Company's Own :30.0 MW + Balance State Grid: 40.0 MW
Project Cost	:	**121,097,426.00 USD.**

2.1b Project Proponent:

Mr. Pawan Mundra (Chartered Accountant; 25+ years of rich professional experience).

Key Achievements And Responsibilities:

- Successfully established companies in Dubai, Sharjah and Oman.
- Successful in running of steel plant from scratch. This includes:
  - Project execution, project erection and project commissioning
  - Introduce new investors to the business
  - Team building
  - Plant administration, plant maintenance and productivity improvement.
  - Quality control and assurance
  - Budgeting and cost control
  - Contract management, sales and marketing, profit and loss.
- Manufacture of flat bars and serrated flat bar used for manufacturing of grating.
- Manage day today trading operations which includes imports.
- Liaison with various government departments across UAE.
- Obtain approvals and required procedures for the running of business.
- As Managing Partner since Jan 2014:

SPM General Trading LLC	***Dubai, UAE***
Atlas Gulf Trading FZE	***Sharjah, UAE***
Atlas Gulf Steel Products LLC	***Buraimi, Oman***

Mr. Madhu Raj Jat (Consultant for Steel Industries; 34+ years of rich professional experience)

Key Achievements And Responsibilities:

- Supported to establishing 25+ Companies successfully in India.
- Established many Steel Plants right from Conceptual Stage to the Stage of Commercial Production. This includes:
  - Identifying suitable land for the factory.
  - Obtaining all licenses for establishing the factory.
  - Identifying suppliers for all the machineries.
  - Obtaining and designing the factory lay out.
  - Identifying contractors for the civil and structural works for the factory.
  - Supervising the erection and commission work for the factory sheds and machineries.
  - Identifying suitable contractor for the production contract.
  - Identifying and appointing suitable technical staff.
- Consultancy for smooth running of the unit for a period of one year from the date of commercial production.
- **Details of Works done till now:**

In the firm's involved as consultants right from the conceptual stage to commercial production for the following units:

S.No	Name of Customer	Location	Period of Contract	Capacity
1.	Dipty Steel	Hyderabad	1991-1993 1 years	50 M.Ton Rerolling Mill
2.	Manoj Steel	Hyderabad	1992-1994 2 years	50 M.Ton Rerolling mill
3.	Shiva Steel	Visakhapatnam	1993-1996 3 Years	60 M.Ton Rerolling Mill
4.	Vijaynagram Steel	Visakhapatnam	1997-2011 14 Years	80 M.Ton TMT Mill with Furnace
5.	Sarita Steel	Shikakulam Andra Pradesh	1999-2005 7 years	50 M.Ton TMT Mill with Furnace
6.	Manu Steel	Nasik	1999-2003 4 Years	100 M.Ton TMT Mill With Furnace
7	Garga Steel	Hyderabad	2001-2012 11 Years	150 M.Tons Seaction Mill

S.No	Name of Customer	Location	Period of Contract	Capacity
8	Cauvery Steel	Hyderabad	2010-2014 4 Years	400 M.Tons Indicator Plant
9	Global Agarwala	Hyderabd	2011-2014 3 Years	200 M.Ton Section Mill
10	Salini Steel	Hyderabad	2012-2018 6 Years	250 M.Ton TMT Mill With Furnace
11	Vijay Iron Steel	Hyderabad	2012-2018 6 Years	300 M.Ton TMT Mill with Furnace
12	Jay Shankar Steel	Hyderabad	2007-2014 7 Years	120 M.Ton Section Mill
13	Raj Steel	Hyderabad	2010-2013 3 Years	70 M.Ton Section Mill
14	Hari Om Pipe	Hyderabad	2014-2018 4 Years	300 M.Ton Pipe and Scrap Folding
15	SD Steels	Vijayawada	2007-2012 5 Years	200 M.Tons TMT Mill with Furnace
16	Sobagi Steel	Rajahmundry	2007-2014 7 Years	150 M.Ton TMT Mill With Furnace
17	Vizag Steel	Visakhapatnam Andhara Pradesh	2001-2010 10 Years	60 M.Ton TMT with Furnace
18	AOne Steels / Narayani Steels	Hindupur	2008-2024 16 Years	200 M.Ton TMT with Furnace
19	Ratnakar Ispat	Bhilwada	2012-2016 4 Years	500 M.Ton TMT Mill with Furnace
20	Vasavi Steel	Bangalore	2018-2023 5 Years	30 M.Ton Section
21	Rama Hi Power	Bangalore	2016-2022 6 Years	100 M.Tons Section
22	SK Steels	Bangalore	2012-2017	500 M.Ton TMT With Furnace
23	Laxsmi Steels	Bangalore	2008-2016	100 M.Ton Section
24	Kamakshi Steel	Vijaywada	2024 till Date	600 M.Ton TMT with Furnace
25	Shakti Steels	Varanasi	2024 till Date	600 M.Ton Section Mill

2.2 Brief Description of Nature of the Project:

The proposed project is to set up DRI Sponge Iron Plant, Waste heat boiler and Steam turbine for power generation, Steel Melt Shop & Various Variety of Finish Steel Product making Mills. Project will be implemented in two years. Capacities of various plants are as follows against 330 Working days/Year:

Phase	Facility Name	Capacity
Ph.IV	DRI Sponge Iron plant (500 TPD x2 Kiln each)	330,000 TPY
	Power generation from WHRB (15 MW x 2 Nos.)	30 MW
Ph.III	Steel Melt Shop (Induction Furnace) (30 T x 3 Nos.)	356,053 TPY
	Rolling Mill for Rebar	338,250 TPY
	Rolling Mill for Light Section	
	Rolling Mill for Strip	
	Rolling Mill for Medium Section	
Ph.II	Galvanizing Unit for Tube & Sheet.	60,000 TPY
	Cold Drawing Line & Wire Mesh Unit	30,000 TPY
Ph.I	ERW Pipe Manufacturing Unit	96,000 TPY
	PEB Shed & Roofing Manufacturing Unit	49,200 TPY

2.3 Need for the Project & Importance to the Country/Region:

AN OVERVIEW OF TANZANIA STEEL SECTOR **(Source : THE CITIZEN)**

Presently, Tanzania's yearly expenditure on steel imports amounts to an average of $1.22 billion, or Sh3.2 trillion, making it the country's second-largest foreign exchange expenditure behind oil. Production is anticipated to start in 2027, according to Dr. Nicolous Shombe, Managing Director of NDC. ***(Source: Article Publish in The CITIZEN dt: Aug/04/2024 wrote By Seif Jumanne)***

The government of Tanzania is set to officially cease the importation of steel following significant growth in local production, marking a major milestone in the country's industrialisation agenda. Tanzania now boasts a robust steel industry that not only meets domestic demand but exceeds it, positioning the country as a key player in regional steel production.

Speaking during a tour of Lodhia Industries in Mkuranga District, Coast Region, the Minister of State in the President's Office (Planning and Investment), Prof Kitila Mkumbo, described the growth of Tanzania's steel production capacity as a game changer.

During the visit, which included Members of Parliament from Dares Salaam Region, Prof Mkumbo said Tanzania now has 19 major companies that steel and corrugated iron sheets.

"We now have the capacity to meet our local needs, with 19 major steel industries capable of fulfilling domestic requirements. With a combined production of 1.2 million tonnes of steel and domestic demand at 600,000 tonnes, we are confident that we no longer need to rely on steel imports," he said.

Prof Mkumbo also underscored the government's commitment to fostering a conducive investment climate to support local industries. "This is a clear testament to the success of our efforts to promote industrialisation through strategic investments." He further stated that the government remains focused on ensuring that the local market remains the primary beneficiary of this industrial progress. "We have satisfied local demand and will no longer prioritise steel exports over the strategic importance of local consumption and investment," he noted.

For his part, Lodhia Industries' Chief Executive Officer, Mr Manoj Gopi, highlighted the company's $100 million investment as a prime example of how local industries can drive Tanzania's economic growth. He revealed that the company currently employs 2,370 workers and is already exporting steel to regional markets such as Rwanda, Burundi, and the Democratic Republic of Congo.

Chair of the Dares Salaam MPs, Ms Mariam Kisangi, stressed the importance of collaboration between the government and investors in driving national development. "Investor play a key role in our economic growth, and we will continue working with them to implement policies the foster investment," she said.

The expansion of Tanzania's steel industry has already had a positive impact on employment, with Lodhia Industries alone providing jobs for over 2,300 Tanzanians. The country's growing steel production capacity has not only reduced reliance on imports but also promises long-term benefits for infrastructure projects and overall industrial growth.

Tanzania Investment Centre (TIC) Director of Investment Facilitation, Mr James Maziku, echoed the minister's sentiments, emphasising that the development of the steel industry is a direct result of the government's efforts to create a favourable business environment. "We are pleased to witness such significant investments in the sector, which not only meet local demand but also strengthen our regional trade relations," he said.

Tanzania's steel industry plays a crucial role in supporting the country's rapidly growing infrastructure, from construction to manufacturing. ***(Source: Article Publish in The CITIZEN dt: Mar/04/2025 wrote By Gadiosa Lamtey; Business Reporter)***

2.3.1 Advantages of the project

- Value addition project by gainful utilization of iron ore and converting intermediate products in to End-use product.
- Promoters are experienced for running 0.5 Million Ton steel plant from last 30 Years.
- Newly designed technology for Steel Furnace and Rolling Mill, reduces conversion cost due to high energy efficiency.
- Reduced operation, transportation and storage cost due to sharing of infrastructures and manpower with integrated unit at one premises reducing overhead by almost 30%.
- Dedicated and experienced workforce available.
- Waste heat recovery boiler and power plant of sponge iron plant is utilising waste heat and utilising this power for SMS. Substantially reducing existing power cost.
- Ready market for the finished products. Easy accessibility to the thriving markets.

2.4 Demand/Supply Gap

The Scenario of Steel Industry is clearly looking upward and the latest data on Steel Industry is as follow:-

Global Scenario:

- In 2013 the world crude steel production reached 1606 million tonnes (mt) and showed a growth of 3% over 2012. (Source: World Steel Association or WSA)
- China remained the world 's largest crude steel producer in 2013 (779 mt) followed by Japan (111 mt), the USA (87 mt) and India (81 mt) at the 4th position.
- USA has projected Indian steel demand to grow by 3.3% in 2014 as compared to global steel use growth of 3% and Chinese growth of 3.1%. For 2015, further recovery is projected for world (3.3%) and India (4.5%) and a slowing down for China (2.7%).
- Per capita finished steel consumption in 2013 is estimated at 225 Kg for world and 515 Kg for China.

Domestic Scenario:

The long steel products market in Tanzania is expected to reach a projected revenue of US$ 489.3 million by 2030. A compound annual growth rate of 1.3% is expected of Tanzania long steel products market from 2023 to 2030.

2.5 Employment Generation

The list of likely employment due to project after expansion is given in table below:

Table V: Manpower Requirement

<table>
<tr><th>Phase</th><th>Description</th><th>Unit Capacity</th><th>Proposed Manpower</th></tr>
<tr><td rowspan="2">Ph.IV</td><td>DRI Sponge Iron plant
(500 TPD x2 Kiln each)</td><td>330,000 TPY</td><td>280</td></tr>
<tr><td>Power generation from WHRB
(15 MW x 2 Nos.)</td><td>30 MW</td><td>100</td></tr>
<tr><td rowspan="5">Ph.III</td><td>Steel Melt Shop (Induction Furnace)
(30 T x 3 Nos.)</td><td>356,053 TPY</td><td>160</td></tr>
<tr><td>Rolling Mill for Rebar</td><td rowspan="4">338250 TPY</td><td>100</td></tr>
<tr><td>Rolling Mill for Light Section</td><td>50</td></tr>
<tr><td>Rolling Mill for Strip</td><td>80</td></tr>
<tr><td>Rolling Mill for Medium Section</td><td>50</td></tr>
<tr><td rowspan="2">Ph.II</td><td>Galvanizing Unit for Tube & Sheet.</td><td>60,000 TPY</td><td>20</td></tr>
<tr><td>Cold Drawing Line & Wire Mesh Unit</td><td>30,000 TPY</td><td>20</td></tr>
<tr><td rowspan="2">Ph.I</td><td>ERW Pipe Manufacturing Unit</td><td>96,000 TPY</td><td>80</td></tr>
<tr><td>PEB Shed & Roofing Manufacturing Unit</td><td>49,200 TPY</td><td>40</td></tr>
<tr><td></td><td>Admin Staff</td><td>-</td><td>30</td></tr>
<tr><td colspan="3">Total Operational Manpower Required</td><td>1010</td></tr>
</table>

The project proponents have decided to give employment to local people within the plant, and outside the plant in direct and indirect employments. 1010 people will be employed and the company would be employing more than 70% people from local area.

The following facilities will be provided for the employees in the plant premises:

1. Administrative building and technical office
2. Construction office and store
3. Time and security office
4. First aid and rest room
5. Canteen and welfare center
6. Toilet and changing Room
7. Parking area

2.6 Raw Material Requirement & Quality:

Table VI: DRI Sponge Iron plant (2x500; Considering 330 days):

Input			Output		
Materials In	**Specific consumption**	**Quantity TPA**	**Products**	**Specific consumption**	**Quantity TPA**
Iron ore	1.75	577,500	Sponge Iron	1	**330,000**
Dolomite	0.05	16,500	Char	0.24	**79,200**
Coal (Higher grade)	1.0	330,000	DRI Fines	0.1	**33,000**
-	-	-	Dust from settling chamber	0.07	**23,100**
-	-	-	Kiln accretion	0.01	**3,300**
-	-	-	Dust from ESP	0.31	**102,300**
-	-	-	LOI	1.07	**353,100**
Total Input	**2.8**	**924,000**	**Total Output**	**2.8**	**924,000**

Table VII: SMS (3x30T; Considering 330 days):

Input			Output		
Materials	**Specific consumption**	**Quantity TPA**	**Products**	**Specific consumption**	**Quantity TPA**
DRI	0.76	330000.00	Billet	0.82	356052.63
Scrap	0.224	97263.16	APCD Dust	0.04	15197.37
Ferro Alloy	0.011	4776.32	Slag/ Impurities	0.10	43421.05
Met Coke	0.005	2171.05	LOI	0.05	19539.47
Total Input	**1.0**	**434210.53**	**Total Output**	**1.00**	**434210.53**

Table VIII: Hot Charging Rolling Mill (Considering 330 days):

Input		Output	
Material In	**Qty.**	**Products**	**Quantity TPA**
Hot MS Billet from Induction Furnace	356052.63	Rolling Mill (Hot charge) to Produce MS Rerolled products (i.e. Bar, Strips, Angle, Channel, Flat etc.)	338250.00
		Mill Scale/Burning Loss	2848.42
		Miss Roll / End Cutting	10681.58
		Short Length	4272.63
Total Input	**356,052.63**	**Total Output**	**356,052.63**

Table IX: Galvanizing Unit (Considering 330 days):

Input		Output	
Material In	**Qty**	**Products**	**Quantity TPA**
Rerolled Steel Products (Wire, MS Pipe, Structure etc)	60000.00	Galvanizing Steel product	60000.00
Zinc	1800.00	Zinc Dross	180.00
Lead	600.00	Zinc Ash	180.00
Acid etc	240.00	Lead skimming	18.00
Furnace Oil	1560.00	ETP Sludge	18.00
Lime for neutralization	15.00	Loss to Atmosphere	3819.00
Total Input	**64215.00**	**Total Output**	**64215.00**

Table X: Tube Mill (Considering 330 days):

Input			Output		
Materials	**Specific consumption**	**Quantity TPA**	**Products**	**Specific consumption**	**Quantity TPA**
Cold Rolled Strip	1.0	**101052.63**	Tube (Finished)	0.95	96000.00
			Edge Trimming at Slitter	0.016	1616.84
			End Shear Cut	0.002	202.11
			Bead Trimming	0.015	1515.79
			Cut Losses (LOI)	0.005	505.26
			Rejections/SL	0.012	1212.63
Total Input	**1.0**	**101052.63**	**Total Output**	**1.00**	**101052.63**

Note: ***All the raw material required for proposed plant will be transported through road in tarpaulin covered trucks.***

Chapter 3.0
Project Description

3.1 Type of project:

M/s. Tanzania Steel Industry Limited, have proposed to setup the Integrated Steel & Power Plants in which company will install DRI Sponge Iron Plant, WHRB for heat recovery & Power Generation, Steel Melt Shop, Online Hot Charging Rolling Mill for TMT, Strip, Light & Medium Section, Tubes Mill, Corrugated Roofing Sheet Plant & Galvanizing Unit for Tube & Sheets.

The brief description of the project includes:

Phase	Facility Name	Capacity
Ph.IV	DRI Sponge Iron plant (500 TPD x2 Kiln each)	330,000 TPY
	Power generation from WHRB (15 MW x 2 Nos.)	30 MW
Ph.III	Steel Melt Shop (Induction Furnace) (30 T x 3 Nos.)	356,053 TPY
	Rolling Mill for Rebar	338,250 TPY
	Rolling Mill for Light Section	
	Rolling Mill for Strip	
	Rolling Mill for Medium Section	
Ph.II	Galvanizing Unit for Tube & Sheet.	60,000 TPY
	Cold Drawing Line & Wire Mesh Unit	30,000 TPY
Ph.I	ERW Pipe Manufacturing Unit	96,000 TPY
	PEB Shed & Roofing Manufacturing Unit	49,200 TPY

3.2 Location of Project:

The proposed Plant along with the manufacturing facilities of the company will be located at **Plot No: S19, Kwala Industrial Park, Opposite Kwala Dry Port, Kwala Village, Kibaha District, Tanzania**

