# BHARAT HEAVY ELECTRICALS LIMITED
## Heavy Power Equipment Plant
**RAMACHANDRAPURAM :: HYDERABAD-502032 (INDIA)**
**Phone No. 040-23182163 : Fax No: 040-23020214**
**E-mail: talarimrao@bhelhyd.co.in**

**PULVERISER ENGINEERING DEPARTMENT**


Ref: HY/PULV.ENGG./OP/2006 Date: **01/12/2006**

**WEB ENQUIRY**

Dear Sir,

**Sub:- Development of Software module for Knowledge based Engineering of Pulverisers Design , BOWL MILL & BALL TUBE MILL" – Tender Invitation – Reg.**

Please find enclosed Tender Notification No.BHEL:HYD-PUL:K-BM-04-001/ HY on the above subject along with Section-1: Vendor Qualifying Criteria, Section-2: Terms & conditions and Section-3: Technical requirements. We request you to kindly submit your best commercial offer for the above project with in the due date indicated in the Tender Notice.

Thanking you,

Yours faithfully,
For Bharat Heavy Electricals Ltd., Hyd.

T.Mohan Rao
DGM/Pulv.Engg./OP

Encl: as above

# BHARAT HEAVY ELECTRICALS LIMITED
**RAMACHANDRAPURAM :: HYDERABAD-502032**

**Notice Inviting Tender (NIT)**

**Tender Notification No. : BHEL-HYD-PUL:K-BM-04-001 / HY**

**Date of NIT Issue : 01/12/2006**

**Tender Due Date : 27/12/2006**

1. This is Notice Inviting Tender for tender notification No. BHEL-HYD-PUL: K-BM-04-001/ HY for the development of customized software module for "Knowledge based Engineering of Pulverisers Design of A) BOWL MILL , B) BALL TUBE MILL C) BOWL MILL + BALL TUBE MILL " .

2. Bidders shall read carefully the enclosed documents that comprise this Tender :
   - Section-I : Vendor Qualifying Criteria
   - Section-II: Terms and Conditions
   - Section-III: Technical Specifications.

3. The offers shall be in complete accordance with Vendor Qualifying Criteria, Terms and Conditions and Technical Specifications enclosed herewith without any deviation.

4. Any clarifications or pre-bid meeting may be sought by Bidder from the undersigned with due written requests before 10 (ten) days prior to Tender Due Date.

5. The offers should be in two-part bid (i.e part-I: Techno-commercial bid and part-II:Price bid).

6. Sealed Tenders shall be addressed to the undersigned and the envelope shall be super scribed with Tender Notification Number, signature & stamp of the Bidder and the Tender due date.

7. The Sealed tenders will be received by the undersigned at his office at BHEL, RCPuram, Hyderabad upto 14.00 hrs on the tender due date. The techno-commercial bid (i.e part-I of the offer) will be opened on the same date at 15.00 hrs in presence of the Bidders or their authorized representatives who choose to be present.

8. During the course of finalization of Tender and Award of Contract, the Bidder shall promptly and completely respond to all clarifications sought by the undersigned and attend any meeting on the date & time called by the undersigned with written intimation to the Bidder.

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9. BHEL reserves the right to reject / cancel any tender or part thereof or all the tenders without assigning any reason.

(T.Mohan Rao)
DGM/Pulv. Engg./OP

Mailing Address :

T.MOHAN RAO.
Dy GENERAL MANAGER
Pulv. Engineering Dept.
TIC Building, opp 02 canteen,
BHEL, Ramachandrapuram,
Hyderabad-502032
Phone : 040 – 2318 2163
E-mail : talarimrao@bhelhyd.co.in

# BHARAT HEAVY ELECTRICALS LIMITED

**RAMACHANDRAPURAM :: HYDERABAD-502032**

**Tender Notification No. : BHEL-HYD-PUL:K-BM-04-001/HY Dated 01/12/2006**

## SECTION-1 : VENDOR QUALIFYING CRITERIA

**1.1 Bidders who meet all the following qualifying criteria are only required to quote for this work.**

1.1.1 Vendors having proven and established experience for at least last three years in delivering services similar to the works under consideration in this tender.
1.1.2 Vendors with a minimum annual turnover of Rs. 200 lakhs.
1.1.3 Vendors willing to take up work on-site (i.e at BHEL, RC Puram, Hyderabad)
1.1.4 Vendors willing to execute this contract using their own software, hardware and manpower requirements.
1.1.5 Before submission of Bid, vendors should have demonstrated their capability to take up this assignment, through presentation and interactions to the satisfaction of BHEL.

**1.2 The bidder shall give full information in respect of the following. Information is to be furnished in the prescribed formats. Non-submission of this information may lead to rejection of the offer.**

1.2.1 **ANNEXURE-A** :

Company details & financial soundness, PAN , PF Code Number etc.

1.2.2 **ANNEXURE-B** :

A statement giving particulars of the various services rendered / in progress for similar works by the bidder- indicating the particulars of each work, the site location, the duration, date of completion etc.

1.2.3 **ANNEXURE-C** :

Declaration regarding submission of the true & complete information, due authorization and non-disclosure of BHEL proprietary information.

**Note**:

All the data that is required as per this section needs to be furnished neatly typed, signed and stamped in the given formats only. Wherever necessary, documentary proof also needs to be enclosed. In the absence of the above information, the tender may be considered as incomplete and is liable for rejection.

# BHARAT HEAVY ELECTRICALS LIMITED
**RAMACHANDRAPURAM :: HYDERABAD-502032**

**Tender Notification No. : BHEL-HYD-PUL:K-BM-04-001 / HY Dated 01/12/2006**

## SECTION-2 : TERMS & CONDITIONS

1. **General Instructions :**

1.1 TWO-PART BID :

1.1.1 The offer shall be submitted in a sealed envelop which would contain two separate sealed envelopes as (i) Technical & Commercial Bid and (ii) Price Bid.

1.1.2 The Technical & Commercial bid should contain (i) vendor qualification forms duly filled, signed & stamped (see ANNEXURE A, B & C) (ii) confirmation of compliance to all terms & conditions (iii) technical offer in detail for the entire scope of the work as given in the Technical Specification. The technical proposal should cover the following, but not limited to:

a) Clear understanding of complete scope of work and deliverables with respect to product information and automation requirements given.
b) Development methodology and all software programs / packages required to be used for the development of the software module.
c) Proposed work schedule with duration so that total duration of the project does not exceed specified delivery period.
d) Clear understanding of the working modalities and bidder should indicate computer systems & manpower proposed to be deployed at BHEL for this project.
e) Assumptions / deviations with respect to the technical specs, if any, and expected technical inputs from BHEL team during the project execution.

