TENDER DOCUMENT

TENDER NO.: DLI/C&E/WI-675/287

FOR

Tender for Supply and Supervision of Installation, Testing & Commissioning of “Vibration Isolation System for 4 nos. of Reversible Hammer Mill” for the project of “Augmentation of Fuel and Flux Crushing Facilities (Package No. 064) of Bhilai Steel Plant (SAIL)”

VOLUME – 2B

TECHNICAL SPECIFICATION
## VOLUME – 2B

### CONTENTS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Documents/Information to be furnished alongwith offer</td>
</tr>
<tr>
<td>2.</td>
<td>Scope of Supply</td>
</tr>
<tr>
<td>3</td>
<td>Technical Specifications of Vibration Isolation System for Reversible Hammer Mill</td>
</tr>
</tbody>
</table>
GENERAL

The following Technical Specification shall be read in conjunction with General Technical Specification (GTS) of Bhilai Steel Plant, SAIL and General Specification. If there are any provisions in this Technical Specification, which are at variance with the provisions of General Technical Specification (GTS) of Bhilai Steel Plant, SAIL and General Specification, the provisions in this Technical Specification shall take precedence.

1.0 DOCUMENTS/INFORMATION TO BE FURNISHED ALONGWITH OFFER

(i) Clear Scope of supply.

(ii) Exclusions, if any.

(iii) List with unit rates of special tools and tackles, if any required.

(iv) Price Schedule for supply and supervision as per the format enclosed.

(v) Weight of the Vibration Isolation System in Kgs.

(vi) Catalogues/Leaflets and O&M Manuals.

(vii) Reference list of your Customers for the similar supply of items.

(viii) Un-priced Copy of supply & supervision (Furnish un-priced copy of Price Schedule alongwith the Technical Bid in Envelope 1).
2.0 SCOPE OF SUPPLY

The scope of the supply includes Design, engineering, manufacture, shop fabrication, assembly, testing and inspection at manufacturer’s works, packing, dispatch, transportation, delivery at site, supervision of installation, testing & commissioning, performance guarantee testing and handing over to Bhilai Steel Plant, SAIL/EPI of ‘Vibration Isolation System for Reversible Hammer Mill’ as per specifications and scope defined in tender documents complete with all accessories, which are not mentioned specifically but are required for the efficient and trouble free operation of the equipment.

a) Following items are also included in bidder’s scope

(i) Vibration Isolation System shall be selected as per the details of Reversible Hammer Mill given in the specifications.

(ii) Special tools & tackles, if any required.

(iii) Painting of equipment as per Clause no. 5 of Vol. 2A.

(iv) All drawings/documents along with operation and maintenance manuals as per requirement mentioned elsewhere in the tender document.

(v) Getting approval of GA Drawings and design calculation related Vibration Isolation System from BSP/MECON/EPI.
3.0 TECHNICAL SPECIFICATION OF VIBRATION ISLOATION SYSTEM (SPRING SUPPORTED FOUNDATIONS FOR REVERSIBLE HAMMER MILL)

The section of specification covers the design/engineering of spring-supported foundations of 300 TPH Reversible Hammer Crushers as per equipment layout drawing and the supply and installation of the spring & Visco Damping system. The vibration isolation system shall consist of steel helical spring units and viscous dampers supporting the top RCC deck which would then support the Reversible Hammer Crusher.

1. SUPPORTING ARRANGEMENT

The supporting arrangement for each crushers shall consist of an RCC top deck i.e. "Spring supported foundation" supported by steel helical spring units and viscous dampers units which in turn shall be supported by a concrete substructure. This substructure may form an integral part of the Crusher house building.

The damper units or spring cum damper units should be of viscous type offering velocity proportional damping. The damper units should be suitable for temperature ranging from 0 Degree to 50 Degree Celsius.

The Vibration Isolation System supplied shall be of a proven make. The bidder should have satisfactorily designed, supplied & installed such systems for same or more capacity of Reversible Hammer Crushers.

Documentary evidence such as attested copy of award letter and completion certificates/performance certificates of previous works executed by bidder should be submitted by the Bidder.

2. SCOPE OF WORK

2.1 Engineering

2.1.1 Design of the vibration isolation system using steel helical springs and viscous dampers to support an RCC deck supporting the machine. This includes the static and dynamic analysis of the vibration isolated system with the RCC top deck and the machine.

2.1.2 Structural design of the RCC top deck including preparation of general arrangement drawings, reinforcement drawings, bar bending schedules etc.

2.1.3 To provide inputs such as loads transferred into the sub-structure below the springs and viscous dampers, their points of application and the stiffness requirements of the supporting structure.

2.1.4 Drawings showing embedments, their locations and other details on the RCC top deck.

2.1.5 Drawings showing block outs, recesses etc., in the RCC top deck.
2.2 **Supply:**

2.2.1 Supply of steel helical spring units and viscous dampers along with viscous liquid including associated auxiliaries for the installation of the spring units and dampers, such as steel shims, adhesive pads etc.

