1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site of Vibration Monitoring System for use in Utility/Captive Power Station/Combined Cycle Station.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 The Design and Materials used for the components shall also comply with the relevant National and International standards.

3.0 TECHNICAL REQUIREMENTS

Vendor shall offer VMS for Auxiliaries (such as Fans, Pumps, Motors etc.) for Power plant application as per requirements below. The scope of supply shall be as per specific project requirement, which will be intimated by BHEL to vendor/s later while Commercial offer is requested.

3.1 Requirement for VMS Hardware:

(i) Microprocessor based Vibration Monitoring System shall be offered for Monitoring the Vibration levels of various Machines or Plant auxiliaries of a Power plant. The Machines to be monitored for Vibration levels are typically Pumps (BFP/ CEP/ CWP/ ECWP/ DMCWP/ ACWP/ AIR COMPRESSOR/ RAW WATER PUMPS/ SEA WATER PUMPS), Fans (ID/ FD/ PA/ CT FANS), Motors (of Fans/Pumps/Mills) etc.

(ii) The measurement of Vibration levels shall be carried out on the Bearing housings of the above machinery in both Horizontal & Vertical planes (X – Y planes).

(iii) The offered Vibration Monitoring System shall as a minimum consists of Sensors with low noise cables of 10 meters length in SS flexible conduits, Local terminal box / Junction boxes, necessary per-amplifier/ electronics mounted in local weather –proof boxes, Vibration monitors, Monitor Racks, Power supplies, integrating units, Signal conditioning devices, sensor-mounting accessories, interconnecting cables, calibration equipment, Panel/s...

(iv) Sensors shall be Velometer / Accelerometer type & selected based on the service requirement / parameters w.r.t machine Speed and the Vibration ranges, for each of the Machine. The Project-specific details of various machines shall be provided by BHEL while Commercial offer is being sought. However, the typical machine data / parameters are indicated below for which the Sensors & other monitoring equipment shall be offered.

a. For Pumps: RPM = Varies from 300 (for certain CWPs) / 1500 (for ECWPs/ACWP/DMCWPs) / upto 6000 (for certain BFPs) & Vibration Range = 0 to 15 / 25 / 35 mms per sec – Peak

b. For Fans: RPM = Varies from 120 to 600 (certain ID fans) / 1500 & Vibration Range = 0 to 15 / 20 / 25 mms per sec – Peak

c. For Motors: RPM = between 600 (for mills) to 1500 & Vibration Range = 0 to 15 / 20 / 25 mms per sec – Peak

(v) The offered Sensors with mounting accessories shall be mounted on Bearing housing of the Machine, in Horizontal and Vertical directions. Weatherproof housing shall be provided for these sensors and shall be suitable for field conditions of the Power plant. Vendor to note that the Cables from Sensor-Local Junction box in field to Vibration monitoring System Panels in Main control room shall be provided by BHEL which is 0.5 Sq. mm – PVC, FRLS, Individual &
Overall shielded Pair Copper Cable

(vi) The offered Vibration Monitors shall be 2 to 4 channel with 4-20 mA output per channel. Independent potential free contacts shall be made available for high alarm & trip purposes for each channel being monitored. The Power supply in the Rack shall be Redundant such that on failure of a single power supply, the power supply shall cater to the requirement of offered equipment. The output of each channel shall be in Velocity units and field programmable to Displacement units. The requirement of no. of Channels per monitor shall be Project-specific and same shall be intimated to Vendor by BHEL when Commercial offer is sought for.

(vii) The front of the offered monitors shall have digital bar graph display for the measured Vibration levels and also have facility to connect another device to analyze the Vibration, of each channel. The front face of these monitors shall have status indications for healthy conditions for Sensor circuit, monitor circuit and power supply. Set point indication with set point adjustment facility for setting Alarm and Trip levels shall be provided. Offered monitors shall be modular in construction, plug-in type and suitable for mounting in 19” Rack. A facility shall be available from front of mounting rack for functional checking of monitors with inhibition of alarm & trip contact outputs during test. Alarm inhibition shall also be provided during start-up.