1.1.3 The price bid should be identical to technical bid but with price details as per the Price Schedule format (see ANNEXURE-D). Bidder must indicate prices for all the items indicated in the Price Schedule. In addition, the total price of contract also should be clearly indicated. All prices should be firm for the duration of the contract. All applicable duties and taxes shall be clearly indicated in the offer. The tariff rates as applicable on the date of bid shall be specified. Wording like “Extra as applicable” or “as applicable at the time of dispatch”, etc will not be acceptable.

1.2 Each sealed envelop should be super-scribed with the type of bid (Technical or Price), Tender Notification number and bidder’s name, stamp & signature. Both these envelops should be submitted through one covering sealed envelop super scribing the Tender Notification number and bidder’s name, stamp & signature.

1.3 The sealed Bids shall be submitted on or before the time & date specified & shall be

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addressed to the official as mentioned in the Notice Inviting Tender. Tenders submitted by post shall be sent preferably as "REGISTERED POST ACKNOWLEDGEMENT DUE / SPEED POST" and shall be posted with due allowance for any postal delay. The tenders received after the due date and time of opening are liable to be rejected. Tenders received through e-mail / fax will not be considered.

1.4 Bidder must fill up all the schedules and furnish all the required information as per the instructions given in various sections of the tender specification. Each and every page of the Tender Specification must be SIGNED, STAMPED AND SUBMITTED ALONGWITH THE OFFER by the Bidder in token of complete acceptance there of. The information furnished shall be complete in itself.

1.5 The Bidder shall quote the PRICES in English Language and international numerals. These rates shall be entered in figures as well as in words. In case of difference in rates between words and figures, THE LESSER OF THE TWO will be treated as valid for the purpose of the tender, the metric system of units shall be used.

1.6 All entries in the tender shall either be typed or be written in ink. Erasures and overwriting are not permitted and may render such tenders liable to rejection. The Bidder shall duly attest all cancellations and insertions.

1.7 Conditional and unsigned tenders, tenders containing absurd or unworkable rates and amounts, tenders which are incomplete or otherwise considered defective and tenders not in accordance with the tender conditions, specifications, etc., are liable to be rejected.

1.8 Tenders shall be signed by persons duly authorized / empowered to do so. Certified copies of such authority and relevant documents shall be submitted along with the tenders.

1.9 Should a Bidder or, in the case of a Firm or Company, its Partner(s) / major Shareholder(s)/ Director(s) have relation(s) employed in BHEL, the authority inviting tender shall be informed of the fact along with the offer. Otherwise, BHEL may, at its sole discretion, reject the tender or cancel the contract at any stage of the contract.

**2. Earnest Money Deposit (EMD) :**

2.1 In compliance with BHEL Works Policy 2003, Earnest Money is to be paid by each tenderer. The bidders for this Tender have to pay an **EMD of Rs. 1,00,000** (Rs One Lakh only) along with offer. EMD can be paid in cash at BHEL Cash Office or through DD in favour of BHEL, Ramachandrapuram, payable at Hyderabad. The Cash Receipt issued by BHEL Cash Office (in case of cash payment) / Demand Draft issued by a Scheduled Bank shall be submitted along with offer.

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2.2 Offers without EMD will be rejected.

2.3 EMD will be returned to unsuccessful vendors normally within fifteen days of acceptance of award of contract by the successful Bidder.

2.4 EMD will not carry any interest.

2.5 EMD by the Bidder will be forfeited if,

2.5.1 After opening the tender, the Bidder revokes his tender within the validity period or increases his earlier quoted rates.

2.5.2 The successful Bidder does not commence the work within the period as specified in the LOI / Contract. In case the LOI / Contract is silent in this regard then within 15 days after award of contract.

**3. Scope of Tender :**

3.1 This tender is for design, development, supply, installation, commissioning, testing and demonstration of the software module as per the requirements identified by BHEL in the enclosed Technical Specification (Section-III).

3.2 The vendor should identify areas in which their solutions conform to open standards and areas that are proprietary in nature. Justification about proprietary components in terms of functionality, up-gradability and performance shall be given.

3.3 The software development will be carried out at BHEL, RC Puram. BHEL will only provide necessary work place and the basic infrastructure for installation of vendor's computers. All the necessary software / hardware and manpower requirements are to be taken care of by the Bidder. All other expenses towards logistics and incidentals including lodging, boarding, travel etc. incurred for execution of this contract will be borne by the Vendor.

**4. Pre-Bid Clarifications :**

4.1 The Bidder shall closely peruse all the clauses, specifications and drawings indicated in the Tender Documents before submission of their bid. Any clarifications on the tender specifications can be sought from the authority inviting the tender, up to 10 (Ten) days before last date of submission of the tender.

**5. Validity of Offer and Evaluation :**

5.1 The offer shall be kept open for acceptance for a period of 90 days from the date of opening of tender. The Technical cum Commercial Bid only will be opened on the due date mentioned in the enquiry.

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5.2 In case of minor changes in scope and / or technical specifications or commercial terms, having price implications, technically accepted bidders shall be asked to submit their revised offer inline with the revised scope and terms & conditions.

5.3 Price Bids of only the Qualified and Technically acceptable bidders will be opened.

5.4 In case BHEL calls for negotiations, such negotiations shall not amount to cancellation or withdrawal of the original offer, which shall be binding, on the Bidder. All expenses for attending such negotiations are to be borne by the bidder.

5.5 The total price for entire scope of work will be considered for bid evaluation. The entire work covered in this Tender shall be entrusted to a **single vendor satisfying the qualifying criteria**.

5.6 The successful vendor shall attend the office of the Official as mentioned in the Notice Inviting Tender on the date fixed by the Official through a written intimation. The vendor shall forthwith accept award of the contract and complete the execution of the agreement by signing all documents connected therewith. The required Security Deposit (SD) amount shall also be paid at the time of award of the contract.

**6. Security Deposit (SD) :**

6.1 The successful Bidder shall pay Security Deposit (SD) at the time of acceptance of the award of contract based on the total contract price as per rates given below :
(a) Upto Rs. 10 lakhs : 10%
(b) Above Rs. 10 lakhs upto Rs.50 lakhs: 1 lakh + 7.5% of amount exceeding Rs. 10 lakhs.
(c) Above Rs. 50 lakhs : Rs. 4 lakhs + 5% of amount exceeding Rs. 50 lakhs.

6.2 EMD of successful bidder will be adjusted against SD

6.3 SD will be returned along with the final bill of vendor at the end of contract period. Any penalties or dues from the vendor will be adjusted against the bill or from SD.