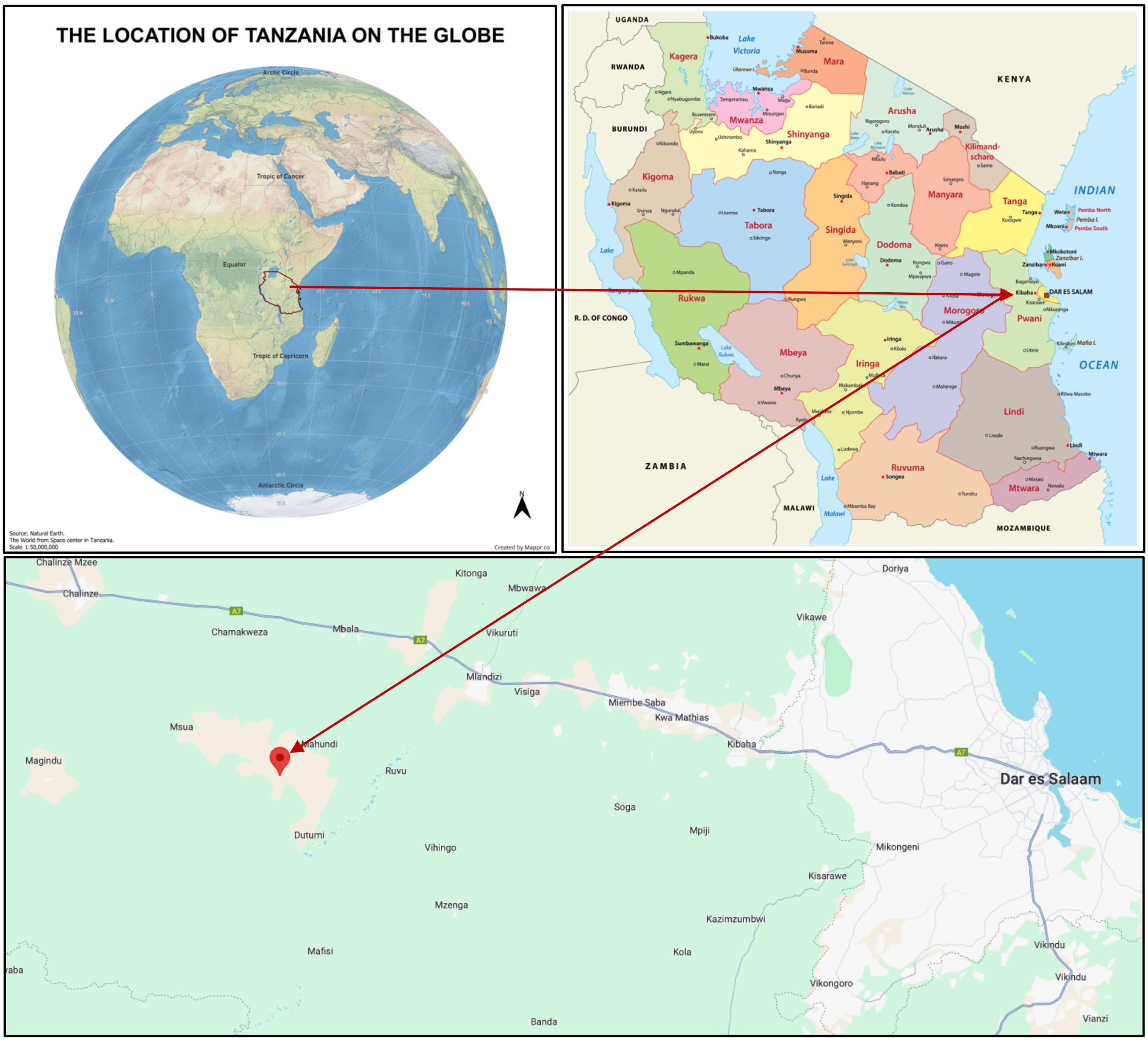
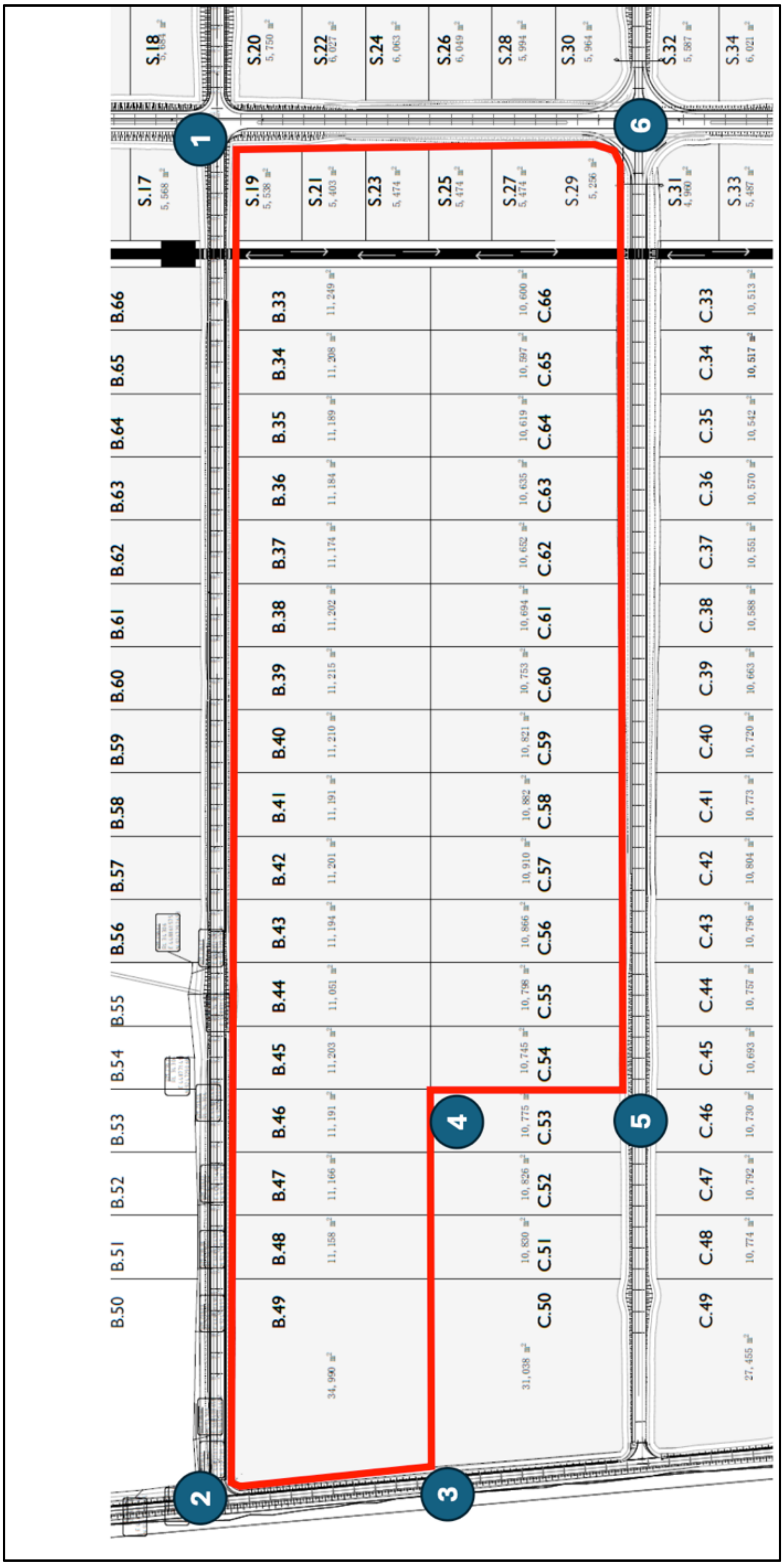


Figure I : General Location of the Project Site.

Figure II : Google Image of the Project Site



Marker Points	Coordinates (google maps)
1	6°48'45.8"S 38°32'41.9"E
2	6°48'45.9"S 38°31'58.9"E
3	6°48'50.7"S 38°31'59.4"E
4	6°48'52.4"S 38°32'13.8"E
5	6°48'56.1"S 38°32'13.8"E
6	6°48'55.4"S 38°32'41.9"E

Figure III : Plot Plan

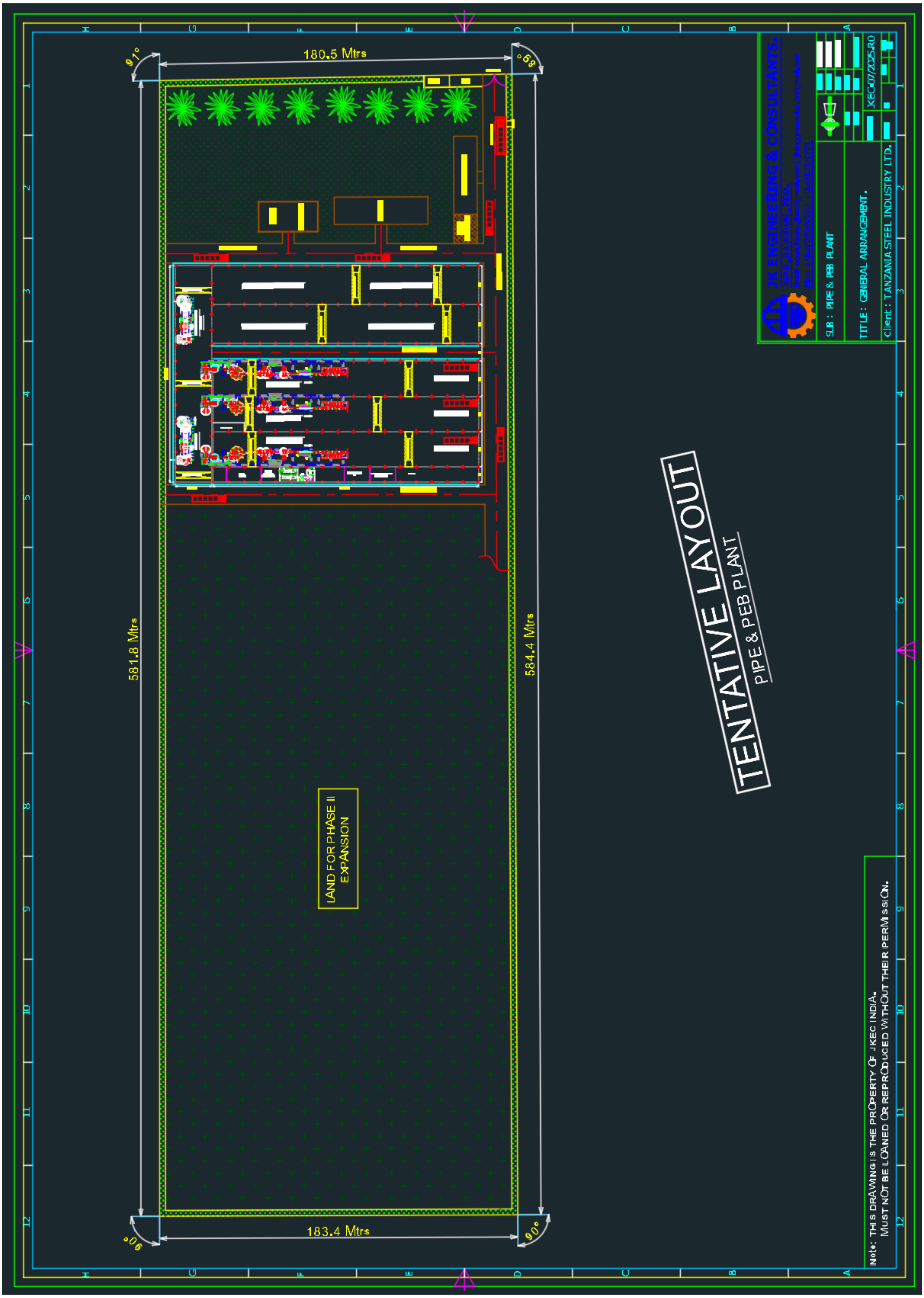


Figure IV : Phase I-General Arrangement Layout

3.3 Details of alternate sites considered and the basis of selecting the proposed site:

In order to achieve Synergy of Operations and to avoid overhead expenses for multiple units, no alternative site has been considered.

3.4 Size or Magnitude of operation: Ref: Table I

3.5 Project Description with process details

3.5.1 Sponge Iron Plant capacity 330,000 TPA

Raw Materials details:

Iron Ore

The quality requirements of sized iron ore for sponge iron production are as follows: - Physical requirement. The ore should be hard and possess high strength. The optimum tumbler index of the ore should be 90% minimum and the size range should be 5-20mm.

Metallurgically ore should be highly reducible, thermally stable and has a low tendency for sticking and disintegration during heating and reduction.

Chemically the ore should be high in iron content and low in gangue content. Apart from the removal of oxygen, no other major chemical change takes place in direct reduction. The content in iron ore viz: silica, alumina, Sulphur and Phosphorous content adversely affect the economy in subsequent steelmaking processes.

i) Physical Specification of Iron Ore:

Size	5-20mm
Over size	<5%(max.)
Under size	<5%(max.)
Tumbler index	88 %(min.)
Abrasion Index	5 % Max

ii) Chemical Specification of Iron Ore:

Fe (Total)	63 - 65%
Sio2+o3	5% (max.)
Sulphur	0.05% (max)
Phosphorous	0.05% (max.)
Moisture	5.0% (max.)
Alkali	0.02% (max)
Contamination	<3% (max.)

Coal

Coal is required to perform two vital functions inside the sponge iron rotary kiln. Firstly it coal is used to provide requisite heat for bringing the reactants to the reduction temperature. Secondly carbon in the char generated from the de volatilization of coal acts as a reductant for converting the iron oxide into metallic iron. Of the irons oxides in iron ore, Fe O is the most difficult to reduce. If the coal is able to reduce Fe O into metallic iron under rotary conditions, then the coal is suitable for rotary kiln sponge iron making process. If the coal is found capable of reducing Fe O to metallic iron, it is automatically able to provide the necessary heat for the process. The coal must have adequate reactivity i.e. the ability of carbon in char to quickly react with CO2 to form CO.

The following reactions are takes place while coal is used in sponge iron process.

FeO +CO Fe+CO2

CO2+C 2CO

FeO +C Fe+CO

Thus selection of coal should have the following indicators for selection:

Lower rank coal coals have high reactivity.

All high volatile bituminous coals are suitable for sponge iron making.

A fuel ration (FC/VM) value should be lower than 1.5 and up to 1.8.

An increase in ash content by 1% reduces kiln productivity by 2%.

The size of coal from free end is required to be roughly of 5 to 20 mm size and the coal from discharge end can be mixture of fine coal i.e.0-5m and lump coal up to 20 mm. The quantity of coal required for manufacturing of Sponge Iron is depend on Fe content in Iron ore and carbon content, ash and volatile matter in the coal.

- **Chemical & Physical Specification of high-grade Coal:**

Size	5 – 20 mm
Fixed Carbon	50.0 Min
Volatile matter	30.0% max
Sulphur	0.5% max
Moisture	8.0% max
Ash	20 % Max
Calorific Value	5500 kCal/kg. Min
Ash fusion Temperature	1200^{o} C

Lime stone/dolomite

The third raw material is the flux, either dolomite or lime stone is required during the sponge iron process. These materials are used to de sulphurise iron ore and to prevent sulphur in coal from entering in sponge iron. Since flux is used in only minor quantities and its quantity has negligible influence on the process. The Dolomite a requirement is 0.03-0.05 MT for manufacture of 1 Ton of sponge iron from Iron Ore and varies depending up on Iron Ore and Coal.

CaO	28% Max
MgO	20 % Min
SiO2	4 % Max
Phosphorus	0.03 % Max
Alkali	0.1 % Max
LOI	Remaining

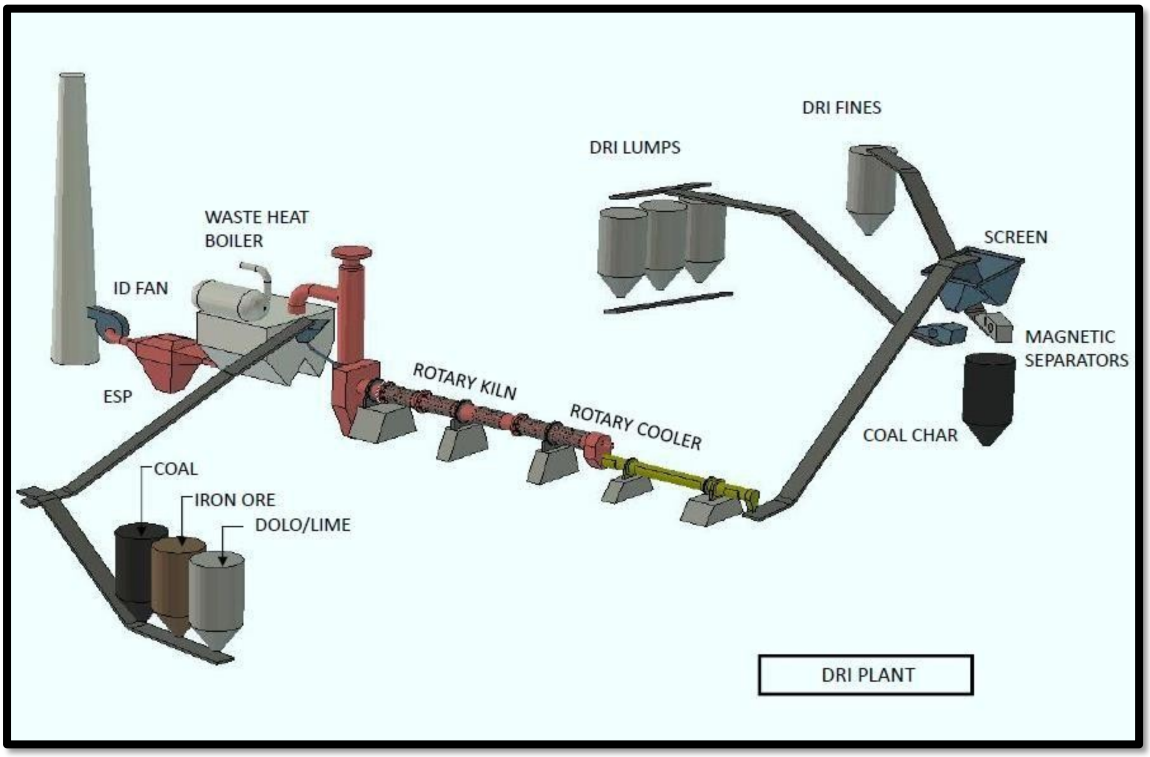


Figure V : DRI Plant Flow Diagram

Material Balance DRI (2x500; Considering 330 days)

Input			Output		
Materials In	**Specific consumption**	**Quantity TPA**	**Products**	**Specific consumption**	**Quantity TPA**
Iron ore	1.75	577,500	Sponge Iron	1	**330,000**
Dolomite	0.05	16,500	Char	0.24	**79,200**
Coal (Higher grade)	1.0	330,000	DRI Fines	0.1	**33,000**
-	-	-	Dust from settling chamber	0.07	**23,100**
-	-	-	Kiln accretion	0.01	**3,300**
-	-	-	Dust from ESP	0.31	**102,300**
-	-	-	LOI (Loss on Ignition)	1.07	**353,100**
Total Input	**2.8**	**924,000**	**Total Output**	**2.8**	**924,000**

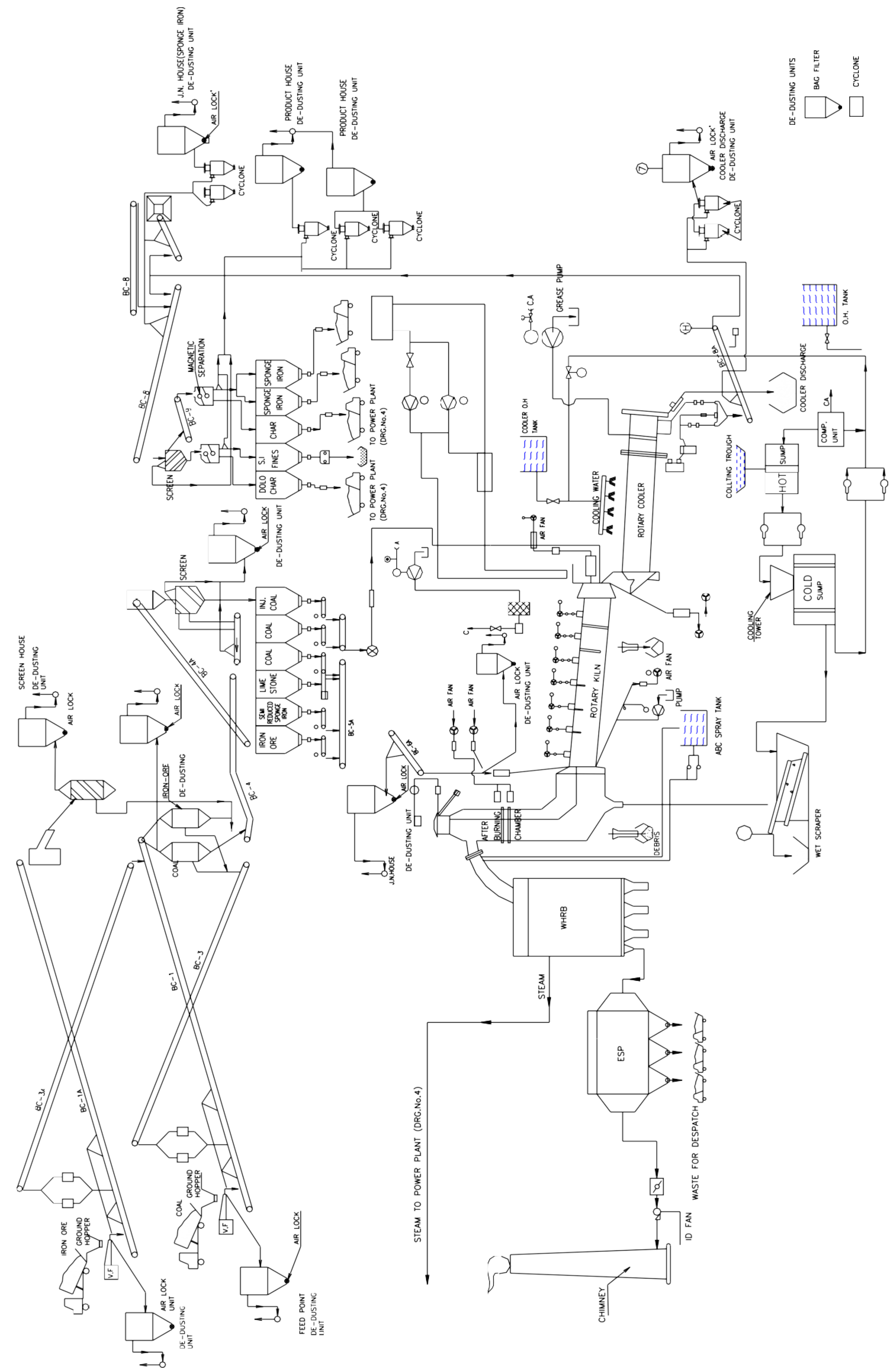


Figure VI : Process Flow Chart For Sponge Iron Plant

Equipment and Machinery in sponge Iron manufacturing

The following major equipment/systems required for coal based sponge Iron plant for manufacturing of sponge iron from iron Ore.