(viii) The requirement of features in the offered monitors as per above Clause (vii): Vendor to offer Display of Vibration levels / Alarm setting functionalities in the Computer provided as a part of Analysis / diagnostic system. This requirement shall be either in Addition to or Alternate to above Clause (vii), which will be intimated to Vendor by BHEL when Commercial offer is sought for.

(ix) Offered Vibration monitoring equipment shall be functionally tested for circuit continuity and output response. All the components & interconnection cables shall be tested to ensure compliance with the specification requirement & all other applicable codes & standards.

(x) When there is a requirement for Analysis & / or Diagnostic package along with VMS, Sensors and related Electronics shall be offered for measurement of Phase angle / speed of the Machine. A Key-slot of dimension “30 mms x 15 mms x 3 mms” typically is provided on the Machine-Shaft / Coupling. Suitable mounting brackets for these sensors shall also be offered.

(xi) Vibration Monitors shall be offered / grouped / assigned in such a way that the channels being monitored for Vibration for a machine will not be in same monitor. E.g. BFP DE – X & Y and BFP NDE – X & Y channels will be in different vibration monitor…etc.

(xii) Vendor to note again that the sensors & monitors offered finally shall be as per project specific data provided later on by BHEL, when commercial offer is sought for. Any revision in selected / offered models of sensors & monitors during detailed Engineering shall be done without any Commercial implications.

3.2 Panel for above equipment:

Panel shall be of typical size 800 mm X 800 mm X 2300 mm. approx.. (Project-Specific requirements shall be as per scope of supply document which will be intimated to Vendor by BHEL when Commercial offer is sought for).

- Panel shall be made up of 2mm thick CRCA steel sheet.
- Anti-vibration pad of about 15 mm shall be provided.
- Panel protection class is IP-30/ IP–32 (for exact requirement refer project-specific scope of supply).

When IP – 32 is asked, the offered Panel height shall be 2415 mms.
• Door shall be provided in the front & rear sides, shall be of 2 mm thick CRCA steel sheet.
• Front door of the panel shall be provided with a suitable Glass window.
• 3 point locking system
• Paint shade/s shall be as per scope of supply, which is Project-specific.
• Panel painting shall be powder coated to 60 to 70 microns thick.
• Cutout with cable-gland plates shall be provided on the bottom of the Panel, for Cabling.
• Suitable Lifting Hooks shall be provided on the Panel.
• Provision shall be made in the Panel to accept two power supply feeders with required MCB’s.
• Terminals shall be Clip-on type for cable termination. 20 % spare terminals shall be offered.

Note: A separate Panel housing the VMS hardware shall be offered for CW-Pumps and this shall be located in the CWP - Control room.

3.3 Other items:

Following shall be offered: Vibration-Sensor Mounting blocks, Phase-angle measurement-Sensor with mounting brackets, required Fasteners, field Junction box with Terminals etc. The offered field Junction boxes (JB) shall be with IP– 65 protection class and vendor shall furnish the Type test reports for acceptance. The material of these Junction boxes shall be CRCA Sheet steel or FRP type, which shall be Project-specific.

3.4 Configuration Requirements:

3.4.1 The offered Panels for VMS shall be located in Main Control equipment room.

3.4.2 Offered Computer hardware shall be located in Computer room near Main Control equipment room.

3.4.3 The distance between Panels in Main Control equipment room (3.4.1) & Computer room (3.4.2) is about 50 meters. Vendor shall offer the type of Cable required for distance less than 50 meters and greater than 50 meters.

3.4.4 Vendor to propose a detailed configuration diagram of the equipment to be supplied along with a list of equipment, which shall be approved by BHEL. This shall also be furnished for Project-specific requirement, as and when BHEL seeks for the same.