6.4 SD will be forfeited if the contract is abandoned by the vendor during the contract period.

6.5 SD will not carry any interest.

**7. Intellectual Property Rights :**

7.1 Vendor shall treat all information that is generated in connection with this assignment as absolutely confidential. All information, analysis, reports and recommendations both in the form of hard copy or on electronic media will be the property of BHEL and must not be used by the vendor for any purpose other than this assignment. All bidders are required to sign non-disclosure agreement with BHEL. On award of the contract, all personnel of the Vendor assigned to and working on the development work has to sign BHEL's '3rd Party Non-Disclosure Agreement' as given in Annexure-E.

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7.2 Vendor shall indemnify BHEL any copyright or legal liabilities that may arise in use of the developed software or the methodology / models / techniques used by the vendor in development / implementation of the software module.

7.3 In the event that the services are to be provided by Vendor in connection with software programmes and related documentation supplied by BHEL in relation to which rights may be owned by third parties, vendor shall warrant and represent that :

7.3.1 BHEL has all necessary permissions, express or otherwise, to enable the software programmes and documentation to be copied or otherwise used by Vendor during the course of the services without infringing any third party copyright, patent or trade secret;

7.3.2 In providing the services Vendor will not be infringing the rights of any third parties;

7.3.3 The disclosures or use of the software programmes and documentation during the course of services will not involve the breach of any confidential or contractual relationship.

7.4 All source code as well as other deliverables generated under this works will become the property of BHEL.

**8. Completion of Contract:**

8.1 Vendor shall deliver the complete scope of work within 36 weeks from the date of award of contract and as per the time schedule approved during award of the contract.

8.2 The Vendor will use reasonable care and skill in providing the services and will be responsible for the quality of workmanship and accuracy of the deliverables. Vendor shall implement in-house quality control and shall carry out 100% quality checks before submitting to BHEL for acceptance.

8.3 The Contract shall be considered successfully completed upon acceptance of deliverables by the BHEL Project Leader. The BHEL Project Leader shall be specified at the time of award of the Contract to successful Bidder.

8.4 Vendor will be responsible for adherence to the material movement and security procedures of BHEL.

8.5 Vendor shall not utilize services of BHEL employees for carrying out contract jobs.
In case of violation of this condition, the contract will be terminated without any notice.

**9. Guarantee Period :**

9.1 The developed software shall be guaranteed for trouble-free operation for a period of 12 months from its acceptance and installation at BHEL. In case of any defects observed during the operation of this module during this period, the Vendor shall render their services at no additional cost for repair / rectification of the same.

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**10. Terms of Payment :**

10.1 No Advance Payments will be made.

10.2 Payment shall be made after certification issued by BHEL Project Leader regarding the successful completion of scope of work as per the Payment Milestones, if any, specified in the Contract. The BHEL Project Leader shall be specified at the time of award of the Contract to successful Bidder.

10.3 Vendor shall submit the invoices to BHEL Project Leader within ten (10) days from the date of successful completion of job.

10.4 Payments will be released within ninety (90) days from the date of receipt of invoices from the vendor.

**11. Penalty Clause :**

11.1 Penalty at the rate of 0.5% per week to a maximum of 10% of the order value will be levied for the late delivery of the job as per certification of the BHEL Project Leader.

11.2 The penalty will be evaluated only at the final delivery completion payment and not at individual payment milestones, if any.

**12. Arbitration and Jurisdiction:**

12.1 In case of any unresolved disputes between the vendor and BHEL with regard to the supplies, same shall, after a written notice to the other party, be referred to sole arbitration of the General Manager of BHEL or his nominee. The Arbitration shall be conducted in accordance with the provisions of the current version of Indian Arbitration and Conciliation Act 1996. The award of the arbitrator shall be final and binding on both the parties to the contract.

12.2 The venue of arbitration shall be at BHEL, Hyderabad and courts at Hyderabad and Sangareddy shall have jurisdiction.

12.3 The contract shall be governed by the Laws of India.

# BHARAT HEAVY ELECTRICALS LIMITED
**RAMACHANDRAPURAM :: HYDERABAD-502032**

**Tender Notification No. : BHEL-HYD-PUL:K-BM-04-001 / HY Dated 01/12/2006**

**ANNEXURE-A**

**VENDOR EVALUATION FORM**

| Sl. No | BHEL Requirement | Vendor Response |
|---|---|---|
| 1 | Name & Address of the Vendor (Company) | |
| 2 | Details of Authorised Signatory to Bid :<br>Name<br>Designation<br>Phone (Office)<br>FAX (Office)<br>Mobile No. (if applicable)<br>E-mail address | |
| 3 | **Enclose** Company Profile covering areas of business, facilities and manpower, Client list, Partner's / Board of Director' names & address etc | YES / NO |
| 4 | **Minimum Annual Turnover of Rs. 200 Lakhs** | YES / NO |
| 5 | **Enclose** audited Profit and Loss account and Balance Sheet for last three years (indicate No. of sheets) | YES / NO |
| 6 | Income Tax Permanent Account Number (relevant document enclosed) | PAN<br><br>YES / NO |
| 7 | Provident Fund Code Number (relevant document enclosed) | PF No.<br><br>YES / NO |
| 8 | Proven and established experience for at least last three years in the delivering services similar to the works under consideration | YES / NO |
| 9 | **Details of experience (Annexure-B) enclosed** | YES / NO |

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| Sl. No | BHEL Requirement | Vendor Response |
|---|---|---|
| 10 | Willing to take up work on-site (i.e at BHEL, RC Puram, Hyderabad ) with required computer hardware, software & manpower | YES / NO |
| 11 | Address and contact details of Office / Branch for close interaction with BHEL during work execution | |
| 12 | **Declaration sheet (as per Annexure-C) by Authorised Signatory to Bid enclosed** | YES / NO |
| 13 | **EMD Payment :**<br>BHEL Receipt Number / Date<br>OR<br>DD Number / Date / Bank | |
| 14 | **Receipt / DD enclosed** | YES / No |

**Vendor's Name & Address**
**Name & Signature of the Bidder**
**(Seal)**

# BHARAT HEAVY ELECTRICALS LIMITED

**RAMACHANDRAPURAM :: HYDERABAD-502032**

**Tender Notification No. : BHEL-HYD-PUL:K-BM-04-001 / HY Dated 01/12/2006**

## ANNEXURE-B

**SIMILAR JOBS EXECUTED IN PAST THREE YEARS**

| SL. NO | AGENCY BY WHOM AWARDED | PARTICULARS OF THE WORKS AWARDED | CONTRACT VALUE | DURATION OF THE PROJECT | DATE OF COMPLETION |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |

Vendor's Name & Address
Name & Signature of the Bidder
(Seal)

# BHARAT HEAVY ELECTRICALS LIMITED
**RAMACHANDRAPURAM :: HYDERABAD-502032**

**Tender Notification No. : BHEL-HYD-PUL:K-BM-04-001 / HY Dated 01/12/2006**

**ANNEXURE-C**

**DECLARATION**

I/We, _____ hereby certify that, all the information and data furnished by me with regard to this Tender Notification **BHEL:HYD-PUL:K-BM-04-001 / HY Dated 01/12/2006** are true and complete to the best of my knowledge. I have gone through the specification, conditions and stipulations in detail and agree to comply with the requirements and intent of specification.