Raw material preparation and handling system

The major raw materials required for the sponge iron production are iron ore, coal and dolomite/lime stone. The iron ore and coal are obtained mostly through the road transport from mines with different sizes. These materials are unloaded in stock yards and then are fed into the respective circuit for further processing. Each raw material has individual crushing circuit. But for the Lime stone which is only small quantity, is procured in the required size and fed to the stock bins through the iron ore circuit. The raw material Handling Equipment required are feeders, vibrating screen, impactors and crusher.

Ore Crushing Circuit

The size of iron ore procured for the suppliers are higher than the required size to feed into the kiln. So, the iron ore is required to crush in to required size, it is essential to install the ore crushing unit. The capacity of crushing unit is depends on the plant capacity. The required size of iron ore in the rotary kiln is in the range of 5-16mm. The Ore crushing unit has ground hopper, feeder, two iron ore crushers and one screen with the interconnected conveyors for handling the material. Dust suppression system is provided for pollution control system.

Coal Crushing Circuit

The size of coal procured for the suppliers are higher than the required size to feed into the kiln. So, the coal is required to crush in to required size, it is essential to install the coal crushing unit. The capacity of crushing unit is depends on the plant capacity. The required size of coal in the rotary kiln is in the range of 5-20mm and 0-5mm. The coal crushing unit has ground hopper, vibrating feeder, one coal crushers and one screen with the interconnected conveyors for handling the material to various bins. Bag filters for separation of dust particles is provided for pollution control.

Raw material Storage System and feeding

The raw material storage system is essential to stock the required raw material for uninterrupted production of the plant. The capacity of storage system is usually designed for one day or more depending up on the plant requirements and operations. The raw material storage system is designed for iron ore, coal and dolomite with feeding systems for better process control. Weigh Feeders are provided under each bin to supply of the required quantity of raw material in each raw material to the kiln.

Reduction Unit.

In coal based sponge iron manufacturing reduction unit is heart of the plant where the actual reduction of iron ore is takes place. The reduction unit consists of rotary kiln and rotary cooler and details are presented below.

Rotary Kiln

The rotary kiln is longer in size and smaller in diameter (higher L/D ratio). This is due to heat transfer from flame to the solid charge in inside the kiln which is the main requirement during the process.

The oxide of Iron is reduced to its metallic form below the melting points of the metal and the oxide in the rotary kiln by supplying the adequate quality and quantity of coal.

The entire process of reduction is takes place in the rotary kiln at higher temperature. In this process coal will be used for producing reducer gas and the process will be carried out in a Horizontal Rotary Kiln.

The Rotary Kiln is operated and rotated with help of AC motor and gears. The speed of the rotation is used by gear box and the speed is controlled by Variable Drive System. The temperature and pressure measuring systems are required to install to measure the different temperatures zones and air flow velocity during the process of kiln.

The sealing system is provided to prevent atmospheric air is enter in to the kiln. Raw material iron ore and coal, dolomite is enter in to the kiln in one side and powdered coal is enter in to the another side of the kiln. The gas generated in the kiln i.e. CO is passes opposite to the raw material pass during the operation. The finished product from the rotary kiln is discharges and enters in to the cooler main drive after completion of the reactions.

Rotary Cooler

The Rotary Cooler is another rotary kiln in reduction units which is used to cool the high temperature metallic iron i.e. sponge iron cooled to around 250 C. The cooler main drive also similar to the rotary kiln but the operation is mainly to cool the finished product. The cooler main drive is driven by the motor with gear system. The cool water is circulated on the top of the kiln for heat exchange between product and water. Sufficient water is sprayed along the cooler main drive at top.

The cooler shell will be of 2.2 m diameter and 22 meters long and the shell plate will be 16mm thick. The shell is supported by 4 numbers of roller assemblies. The other items include gear rim, spring plate system, pinion shaft system, thrust roller base frame for rollers, drive frame for cooler, thrust roller for frame, Transfer chutes, cooler hood, needle gate head for cooler outlet, spring ring carriage.

Product separation and Storage System

The finished product from the cooler drive is sent to the magnetic separators where metallic and non-metallic is separated. The separated non-metallic material is send to the dumping yard. The segregated metallic material i.e. sponge Iron is sent to vibrating screens for segregating the different sizes. Conveyor belts are used to transport the metallic and non-metallic material.

The segregated material is stored in intermediate storage system provided in the plant. A Bag filter is provided for collecting the fine dust during the material transportation. The Product Separation system has one screen and two magnetic separators positioned at various elevations. The product house bins have three to four bins with the higher volume of storage capacity. The four bins have the material discharge system with three bins for sponge iron and one for char + dolo char.

Waste Gas Cleaning System

The flue gasses are generated in the kiln during the sponge iron manufacturing. These gases are mainly contains CO, dust particles with higher temperature. The dust settling chamber (DSC) is provided where the higher particles are settle down and gases with fine particles are passes to After Burner Chamber (ABC).The water is sprayed in the ABC where the dust particles coagulate and further settle in the DSC tank. The hot gases from kiln have higher temperature and contain CO which cannot escape to environment. The ABC system is provided to convert the CO in to CO2 by supply the atmospheric air. The higher temperature

CO is converted in to CO2, and the temperature of the gas increased up to 1000 C. The gases from the ABC are required to cool which cannot be sent directly to atmosphere.

The hot gasses from after burner chamber (ABC) are passed through the Forced Draft cooler (FDC)/Gas Cooled Terminal (GCT) to cool the hot gases from 1000 C to 250C.These gases are passes further through Electro-Static Precipitator (ESP) where fine dust particles in gasses were removed. Induced draft (ID) fan is used to suck the gases from ESP and sent to atmosphere through chimney.

Auxiliary Facilities

The other equipment/machinery required for sponge iron plant is discussed which are directly/indirectly required for the operation of the plant. Water supply system Make up water and water circulating system is required for cooler main drive to cool the product. Pumps are used to supply the water in cooler main drive and makeup water in the ponds. The quantity of makeup water is required is depends up on the how much water is evaporated during the process. In some industries where Gas cooled Terminal is used for cool the waste gases are required water for cooling the gas.

Compressed air system

Compressors are used to for supply the compressed air required in the both rotary kiln and cooler main drive.

Shell Air Fans

Shell air fans are required to supply the air to the rotary kiln for combustion of coal. These fans are mounted in the across the rotary kiln. The quantity of air is depends upon the coal consumption and temperature inside the kiln. At least 5 to 7 shell air fans are provided in the rotary kiln across the kilns.

Instrumentation

The instrumentation has been designed to meet the continuous operation of the plant to meet the desired parameters in the kiln. Instrumentation is required for electrical and process operations in sponge iron plants due to continuous operations. During the process in the sponge iron many parameters i.e. temperatures, excess air, raw material feed are required to observe and maintain required values. To control the all the parameters it is require proper instrumentation system in the plant for smooth operation of plant.

Production /Manufacturing Process

The process of sponge iron manufacturing involves removal of oxygen from iron ore. Sponge Iron also called as Direct-Reduced Iron (DRI) is produced from direct reduction of iron ore (in the form of lumps, pellets or fines) by a reducing gas using fuel i.e. natural gas or coal. The reducing gas is a mixture majority of Hydrogen (H2) and Carbon Monoxide (CO) which acts as reducing agent. This process of directly reducing the iron ore in solid form by reducing gases is called direct reduction. In this process coal will be used for producing reducer gas and the process will be carried out in a Horizontal Rotary Kiln. The finished product i.e. sponge Iron observed under a microscope, resembles a honeycomb structure, which looks spongy in texture. Hence the name is called sponge iron. The reduction of Iron Ore can be achieved by using either carbon bearing material, such as non-coking coal or a suitable reducing gas in the form of reformed natural gas. The processes employing coal are known as solid- reluctant of coal-based processes while those employing reducing gases are known as gas-based processes. The basic reactions in this process are as follows:

C + O2 = CO2

CO2 + C = 2CO

Fe2O3 + CO = Fe2O3 + CO2

Fe3O4 + CO = FeO + CO2

FeO + CO = Fe + CO2

Process

Non-coking coal and iron ore along with limestone in the required size range and quantity are continuously fed into the feed – end of the inclined rotary kiln through a feed pipe. The materials move along the length of the kiln due to its inclination and rotation. Air is blown in through required number of air tubes suitably located along the length of the kiln. At the feed-end of the kiln air is blown in through nozzles for drying and pre heating of the charge. Initial heating of the kiln is carried through a central oil burner located at the discharge feed end. As the charge moves through the kiln, it is heated by the hot gases, which flow in the opposite direction to the charge (i.e. counter current flow). The initial part of the kiln (about 30%) is called the pre heating zone, where moisture in the charge and volatiles in the coal are removed / burnt off as waste gases.

The required heat in this zone is provided by the combustion of the feed coal. The remaining portion of the kiln is called as the reduction zone. In this zone, oxygen in the iron ore is removed leaving metallic iron as per the following chemical reaction.

$C + O_2 = CO_2$

$CO_2 + C = 2CO$

$Fe_2O_3 + CO = Fe_2O_3 + CO_2$

$Fe_3O_4 + CO = FeO + CO_2$

$FeO + CO = Fe + CO_2$

The CO is generated for the above reaction according to $CO_2 + C = 2CO$, at temperature above 900 deg. C, carbon monoxide will combine with the oxygen in the iron ore forming carbon dioxide and thus reduce the ore to metallic state. Higher the temperature, the faster would be the oxygen removal.

After the removal of oxygen and grater is the metallization of sponge iron. Metallization levels can roughly be checked by density of the sponge iron. It can also be judged by the metallic luster if a sample is rubbed against a rough surface.

After the iron ore has been metallic to the desired level, sponge iron and residual char are discharged from the kiln into a rotary drum type cooler. In the cooler sponge iron is cooled to below 250 deg. C before the material is discharged on to a belt conveyor.

If the sponge iron were exposed to air at high temperatures (i.e. above 250 deg C) it would tend to re oxidize. It is therefore, necessary that the temperature of the product at the point of discharge from the cooler is as close as possible to the ambient temperature. The reduction process occurs in solid state.

The crucial factor in this reduction process is the controlled combustion of coal and its conversion to carbon monoxide to remove oxygen from the iron ore. The overall process extends to a period of 10 to 12 hours inside the kiln. During this time, iron ore is optimally reduced and the hot reduced sponge iron along with semi-burnt coal is discharged to a rotary cooler for indirect cooling to a temperature of around 120°C.

Sponge iron being magnetic in nature, the discharge from cooler main drive consisting of sponge iron, chars & other contaminations are routed through electromagnetic separators, to separate other impurities from sponge iron. The product is then screened in size fractions of lump (+3mm) and fines (0-3 mm). Separate bins are installed to preserve its quality, reduce re oxidation and facilitate faster loading on to the trucks.

The schematic layout of a DRI Plant is given below:

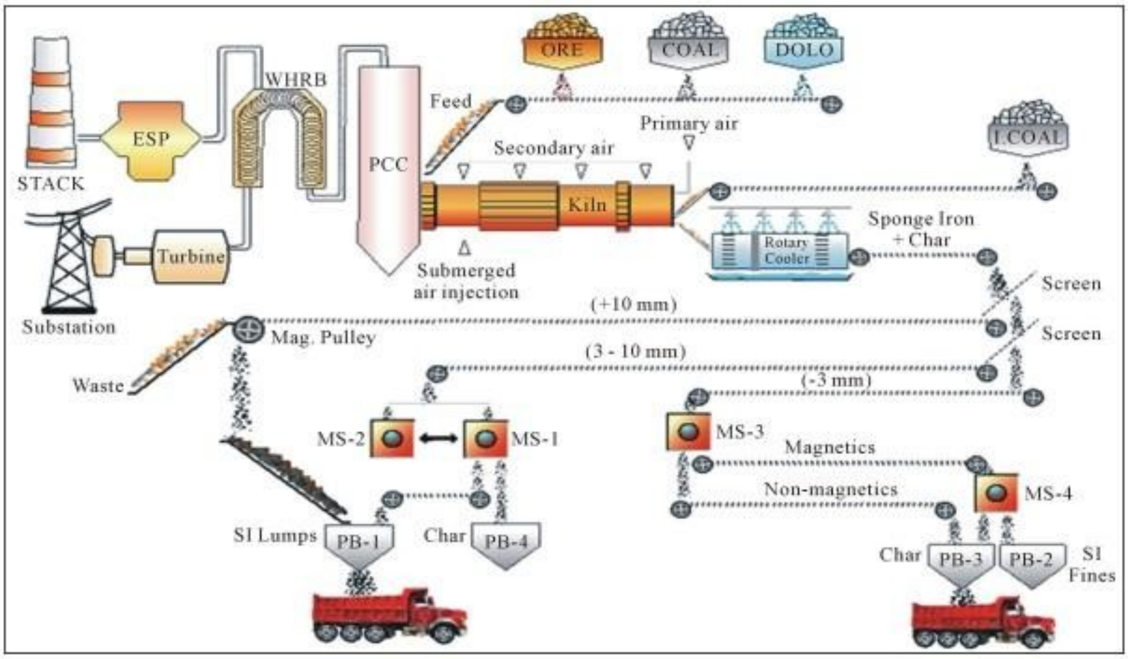


Figure VII : The schematic layout of a DRI Plant

3.5.2 Waste Heat Recovery System:

Waste heat recovery system to generate Power

In Sponge Iron manufacturing, flue gases are generated with a temperature of 900- 1000 deg.C during the process. This heat is cooled without utilizing heat by supplying the air by using FD fans. The heat content in the flue gas is enough to generate the power by installing the waste heat recovery system i.e. boiler. The high temperature flue gases are pass through the boiler for generate the steam and that can be used in turbine to generate the power.

Background

All sponge Iron Manufacturing Industries are coal based industries and flue gases are generated during the process which have higher temperature i.e.900-1000 Deg C. These industries are operated throughout the year. At present all industries are not utilizing the heat from the flue gases and cooled by FD/GCT system before sending to ESP. Thus power generation using generated flue gases are one of energy conservation opportunities in sponge iron plants by installing waste heat recovery system.

Energy Conservation Potential

In 1000 TPD coal based sponge iron plants, during the process at least 120000 m3/hr flue gases are generated and having the temperature of 900-1000 0C. The total power generated in sponge iron plants are depends on installed capacity of sponge iron plants.

Technical Specifications

For 1000 TPD Sponge Iron Plant Technical specification is as follows,

S.no.	Parameter	Unit Value	Design Parameter
1	Type of Boiler	Four Pass	Horizontal
			Water Tube
			Natural Circulation
			Single Drum Boiler
2	Steam Pressure	Kg/C m2	66
3	Steam Temperature	Deg C	485
4	Steam Flow	TPD	100
5	Flue Gas Temp.	Deg C	950
6	Installed Capacity of Sponge Iron Plant	TPD	1000
7	Total No of Sponge Iron Plant	Unit	2
8	Flue Gas Flow Per Hour Per Unit	Nm3/Hr	120000
9	Flue Gas Outlet Temp.	Deg C	180
10	WHRB Power Plant Capacity	MW	30

After installing 2 Kilns of 500 TPD for sponge Iron, Waste heat from these two Kilns are 24 MW Possible.

The gases are reduced to around 180 Deg C for the economizer. After the economizer, the gases are let into a ESP which is provided to reduce the dust emission level. An ID fan has been provided to take care of the gas draft losses in the system. The steam turbine is of multistage horizontal spindle condensing type turbine. The turbine is provided with gear unit capable of continuously transmitting the necessary power and designed for speed reduction ratios for the turbine.

Availability of Technology /Equipment

Power generation from waste heat gases Technology is proven in sponge Iron plants and operating successfully in many sponge Iron plants across the world. The technology is available and manufacturing in India/China by few major companies.

The following benefits are expected by Installing waste heat recovery Power plant using flue gases during the process in sponge iron plants.

- Heat from flue gases is used for power generation. No other raw material is required for power generation.
- Reduction in environment Pollution
- Generated power can be used in SMS which is high power requirement industry. This will save the energy cost.
- Reduce the GHG emissions.

3.5.3 Steel Melting Shop

The principle of melting in IF is that a high voltage electrical source from a primary coil induces a low voltage, high current in the metal or secondary coil. IF uses the heat produced by the eddy currents generated by a high-frequency alternating field. The alternating magnetic field produced by the high-frequency current induces powerful eddy currents in the charge resulting in very fast heating.

Features:

- An Induction Furnace requires an electric coil to produce the charge.
- The crucible in which the metal is placed is made of stronger materials that can resist the required heat, and the electric coil itself is cooled by a water system so that it does not overheat or melt.

Construction:

- The electrical coil is placed inside of the crucible, which holds the metal to be melted. This crucible is divided into two different parts. The lower section holds the melt in its purest form, the metal as the manufacturers desires it, while the higher section is used to remove the slag or the contaminants that rise to the surface of the melt.
- Crucibles may also be equipped with strong lids to lessen how much air has access to the melting metal until it is poured out, making a purer melt.
- Coreless Induction Furnace shall be used by OSL.

Coreless Induction Furnace

- The heart of the furnace is the coil, which consists of a hollow section of heavy- duty, high conductivity copper tubing which is wound in the form of a helical coil.
- Coil shape is contained within a steel shell and magnetic shielding is used to prevent heating of the supporting shell.
- To protect it from overheating, the coil is water-cooled, the water being recirculated after cooling in a cooling tower.
- The shell is supported on trunnions on which the furnace tilts to facilitate pouring.
- The crucible is formed by ramming a granular refractory between the coil and a hollow internal former which is melted away with the first heat leaving a sintered lining.

The furnace has two separate electrical systems,

- for the cooling system, furnace tilting, and instrumentation, and
- for the induction coil power.

The power for the induction coil is fed from a 3-phase, high voltage, high amperage electrical line. The power unit converts the voltage and frequency of the main supply, to that required for electrical melting. Frequencies used in induction melting vary from 50 cycles per second (mains frequency) to 10,000 cycles per second (high frequency). The higher the operating frequency, the greater the maximum amount of power that can be applied to the furnace of given capacity and the lower the amount of turbulence- induced.

When the charge material is molten, the interaction of the magnetic field and the electrical currents flowing in the induction coil produce a stirring action within the molten metal. This stirring action forces the molten metal to rise upwards in the center causing the characteristic meniscus on the surface of the metal.

