**B. TECHNOLOGY ABSORPTION**

**e) efforts made in technology absorption as per Form B given below**

**FORM - B**

**Form for disclosure of particulars with respect to absorption**

**RESEARCH AND DEVELOPMENT (R&D):**

**1. Specific areas in which R&D carried out by the Company**

i. Process of beneficiation of new Coal Washery at Mines has been standardized with high ash coal.

ii. Standardisation of rolling parameters for wide parallel flange beams upto 700 X 300 mm size.

iii. Improved design of transfer chute between kiln segment and cooling segment of rotary kiln to eliminate the problem of Transfer Chute Jamming.

iv. Product development of structural section in different high tensile grades with transverse impact properties.

v. Development of High Conductivity Rail for Third rail for railways.

vi. Standardisation of operating parameters of new DRI Kilns (of 500 T/day capacity).

vii. Development of new round sections of 140 mm and 220mm diameters.

viii. Standardisation of total system of generation of producer gas, its boosting, mixing with BF gas and distribution in new producer gas plant.

**2. Benefits derived as a result of the above R&D**

i. High ash coal of seam VII and VIII could be beneficiated through 100% deshalling and heavy media cyclone separator to give clean coal for increased capacity DRI plants and preserving seam IX coal.

ii. Indigenous supply of wide parallel flange beams have been made possible, thereby helping in structural designing and stopping import of these sections.

iii. Reduced wastage of iron ore Rotary kilns, conserved natural resources and improved environmental protection.

iv. Helped in making off-shore platform for raising crude petroleum from indigenous supply of structural sections.

v. Supplied railways third rail for metro sky bus project.

vi. Higher availability of metallics for enhanced capacity of steel making.

vii. Led to customer satisfaction in seamless tube / pipe manufacturer.

viii. Achieved petroleum conservation in Reheating Furnace of Rail and Universal Beam Mill by increasing the calorific value of mixed gas of producer gas and Blast Furnace gas.

**3. Future plan of action**

i. Product development of different sections of blooms and beam blanks.

ii. Standardisation of operating parameters of non-recovery Coke-Oven and correlation with properties.

iii. Installation of CSR CRI determination of equipment and standardisation of these properties in coke.

iv. Standardising new inspection scheme for long rails including mirror inspection NDT and other requirements.

**4. Expenditure on R&D**

| | | | |
|---|---|---|---|
| **a.** | **Capital** | : | **Rs.3.36 Lacs** |
| **b.** | **Recurring** | : | **Rs.87.90 Lacs** |
| **c.** | **Total** | : | **Rs.91.26 Lacs** |
| **d.** | **Total R&D expenditure as a percentage of total turnover** | : | **0.04%** |

**TECHNOLOGY ABSORPTION, ADAPTATION AND INNOVATION**

**1. Efforts in brief, made towards technology absorption, adaptation and innovation**

i) Steel making in Electric Arc Furnace with supersonic oxygen lance in order to reduce heat time, energy consumption and homogenisation of steel bath.

ii) Long rail welding technology has been adapted to produce 480 metre length rail panel by welding 4 rails of 120 metre length to supply to Railways.

**2. Benefits derived as a result of the above efforts e.g. product improvement, cost reduction, product development, import substitution, etc.**

i) Increase in furnace productivity, reduction in energy consumption and better steel quality.

ii) Long rail welding will fulfil the requirement of railways for longer welded rail panels.

**3. In case of imported technology (imported during the last 5 years reckoned from the beginning of the financial year) following information may be furnished.**

**a) Technology imported**

i) 2.4 million tonne sinter plant technology is under import.

ii) Present intermediate stands and finishing stand will be replaced by CCS stands and both structural sections and rails will be rolled in universal configuration.

**b) Year of import**

2006-07

**c) Has technology been fully absorbed**

Technology will be absorbed after installation and commissioning of the plants.