I/We, further certify that I am / we are the duly authorized representative(s) of the under mentioned tenderer and a valid power of attorney to this effect is also enclosed.

I/We, hereby declare that I/We shall treat the tender documents, drawings, specifications and other records connected with the work as secret/confidential and shall not communicate information / derived there from to any persons other than a person to whom I/We am/are authorized to communicate the same or use the information in any manner prejudicial to the safety of the same.

Vendor's Name & Address
Name & Signature of the Bidder
(Seal)

# BHARAT HEAVY ELECTRICALS LIMITED
**RAMACHANDRAPURAM :: HYDERABAD-502032**

**Tender Notification No. : BHEL:HYD-PUL:K-BM-04-001 / HY Dated 01/12/2006**

**ANNEXURE-D**

**PRICE SCHEDULE**

| | |
|---|---|
| **A) BOWL MILL MODULE** | **Rs. _____**<br>**(In words:)Rupees _____** |
| **B) BALL TUBE MILL MODULE** | **Rs. _____**<br>**(In words:)Rupees _____** |
| **C) BOWL MILL + BALL TUBE MILL MODULE** | **Rs. _____**<br>**(In words:)Rupees _____** |

Vendor's Name & Address Name , Signature & Office Seal of the Bidder

# BHARAT HEAVY ELECTRICALS LIMITED

**RAMACHANDRAPURAM :: HYDERABAD-502032**

**Tender Notification No. : BHEL:HYD-PUL:K-BM-04-001 / HY Dated 01/12/2006**

**ANNEXURE-E**

## THIRD PARTY NON-DISCLOSURE AGREEMENT

I, _____, on behalf of the _____ (Name of Company), acknowledge that the information received or generated, directly or indirectly, while working with BHEL on contract is confidential and that the nature of the business of the BHEL is such that the following conditions are reasonable, and therefore:

I warrant and agree as follows:

I, or any other personnel employed or engaged by our company, agree not to disclose, directly or indirectly, any information related to the BHEL. Without restricting the generality of the foregoing, it is agreed that we will not disclose such information consisting but not necessarily limited to:

- Technical information: Methods, drawings, processes, formulae, compositions, systems, techniques, inventions, computer programs/data/configuration and research projects.

- Business information: Customer lists, project schedules, pricing data, estimates, financial or marketing data,

On conclusion of contract, I, or any other personnel employed or engaged by our company shall return to BHEL all documents and property of BHEL, including but not necessarily limited to: drawings, blueprints, reports, manuals, computer programs/data/configuration, and all other materials and all copies thereof relating in any way to BHEL's business, or in any way obtained by me during the course of contract. I further agree that I, or any others employed or engaged by our company shall not retain copies, notes or abstracts of the foregoing.

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This obligation of confidence shall continue after the conclusion of the contract also.

I acknowledge that the aforesaid restrictions are necessary and fundamental to the business of the BHEL, and are reasonable given the nature of the business carried on by the BHEL. I agree that this agreement shall be governed by and construed in accordance with the laws of country.

I enter into this agreement totally voluntarily, with full knowledge of its meaning, and without duress.

Dated at _____, this _____ day of _____, 20__.

**Name:**

**Company:**

**Signature:**

# BHARAT HEAVY ELECTRICALS LIMITED
**RAMACHANDRAPURAM :: HYDERABAD-502032**

**Tender Notification No. : BHEL:HYD-PUL:K-BM-04-001 / HY Dated 01/12/2006**

**SECTION-3 :**

## TECHNICAL REQUIREMENTS

### 1.0 INTENT OF SPECIFICATION

Procurement of custom-built KBE software module for "automation of Pulveriser Design of (A) Bowl Mill and (B) Ball Tube Mill C) Bowl Mill + Ball Tube Mill " for BHEL Hyderabad.

### 2.0 INTRODUCTION ABOUT BHEL & PULVERISER DIVISION

Bharat Heavy Electricals Ltd.(BHEL) is a premier Govt of India undertaking and ranks among the top ten power generation equipment manufacturers in the world. BHEL manufactured and supplied (aprox.) 70% of power generation equipment in India .

Large capacity coal pulverizing Mills like Bowl Mills, Ball Tube Mills, Ball & Race Mills are essential to meet the Thermal Power Plant operation. The Bowl Mills, Ball Tube Mills in different capacities are engineered and manufactured at BHEL Hyderabad Unit.

These Pulverisers are supplied as a part of Boiler Auxiliary in the power station equipment package to various important customers like NTPC, State Electricity Boards and power generation companies of various states.

### 3.0 PRODUCT DESCRIPTION

The Pulverisers are primarily meant to pulverize coal to a fine powder for combusting instantly and efficiently in the furnace of a power plant. These Pulverisers are custom built to suit the specific Coal characteristics available for the specific project requirements, operating parameters and site layout conditions of each plant.

The two basic types of pulverisers manufactured by BHEL are I. BOWL MILL and II. BALL TUBE MILL

### I . THE BOWL MILL :

The pre crushed Coal is fed to the center of the pulveriser on to a revolving bowl. Centrifugal force causes the coal to travel towards the perimeter of the bowl. The coal passes between the bull ring and the grinding rolls, which impart the pressure

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necessary for grinding. The partially ground coal continuous outward and over the edge of the bowl.

Hot air enters the mill side air inlet housing below the bowl and is directed upward around the bowl outside diameter and separator body annulus, by the rotating vane. It continues upward and into the deflector openings in the classifier at the top of the inner cone, then out through the venturi and multiple port outlet assembly. As the air passes upward around the bowl, it picks up the partially pulverized coal particles are carried up through the deflector openings of the classifier. The deflector blades in the openings cause the coal - air mixture to spin within the inner cone. The angle of the blades determines the velocity of the spin and the resulting fineness of the finished product. Heavier pulverised coal are returned through the inside of the inner cone to the bowl for further grinding. Coal that is pulverised to the desired fineness leaves the pulveriser and enters the fuel piping system.

Any tramp iron or dense, difficult to grind foreign material in the coal feed is carried over the top of the bowl, where it drops through the air stream and rotating vanes to the mill bottom. Pivoted scrapers attached to the bowl hub sweep the tramp iron or other material to the tramp iron discharge opening. The tramp iron spout is fitted with a valve. Under normal operation this valve remains open and material is discharged into a sealed pyrites hopper. The valve is closed only while the hopper is being emptied.