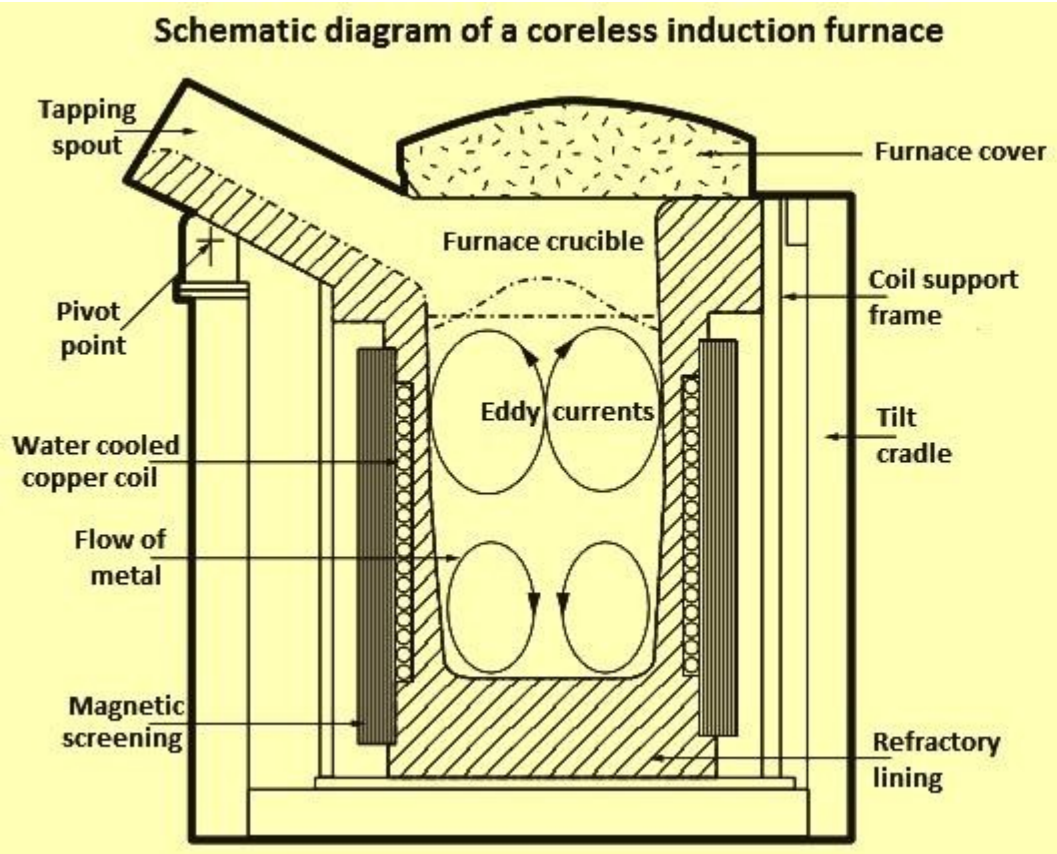


Figure VIII : Coreless Induction Furnace

PROCESS DESCRIPTION:

Induction Furnace Consist of:

1. Furnace
2. Water-cooled induction coil
3. Magnetic Yokes
4. Water-cooled Cables
5. Tilting Cylinder

1. **Furnace:**

The furnace consists of a steel structure fabricated from rolled steel sections and plates. The furnace is provided with a tilting stand, which is grouted to the foundation. Mounted on the tilting stand are two spherical bearing Crucible structures. The furnace frame consists of columns with a dished bottom. The platform is integrated with the crucible structure.

2. **Water Cooled Induction Coil:**

Induction coils are water-cooled copper conductors created from copper tubing which is readily formed into the shape of the coil for the induction heating process. As water flows through them, induction heating coils themselves do not get hot. The coil is radially supported using magnetic yokes.

3. **Magnetic Yokes:**

The component comprises silicon steel sheets which are tightly arranged together, wherein aluminium alloy plates are arranged at the two ends of the silicon steel sheets; stainless clamping plates fixedly clamp the silicon steel sheets and the aluminium alloy plates; the stainless clamping plates and the silicon steel sheets are welded together, and the working temperature is less than 55 ^{o}C. The magnetic yoke component is characterized in that by a non-magnetic material and technology, the condition that the temperature of a magnetic yoke of the magnetic yoke component on the current market is required to be cooled by a water-cooling device is broken through, the structure is simpler, the containing area between the magnetic yoke and an inducer is increased because the water-cooling device is omitted, the magnetic shielding effect is better, and under the same power, the working temperature is always kept within a normal range value and never goes beyond 55 ^{o}C.

4. Water Cooled Cables:

Power is fed to the crucible (induction coil) using flexible water-cooled cables. These allow for raising, lowering and swinging of the electrodes. Furnaces usually operate between two and four cables per phase. The water-cooled cable generally consists of multiple copper wire strands which are soldered or crimped to copper terminals at either end of the cable. The copper cable is covered with a rubber hose which is secured at the terminals with nonmagnetic stainless-steel bands.

5. Tilting Cylinder:

The furnace is tilted using hydraulic cylinders. These cylinders are subjected to high dynamic loads and therefore need to be designed and built for extremely heavy-duty service. Backpressure values are provided such that in the event of hose failure the furnace returns in a controlled manner. High-pressure hoses connect the hydraulic pipeline to the tilting cylinders allowing radial movement.

Operation of Induction Furnace

Charge Preparation and Charging: The raw materials are weighed and kept near the furnace on the furnace charging floor before starting the melting. The charge is to be free from all the foreign materials including sand, dirt and oil/grease. Rusty scrap not only takes more time to melt but also contains less metal per charging. For every 1 % slag formed at 1500 deg C, the energy loss is 10 kWh/t. The scrap is to be clean. The exact weight of the ferro-alloys is to be kept ready since the ferro-alloys are very expensive and their handling not only reduces wastage but also reduces the time lost in their addition.

The maximum size of a single piece of metal/scrap is not to be more than one-third of the diameter of the furnace crucible. It avoids the problem of bridging. Moreover, each charge is to be around 10 % of the crucible volume. Also, there are not to be any sharp edges, particularly in the case of heavy and bulky scrap, as this can damage the refractory lining of the furnace. Further, the furnace is not to be charged beyond the coil level, i.e. charging the furnace to its capacity. It is to be understood that as furnace lining wears out, the charging can slightly increase.

The charge sequence is to be followed. Bigger size metal is to be charged first followed by charging the smaller size and gaps are to be filled by turnings and boring. The use of baled steel scrap and loose borings (machining chips) is to be controlled. Charge driers and pre-heaters are to be used to remove moisture, pre-heat the charge, and remove any oil or grease. The introduction of wet scrap in the melt is to be avoided as this can cause an explosion.

Melting and Making Ready the Heat

The furnace must be always run with full power. This not only reduces batch duration but also improves energy efficiency. By the use of furnace cover, the radiation heat loss can be reduced substantially. The build-up of slag on furnace walls is to be avoided. Typical slag build-up takes place near the neck, above coil level where agitation effect is less. The quantity of flux used for slag removal is important. Typically flux consumption is less than 1 kg per ton of steel. Tools are to be used for de-slagging. Tools with the flathead are to be used instead of a rod or bar for de-slagging. They are more effective and take very little time Process control through melt processor leads to fewer interruptions. Typically process control reduces interruptions by 2 minutes to 4 minutes. The spectral testing laboratory is to be located near to steel melting shop to avoid waiting time for the chemical analysis of the heat and slag samples. Un-necessary super-heating of the liquid steel is to be avoided. Superheating by 50 deg C can increase furnace-specific energy consumption by 25 kWh/t.

Tapping of The Heat

The plant layout plays an important role in determining the distance travelled by the liquid steel in the ladle and the temperature drop. The ladle size is to be optimized to minimize the heat losses and to empty the furnace in the shortest possible time. The melting is needed to be synchronized with the casting of the liquid steel. Liquid steel is not to wait in the furnace. The ladle pre-heater is to be used to avoid a drop in the temperature. The use of liquid steel to pre-heat the ladle is quite energy-intensive and expensive. The quantity of liquid steel left in the ladle is to be as low as possible. The ladle covering compound is to be used to minimize the temperature drop due to the radiation losses from the ladle top.

Production of Mild Steel by Induction Furnace

A large tonnage of mild steel is made globally through the IF route. While producing this steel, the chemistry of the end product is controlled. The chemical analysis of all the input materials is to be done to have a decision on the charge mix. After completing 50% charging of the input materials, a bath sample is analysed for chemical composition. Based on the chemical analysis of the bath sample at this stage, calculations are made for further additions of the metallics. If the bath sample at this stage shows a high percentage of carbon, sulphur and phosphorus, then the sponge iron content of the charge is to be increased. The final bath sample is taken when 80 % melting is completed. Based on the analysis of this sample, there is another adjustment made in the charge. The lower content of carbon in the sample is corrected by increasing the quantity of pig iron/charge iron in the charge. Silicon and manganese in the metal are oxidized by the iron oxide of the sponge iron. Sulphur and phosphorus are also diluted by the sponge iron. Because of the use of sponge iron, the trace elements in the steel made in the IF remains under control.

The steps involved in operation of induction furnace are shown in Figure below.

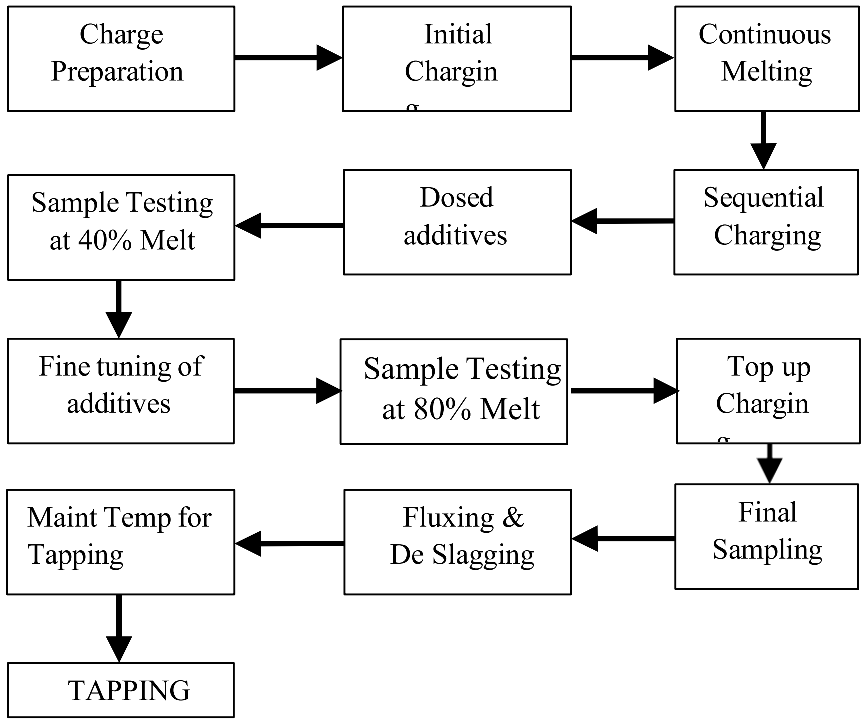


Figure IX : Stages of operation during steelmaking in an induction furnace

Process control and automation

The project envisages all the modern concepts for control of all of the functions taking place so that a detailed knowledge of quality of liquid steel and costs can be collected. Computers and programmable logic control (PLC) devices in control systems of varying degrees of complexity are to be installed. These systems will perform several functions which can be classified under the headings of (i) process automation, (ii) process monitoring, (iii) information display and recording, and (iv) interfacing with other furnaces and control systems.

Process automation

The most advanced automation systems will be deployed to control the steelmaking cycle from the selection of charge materials to the tapping of the liquid steel and also interface with other management systems. For functioning, these systems will collate information on charge weight, time and power input. The charge weight is obtained from load cells or input from the operator while time is known from the internal clock of the device which is reset at the start of each heat. Power is derived from the voltage and current measurements for the furnace coil. The energy input is then calculated and compared with a set value which is determined from the experience of the manufacturer with similar furnaces and can be altered by the operator to suit the individual case. When the set value is reached the furnace is automatically switched off and the charge is molten at around the target temperature. Measurement of these parameters will be ensured reasonably accurate, however variation in the charge and how it lies in the furnace results in varying induced energy so that the temperature obtained varies between the heats. The next stage will be to superheat the metal to the set tapping temperature which will be achieved by accurate dip measurement of the liquid metal, with the result either being directly fed to the control system.

Between melting and superheating, the metal will be de-slagged, sampled and composition altered to meet specification. If required, the control system will hold the temperature at any set value by calculating the optimum power level to do it. In this way an accurate control will be kept on the energy supplied, avoiding high energy cost and excessive temperature.

The control systems will also be used for other automatic operations such as

(i) cold starting furnace, and

(ii) sintering of a new lining. In these cases, temperature data is provided by thermocouples and the system controls the temperature by varying the power input.

Process monitoring

While controlling the steelmaking operation, the system will also monitor the auxiliaries such as water, hydraulics, power supply and fume extraction system. When a problem occurs, an alarm display will alert the operator. A long-term record can be kept of the coil current and its trends at a particular voltage as any increase can indicate lining wear. Hence, the system can provide the operator an indication when the refractory needs replacing.

Information display and recording

The control system will provide the information and the more complex systems do it at all levels from operator to management. A visual display unit (VDU) will give information on energy consumption, power, temperature and metal weight in the furnace during melting, holding and superheating. The data will be frequently shown in a graphical form to assist in reading the information. There will be different menu screens for different functions such as (i) to indicate alarms, (ii) to fit the lining, or (iii) to tap. A slave monitor will duplicate the display away from the furnace platform.

Production Capacity:

Description	Unit	Capacity
Billet production	Tons/ Annum	356052.63
Furnace Charge	Tons/ Annum	434210.53
Operating days	Days/ Annum	330
Tap to tap time	Min	130-140
No of heats (Each Furnace)	Per day	11 Approx
Furnace capacity (each furnace)	Tons	30
No of furnace sets	No	3

Material Balance SMS (3x30T; Considering 330 days)

Input			Output		
Materials	**Specific consumption**	**Quantity TPA**	**Products**	**Specific consumption**	**Quantity TPA**
DRI	0.76	330000.00	Billet	0.82	356052.63
Scrap	0.224	97263.16	APCD Dust	0.04	15197.37
Ferro Alloy	0.011	4776.32	Slag/ Impurities	0.10	43421.05
Met Coke	0.005	2171.05	LOI (Loss on Ignition)	0.05	19539.47
Total Input	**1.0**	**434210.53**	**Total Output**	**1.00**	**434210.53**

3.5.4 Continuous Casting Machine (CCM):

CCM will be used to continuously cast the liquid steel in required cross section and in length. It consists of Tundish, Mould, Bow with withdrawal mechanism, straightening mechanism and cooling bed, hydraulic system for withdrawal mechanism, water pumps and cooling towers for water spray on the withdrawn section as well as on the cooling bed. Dummy bar will be provided to start the casting. Tundish is a rectangular vessel, lined with refractory and having discharge nozzle with pneumatically operated gate. A stand is erected over the CCM where the ladle is stationed for discharging the liquid into CCM. Mould is made of copper with water cooled jacked surrounding it to keep cool. Its cross-section in the bottom is of the size of which billet is to be drawn. Initially the dummy for of the same size is kept inserted. When the liquid steel is poured in the mould, the dummy bar is drawn slowly, so that the liquid steel in partially frozen state comes out of the mould. Water spray nozzles are installed to spray water over the just drawn billet to cool it further and to harden the skin of the drawn billet.

Process Description:

In the continuous casting, molten steel is poured from the tundish in the water-cooled mould, and partially solidified billet (hereafter called strand) is withdrawn from the bottom of the mould and hot billets are directly charged to the Rolling Mill.

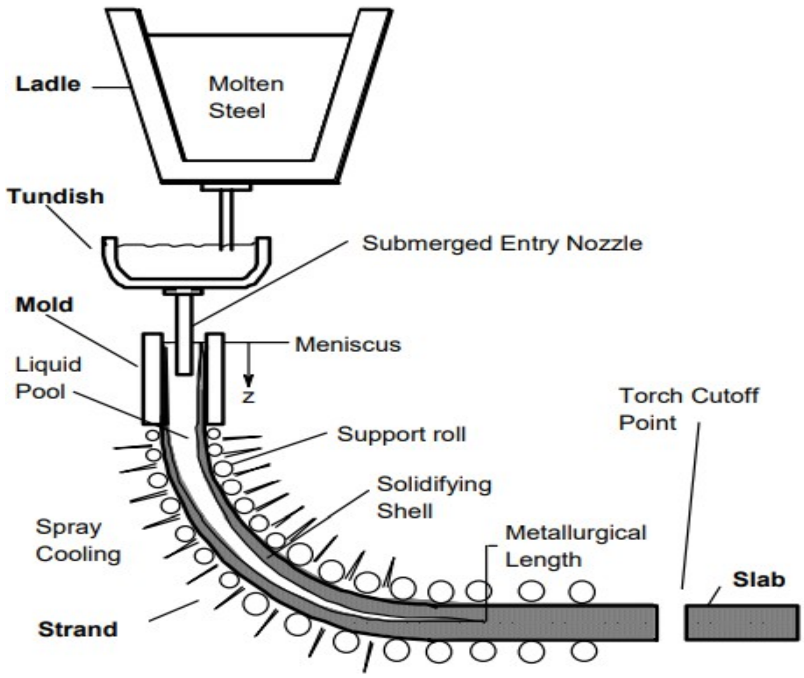


Figure X: Continuous Casting Machine

Working Principle

In the continuous casting process, molten steel flows from a ladle, through a tundish into the mould. It should be protected from exposure to air by a slag cover over each vessel and by ceramic nozzles between vessels. Once in the mould, the molten steel freezes against the water-cooled copper mould walls to form a solid shell. Drive rolls lower in the machine continuously withdraw the shell from the mould at a rate or "casting speed" that matches the flow of incoming metal, so the process ideally runs in a steady-state. Below the mould exit, the solidifying steel shell acts as a container to support the remaining liquid. Rolls support the steel to minimize bulging due to the ferrostatic pressure. Water and air mist spray cool the surface of the strand between rolls to maintain its surface temperature until the molten core is solid. After the center is completely solid (at the "metallurgical length") the strand can be torch cut into slabs.

Transfer of Liquid Steel:

There are two steps involved in transfer (or demand) from the ladle to the moulds.

- The steel must be transferred (or teemed) from the ladle to the tundish.
- The steel is transferred from the tundish to the moulds.

a) Tundish

Tundish is a refractory-lined vessel. Liquid steel is usually tapped from the ladle into the tundish. The stream is shrouded as it enters from ladle to tundish. The functions of the tundish are:

- The reservoir of molten steel
- Distributor
- Inclusion removal

(i) The reservoir of molten steel:

Tundish acts as a reservoir for molten steel. It supplies molten steel in presence of a slag cover to all continuous casting moulds constantly and continuously at a constant steel flow rate. The flow rate is maintained constant by maintaining a constant steel bath height in the tundish through teeming of molten steel from the ladle. The number of moulds is 2 strands for Billet casting machines. During sequence casting and ladle change over periods, the tundish supplies molten steel to the moulds.

(ii) Distributor:

Tundish distributes molten steel to different moulds of the continuous casting machine at constant flow rant and superheats which is required for stand similarly concerning solidification microstructure. Control of superheat is required in all the moulds to reduce break-out. The location of the ladles stream in the tundish is symmetric to the center of the tundish which is depending on the number of moulds. For 2 strands of tundishes, a ladle stream is at the center of the tundish.