3.5 Spares:

3.5.1 Commissioning Spares and consumables

As part of the main equipment supply, the bidder shall supply all commissioning spares and consumables required during Start-up, commissioning and Trial-runs of the plant on as required basis.

3.5.2 Mandatory Spares

The detailed list of Mandatory Spares for sensors, field items, Cabinet mounted items, Analyzers equipment shall be furnished. The list shall include at least the following items and quantity:

a) One No. of each type of Sensor with Accessories
b) One No. or 5 % of power supply modules, whichever is more.
c) One no or 5 % of each variety of Monitors / Electronic modules, whichever is more.

Unit prices shall be indicated in the offer, when BHEL requests for commercial offer.
3.6 Quality Requirements

3.6.1 Following minimum test requirements:

- Calibration report of Sensors for the selected / approved Range with curves shall be furnished.
- For Vibration Sensors, Frequency response curves and for Proximity probes, Gap v/s voltage data to be furnished. Sample reports shall be included as a part of Quality plan.
- Calibration of Monitors for the approved Range shall be submitted.

The above documents shall form part of Acceptance documentation.

3.6.2.1 Special tests / Type tests requirements, which are Project-Specific:

SWC test, Damp test, Dry heat test, Electro-Static Discharge (ESD), Radio Frequency Interference (RFI), EMI & Vibration tests, as per IEC standards shall be performed by Vendor on the offered Electronics / Modules. Test Reports shall be submitted to BHEL for approvals.

4.0 Documents:

4.1 Datasheets, Drawings, BOM, all Schemes, Technical literature...etc. in Two sets with the offer. In the event of order, no. of sets of Documents (hard copy) required to be submitted for Approval of the End-User shall be informed when commercial bid is sought for. Also these documents shall be submitted also in Soft-copy, in Acrobat reader / PDF format.

4.2 Manufacturer's Quality Plan:

These shall be submitted for End-User's approval. In the event of order, no. of sets of Documents (hard copy) required to be submitted for Approval of the End-User shall be informed when commercial bid is sought for. List of sub-vendors for all Bought-out items by the vendor to be furnished for Approval of End-User along with above QP. Also this QP documentation shall be submitted in Soft-copy, in Acrobat reader/ PDF format.

5.0 Training:

Vendor shall provide necessary training on the operation & application to BHEL / End-User. The training shall cover the basic aspects of Vibration monitoring, details of the System supplied, Operation and Maintenance

6.0 Warranty:

The offered systems/ equipments shall be guaranteed for Satisfactory operation of 18 months from date if Commissioning or 24 months from date of supply, whichever is earlier.

7.0 Vendor to note that any Item / services required to complete the Equipment to meet the Specification requirement shall be taken care without any Cost implication to BHEL.

8.0 Erection & Commissioning (E & C) Scope:

8.1 Vibration Monitoring System portion:

Vendor shall provide separate offers for Erection activity (as applicable), Supervision of Erection and total commissioning of the offered Vibration Monitoring System as detailed below.
• Collection of material from stores
• Mounting of offered sensors with its mounting block on the machine bearing and terminate the sensor cable to Local Junction box supplied.
• Mounting of Key-phasor sensor and its bracket shall be suitably installed by Vendor at site and terminate the sensor cable to Local Junction box supplied.
• Supervision of Erection of offered System
• Commissioning of offered System
• Handing Over the system to End-User
• Training the operation personnel on operation and maintenance aspects while carrying out the above E & C activities.

Note: The total responsibility of above activities on the offered system shall rest with the vendor.

9.0 TESTING AND INSPECTION

9.1 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

9.2 Inspection will be conducted by BHEL and/or their authorised representatives as per the agreed inspection schedule. The inspection schedule will be submitted by the bidder for BHEL’s approval at contract stage. The cost of all tests and inspections will be deemed to have been included in the bid.