## II. BALL TUBE MILL:

Ball tube mill is a horizontal shell closed with end shields , fixed with trunions on either ends and support journal bearings. These mills are manufactured and supplied for Pulverization of the Raw coal. These mills are of Low Speed type and known as Horizontal Ball Tube Mills also.

### PRINCIPLES OF GRINDING IN THE BBD MILLS:

The BBD Mills consists of two perfectly symmetrical grinding circuits. Each circuit can be described as follows:

The Coal is taken from the bunker by a raw coal feeder. The feed rate to the mill is controlled by varying the Feeder speed. At the feeder discharge the coal falls into a mixing box where it is pre-dried by the hot bypass air. The coal then enters the mill through the Conveyor body and trunion tube. The screw conveyor pushes the coal into the mill by its rotational movement. The movement of the balls inside the rotating mill body then pulverizes the coal.

The hot primary air is introduced into the mill through the central tube of the conveyor. It completes the coal drying and carries the pulverized coal out of the mill via the trunnion annulus around the central tube, counter to the direction of raw coal feeding to the mill.

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The Pulverized coal and primary air mixed with the by-pass air from the mixing box enter the classifier installed above the mills, often provided at the feeder level.

The double cone type classifier is fitted with adjustable vanes to regulate the pulverized coal particle size to the required value. The large grains of coal fall back by gravity into the conveyor body inlet pipe, where they mix with the raw coal and are re-pulverized. The finely ground coal, suspended in the primary air, is transported from the classifier outlet to the burners, where it is injected into the furnace and burned. Grinding takes place by the impact & friction of the balls on the raw coal .

**PRINCIPLE OF CONTROL**

The flow of ground coal in the BBD mill is controlled by adjusting the flow of primary air through the mill.

The air-to-coal ratio remains steady whatever the load in the mill. This means that, if at a given load it is desirable to increase the flow of pulverized coal at the mill outlet, it is sufficient to give an opening order to the primary air through mill damper and instantaneously the flow of air, and thus the entrained pulverized coal will increase. This feature is specific to the BBD and provides extremely short response times, permitting boiler load variation speeds as high as those obtained in boilers burning liquid or gaseous fuels.

This steady air-to-coal ratio in the mill leads to low velocities at low loads. Thus, to facilitate transport of the pulverized coal through the piping, an additional air **(called by-pass air)** is added which maintains the optimum total airflow in the piping, no matter what the mill load is.

The auto control of airflow to mill combines both the advantages of the use of by-pass air:

Automatic control optimizes the by-pass air quantity at all times to keep the pulverized coal pre- drying air at the required value and also maintain optimum velocities in the piping at any mill load.

This bypass air is used for pre-drying of the raw coal and it is introduced into a mixing box together with the raw coal. After pre-drying, the bypass air joins the air through mill at the conveyor body outlet, before entering the classifier.

For the BBD mill to operate correctly, it is necessary for the amount of coal in it to remain steady whatever be the flow of pulverized coal out of the mill. To achieve this, an independent control loop measures the amount of coal inside the mill and regulates the feeders speed accordingly.

The amount of the coal in the mill is measured either by noise monitoring (the more the coal in the mill, the less noise it makes) or by monitoring the pressure differential, which is a reflection of the dust concentration inside the mill (the more the coal in the mill, that is in pulverised form, the higher the pressure differential)

con…4

The shell is fabricated from a plate material and the supporting / guiding components are mostly castings .The other ducting components are sheet metal/ plates. A typical cross-sectional assembly drawing of the Pulverizers showing the major components are enclosed as Annexure-1.

## 4.0 PULVERISERS DESIGN METHODOLGY PRESENTLY FOLLOWED

i. BHEL has got a library of basic Pulveriser models. The sizes of these Pulveriser models are scaled up / down, using certain manual design calculations, to meet the specific needs of a particular application.

ii. For a particular application an in-house developed software FORTRAN program is used to get a set of alternate models, each with a different quality of coal and size factor. The most optimum model is then selected manually from among these alternatives, based on certain design criteria like Boiler size, Coal quality & quantity.

iii. The size (scale) factor of the selected model is used to compute the dimensions of the Pulveriser components.

iv. The relevant components are selected manually for the type of mill & each element is then finalized.

v. The sizes of the components are selected manually based on the mill, size.

vi. The selected mill predicted performance is calculated using coal characteristic curves , quantity of air flow and coal air velocity ,a computer program based on the Coal quantities for different calorific values and different types of coals.

vii. Other “bought-out” items like suitable castings ,Forgings , Worm Shaft , Worm Gear , Planetary Gearbox , Speed reduction Gear box, Auxiliary Gear box , Lubrication System , Girth Gear & Pinion etc are selected manually from the standard data base.

viii. Detailed 2D drawings are generated on Auto Cad for the individual components, sub- assemblies and the main Pulveriser assembly.

ix. Bill of materials / parts list is generated on the LAN computer systems.

## 5.0 LIMITATIONS OF PRESENT DESIGN METHODOLOGY

a) As the Pulverisers are custom built to suit the specific design parameters and site layout vary for each station, all the steps mentioned at 4.0 above are to be repeated for every project.

Con….5

b) Some of the present design processes are based on in-house developed software programs, while others are carried out using manual calculations. This activity takes a long cycle time for each project.

c) In view of the need to cater to different customers simultaneously, sometimes it is getting difficult to meet the tight project schedules.

## 6.0 OBJECTIVES OF THE PROPOSED "AUTOMATED DESIGN MODULE"

a) Integration of individual design steps into a unified, automated module for the selection, design and generation of detailed drawings for the complete Bowl Mill and Ball Tube Mill.

b) Reduction of engineering cycle time

c) To maintain accuracy and consistency in the design documentation for all projects.

d) Standardization of pulveriser design for a specific model

e) Development of a methodology and software program for new mill size designing .