(iii) Inclusion removal:

Tundish helps to remove inclusions during the process of continuous casting. The whole idea is to utilize the residence time available before steel leaves the tundish. During the average residence time., inclusion removal can be exercised. For this purpose, flow of steel melt in the tundish has to be modified to accelerate the inclusion removal. The Inclusion removal is a two-step unit operation, namely floatation and absorption by a flux added on the surface of the tundish.

b) Mould:

Mould is the heart of continuous casting. In the water-cooled mould, the molten stream enters from the tundish into a mould in presence of flux through the submerged nozzle immersed in the liquid steel. The solidification of steel begins in the mould. The casting powder is added onto the top of molten steel in the mould. It melts and penetrates between the surface of the mould and the solidifying strand to minimize friction. Control of the height of molten steel in the mould is crucial for the success of the continuous casting machine. The solidification begins from the meniscus of steel level in the mould. Mould level sensors are used to control the meniscus level in the mould.

The flux melts and enters into the gap between the mould surface and solidified strand. Moulds are made of copper alloys. Small amounts of alloying elements are added to increase the strength. Mould is tapered to reduce the air gap formation. Taper is typically 1% of the mould length. The mould is oscillated up and down to withdraw the partially solidified strand. The oscillated frequency can be varied. Steel level in the mould is controlled, that is the meniscus for smooth caster operation. Sensors are used to control the meniscus level.

The functions of mould flux are.

- Inclusion absorption capability.
- Prevention of oxidation.
- Minimization of heat losses.
- Flux on melting enters into the air gap and provides lubrication.

3.5.5 Online Hot Charging Rolling Mill:

1. Raw Material i.e. Billet coming from CCM in red hot condition is cut either by Gas Cutting or automatic hot billet Shearing Machine. In the proposed plant automatic hot billet shear machines are going to be installed with each strand. The gas cutting facility will be maintained as a backup to the hot billet shearing machine.

2. After the Billet is cut into required length, then pushed out to rolling stands for re-rolling. Steel Pieces are rolled through all stands in order to get required shape of finished goods i.e. rerolled product etc.

Material Balance : For Hot Charging Rolling Mill

Input		Output	
Material In	**Qty.**	**Products**	**Quantity TPA**
Hot MS Billet from Induction Furnace	356052.63	Rolling Mill (Hot charge) to Produce MS Rerolled products (i.e. Bar, Strips, Angle, Channel, Flat etc.)	338250.00
		Mill Scale/Burning Loss	2848.42
		Miss Roll / End Cutting	10681.58
		Short Length	4272.63
Total Input	**356,052.63**	**Total Output**	**356,052.63**

Finish Product:

S.No	Mill Description	Product
1.	Rolling Mill for Rebar	Rebar 8-32mm. Wire Rod 5.5-12mm.
2.	Rolling Mill for Light Section	Angle: 25-50mm Flat: 18-50mm Round: ∅10-25mm Square: 9-25mm
3.	Rolling Mill for Strip	Width: 200-440mm Thickness :1.2-4mm
4.	Rolling Mill for Medium Section	Angle:50-150mm I-Beam: 75-300mm

3.5.6 ERW Pipe Manufacturing Unit:

The company has planned to set up a new ERW pipe manufacturing unit for the production of 1,00,000 TPA of ERW pipe. In Electric Resistance Welding (ERW) process, pipe is manufactured by cold-forming a flat sheet of steel into a cylindrical shape. Then current is passed between the two edges of the steel cylinder to heat the steel to a point at which the edges are forced together to form a bond without the use of welding filler material. Several Electric Resistance Welding (ERW) processes are available for pipe production. The two main types of ERW are:

- **High Frequency Welding**
- **Rotary Contact Wheel Welding.**

High Frequency Welding

Initially ERW manufacturing process used low frequency A.C. current to heat the edges. This low frequency process was used from the 1920's until 1970. In 1970, the low frequency process was superseded by a high frequency ERW process which produced a higher quality weld. Over time, the welds of low frequency ERW pipe was found to be susceptible to selective seam corrosion, hook cracks, and inadequate bonding of the seams, so low frequency ERW is no longer used to manufacture pipe. The high frequency ERW process is still being used in pipe manufacturing.

There are two types of High Frequency ERW processes:

(a) High Frequency Induction Welding
(b) High Frequency Contact Welding

(a) In High Frequency Induction Welding, the weld current is transmitted to the material through a work coil in front of the weld point. The work coil does not contact the pipe. The electrical current is induced into the pipe material through magnetic fields that surround the pipe. High frequency induction welding eliminates contact marks and reduces the setup required when changing pipe size.

(b) In High Frequency Contact Welding, the weld current is transmitted to the material through contacts that ride on the strip. The weld power is applied directly to the pipe, which makes this process more electrically efficient than high frequency induction welding. Because it is more efficient, it is well-suited to large diameter and high wall thickness pipe production.

Both the High Frequency Induction Welding and High Frequency Contact Welding processes have been presented below:

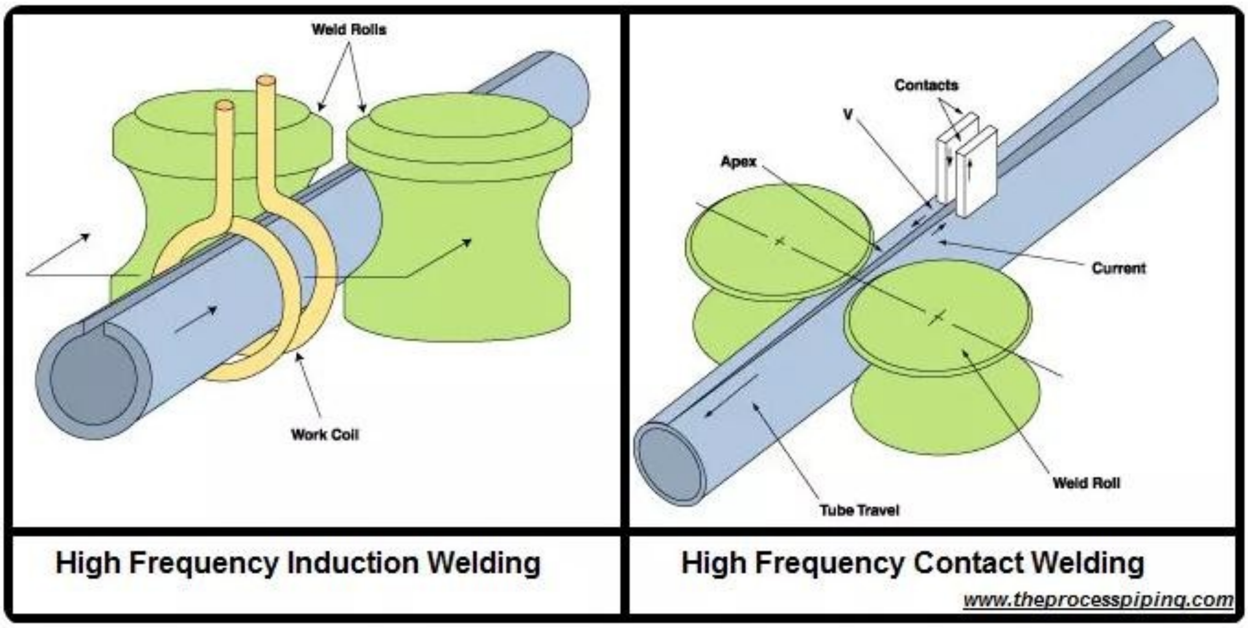
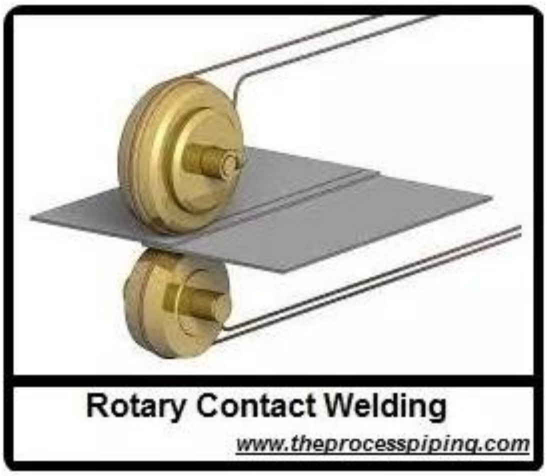


Figure XI : High Frequency Induction Welding and High Frequency Contact Welding processes.

Rotary contact welding

In Rotary Contact Wheel Welding, the electrical current is transmitted through a contact wheel at the weld point. The contact wheel also applies some of the forge pressure necessary for the welding process. The three main types of rotary contact wheel welders are AC, DC, and square wave. In all three power supplies, electrical current is transferred by brush assemblies that engage slip rings attached to a rotating shaft that supports the contact wheels. These contact wheels transfer the current to the strip edges.



Rotary contact welding is useful for applications that cannot accommodate an impeder inside the pipe or tube. Examples of this are small-diameter refrigeration grade tube and tube that is painted on the ID immediately after the welding process.

A few advantages to note with ERW pipe:

- There are no fusion metals used during the manufacturing process. This means that the pipe is extremely strong and durable.
- The weld seam cannot be seen or felt. This is a major difference when looking at the double submerged arc welding process, which creates an obvious welded bead that might need to be eliminated.
- With the advances in high-frequency electric currents for welding, the process is far easier and safer.

The conventional ERW manufacturing procedures of steel pipes and tubes are shown in below:

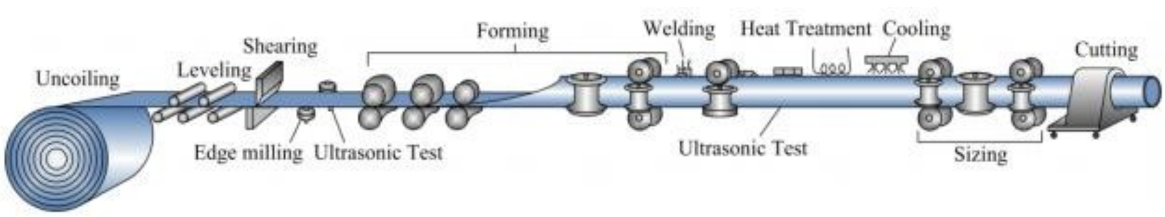


Figure XII : Conventional electric resistance welding (ERW) manufacturing procedures of the steel pipes and tubes.

S.No	Tube Mill Line	Outside Diameter	Thickness
1.	Tube Mill I	Min 12.7 Max 38.10 mm	Min 1.0 Max 2.5 mm
2.	Tube Mill II	Min 33.7 Max 114.3 mm	Min 1.2 Max 6.0 mm
3.	Tube Mill III	Min 60.3 Max 168.3 mm	Min 1.5 Max 7.0 mm

Material Balance : Tube Mill

Input			Output		
Materials	**Specific consumption**	**Quantity TPA**	**Products**	**Specific consumption**	**Quantity TPA**
Cold Rolled Strip	1.0	**101052.63**	Tube (Finished)	0.95	96000.00
			Edge Trimming at Slitter	0.016	1616.84
			End Shear Cut	0.002	202.11
			Bead Trimming	0.015	1515.79
			Cut Losses (LOI)	0.005	505.26
			Rejections/SL	0.012	1212.63
Total Input	**1.0**	**101052.63**	**Total Output**	**1.00**	**101052.63**

3.5.7 Galvanising Unit:

- Galvanizing, or galvanization, is a manufacturing process where a coating of zinc is applied to steel or iron to offer protection and prevent rusting. There are several galvanizing processes available, but the most commonly offered and used method is called hot-dip galvanizing.
- Galvanized steel is among the most popular steel types because of its extended durability, having the strength and formability of steel plus corrosion protection of the zinc-iron coating. The zinc protects the base metal by acting as a barrier to corrosive elements, and the sacrificial nature of the coating results in a long- lasting and high-quality steel product.
- This versatility makes it applicable to a variety of projects and industries, including agriculture, solar, automotive, construction, and so on. Below, we aim to provide a comprehensive description of how galvanized steel is processed, different galvanization methods, its benefits, and how it is used in these various industries.
- Galvanized steel is preferred for its durability and corrosion-resistance. But for as strong as the finished material is, the process is surprisingly simple and straightforward.
  The steps in the galvanizing process are as follows:

  Galvanizing steel consists of just three steps:
  - Surface Preparation.
  - Galvanizing.
  - Inspection.

1. Surface Preparation

Like most things, the quality of a finished galvanized product is directly influenced by the amount of effort put into the preparation. Poor surface prep can cause the galvanization to fail, but galvanization has built-in quality control of sorts. The zinc used in galvanizing won’t react with an unclean steel surface. This makes it easy to see poorly coated areas as soon as the piece is pulled out of the galvanization tank. Unclean areas remain uncoated, allowing technicians to correct the problem right away. Process Flow diagram are shown in **Figure XII.**

Surface preparation consists of three steps:

a. Degreasing/Caustic Cleaning:

An acidic "bath" removes organic contaminants from the steel surface. Dirt, paint, grease, and oil can be removed this way. Materials that cannot be removed via the bath include: epoxies, vinyls, asphalt, and slag. These contaminants are removed by degreasing, grit-blasting, sand-blasting, or other mechanical means.

b. Picking:

A dilute solution of acid is used to remove mill scale and rust from the steel. Instead of or in place of the acid, an abrasive cleaner or air blasted sand could be used.

c. Fluxing:

Fluxing is a zinc ammonium chloride solution that removes remaining rust particles and adds a protective layer to the steel, helping to prevent any further oxides from forming on the surface before it can be galvanized.

2. Galvanizing

Once the steel is ready for galvanizing, it is immersed in molten zinc. The chemistry of the bath must meet certain standards, requiring at least 98% pure zinc and a temperature of 750°C During the bath, the zinc reacts and bonds with iron in the steel to form an extremely hard alloy layer that strengthens and protects the steel. Excess zinc is removed from the galvanized piece by draining, vibrating and/or centrifuge but the metallic reaction continues as long as the steel remains near bath temperature. Galvanized pieces are cooled by immersing them in a passive solution, in water, or by being left in open air.

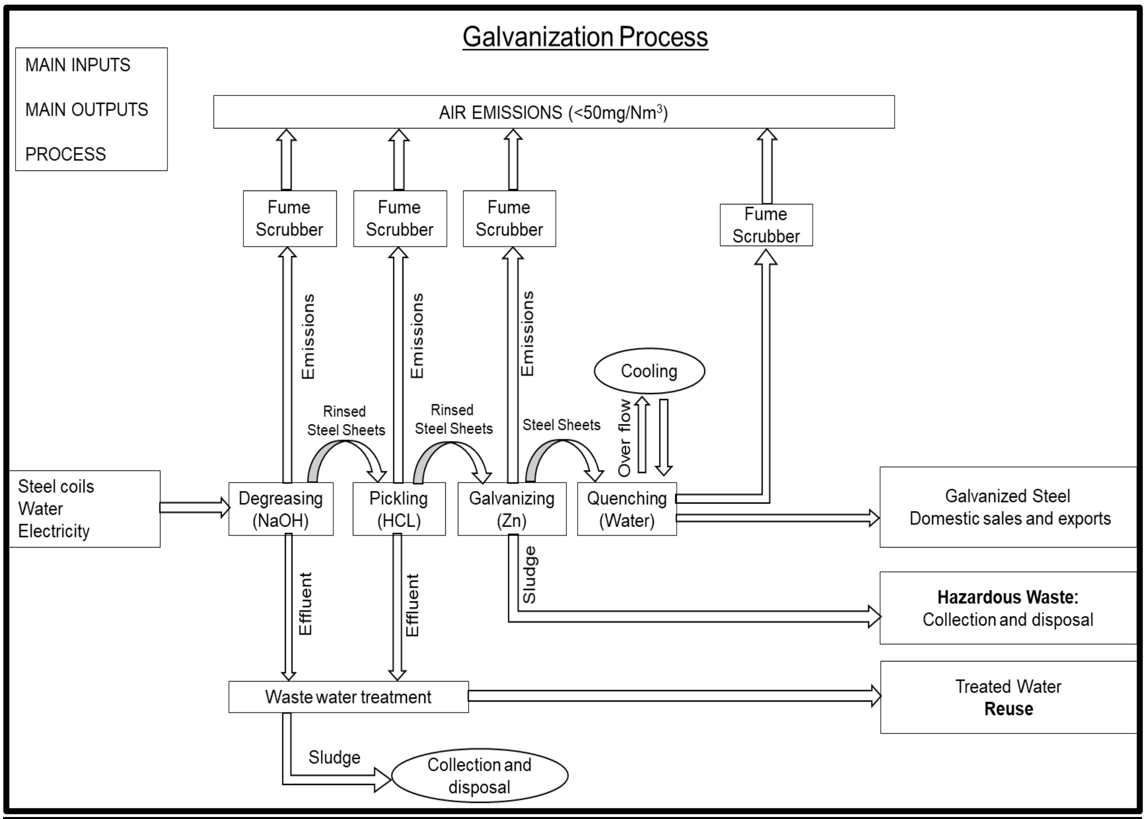


Figure XIII : Process Flow of Galvanisation Process

3. Inspection

The last step, the inspection process, is also the quickest. Coating thickness and surface condition are both closely scrutinized for integrity. Several tests are used to determine coating thickness, uniformity, adherence, and appearance. Results are compared to long-established and accepted standards set by the ASTM, the International Standards Organization (ISO) etc.

What are the advantages of galvanized steel?

- Many different industries utilize galvanized steel primarily because it has such a wide array of benefits for industries to take advantage of, including having:
- Low initial cost compared to most treated steels. In addition, galvanized steel is immediately ready to use when delivered. It does not require additional preparation of the surface, inspections, painting/coatings, etc. sparing companies more costs on their end.
- Longer life. With galvanization, a piece of industrial steel is expected to last more than 50 years in average environments and can last over 20 years with severe water exposure. There is no maintenance required. The increased durability of the steel's finished product also increases the product's reliability.
- The sacrificial anode ensures that any damaged steel is protected by the surrounding zinc coating. It doesn't matter if the steel section is completely exposed; the zinc will still corrode first. The coating will corrode preferentially to the steel, creating sacrificial protection to the areas that are damaged.
- Rust resistance from the zinc coating. The iron elements in steel are incredibly prone to rust, but the addition of zinc acts as a protective buffer between the steel and any moisture or oxygen. Galvanized steel is very protective, including sharp corners and recesses that couldn't be protected with other coatings, making it resistant to damage.

Galvanized metals are used everywhere:

- The bodies of cars and many bicycles are made from galvanized metals.
- Some drinking water pipes are still made from galvanized steel.
- Cool rolled sheet metal is also frequently galvanized. Nuts, bolts, tools, and wires of all kinds are now galvanized because it is a cheap process, and helps boost the metal's lifespan!
- Galvanized steel, in particular, is often what is used in modern "steel frame" buildings. Galvanized steel is also used to create structures like balconies, verandahs, staircases, ladders, walkways, and more.
- Galvanized metal is the ideal choice if your project will live outside after it's done. Fences, roofs, outdoor walkways, these are all great choices for galvanized metal.

Different methods of galvanizing

As stated above, there are several different processes for galvanizing steel.

1. Hot-Dip Galvanizing

The first and foremost method for galvanization is hot-dip galvanizing. The process is very similar to what the name suggests! In this method, steel or iron is dipped in a molten pool of zinc that maintains a temperature of around 860°F (460 °C). This molten bath begins a metallurgical bond between the zinc and the receiving metal. After the metal is pulled from the bath, it reacts to being exposed to the atmosphere, and the pure zinc mixes with oxygen to form zinc oxide. The zinc-oxide further reacts to carbon dioxide and forms zinc carbonate, which makes up the final protective coating on the material. The tell-tale sign of a hot-dipped galvanized material is the presence of a crystalline-like pattern on the surface, sometimes referred to as "spangle."

The hot-dipped galvanizing method is an economical choice that can be quickly executed on both simple and complex shapes.

The new coated material can be worked and machined similarly to uncoated materials. Galvanized steel can be used in high-temperature applications up to 392 °F, but use in temperatures exceeding that level will cause the zinc-carbonate layer to peel off.

