INDENT NO. :C/T/4100/20089404 DATED:09.03.2009

APPLICATION :

The above system will be use for turbogenerator stator end winding vibration measurement on loads during operation of the machines at site. The system shall be suitable for installation on generators of 210 to 1000 MW ,15 KV to 27 KV rating. A total of 09 location/ points will be required to be monitored. These points will be on "LIVE" points of the turbogenerator stator winding overhang .The probe system and measurement system should be open type i.e. they should be independent of each other. The measurement/monitoring system shall also be easily interfaced with probe system provided and it shall give analogue output in terms of voltage / unit acceleration & velocity selectable.

A. PROBE SYSTEM :

No. of probes required : 16

Operation Parameters :

1. Frequency Range : 50 -300 Hz or more (higher frequency range will be preferred)

2. Amplitude Range : ≥ 0-1000 μ m (Peak-Peak), / 360ms^{-2} (RMS) @ 100 Hz

3. Output : 10V (approx.) including dc bias voltage

4a. Sensitivity : ≥ 10mV / ms^{-2} ± 5 % at 100 Hz

4b. Linearity : Better than 10 % over the frequency range specified

5. Insulation Voltage (between sensor head and ground) :
   a) Normal operation : ≥ 27 KV at 50 Hz
   b) During application of 1 minute proof voltage : ≥ 56 KV at 50 Hz
6. Operating Pressure/ Environment : ≥ 5 bar (Hydrogen)

7. External Power Supply : ≤ 30 V dc , 1 Amp. Rating

8. Maximum Shock Acceleration : ≥ 5000 ms^{-2} (pk) for about 1ms

9. Resonance Frequency : ≥ 500 Hz
10. Transverse Sensitivity : Typically < 5% with respect to sensitive axis

11. Residual Noise : Typically < 10 mV overall noise in the frequency range

12. Resolution : < 1μ m (pK-pK)

Prepared & Checked by	D. S. More Mgr. (GRI)	
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Environmental :

A. Sensor :

1. Temperature : 20 to 90° C
2. Relative humidity : ≥ 90% RH
3. Magnetic Field : ≥ 1 tesla at 50 Hz
4. Electrical field : ≥ 1 KV / mm at 50 Hz

B. Electronics :

1. Temperature : 20 to 70° C
2. Relative humidity : ≥ 90% RH
5. Mains Power : 240 ± 10% V, Single phase, 48-51 Hz

Physical Parameters :

1. Sensor body : PPO Noryl and Ceramic or any other appropriate high insulation material
2. Weight : < 40 gram (light and compact design is preferable)
3. Optical Integral Cable Length : ≥ 10 meter
4. Fibre-Optic Cable Sheath : Integral PTFE tubing of dia. ≥5 mm thick or any other material appropriate with sufficient strength and minimum bending radius of about 80 mm

B . Accessories :

1. 24 V/ Matching DC power supply for FOA (Mains Power 240 ± 10% V, Single phase, 48-51 Hz) — 2 Nos.
2. FOA standard extention cable (30M) — 18 Nos.
3. Vibration input module for FOA accelerometer — 9 Nos.
   - Input (Number upto) : 2- channel
     Input device : Fibre optic Accelerometer
     Signal : Digital RS-422-A for analog voltage or current (±10 V, ±20 V or 4 to 20 mA, 0 to 20 mA)
   - Signal Processing(DSP) : Analog-to-Digital and Digital-to-Analog, absolute vibration
   - Output (Number upto) : 2 external channels(signal)
     Signal : Internal- Digital
     External – Analog,high-speed raw,linearized(PCS), Proximity probe - 2 to -18V, accelerometer ±10 V
   - Probe Supply : Voltage - + 12 Vdc(PCS)
     +24 Vdc (accelerometer)
     Current-Short circuit protected, +30mA(PCS), +15mA(accelerometer)

GENERAL :

1. Prices should be quoted for individual items separately for all items.
2. Any limitation on length of cable between sensor and conditioning amplifier may please be indicated.

3. Different types of connector along with cables and adapters combinations and installation accessories may be quoted which are useful for increasing versatility of equipments and also field-testing as and when required.
4. Party should indicate any other operating/ environmental requirement for safe and trouble-free operation of the system and also any specific requirements of the system for continuous operation over prolonged periods as may be required in process monitoring/control applications.
5. Pre-Qualifying Requirement : The equipment offered (mainly FOA Sensors)shall be of proven design. Party should send reference list of customers (last 5 years) to whom they have supplied such items.
6. Detail calibration chart for each accelerometer with all the details like frequency response curve, dynamic range, sensitivity, etc. be furnished.

6a. Party shall supply following documents along with technical offer.

1. Typical graphs of acceleration(0-40g) vs mV output at temperatures of 20° C ,40° C,60° C,80° C & 90° C at 50Hz and 100 Hz
2. Typical graph of Sensitivity vs temperature at 50Hz and 100 Hz
3. Typical graph of Sensitivity vs frequency at 25° C

6b.
1. Type test report indicating performance under endurance / fatigue test(endurance /fatigue test parameters may be given)
2. Type test report for long term stability of Fibre Optic Accelerometer.
   For these type test certificates for tests carried out earlier(as part of FOA development /establishment activity) or in respect of any other supply may also serve the purpose.

7. **Sensitivity of the accelerometer as reported in the calibration chart should be within ± 10% of typical sensitivity in the manufacturer catalog. Further sensitivity of all accelerometer should be within ± 10% of the mean sensitivity of all the accelerometers.**
8. CALIBRATION : Calibration certificate, traceable to national / international body, of individual accelerometer is required. It should carry the periodicity, uncertainty etc. among other parameters.
9. GUARANTEE: Party shall give guarantee certificate for a period of 24 months from the date of its successful commissioning of the quoted system
10. O&M MANUALS : The party shall provide operation and service manuals containing detailed circuit diagram as well as installation scheme. Also, party shall provide check list for evaluation of the operational parameters of the system for trouble free operation.
11. PACKING: The accelerometer shall be packed in such a way that no damage occurs to any of its component during transit and storage i.e accelerometer head & cable connector should always remain protected on both ends from any direct contact with any external object.
12. MARKING/ IDENTIFICATION :

12.1 Each packing shall be marked with the following:

a. BHEL order no. b. Designation of the component.
c Supplier's name and reference d. Batch no and date of manufacture.
e. Net weight/ Gross weight.

12.2 Each accelerometer shall be tagged with the following information:

a. Supplier reference. b. Designation of the component.
c. Date of manufacture.

12.3 Each accelerometer shall be distinctly identified by punched/engraved type/ Sr. no. on it.