Con..6

## 7.0 **THE EXISTING PULVERIZER TYPES**

| XRP BOWL MILL EXISTING SIZES ,CAPACITIES & MOTOR RATING | | | | | |
|---|---|---|---|---|---|
| FAMILY (INCHES) | MILL SIZE | BASE CAPACITY (T/Hr) | MAX AIR FLOW (Lb/Min) | INPUT TO MOTOR (KW) | MOTOR SERVIE FACTOR |
| 60 | XRP 603 | 16.7 | 950 | 146 | 1 |
| | XRP 623 | 18.37 | 1060 | 160 | 1.15 |
| | | | | | |
| 70 | XRP 683 | 24.04 | 1325 | 209 | 1 |
| | XRP 703 | 26.3 | 1450 | 229 | 1.15 |
| | | | | | |
| 80 | XRP 763 | 33.79 | 1925 | 260 | 1 |
| | XRP 783 | 36.5 | 2000 | 273 | 1.15 |
| | XRP 803 | 39.68 | 2180 | 295 | 1 |
| | | | | | |
| 90 | XRP 883 | 51.03 | 2820 | 365 | 1.15 |
| | XRP 903 | 53.97 | 3050 | 387 | 1.15 |
| | XRP 923 | 56.92 | 3140 | 408 | 1.15 |
| | XRP 943 | 59.87 | 3300 | 429 | 1 |
| | | | | | |
| 100 | XRP 963 | 62.59 | 3480 | 448 | 1 |
| | XRP 983 | 65.31 | 3600 | 468 | 1.15 |
| | XRP 1003 | 68.03 | 3750 | 487 | 1.15 |
| | | | | | |
| 110 | XRP 1043 | 77.11 | 4250 | 552 | 1.15 |
| | BHEL 280 | 90.71 | 5000 | 650 | 1.15 |

| EXISTING BALL TUBE MILL SIZES | | | |
|---|---|---|---|
| MILL SIZE | BASE CAPACITY T/HR | MAX.CAPACITY T/HR | MOTOR RATING (Kw) |
| BBD 3448 | 30.5 | 40.0 | 770 |
| BBD 4760 | 70.0 | 90.0 | 2150 |
| BBD 4772 | 80 .0 | 110.0 | 2400 |

Con..7

**Enclosure :** Typical Cross-sectional assembly drawing of Pulverisers indicating major parts.

XRP BOWL MILL

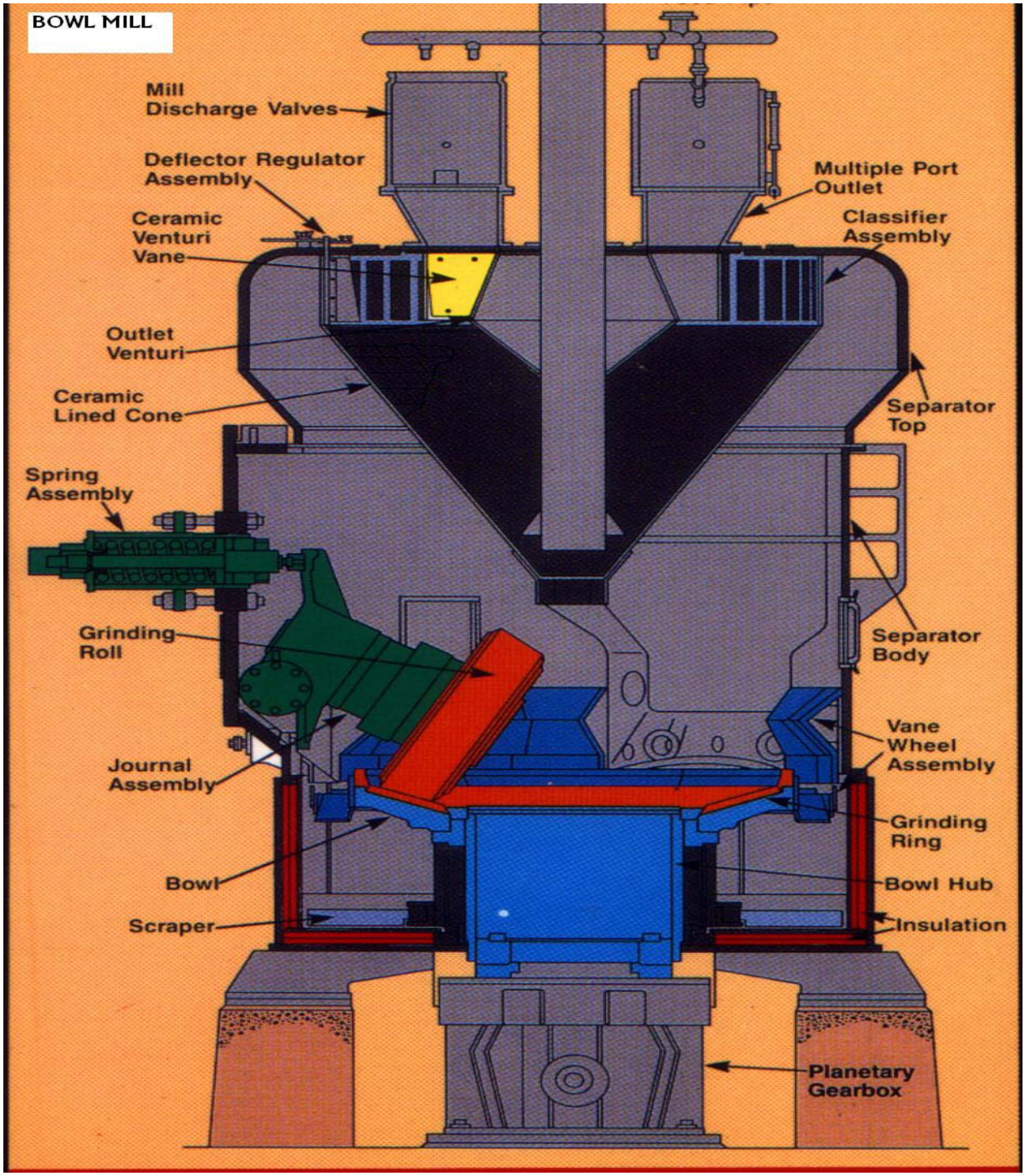
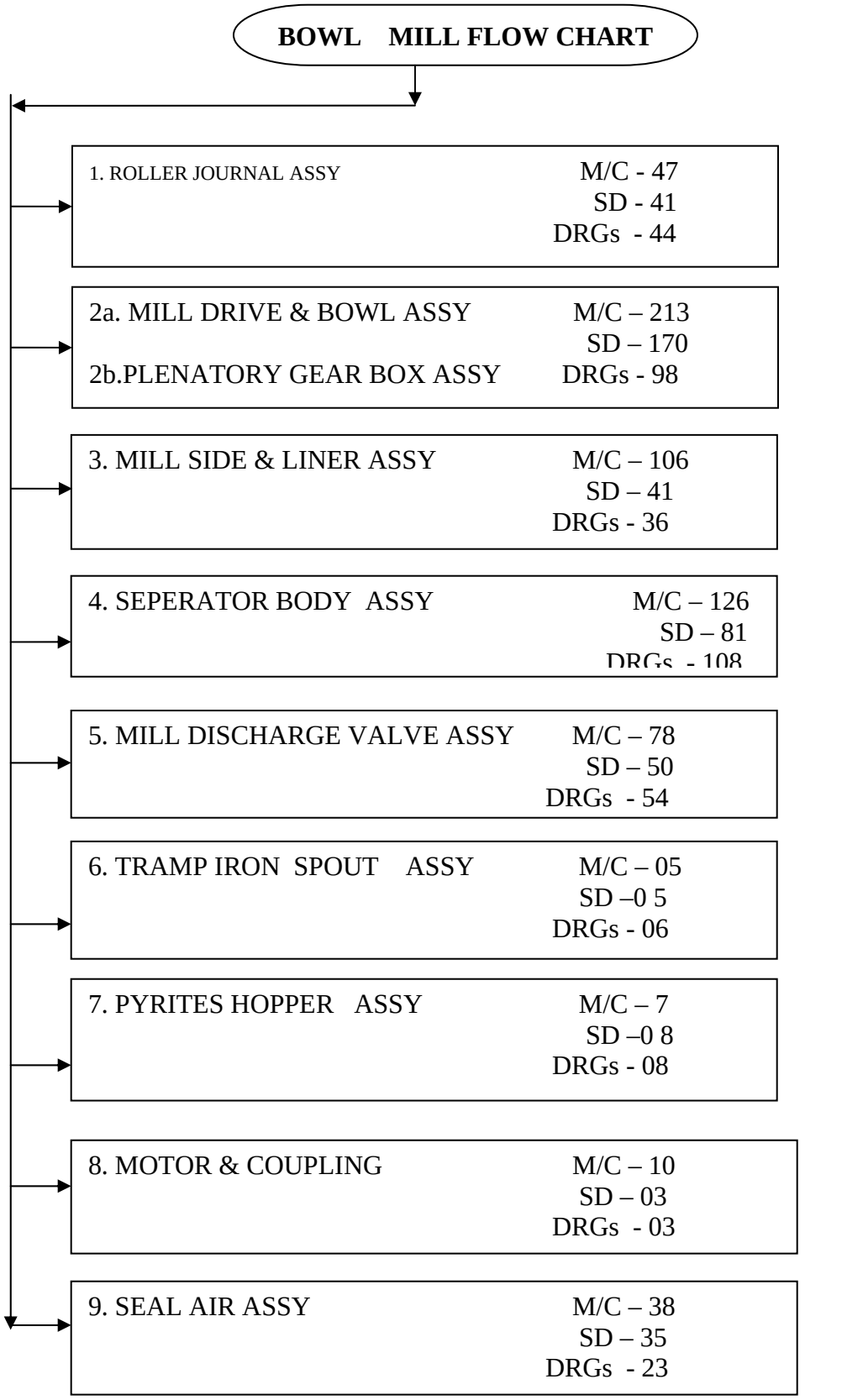