2. Galvannealing

Galvannealing is the outcome of combining the annealing and hot-dip galvanizing processes to produce a specialized coating on steel. The process of galvanization is performed via hot-dipping and instantaneous annealing, which produces a matte gray finish.

Galvannealed steel is a zinc-iron alloy product, where the base metal is coated by the hot-dip process, then heated to induce alloying between the molten zinc coating and the steel. The resulting finish is a dull matte surface. Galvannealed steel is conducive to welding and the surface is excellent for paint adhesion.

3. Pre-galvanizing

Also similar to the hot-dip galvanizing method, but performed at the very first stage of production. Pre-galvanizing is a process that involves rolling the sheet metal through a cleaning agent to quickly prime material for galvanizing. Then, the metal is passed through a pool of molten liquid zinc and is immediately recoiled. The primary advantage of this method is that coils of steel sheets can be rapidly galvanized on a large scale with a more unified coating than the traditional hot-dipped method.

4. Electro galvanizing

The most unique of these outlined methods, electro galvanizing does not involve dipping the material in a molten vat of zinc. Instead, an electric current is introduced to an electrolyte solution that is applied to the steel, which reduces positively charged zinc ions to zinc metal – which is then deposited on the positively charged steel. Like pre- galvanizing, this method is typically done at the first stage of production.

Galvanizing advanced high-strength steel

Out of the above process, we have **selected to install Hot-Dip Galvanising Technology** as followings are the advantages over electro galvanising.

- Steel is said to be dipped in molten zinc bath @ 460 degree Celsius to achieve the coat for hot dip galvanization.
- Hot dip galvanization produces on steel surface Fe-Zn alloy layer, leaving behind pure zinc coating on outer surface. This alloy is quite hard. Damage is not caused to the coating by the usual abrasion.

- Hot dip galvanization is known to have very high life averaging between 20 to 50 years.

Pollution control for Zinc processing:

Zinc treated in a vessel, consumption will be 30,000 TPA and zinc dross will be 1800 TPA, collected at the bottom of the vessel, it will be sold to the authorized hazardous waste processer.

Process Flow for Galvanizing Unit

- Pickling/cleaning/ Rinsing of MS Pipe or Tube to remove surface oxides and impurities
- Mechanical Scraping of the surface
- Annealing if required
- Pre-treatment, cleaning and degreasing will be carried out followed by pickling
- Galvanizing by immersing of Rerolled product/ Pipe in the molten bath of Zinc followed by water quenching
- Inspection of Galvanized
- Dispatch to market

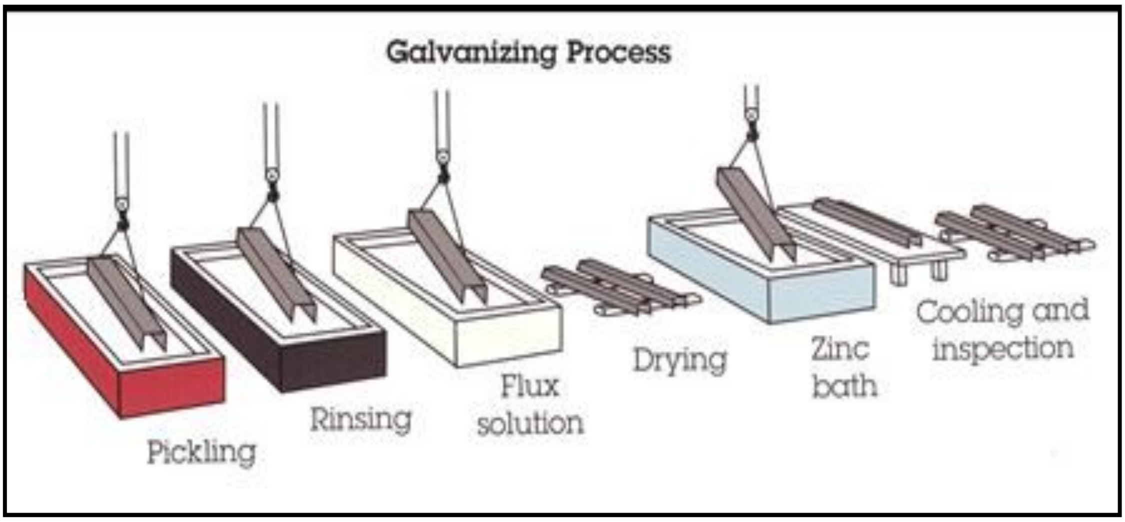


Figure XIV : Process Line of Galvanisation Process

Material Balance : Galvanizing Unit

Input		Output	
Item	**Qty**	**Item**	**Qty**
Rerolled Steel Products (Wire, MS Pipe, Structure etc)	60000.00	Galvanizing Steel product	60000.00
Zinc	1800.00	Zinc Dross	180.00
Lead	600.00	Zinc Ash	180.00
Acid etc	240.00	Lead skimming	18.00
Furnace Oil	1560.00	ETP Sludge	18.00
Lime for neutralization	15.00	Loss to Atmosphere	3819.00
	64215.00		**64215.00**

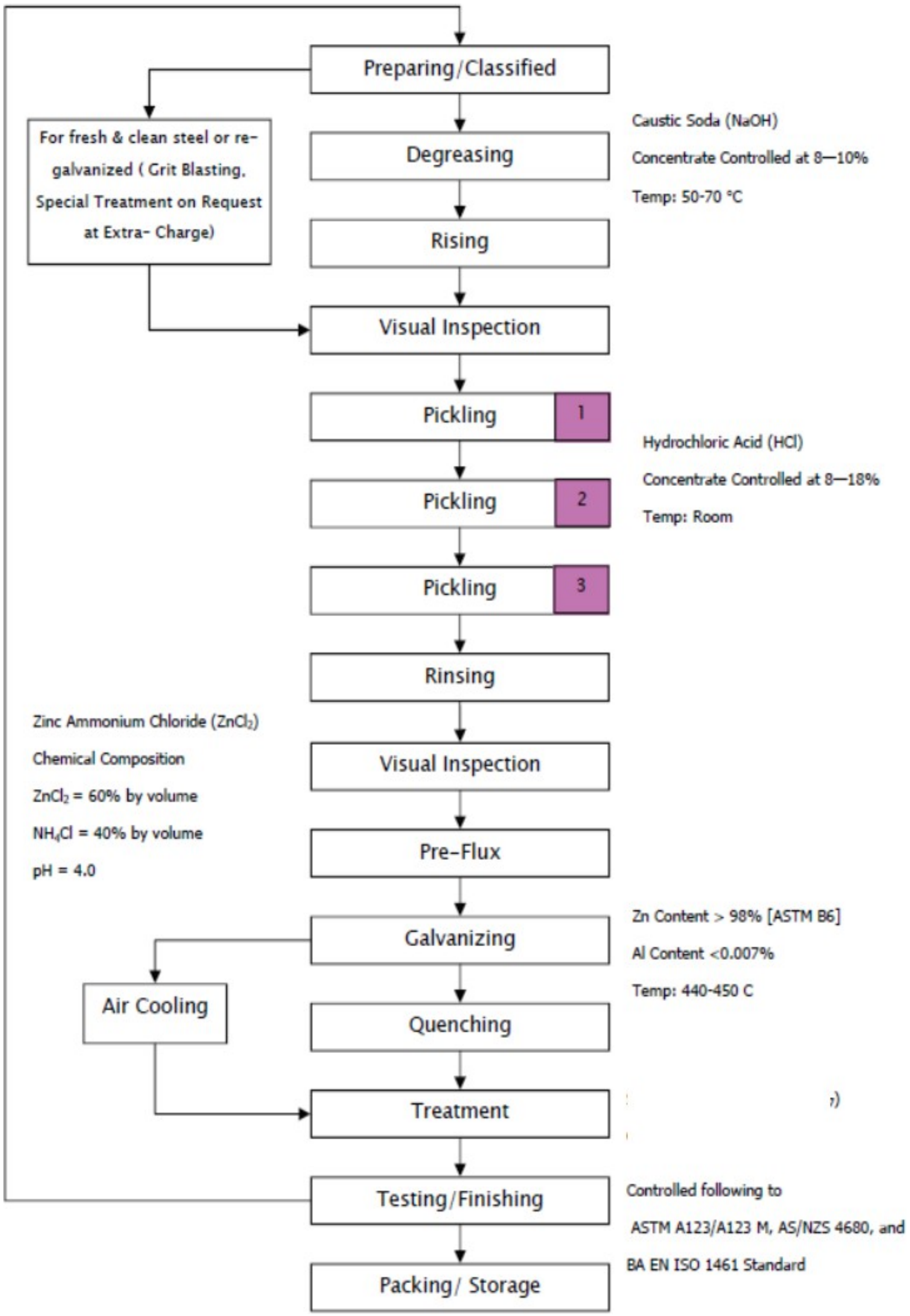


Figure XV : Various Stages of Galvanisation Process

3.5.8 PEB Shed Manufacturing Unit:

Pre Engineered Buildings (PEB) are the buildings which are engineered at a factory and assembled at site. Usually PEBs are steel structures. Built-up sections are fabricated at the factory to exact size, transported to site and assembled at site with bolted connections. This type of Structural Concept is generally used to build Industrial Buildings, Metro Stations, and Warehouses etc.

Pre-Engineered Steel Buildings use a combination of built-up sections, hot rolled sections and cold formed elements which provide the basic steel frame work with a choice of single skin sheeting with added insulation or insulated sandwich panels for roofing and wall cladding. The concept is designed to provide a complete building envelope system which is air tight, energy efficient, optimum in weight and cost and, above all, designed to fit user requirement like a well fitted glove.

These Pre-Engineered Steel Buildings can be fitted with different structural accessories including mezzanine floors, canopies, fascias, interior partitions, crane systems etc. The building is made water-tight by use of special mastic beads, filler strips and trims. This is a very versatile building system and can be finished internally to serve any required function and accessorized externally to achieve attractive and distinctive architectural styles. It is most suitable for any low-rise building and offers numerous benefits over conventional buildings.
Pre-engineered buildings are generally low rise buildings; however the maximum eave heights can go upto 25 to 30 metres. Low rise buildings are ideal for offices, houses, showrooms, shop fronts etc. The application of pre-engineered concept to low rise buildings is very economical and speedy. Buildings can be constructed in less than half the normal time especially when complimented with other engineered sub-systems.

The most common and economical type of low-rise building is a building with ground floor and two intermediate floors plus roof. The roof of a low rise building may be flat or sloped. Intermediate floors of low rise buildings are made of mezzanine systems. Single storeyed houses for living take minimum time for construction and can be built in any type of geographic location like extreme cold hilly areas, high rain prone areas, plain land, extreme hot climatic zones etc.

Various systems in PEB

Primary System

Primary system consists of tapered or parallel columns and tapered beams which are called as rafters. The base of the columns can be either pinned or fixed based on the load requirements. Lengths of these members are generally restricted to 12m for ease of transports. Joints are connected with high tensile bolts.

Secondary System

Secondary structural system consists of Purlins(roof), grits (side cladding) and Eave Struts (at eaves) stiffened with slag rods. This also includes flange stifferners which connects the untied flanges of the PEB primary structure to secondary system. Some of the commonly used secondary system are Lipped C or Lipped Z purlins, MS rods and Lipped Angles. These are generally cold formed sections conforming to IS: 801.

Wind Bracing System

There are two types of wind bracing systems. The first one is Rod bracing system and the second one is portal system. Each type of system is chosen based on the design and functional requirement of the structure.

Roofing & Cladding System

Roofing and cladding system can be with single skin zinc and aluminum coated steel sheets, GI sheets, both of which could be bare or color coated; It could with double skin sheets with or without insulation material in between; It could be sandwich panels with steel sheets outside and PUF/PIR/Mineral Wool/Glass wool core inside. Roofing and cladding could have skylights with Poly Carbonate / PVC or FRP sheets.

Accessories

Accessories include, Toubo ventilators, Ridge vents, Flashings, trims, Gutters,

Finishing

Primary structural members are generally finished with shot peening, Sand blasting, and two coats of anti-corrosive primers, followed by two coats of paints to specifications. secondary members or either painted after sand blasting or Galvanized to 275 gsmor above based on the requirement.

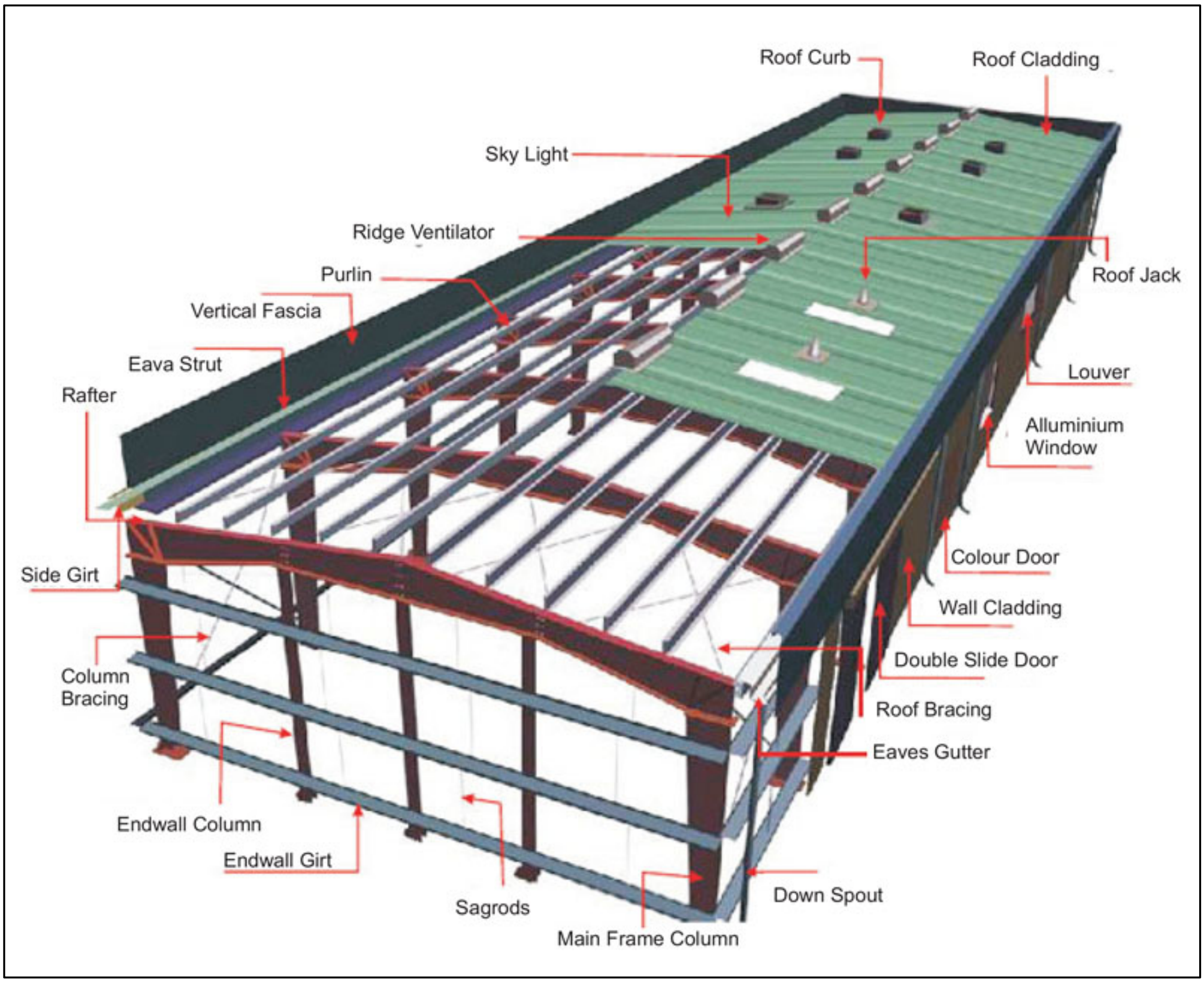


Figure XVI : PEB Structure & Components

List of Machinery for PEB Shed & Roofing Manufacturing Unit:

S.No	Description	Quantity	
1.	EOT Cranes 20MT Capacity	4	Nos.
2.	Cut to Length Line	1	No.
3.	CNC Plasma & Oxy-Fuel Cutting Machine	2	Nos.
4.	Saw-Welders for H-Beams - Gantry Type	2	Nos.
5.	Mig Welding Machine 400 amps	30	Nos.
6.	Other Tools & Tackles	1	Lot.
7.	Bending Machine	1	No.
8.	Shearing Machine	1	No.
9.	Radial Drilling Machine	2	Nos.
10.	Punching Machine for Multipurpose use.	3	No.
11.	Hydraulic Presss 500 Ton Capacity - 4 Piller Type for Bend Removal, Bending etc	1	No.
12.	Purlin Roll Forming Machine	1	No.
13.	Shot Blasting Unit		
a.	Manual with 2-Headers	1	No.
b.	Automatic for H-Beam	1	No.
14.	Painting Unit & Air Compressors	1	Lot.
15.	Profile Machine for Corrugation	3	Nos.

3.5.9 Cold Drawing Line & Wire Mesh Unit:

COLD DRAWING LINE (FOR REBAR) :

Cold-drawn rebar is steel rebar that has been processed by drawing it through a die at room temperature, which improves its dimensional accuracy, straightness, and surface finish, while also enhancing its mechanical properties. This process, known as cold drawing, involves pulling the hot-rolled steel bar through a die, which reduces its cross-sectional area and alters its shape. The resulting cold-drawn rebar is then used in reinforced concrete structures to enhance their strength and durability.

What is Cold Drawing?

Cold drawing is a metalworking process where a steel bar is pulled through a die (a tool with a specific shape and size) at room temperature. This process deforms the steel, changing its shape and dimensions while increasing its strength and improving its surface finish.

How it Works:

- **Starting Material:** Hot-rolled steel bars are the starting material for cold drawing.
- **Die:** A die with a smaller opening than the incoming bar is used.
- **Drawing:** The steel bar is pulled through the die, reducing its cross-sectional area and increasing its length.
- **Properties:** This process results in improved dimensional tolerances, better straightness, a smoother surface, and increased strength of the steel.

Cold Drawn Rebar in Construction:

Reinforced Concrete:

Cold-drawn rebar is commonly used as a reinforcing material in concrete structures like buildings, bridges, and pavements.

Increased Strength:

The cold drawing process increases the yield strength and tensile strength of the rebar, allowing it to withstand greater loads and stresses.

Improved Performance:

The enhanced properties of cold-drawn rebar contribute to the overall strength, durability, and longevity of reinforced concrete structures.

Advantages of Cold Drawn Rebar:

Improved Dimensional Accuracy:

Cold drawing ensures tighter tolerances, which is crucial for precise construction.

Enhanced Surface Finish:

The smooth surface of cold-drawn rebar reduces friction and improves bond with the concrete.

Increased Strength and Stiffness:

Cold drawing increases the mechanical properties of the steel, making it more resistant to bending and cracking.

Better Straightness:

Cold-drawn rebar is straighter than hot-rolled rebar, making it easier to handle and place in concrete.

Reduced Machining Losses:

The improved surface finish and dimensional accuracy can minimize the need for machining during construction

WIRE MESH UNIT :

Introduction :

Welded wire mesh is the latest development in land wire product industry. The welded wire, generally called reinforcing wire, is mostly used in cement concrete work for construction of buildings, National Highway pavements, runways, dams, airports etc. It is also used for fencing purposes and for partition walls and as a safety guard in engineering workshops.