**d) If not fully absorbed, areas where this has not taken place, reason therefor and future plans of action.**

N.A.

| | | | |
|---|---|---|---|
| 4. | FURNACE OIL | | |
| | Quantity (K. ltrs) | 7,835.552 | 9,557.505 |
| | Total cost (Rs. in lacs) | 1,267.14 | 1,164.71 |
| | Average rate / Ltr (Rs.) | 16.17 | 12.91 |
| 5. | OTHERS / INTERNAL GENERATION | | |
| | Quantity | NIL | NIL |
| | Total cost (Rs. in lacs) | NA | NA |
| | Average rate / Kg. (Rs.) | NA | NA |
| B. | CONSUMPTION PER UNIT OF PRODUCTION | | |
| 1. | ELECTRICITY | | |
| | For Sponge Iron mfg. (unit / ton) | 69.710 | 60.530 |
| | For Ferro Chrome mfg. (unit / ton) | 3,824.440 | 4,251.000 |
| | For Slab / rounds / Beam / Blank Mfg. (unit / ton) | 777.780 | 638.573 |
| | For Rail / Beam / Channels Mfg. (unit / ton) | 222.670 | 250.635 |
| | For Steel melting (Ingots & Casting) (unit / ton) | 1,037.000 | 1,079.000 |
| | For Machine / machinery parts Mfg. (unit / ton) | 460.000 | 108.000 |
| 2. | FUEL OILS: | | |
| | For Sponge Iron Mfg. (litre / ton) | NIL | NIL |
| 3. | COAL: | | |
| | For Sponge Iron Mfg. (mt. / ton) | 1.587 | 1.496 |
| | For Ferro Chrome Mfg. (mt. / ton) | 0.125 | 0.155 |
| | For Power Plant (MT / Kwh) | 0.845 | 0.957 |

B) TECHNOLOGY ABSORPTION

**(e) Efforts made in technology absorption as per Form B given below:**

**FORM – B**

**Form for disclosure of particulars with respect to absorption**

**RESEARCH AND DEVELOPMENT (R&D):**

**1. Specific areas in which R&D carried out by the company**

i) Standardization of process parameters for 500 tpd sponge iron rotary kilns.

ii) Replacement of costly element Ni in copper bearing structural steel by Silicon.

iii) Standardization of vacuum degassing parameters for rail steel.

iv) Development of high strength and high impact property structural sections in Rail and Universal Beam Mill.

v) Development of channel sections in Rail & Universal Beam Mill.

vi) Process development for reduction of residual stress in rails.

vii) Standardisation of casting practice of Beam Blanks.

**2. Benefits derived as a result of the above R&D**

i) This has resulted in enhanced production of sponge iron with consistent quality.

ii) Replacement of Ni with cheaper alloying elements like Si and P (percentage adjusted) to combat the hot shortness during reheating caused by Cu in copper bearing structural steel.

iii) Standardization of vacuum degassing parameters for rail steel has led to production of high quality rail steel with enhanced production rate. This has resulted in increased availability of rail steel blooms for rolling into rails and supply to customers.

iv) With standardization of chemistry for high strength steel and standardization of rolling parameters increased supply of sophisticated high tensile structural has been achieved.

v) Development of channel sections has resulted in fulfillment of customer requirement.

vi) With reduction in residual stress in rails, higher quality of rails are being produced.

vii) This has resulted in better surface and internal quality of Beam Blanks.

**3. Future plan of action**

i) Standardization of blending of low and high rank coals to get the desired coke for blast furnace.

ii) Studying and standardization of raw material and process parameters in DRI kilns to avoid accretion and ring formation.

iii) Installation of Fatigue Testing, Fracture Toughness testing machine.

iv) Development of API grade plates in plate mill.

v) Standardizing the process parameters of new high capacity Blast Furnace.

vi) Standardizing the sinter plant parameters.

vii) Study of energy and mass balance in Electric Arc Furnace.

**4. Expenditure on R&D:**

| | | | |
|---|---|---|---|
| a. | Capital | : | Rs. 58.36 Lacs |
| b. | Recurring | : | Rs.103.77 Lacs |
| c. | Total | : | Rs.162.13 Lacs |
| d. | Total R&D expenditure as a percentage of total turnover | : | 0.06% |

**Technology Absorption, Adaptation and Innovation**

**I. Efforts in brief, made towards technology absorption, adaptation & innovation**

i) In 100 tonne Electric Arc Furnace latest technology has been adapted with respect to heat making and in Vacuum Degassing unit, degassing practice of rail steel has been standardised.

ii) Four strand caster with capability of casting rounds of different sections, beam blanks, blooms of different sections has been adopted and standardised. Six-strand high-speed billet caster has been commissioned.

iii) Commissioned non-recovery Coke Oven. Working condition of the coke oven shop has been environment friendly.