FIG-I

Con..8

**8.0 THE MAJOR SUB-ASSEMBLIES OF A BOWL MILL**




Con…9

Abbr: M/C – Machined components, SD – Bought-out components

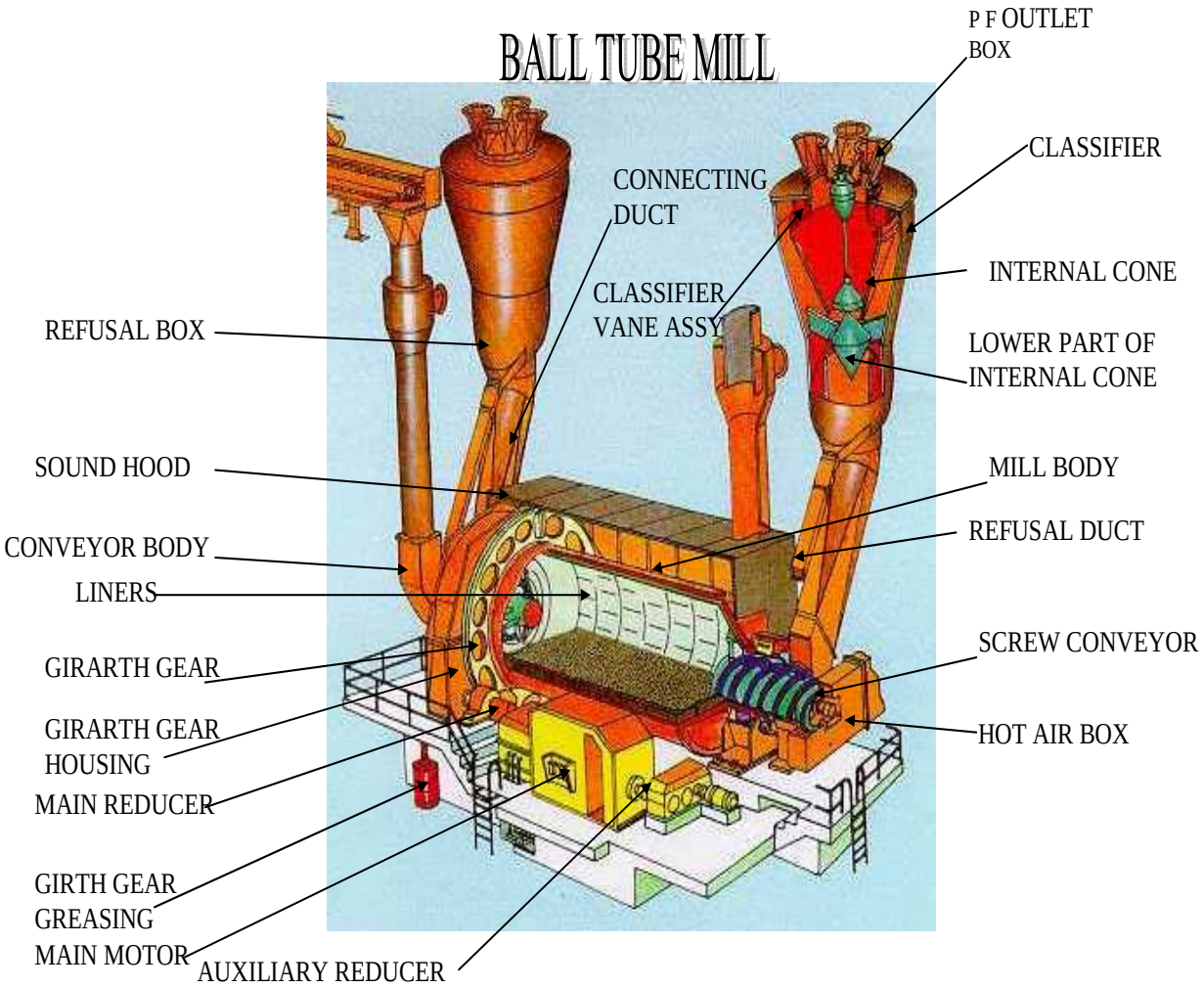
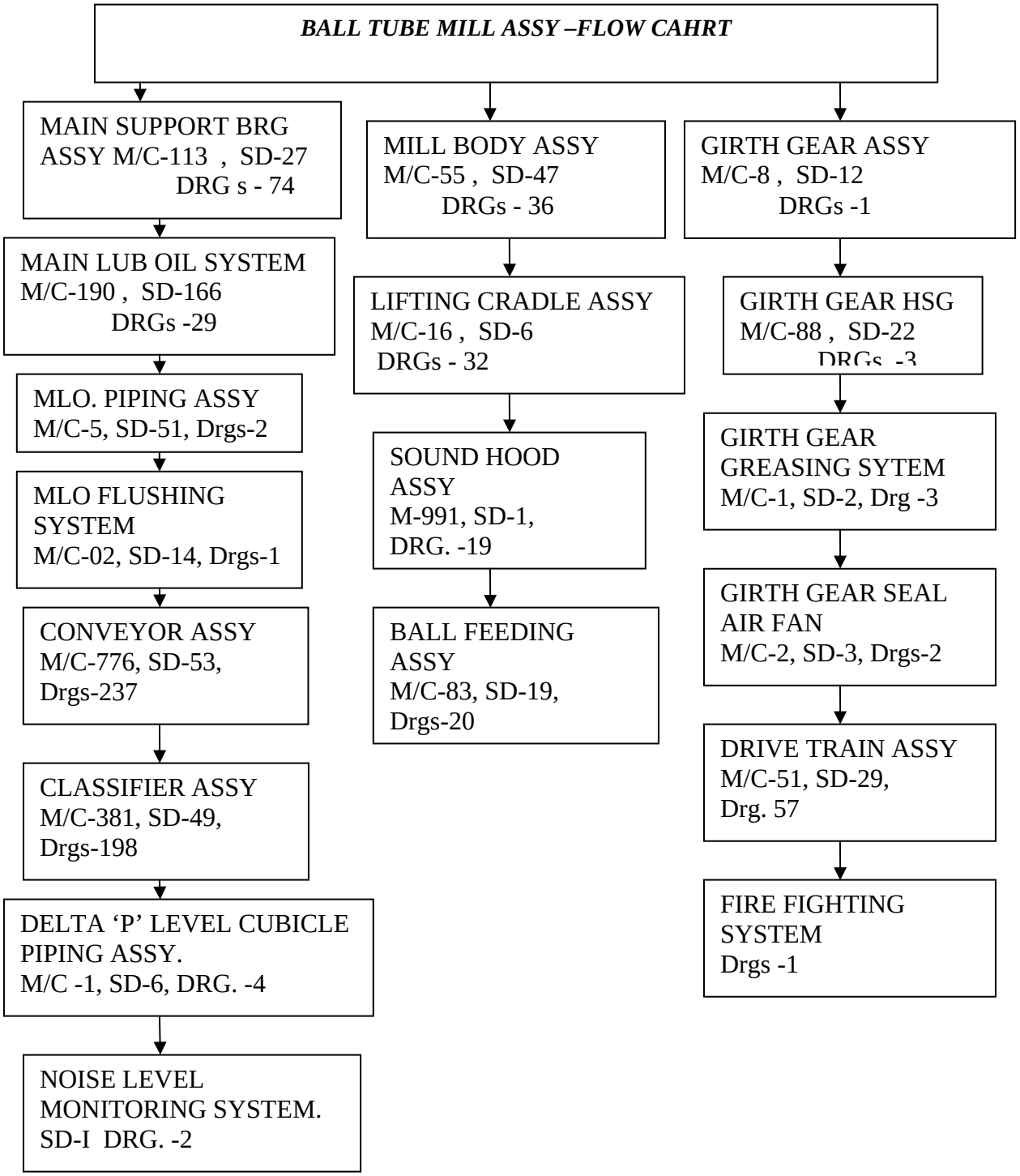