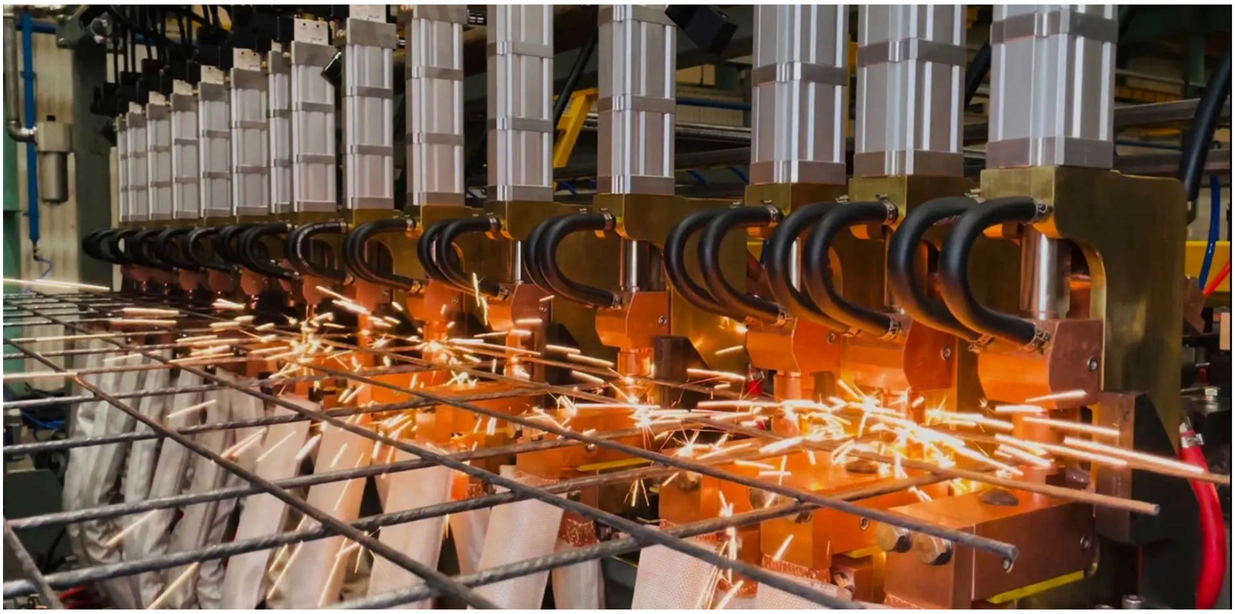
Steel Reinforcement welded wire mesh panels are made of ribbed steel bars bonded via spot welding for slab and wall constructions.

Ribbed steel rod used can improve bonding to the concrete and minimize any concrete cracking that may occur as a result of concrete shrinkage.

Also the feature enables the ribbed steel weld mesh widely used as building materials for block slab structure reinforcing.

Meanwhile, hollowed slabs reinforcement, building wall reinforcement and support wall reinforcement.

In practical uses, it is commonly used with bar chairs as supports.



Deformed Concrete Reinforcing Welded wire mesh is also known as concrete welded steel mesh, reinforcing welded wire mesh, by transverse and longitudinal reinforcement bars together.
Rebar Reinforcement mesh is used to provide tensile strength and crack control to structural concrete elements.

Market Potential

Welded wire mesh is used extensively in constructional work and fencing purposes. The wire mesh is made by automatic welding process, thus saving a lot of human labour and achieving uniformity in distance and quality.

MANUFACTURING PROCESS:

Wire Feeding:

Longitudinal (horizontal) wires are fed into the machine from coils, typically in parallel rows. Cross (transverse) wires are fed in at specific intervals, often after being straightened and cut to the correct length.

Welding:

Electric resistance welding is the most common method, where the wires are welded at each intersection to form a strong bond.

The welding process is automated and controlled by a machine, ensuring consistent weld quality.

Mesh Movement and Cutting:

The welded mesh is moved along the production line, often by servo motors. At the end of the line, the mesh may be cut to the desired length or rolled up for further processing.

Optional Processes:

Trimming: Excess wire may be trimmed from the edges to create a clean, uniform mesh.

Surface Treatment: The mesh may be treated (e.g., galvanized or powder-coated) to enhance its resistance to corrosion.

Quality Control:

Throughout the process, quality control measures are implemented to ensure the mesh meets specified standards.

Packaging and Distribution:

The finished mesh is packaged according to customer specifications.

It is then prepared for distribution to various industries, such as construction, agriculture, and manufacturing.

3.6 Raw Material requirement and Quality:

a. DRI Sponge Iron plant (2x500; Considering 330 days)

Input			Output		
Materials In	**Specific consumption**	**Quantity TPA**	**Products**	**Specific consumption**	**Quantity TPA**
Iron ore	1.75	577,500	Sponge Iron	1	**330,000**
Dolomite	0.05	16,500	Char	0.24	**79,200**
Coal (Higher grade)	1.0	330,000	DRI Fines	0.1	**33,000**
-	-	-	Dust from settling chamber	0.07	**23,100**
-	-	-	Kiln accretion	0.01	**3,300**
-	-	-	Dust from ESP	0.31	**102,300**
-	-	-	LOI	1.07	**353,100**
Total Input	**2.8**	**924,000**	**Total Output**	**2.8**	**924,000**

b. SMS (3x30T; Considering 330 days)

Input			Output		
Materials	**Specific consumption**	**Quantity TPA**	**Products**	**Specific consumption**	**Quantity TPA**
DRI	0.76	330000.00	Billet	0.82	356052.63
Scrap	0.224	97263.16	APCD Dust	0.04	15197.37
Ferro Alloy	0.011	4776.32	Slag/ Impurities	0.10	43421.05
Met Coke	0.005	2171.05	LOI	0.05	19539.47
Total Input	**1.0**	**434210.53**	**Total Output**	**1.00**	**434210.53**

c. Hot Charging Rolling Mill

Input		Output	
Material In	**Qty.**	**Products**	**Quantity TPA**
Hot MS Billet from Induction Furnace	356052.63	**Rolling Mill (Hot charge) to Produce MS Rerolled products (i.e. Bar, Strips, Angle, Channel, Flat etc.)**	338250.00
		Mill Scale/Burning Loss	2848.42
		Miss Roll / End Cutting	10681.58
		Short Length	4272.63
Total Input	356,052.63	**Total Output**	356,052.63

d. Galvanizing Unit

Input		Output	
Material In	**Qty**	**Products**	**Quantity TPA**
Rerolled Steel Products (Wire, MS Pipe, Structure etc)	60000.00	**Galvanizing Steel product**	60000.00
Zinc	1800.00	**Zinc Dross**	180.00
Lead	600.00	**Zinc Ash**	180.00
Acid etc	240.00	**Lead skimming**	18.00
Furnace Oil	1560.00	**ETP Sludge**	18.00
Lime for neutralization	15.00	**Loss to Atmosphere**	3819.00
Total Input	**64215.00**	**Total Output**	**64215.00**

e. **ERW Tube Mill**

Input			Output		
Materials	**Specific consumption**	**Quantity TPA**	**Products**	**Specific consumption**	**Quantity TPA**
Cold Rolled Strip	1.0	**101052.63**	Tube (Finished)	0.95	96000.00
			Edge Trimming at Slitter	0.016	1616.84
			End Shear Cut	0.002	202.11
			Bead Trimming	0.015	1515.79
			COC Cut (LOI)	0.005	505.26
			Rejections/SL	0.012	1212.63
Total Input	**1.0**	**101052.63**	**Total Output**	**1.00**	**101052.63**

Note: ***All the raw material required for proposed plant will be transported through road in tarpaulin covered trucks.***

3.7 Water Requirement and Its Source:

3.7.1 Water Requirement:

Plant Facilities	Circulating Water (KLD)	Makeup Water (KLD)	Recirculation Water (KLD)	Evaporation (KLD)	Discharge as waste (KLD)
DRI (2x500 TPD)	76,150	705	76,122	705	-
WHRB 30 MW	151,200	2,160	149,040	1,848	312
SMS (3x30T)	51,408	640	50,760	576	72
Hot Rolling 338,250 TPA	11,360	97.5	11,216	120	24
Drinking & Sanitation	23.28	23.28	0	3.60	19.2
waste water generated to be used in Ash quenching, Road and RM yard sprinkling & Gardening					(-) 427.2
TOTAL	**290,141**	**3625.78**	**287,138**	**3252.6**	**0**

Note: The above requirement source will be Industrial Water Supply.

3.7.2 Wastewater regeneration

Process Unit	Wastewater Qty. (KLD)	Source	Wastewater management
Industrial	912	Cooling Tower Blowdown	Treated in ETP and then reused in Road quenching, ash quenching, gardening and dust suppression.
	216	Blow Down from Boiler	
Domestic wastewater	28.8	Domestic use for the plant (Toilet, Washing)	Discharged as waste.

The waste generated from the industrial process will be treated in ETP and reused in the process and for dust suppression and waste water generated from domestic use will treated in packaged type STP and used for plantation.

3.8 Environmental Management Plan:

A comprehensive environmental management plan has been framed and implemented to keep the pollution levels within prescribed limits. All the following measures will be practiced.

3.8.1 Air Pollution Control

Table: Air Pollution Control Device

Sl. No.	Name of the Units	Name of APCD	Stack Height (mtr)	No. of Bag filters/ESP	Emission Design
1.	**DRI Kiln**	WHRB Boiler I & II (ESP)	70	2	<30mg/Nm^3
		Kiln discharge end (Dust extraction with Bag filter)	30	2	
		Coal Circuit, Iron ore circuit (Dust extraction with Bag filter)	30	2	
		Stock House (Dust extraction with Bag filter)	30	2	
		Cooler Discharge end (Dust extraction with Bag filter)	30	2	
		Product House & Product separation Bin (Dust extraction with Bag filter)	30	2	
		Coal Injection (Dust extraction with Bag filter)	30	2	
		Coal Handling (Dust extraction with Bag filter)	30	2	
3.	**SMS**	(Fume extraction with Bag filter)	30	1	<30mg/Nm^3
4.	**Hot Rolling Mill**	(Dust extraction with Bag filter)	30	1	<30mg/Nm^3
5.	**Cold Rolling Mill**	(Dust extraction with Bag filter)	30	1	<30mg/Nm^3
		Pickling Line (Fume Extraction System)	30	1	

3.8.2 Water Pollution Control:

The plant shall be designed on the modern concept of zero discharge by adopting measures as mentioned below:

- Adoption of re-circulation systems.
- The blow down of cooling water systems containing suspended particulates and floating oils would be clarified in the Effluent Treatment Plant (ETP).
- The clarified water would be recycled to the process for dust suppression.

Wastewater generation, treatment, and disposal

Each of the production facilities will have primary effluent treatment for recycling purposes. The effluent stored after treatment and primary recycling in respective Plant units are planned to be utilized for controlling fugitive dust emissions and cooling of slag, dry fogging in the closed zone raw material handling areas, and also for plant greenbelt and landscape development.

Table: Wastewater regeneration

Process Unit	Wastewater Qty. (KLD)	Source	Wastewater management
Industrial	912	Cooling Tower Blowdown	Treated in ETP and then reused in Road quenching, ash quenching, gardening and dust suppression.
	216	Blow Down from Boiler	
Domestic wastewater	28.8	Domestic use for the plant (Toilet, Washing)	Discharged as waste.

3.8.3 Zero discharge concepts:

To have a 'near-zero discharge' of the proposed plant, the CT blow-down along with all other primary treated wastewater streams with high TDS levels would be used for slag cooling or greenbelt development purpose as the existing practice.

3.8.4 Work zone comfort:

In addition to natural ventilation, selected areas like control rooms would be provided with air conditioning. Where ambient temperature is above 35°C, man coolers would be provided in selected areas of the shop floors. Mechanical sweeper/industrial vacuum cleaner, air circulator, and water mopped would be used to keep the shop floor clean from settled dust. The process control rooms, cubicles, etc will be air-conditioned.

3.8.5 Green Belt Development/Plantation:

- Greenbelt/plantation will be done in 33% of the total plant area.
- A three-tier plantation is proposed comprising of an outermost belt of taller trees which will act as a barrier.
- Greenbelt development along the plant boundary attenuates noise level, arrests dust, and improves the surrounding environment.

3.8.6 Waste generation and Management:

Table: Solid and hazardous waste Generation and Management

Facility	Waste	Quantity (TPA)	Management
Solid Waste			
Rolling Mill	Scrap (Miss Roll & End Cuts)	10,000	Recycle in IF (used in house)
	Mill scale	5,000	Sale in Market
Cold Rolling mill	Scrap	10,000	Recycle in IF (used in house)
DRI Kilns	Kiln Accretion	6765	Brick Manufacturing & for Ash Bricks/Blocks Industry/ Agarbati Industry (sale in market)
	DRI Fines	67,650	
	Dust from Settling Chamber	47,355	
	Dust from ESP	209,715	
	Dolochar	1,62,360	As AFBC Boiler fuel (used in House)
S M S	Slag/ Impurities	101,880	After recovery of metal in-house, disposed to construction contractors for road & construction filings.
	APCD Dust	24,906	Disposed to construction contractors with crushed slag for road & construction filings.
Hazardous Waste			
Waste Description	**Category of Hazardous Waste as per HWM Rules, 2016**	**Quantity**	**Mode of Disposal**
Used oil	Cat. 5.1	1 KL/yr	Will be collected by Authorized Vendor
Zinc dross	Cat. 6.1	1800 TPA	Sold to Authorized Hazardous waste processer
Oily Sludge	Cat. 4.1	0.2 KL/yr	Will be stored in demarcated area and disposed to CHWTSDF
The residue of the oil Storage tank	Cat. 5.2	0.01 KL/yr	

Chapter – 4.0
Site analysis

4.1 Connectivity:

The company's proposed site is located at about 130.0 Kms from boundary of Dar es Salaam. The project site is along the Railway Line and the facilities will be located away from the Highway. The nearest railway station is Ruvu SGR Station (around 5 Kms.). The nearest airport is located at Dar es Salaam Airport at a distance of about 144 kms. from the site.

Details of buffer zone of Project site

Sr. No.	Particulars	Details
1	Nearest Highway	A7, Dar es Salaam-Morogoro-Iringa Road 38kms from Proposed Site.
2	Nearest Airport	Julius Nyerere International Airport, Dar es Salaam. 144 kms from Proposed Site.
3	Nearest Railway Station	Ruvu SGR Station 5kms from the Proposed Site.
	Nearest Interstate Boundary	Dar es Salaam. 130 kms from the Proposed Site.
4	Nearest Village	Mahundi/Msua/Dutumi Village
6	Nearest water body	-
7	Forest	-

4.2 Land Form, land use and land ownership:

Land Form : Flat Terrain.

Land Use : Industrial.

Land Ownership : Sole Owned by the **M/s Tanzania Steel Industry Limited.**

The proposed Plant along with the manufacturing facilities of the company will be located at **Plot No: S19, Kwala Industrial Park, Opposite Kwala Dry Port, Kwala Village, Kibaha District, Tanzania**

4.3 Topography along with Google map:

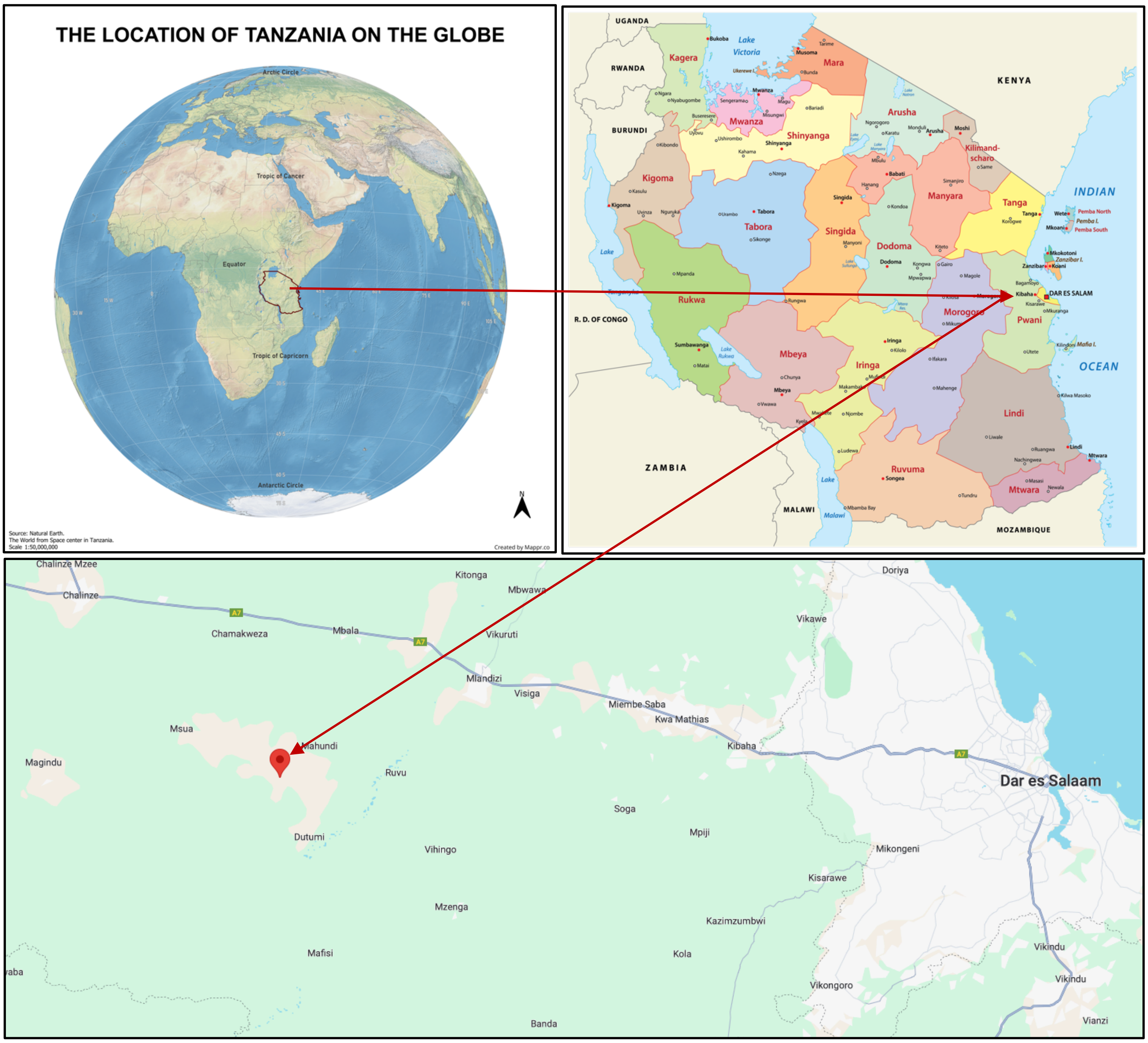
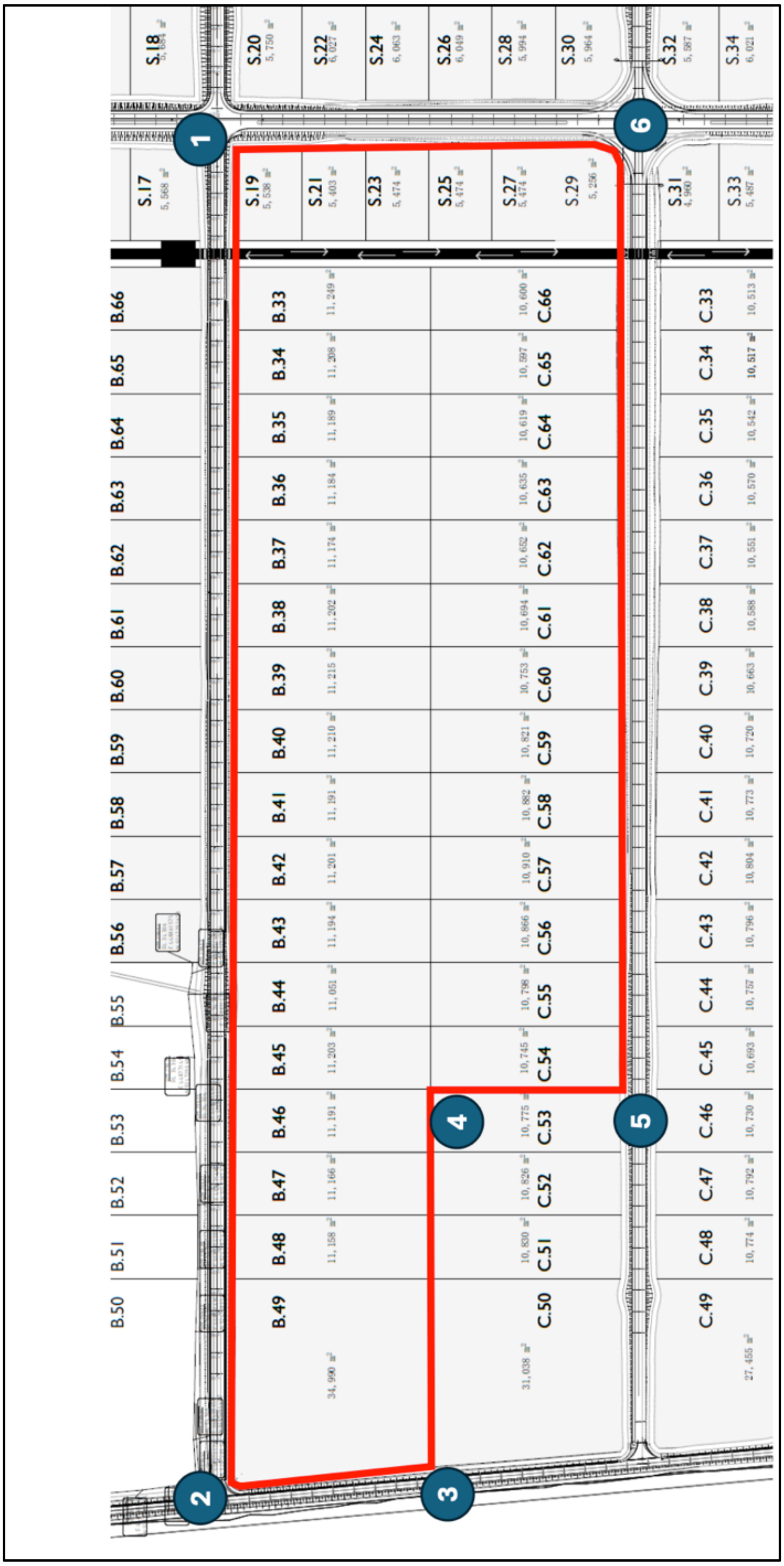


Fig I : General Location of the Project Site.