2.2.2 Suitable hydraulic jack system, required for the installation, alignment etc. of the spring units.

2.2.3 Frame for pre-stressing of spring elements.

2.3 **Installation and Commissioning**

Supervision of installation and commissioning of the vibration isolation system including pre-stressing and positioning the elements, releasing the pre-stressed spring elements subsequently, making final adjustments and alignments after machine installation and so on.

2.4 **Documentation:**

2.4.1 Submission of GA Drawing of VIS indicating RCC Deck Layout, Spring Arrangement & Load details for Design of Sub-structure.

2.4.2 Submission of detailed design calculation, analysis (Static & Dynamic).

2.4.3 Submission of reinforcement drawing & bar bending schedule for RCC top Deck.

2.4.4 All drawings and documents shall be submitted in title block approved by MECON.

2.4.5 All expenses for visits to Bhilai Steel Plant, Bhilai/MECON, Ranchi performed by the Agency in connection with planning, designing, detailing, obtaining approval from client/client’s consultant till the stage of approval of “Good for Construction drawings” are included in the scope of Agency.

3. **Design Requirements for Crusher Foundation:**

3.1 **Dynamic analysis**

Detailed dynamic analysis shall be done for the top deck together with springs & dampers and the natural frequencies and amplitudes of vibration shall be determined.

Natural frequencies of the Top Deck shall be 20 % away from operating frequency as per IS:2974 Part 4.

Forced response dynamic analysis shall be carried out for the operating condition unbalance forces using a sinusoidal forcing function. Unbalance forces as given by Crusher Manufacturers shall be used for this purpose. The amplitude thus calculated shall be checked against the design criteria.

3.2 **Isolation Efficiency**

The vibration isolation system shall be designed for about 90% isolation efficiency.
3.3 **Unbalance Forces**

Unbalance forces arising out of all the following cases shall be considered for checking the design and amplitudes.

3.3.1 Balance Quality Grade Q40 as recommended by equipment Vendor i.e. 9 mm/s.

3.3.2 Two Hammer Broken Condition.

3.4 **Amplitude Criteria**

The calculated amplitudes (mean to peak values) shall not exceed 100 microns (0.1 mm).

The amplitudes limits mentioned above is in both vertical & horizontal directions. The amplitudes shall be calculated at the critical points on the top surface of the RCC deck.

3.5 **Transient Resonance**

Transient Resonance, which may occur during the start – up or coasting down of the crusher, shall be checked, and the amplitudes in such a condition should not exceed the permissible limits as specified for operating speed i.e 100 micron (0.1 mm) for each design condition. Frequency for Transient Resonance shall be considered +/- 5 % of Motor & Rotor.

3.6 **Strength Criteria**

The following criteria shall apply for the design of top deck:

a) Dead Loads, Live Loads, Seismic Loads & Dynamic Loads shall be considered for the design. The most unfavourable combination shall be considered for design.

b) Seismic Loads shall be assumed to act together with dynamic loads for a one millimeter eccentricity in the rotor. However, seismic loads & dynamic loads arising out of hammer breakage need not be considered together.

c) Fatigue shall be considered while designing for dynamic loads. A fatigue factor of 2.0 shall be used on all dynamic forces to arrive at the equivalent static force for the purpose of design.

d) The RCC top deck shall be at least of M25 grade of concrete as per IS: 456-1978

e) Fatigue need not be considered for three hammer broken condition.

f) For calculating unbalance forces, 1.2 times Rotor weight shall be considered (20 % additional for coupling shaft).

3.7 **Approval of Design & Drawings:**

All design calculation, drawings & documents shall be in English. All design calculations & drawings shall be submitted to EPI for approval from MECON/BSP. Approval of Drawings and documents from MECON is in bidder's scope. However, approval of such designs and drawings shall not relieve the contractor of his responsibility regarding the adequacy of the foundation to carry the design forces.
3.8 **Standards:**

Latest revision of following codes shall be used for the design of crusher foundations top deck.

b) IS: 2974 (Part IV) Code of practice for design & construction of Machine Foundations (Part IV) for rotary type Machine of low frequency.
c) DIN 4024 Machine Foundations: Flexible supporting structures for Machines with rotating masses.
d) DIN 2089: Helical Compression Springs out of round wire & rod: Calculation & Design.
e) DIN 2096: Helical Compression Springs out of round wire & rod: Quality requirements for hot formed compression springs.
f) VDI 2056: Criteria for assessing mechanical Vibrations.
g) VDI 2060: Criteria for assessing the state of balance of rotating rigid bodies.

3.9 **Erection of Vibration Isolation System:**

The erection of Vibration Isolation System shall be done by EPI under Supervision of supplier of VIS.

- For accepting values, following acceptance criteria shall be followed:
  1. General Workmanship is being good and as recommended by the manufacturer & approved QAP.
  2. Tolerances are within the specified limit.
  3. Material Test certificates are in compliance with the applicable codes standards.
  4. Bought out material is from the approved manufacturer/vendor.