FIG - II

Cont--10

9.0 **THE MAJOR SUB-ASSEMBLIES OF A BALL TBUE MILL**




Cont--11

## 10.0 SCOPE OF WORK INVOLVED IN DEVELOPMENT OF DESIGN MODULE

1) Parameterization of design process

2) Creation of standard / parametric 3D drawings / models of components

3) Creation of Data Bases for Pulveriser models including materials

4) Automation of Pulveriser model & scale factor selection methodology

5) Automation of Pulveriser layout preparation based on Pulveriser type , size and type of foundation.

6) Automation of the sizing of Pulveriser components based design logic and scale factor

7) Automatic generation of 2D drawings for all casting, fabrication , manufacturing items and the assembly drawing for complete Pulveriser.

8) Automatic generation of parts list / Bill of materials for the drawings

9) Material indents generation from the model for procurement

10) Animated assembly procedure of all components

11) Providing inputs for generation of CNC codes.

12) Providing inputs for adding 3D drawings to existing E-commerce system with hotspots

## 11.0 FLEXIBILITY AND USER FRIENDLINESS OF THE MODULE

11.1 The software module shall be highly interactive in nature. User intervention is to be permitted at every stage of the design process.

11.2 The software module should have provision for editing / modifying the output results after every stage by the user.

11.3 The software module should be amenable for modification by BHEL after installation, if required.

11.4 The software module should be compatible with or able to migrate on new versions of the software packages used for development / running of the module.

11.5 The software module should be amenable for installation on more than one computer system, preferably a LAN version.

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12.0 **ESTIMATED WORK SCHEDULE**

(1) System Design and Project Plan

(2) Development of software program including graphic user interfaces, databases, libraries of 3-d part/assembly models & drawings, interfaces to other software as required

(3) Periodic testing of development with participation of BHEL team

(4) Preparation of System Documentation and User Manuals

(5) Training to BHEL users and system administrator

(6) Installation of the developed software on BHEL computer system

(7) Final acceptance testing of installed system by BHEL

**Estimated Total duration of project - 24 weeks**

13.0 **SUGGESTED SOFTWARE PROGRAMS / PACKAGES TO BE USED**

System Designing - UGS

3D models & drawings – UGS

Data bases - MS Access / Oracle

Programming / logics - C, C ++

Development of 2D drawings - AutoCAD

Development of Integrated System – UGS Knowledge Fusion sharing

Front end Display - Visual Basic

Operating System - Windows XP Professional

14.0 **COMPUTER SOFTWARE & HARDWARE**

14.1 All the required computer software (Programs, Packages, etc) and the hardware (PCs, Printers, Scanners, etc) for development of this module have to be taken care of by the bidder. BHEL do not have any spare facilities to be extended for this project. BHEL shall only provide work space and power supply for the equipment.

14.2 The software module is to be completely developed at the BHEL works.

14.3 The developed module shall be installed on BHEL's computer and its satisfactory operation demonstrated.

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14.4 The software module should have provision for editing / modifying the output results after every stage by the user.

## 15.0 DELIVERABLES

Design module in CD-RW (Re-writable CD format) along with necessary support software and 5 sets of Hard copies of all documentation.