Figure II : Google Image of the Project Site



Marker Points	Coordinates (google maps)
1	6°48'45.8"S 38°32'41.9"E
2	6°48'45.9"S 38°31'58.9"E
3	6°48'50.7"S 38°31'59.4"E
4	6°48'52.4"S 38°32'13.8"E
5	6°48'56.1"S 38°32'13.8"E
6	6°48'55.4"S 38°32'41.9"E

Figure :III Plot Plan

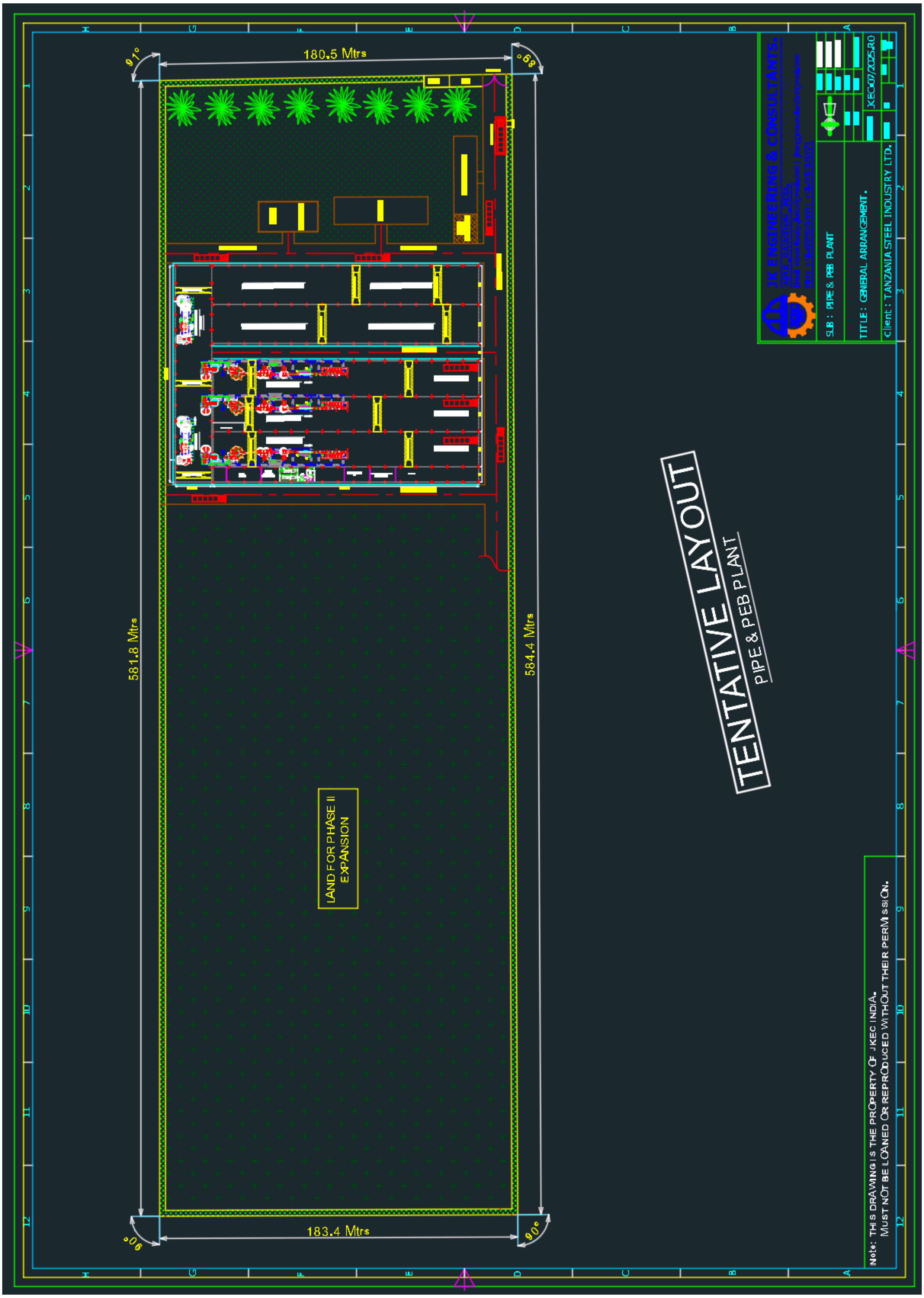


Figure IV : Phase I-General Arrangement Layout

Chapter 5.0

Planning Brief

5.1 Planning Concept:

M/s. Tanzania Steel Industry Limited, have proposed to setup the Integrated Steel & Power Plants as per below Planning model:

Srl.	Description	Unit Capacity	Phase
1.	DRI Sponge Iron plant (500 TPD x2 Kiln each)	330,000 TPY	4th
2.	Power generation from WHRB (15 MW x 2 Nos.)	30 MW	
3.	Steel Melt Shop (Induction Furnace) (30 T x 3 Nos.)	356,053 TPY	3rd
4.	Rolling Mill for Rebar	338250 TPY	
5.	Rolling Mill for Light Section		
6.	Rolling Mill for Strip		
7.	Rolling Mill for Medium Section		
8.	Galvanizing Unit for Tube & Sheet.	60,000 TPY	2nd
9.	Cold Drawing Line & Wire Mesh Unit	30,000 TPY	
10.	ERW Pipe Manufacturing Unit	96,000 TPY	1st
11.	PEB Shed & Roofing Manufacturing Unit	49,200 TPY	

Key factors that would facilitate successful and timely project implementation are:

- Proper choice of technology and machinery supplies.
- Adequate diligence in formulating the technical concept and system design/ selection of plant.
- Establishment of an efficient system for project planning and monitoring including reporting procedure for progressive review and coordination.
- Customization of project execution as per the suitability of the promoter.

The key features of the project includes:

- Zero Wastage: There is No Wastage. Waste Products or By Products of one Process is used as the Input / Output of another Process.
- Energy Efficiency: Energy efficiency is a key measure both for the Environment and for the Industry itself to remain competitive. No stone is left unturned while in the planning stage to tap, conserve and use/ re-use energy at every possible stage. The plant will utilize its captive power for the total operation of the plant.

Advantages of this Project can be enumerated as below:

- Absolute Value addition project by gainful utilization of wastes and converting intermediate products into End-use product.
- Improved productivity of the existing process.
- Reduced operation cost due to sharing of infrastructures and manpower with existing unit reducing overhead by almost 30%.
- Dedicated and experienced workforce already available.
- Ready market for the finished products.
- Technology is not new and has already been successfully time tested for decades in number of world-wide plants.
- Proximity to Raw Material sources (Coal & Iron ore) thereby minimal transportation and impact on environment and infrastructure.
- Employment generation in Rural / Semi Urban area along with improvement in socio economic status of population around the Project site.

5.2 Population Projection:

There is no human settlement in the close vicinity of project site. The manpower requirement will be sourced from the local area to the extent possible, hence not much of settlement of outside people in the area.

5.3 Assessment of Infrastructure Demand (Physical & Social):

Basic infrastructure demand for nearby area would be first to have internal roads, availability of clean and pure drinking water, availability of good schools, availability of Hospitals, community halls, Toilets, easy and faster means of transportation and connectivity to nearby town and city, availability of uninterrupted electricity etc.

5.4 Amenities/Facilities:

Facilities like canteen, rest room, toilet will be provided in the proposed plant as basic facility to workers. No other additional facilities are proposed.

Chapter 6.0
Proposed infrastructure

6.1 Industrial Area (Processing Area)

M/s. Tanzania Steel Industry Limited, have proposed to setup the Integrated Steel & Power Plants at **KWALA Industrial Park, KIBAHA District, TANZANIA** in which company will install DRI Sponge Iron Plant, WHRB for heat recovery & Power Generation, Steel Melt Shop, Online Hot Charging Rolling Mill for TMT, Strip, Light & Medium Section, Tubes Mill, Galvanizing Unit for Angles/Tube/Sheets, PEB Shed Manufacturing Unit & Cold Drawing Line & Wire Mesh Unit.

6.2 Green Belt

More than 1/3rd of total land availability is reserved for plantation i.e. greenery.

Greenbelt development plan

• Local DFO will be consulted in developing the green belt.

• Greenbelt of 33% of the area will be developed in the plant premises as per CPCB guidelines.

• 15 m wide greenbelt is being maintained all around the plant.

• The tree species to be selected for the plantation are pollutant tolerant, fast growing, and wind firm, deep rooted. A three-tier plantation is proposed comprising of an outer most belt of taller trees which will act as barrier, middle core acting as air cleaner and the innermost core which may be termed as absorptive layer consisting of trees which are known to be particularly tolerant to pollutants.

- Greenbelt development along the plant boundary attenuates noise level, arrests dust, and improves the surrounding environment.

6.3 Social Infrastructure

Social infrastructure will be developed as per need based in the Villages of the close vicinity of the project. A proper CSR plan will be prepared and implemented in the nearby villages based on the social need.

6.4 Connectivity

The connectivity in terms of traffic, transportation road is already developed and good. There are well connected roads in the area.

6.5 Drinking Water Management

Drinking water facilities will be provided to employees in proposed plant provided by Local Water Authorities.

6.6 Waste water treatment system

M/s Tanzania Steel Industry Ltd will maintained a policy of Zero Liquid Discharge.

- There will be no effluent generation in the DRI plant, SMS & Rolling Mill as closed-circuit cooling system will be adopted.
- Effluent from power plant will be treated and after ensuring compliance with CPCB norms, it will be utilized for dust suppression, ash/ slag conditioning and for greenbelt development.
- Sanitary waste water will be treated in septic tank followed by sub-surface dispersion trench.

6.7 Power Requirement & Supply/Source

Total Power required for proposed project is 70 MW.

Table II: Power Requirement

Sl. No.	Facility Name	Proposed (MW)
1.	DRI Sponge Iron plant (500 TPD x2 Kiln each)	3.0
2.	Power generation from WHRB (15 MW x 2 Nos.)	
3.	Steel Melt Shop (Induction Furnace) (30 T x 3 Nos.)	45.0
4.	Rolling Mill for Rebar	4.0
5.	Rolling Mill for Light Section	3.0
6.	Rolling Mill for Strip	4.0
7.	Rolling Mill for Medium Section	3.0
8.	Galvanizing Unit for Tube & Sheet.	1.5
9.	Cold Drawing Line & Wire Mesh Unit	1.0
10.	ERW Pipe Manufacturing Unit	2.0
11.	PEB Shed & Roofing Manufacturing Unit	1.5
12.	Auxiliary & other loads	2.0
	Total ::	**70.0**
	Company's Own Source of Power Generation (MW):	**30.0**
	Balance (MW), will be procured from State Grid:	**40.0**

Chapter 7.0
Rehabilitation and Resettlement Scheme

No rehabilitation and resettlement plan have been made as no displacement of population is there. Company has purchased directly **397,167 sqm** private land, which will be under industrial usage. The plant and allied activities will provide job opportunities for eligible persons and many will find employment in ancillary & other services connected with this project. Thus, the impact will be significantly beneficial since un-employment and under employment is the main socio-economic problem faced by the people in this area.

Chapter 8.0

Project Schedule & Cost Estimates

8.1 Project Schedule:

M/s Tanzania Steel Industry Limited has initiated to get clearance from the statutory bodies. The site selected and land for the proposed project is an industrial land and no additional land required to establish the project.

The consent required under Air, Water Act will be obtained from the concern department giving details of the process involved.

As the land belongs to non-forest land so no clearance under the Forest Act is required.

Project implementation Schedule:

The project schedule includes various activities like civil works, engineering, procurement, erection and commissioning. It will be imperative to complete many activities before the zero date and soon afterward include:

- Basic engineering
- Clearance from statutory authorities
- Land acquisition
- Preparation and issue of tender document for major technological units.
- Placement of order for major technological units.
- Final Tie-up
- Finalization of terms with overseas agencies if any.

The schedule of implementation of the project is as below:

Particulars	Start	Completion
Civil work	Zero date	04 months
Placement of orders	1 month	06 months
Fabrication	2 months	14- 16th month
Electrical installation	8 months	20-22 month
Trial production		23rd month
Commercial Production		24th Month

8.2 Estimated Project Cost:

Description		Total (USD)
Land Procurement		11,120,676.00
Boundary & Site Development		1,500,000.00
Building and Civil Work		357,000.00
Plant & Machinery & Other Equipment	**Capacity**	
DRI Sponge Iron plant (500 TPD x2 Kiln each)	330,000 TPY	29,406,000.00
Power generation from WHRB (15 MW x 2 Nos.)	30 MW	20,124,000.00
Steel Melt Shop (Induction Furnace) (30 T x 3 Nos.)	356,053 TPY	19,350,500.00
Rolling Mill for Rebar Rolling Mill for Light Section Rolling Mill for Strip Rolling Mill for Medium Section	338,250 TPY	23,991,500.00
Galvanizing Unit for Tube & Sheet.	60,000 TPY	2,380,000.00
Cold Drawing Line & Wire Mesh Unit	30,000 TPY	3,000,000.00
ERW Pipe Manufacturing Unit	96,000 TPY	5,061,000.00
PEB Shed & Roofing Manufacturing Unit	49,200 TPY	3,613,750.00
Electrical Installations – Sub Station & Transformer.		595,000.00
Misc. Fixed Assets – Office, Weigh Bridge etc.		598,000.00
	TOTAL ::	**121,097,426.00**

Chapter 9.0
Analysis of the Proposal

9.1 Financial and social benefit :

With the implementation of the proposed project, the socio-economic status of the local people will improve substantially. Apart from direct earnings for the local people employed, there shall be avenues for secondary trade and business in the area. The land rates will improve in the nearby areas due to the proposed activity. This will help in upliftment of the social status of the people in the area. Educational institutions will also come-up and will lead to improvement of educational status of the people in the area. Annual health check-ups shall be conducted by us and the medical facilities will certainly improve due to the proposed project.

9.2 Socio Economic Objectives :

The management is committed to uplift the standards of living of the villagers by undertaking following activities / responsibilities as the part of Corporate Social Responsibility.

- **Skill Development**
  Since inception of the activities of the company, a policy has been made to appoint trainees in each department to provide skill improvement trainings. Sponge Iron and Steel is becoming a booming sector across the globe and is in need of huge manpower. Upon completion of the project, facilities will be created to impart vocational and internship training to students of nearby engineering, science and polytechnic institutes.
- **Health & Hygiene**
  The company wishes to conduct annual health check up camps for the nearby villages on regular basis as part of its CSR activities.
- **Drinking Water**
  Company will install solar based RO purifier in nearby villages as part of its CSR activities.
- **Education for poor**
  Company will fix scholarships for meritorious and poor students in the nearby villages as part of its CSR activities.

- **Village roads**
  Company will undertake periodic repairs and maintain plantation on both sides of the village roads joining the plant and running adjacent to plant boundaries as part of its CSR activities.
- **Lighting**
  Company will install solar based street lamps at prominent places of the nearby villages as part of its CSR obligations.

9.3 Environment Management Plan:

Air pollution

- The pollutants in the form of gases generated from the Sponge Iron Plant. Adequate measures will be undertaken by installation of ESP with adequate stack height to arrest the emission of pollutants within the stipulations of statutory norms. The plant wise pollution control devices will be installed with adequate stack height as per following table to control the pollutant level below the statutory norms
- Adoption of technology like recovery of dust/ash for re-use as raw material is fulfilling the twin objectives of material conservation and pollution control.
- Proper Dust Suppression is proposed in the premises, sprinkling on internal roads, regular checkup & maintenance of vehicles, it will be ensured that all trucks/dumper will be covered by Tarpaulin.
- Water spraying on coal hip, coal yard and raw material is being done to control the fugitive emissions
- Internal roads are being Tarred / Concreted with installation of water sprinklers to suppress dust due to transportation.

Water Pollution

- The wastewater generated from all the process will be treated in ETP and reused in the process. The domestic wastewater generated will be treated in Packaged Type STP and reused.

Noise Pollution

- Noises from fans, centrifugal pumps, electrical motors etc. will be kept in control so that the ambient noise level shall not exceed 75dBA during daytime and 70dBA during night time. Noise pollution control measures will be provided in respective departments by way of providing silencers soundproofs cubicles / covers and proper selection of less noise prone machinery and by development of green belt.

Solid Waste Management in Pellets plant

- The main solid waste generation from the coal gasifier unit used in Pellets plant Ash and Tar. Ash will be sold to Brick manufacturer and Tar which will be sold to authorized vendors.

Solid Waste Management in Sponge Iron

- The solid waste generation from the Sponge Iron process is Char & Dolochar which will be used in captive power plant & sold to secondary users viz. nearby power plant and dust from ESP will be used for land filling and will sell to brick manufacturing unit

Plantation & Green belt

- The 33% of the total plant area will be developed as green belt.

9.4 Conclusion And Recommendation :

The location is ideally suitable, and steel sector demand gap encourages the investors to invest in project. The project is not likely to cause any significant impact on the existing environment settings. Hence the company is confident to get required sanction from the concerned authorities of State and Centre Government dealing in Environmental Laws.

The proposal is for brown field project based on clean. It is an environment friendly and the project does not depend on Fossil fuel.

Looking in to the Technological and Financial Strength of the Promoters, Financial viability of the Project, we find the project worthy for promotion and implementation.

In view of these facts the Project is recommended from all angles. All concerned are requested to extend their whole-hearted support to the company.