1. **Objective:** Guidelines for repair/rehabilitation of AC traction motors.

2. **Description of Traction motor:**

   2.1 The AC Traction motor used in the existing HHP locomotives is a four-pole three-phase asynchronous induction motor. The original traction motors were supplied by M./s Siemens having model no: 1TB2622OTA02/OTB02 and 1TB2525OTA02/OTB02.

   2.2 **Specifications:** The traction motor used on the HHP locomotives is procured as per RDSO specification no: MP.0.2400.52 (Rev-01) June-2009 or latest version. Copy placed at annexure B.

3.0 **Traction Control Equipment:**

   3.1 The functional details of the traction control equipment and system is governed by RDSO specification no:MP.0.2400.43 (Rev-04), Nov-2011 or latest version.

4.0 **Limitation:**

   4.1 The available details of the traction motor have been furnished above. The vendor may study the design and application properly in order to understand the product and its end use.

   4.2 The potential vendors may interact with IR to obtain further technical details. It must be understood that IR may not have all the relevant design/manufacturing details of the traction motor or the design parameters of the traction control converter/loco control and the vendors shall have to use their own expertise to achieve the desired objectives.

   4.3 At present, following Makes/types of 3-phase AC traction motors are in service in IR for Broad Gauge Diesel Electric locomotives:

   - M/s Siemens Type: 1TB2622-OTA-02, 1TB2622-OTB-02, 1TB2525-OTA-02 and 1TB2525-OTB-02.
   - M/s EMD Type: A2916-8.
   - M/s Yongji Type: YJ157A.
   - M/s BHEL Type: IM4507 and IM4508.
   - M/s CGL Type: C1004 and C1015.

5.0 **Scope of work:**

   The scope of work is to carry out repair/rehabilitation of AC traction motors of HHP locomotives and service support back up for issues related to the above under contractual agreement and terms that are defined elsewhere in this tender document.

6.0 **General credentials of the successful vendor for qualification against the tender;**

   6.1 The successful bidder shall be an established manufacturer of AC traction motors for application on Diesel Electric locomotives. The equipment being manufactured by the firm should be for locomotives in high horse power range i.e. 4000 HP and above. The firm
shall have manufactured and supplied at least 600 AC traction motors for application on high horse power loco (4000 HP and above). The firm shall submit clear evidence in support of the claim and also submit evidence of satisfactory service of these equipments in field.

6.2 In case of overseas firms, the firm shall undertake the work singly or jointly along with an Indian joint venture partner/collaborator. In case of latter, the facility/factory where the work in proposed to be conducted shall be clearly identified and shall possess a valid factory licence, relevant ISO certifications income tax returns etc.

6.3 Preference shall be given to firms that have supplied some of these traction motors to Indian Railways for application on high horse power locomotive with satisfactory field performance.

6.4 The firm shall submit detailed QAP being followed by them for repair/manufacture of traction motor at their existing plant. The QAP shall include the following information:

- List of machinery and plant.
- Inspection plan of various components subassemblies.
- Inspection plan of raw material.
- Stage wise inspection plan of repair/rehabilitation of the motor assembly.
- Relevant specifications for testing etc.
- Assemblies procured from external/sub vendors.

Indian Railway may verify these QAPs by visiting the firm’s premises.

6.5 In case the firm intends to undertake the repair/overhaul in factory other than its existing manufacturing facility, the facilities in the factory shall be assessed by RDSO and shall generally meet the stipulations in para-7.3.

7.0 Specific requirements for Traction motor:

7.1 The design of the traction motor to be overhauled/rehabilitated shall be governed by RDSO specification no MP.0.2400.52 (Rev-01) June-2009 or latest version. IR shall share additional information available with the successful vendor.

7.2 The proposed overhauling/rehabilitation activity shall not change the basic design parameters of the traction motor and the motor must remain compatible with the locomotive traction control equipment and interchangeable with the existing traction motors.

7.3 Overhaul/Rehabilitation in proposed factory:

7.3.1 The facilities given below are for guidelines for availability at the factory where the repair/rehabilitation work is proposed to be carried out. The actual facilities shall depend upon the work distributed between the proposed factory and the main manufacturing unit. The work distribution
shall be clearly brought out in the QAP submitted by the firm and the facilities shall accordingly be verified by IR.

- Rotor core building facility
- Rotor bar insertion facility
- Rotor bar swaging facility (Automatic not manual)
- Induction brazing plant for rotor bar
- Stator core building and stator coil making
- Rotor balancing
- Facilities for manufacturing of complete rotor assembly.
- VPI facilities.
- Complete facilities for Routine / acceptance testing of the motor as per IEC 60349 part-II. Type test (In main factory)

The firm shall clearly indicate the work to be carried out in the proposed factory as well as the work to be carried out in the main manufacturing unit.