**II. Benefits derived as a result of the above efforts**

i) Productivity in Electric Arc Furnace has improved. Rail steel making has been streamlined with increased production and quality is as per the Railways' specification.

ii) Caster productivity has increased and customer requirement of different sections of rounds and blooms is being fulfilled. With commissioning of billet caster, diversification of product for different sectors like forging grade blooms and blooms for other structural sections can be made through captive rolling.

iii) Coke Oven has started producing good quality coke. Also, power generation from the waste gas of coke oven will be unique achievement, which is a 'Clean Development Mechanism' (CDM) Project also.

## B. TECHNOLOGY ABSORPTION

**e) Efforts made in technology absorption as per Form B given below**

**FORM B**

**(Form for disclosure of particulars with respect to absorption)**

**RESEARCH AND DEVELOPMENT (R&D):**

**1. Specific areas in which R&D carried out by the company**

1. Process development for SAE 4140 & 42CrMo4 in higher section (285x390 mm) of steel bloom.
2. Casting parameters standardisation for Beam Blank.
3. Replacement of costly element "V" with "Nb" in micro - alloyed structural steel.
4. Process standardisation of casting of steel round sections.
5. Standardisation of roll pass designing in universal tandem rolling in Rail & Universal Beam Mill.
6. Studying the cold strength, RI & RDI of sinter for standardisation of Sinter quality.
7. Various studies and analysis taken up to find out the root cause of:
   a. accretion formation in DRI kilns.
   b. cracking phenomenon in air tubes in DRI kilns.
8. Standardization of online ultrasonic testing unit of RUBM through in-house effort with indigenously developed probes & test rails.
9. Successful trial of pellets in DRI kiln.

**2. Benefits derived as a result of the above R&D**

1. This is in house development to cater the need for forging sectors for automobiles.
2. By optimising the parameters like casting speed, casting powder, chemistry, primary and secondary cooling water and mould alignment the longitudinal cracking in beam blank has been eliminated.
3. Replacement of vanadium with niobium has given a cost reduction of high tensile steel without sacrificing the mechanical properties.
4. Standardization of casting parameters of rounds has resulted in reduction of surface defects and rejections.
5. Consistency in the dimension of the structural rolling (Beam & Columns) has been achieved and rolling rate has increased.
6. This has helped in optimization of sinter chemistry suitable for blast furnace.
7. a. The studies have helped to find out the root cause for accretion formation in DRI kilns, the suitable actions had been taken to minimise the accretion formation and to improve the kiln life.
   b. This has helped to find out the suitable alloy for air tube for longer life.
8. This has resulted in eliminating noise in ultrasonic testing of rails resulting in more precise testing.
9. By use of pellets, production capacity of DRI kiln has been achieved and this has given a better understanding of the kiln behaviour with respect to iron oxide reduction in form of pellets.

**3. Future Plan of action**

1. Project on Non-recovery type Pilot Coke Oven Plant for blend optimization including use of non-coking coals.
2. Development of coal characterization laboratory with advanced equipments like Petrographic Microscope with reflectance measurement, Gieseler Plastometer to measure the coal fluidity. This will be useful for selection of coal for coke making.
3. Iron Ore beneficiation at laboratory scale to reduce Alumina and to improve iron ore quality
4. Development of SAE1552 and SAE52100 (Ball Bearing quality) steel.
5. Development of API grades in plate mill.
6. Optimization of pulverized coal injection at blast furnace-2.

**4. Expenditure on R&D**

| | | |
|---|---|---|
| **a.** | **Capital:** | **108.79 Lacs** |
| **b.** | **Recurring:** | **151.58 Lacs** |
| **c.** | **Total** | **260.37 Lacs** |
| **d.** | **Total R&D expenditure as a percentage of total turnover:** | **0.07 %** |