7.4 Availability of routine rest facilities as per IEC- 60349 part-II are mandatory with the factory where repair/rehabilitation is proposed to be conducted. Type test facilities shall necessarily be available with the main manufacturing unit of the firm.

7.4 The firm shall submit detailed flow diagram and activity chart for overhaul/rehabilitation of the motor and ensure full compatibility with loco control system and interchange ability with the existing motor designs. In case this is not achieved, the indenter may levy a penalty on the firm.

8.0 Warranty, failure rate and testing of Traction Motor:

All newly repaired/overhauled traction motors shall remain under warranty for a period of 24 months from the date of fitment or 36 months from date of supply.

8.1 Repeated failures of certain nature shall be classified as design defect and the firm shall have to address this problem at its own cost on all the motors irrespective of warranty status.

8.2 The firm is required to adhere to all the relevant specification and drawing of OEM of the traction motor (Siemens), RDSO, relevant IEC /NEMA/IEEEC standards etc. Deviation, if required shall be clearly brought out in the tender itself and applicable only after the approval of Indian Railways.

8.3 Every traction motor shall undergo routine tests as per IEC 60349 part-II and other relevant documents and the test reports shall be preserved for scrutiny of independent inspecting agency.

8.4 The first overhauled/rehabilitated traction motors shall be subjected to type test as per IEC 60349 part-II or an approved test schedule to ensure
matching of characteristics with the original motor. Thereafter these motors shall be subjected to field trials followed by mixed trials with existing motors as per approved plan. Type testing of the overhauled/rehabilitated motor may be witnessed by IR personnel, if required.

All repaired/rehabilitated motors shall have to undergo routine test as per IEC-60349 (pt-11) and the values obtained against the various parameters shall be as per the list given below. This is to ensure compatibility with the existing motors.

<table>
<thead>
<tr>
<th>S No.</th>
<th>Parameter</th>
<th>Test condition</th>
<th>Specified value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Resistance measurement (ohms)</td>
<td>U-V</td>
<td>0.22123 to 0.24451</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V-W</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>W-U</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Warming up of motor</td>
<td>1415V, 74.1A, 20Hz</td>
<td>To run for 15 minutes.</td>
</tr>
<tr>
<td>3</td>
<td>No load test</td>
<td>20Hz, 1415V record current and power input</td>
<td>66.7 to 81.5A</td>
</tr>
<tr>
<td>4</td>
<td>Locked rotor test</td>
<td>20Hz, 320A record voltage and power input</td>
<td>316.1 to 349.3</td>
</tr>
<tr>
<td>5</td>
<td>Vibration measurement</td>
<td>1000 rpm to 3300 rpm</td>
<td>1000-2.8 mm/s</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2600-3300-4.5mm/s</td>
</tr>
<tr>
<td>6</td>
<td>High voltage test-Stator</td>
<td>6.2 kV,50Hz for 1 minute</td>
<td>Shall withstand</td>
</tr>
<tr>
<td>7</td>
<td>Insulation Resistance measurement</td>
<td>1000V megger</td>
<td>&gt;10 Mohm</td>
</tr>
</tbody>
</table>

The type test parameters/test values are not a part of this document and shall be obtained by the tenderer who qualifies technically in the bid, from RDSO/LKO.

The following major repairs are generally required in the traction motors:

1. Repairs due to rotor damage.
2. Stator repair.

8.5 To identify the motors that are suitable for repairs, all motors shall be jointly inspected between the user railway and the firm at Railway premises and all repairs shall be jointly noted down and the firm shall submit details of work plan.
for repair of these motors. The detailed plan shall indicate work to be carried out at the ancillary unit and the main manufacturing unit of the firm.

8.6 The firm shall develop a standard work process sheet for all major repairs and all actual repairs shall be conducted as per the plan.

8.7 At least one traction motor after each type of repair shall be subjected to type test and compatibility test on a locomotive to ensure the compatibility with the existing traction motors and locomotive control system. The process plan shall be finalised after the motor is subjected to the above tests and got approved by RDSO before execution of the work. (The deviation to the plan in a specific issue shall be clearly brought out by the firm). Rest of the motors shall undergo routine testing.

The work plan shall include the following:

<table>
<thead>
<tr>
<th>Motor No.</th>
<th>Repair required (AS PER JOINT REPORT)</th>
<th>Work process</th>
<th>Test protocol</th>
<th>ACCEPTANCE CRITERIA</th>
</tr>
</thead>
</table>

4.4 RDSO has modified the rotor over hang design to minimize the failures of rotor bars. In case the motor requires repair to the rotor, the firm shall also modify the rotor as per the drawing attached (in case the rotor is not already modified). The drawing of the modified rotor is placed at Annexure - A.

4.5 As far as applicable, the firm shall use all items approved in the RDSO vendors directory.