



भारतीय प्रौद्योगिकी संस्थान मद्रास, चेन्नै / 600 036
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केन्द्रीय इलेक्ट्रॉनिकी केंद्र
CENTRAL ELECTRONICS CENTRE

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प्रो. वी. जगदीश कुमार
Prof. V. Jagadeesh Kumar
अध्यक्ष/Head

दिनांक/Dated: 14/09/2015

INVITING QUOTATIONS for Vibration Shaker

Ref.No.


CEC	15-16	015	DEIT	VJAG	VIB	1
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DUE DATE : 30.10.2015

To,
Dear Sirs,

1. Quotations are invited in duplicate for the **Vibration Shaker** in Two Bid System (specification attached).
2. The Quotations are to be in **two bid system** as: Technical bid and Commercial bid. Two parts of the offer are to be clearly marked on the envelopes. The two parts of the offer in a separate envelop must enclosed in the one bigger envelop duly sealed and superscribed with reference number and due date and, should be addressed to the undersigned so as to reach him on or before the due date stipulated above. A blank price quote (identical to the Commercial bid with numbers removed) should be enclosed with the Technical Part.
3. The Quotations should be valid for Ninety days (90 days) from the due date and the period of delivery required should also be clearly indicated.
4. If the item is under DGS&D Rate contract No. and the price must be mentioned. It may also please be indicated whether the supply can be made direct to us at the Rate contract price (Please note that we are not Direct Demanding Officers). If so please send copy of the RC.
5. Relevant literature pertaining to the items quoted with full specifications (and drawing, if any) should be sent along with the Quotations, wherever applicable. Samples if called for, should be submitted free of charges, and collected back at the supplier's expenses.
6. Local Firms: Quotations should be for free delivery to this Institute. If Quotations for Ex-Godown delivery charges should be indicated separately.
7. Firms Outside Madras : Quotations should be for CIF/F.O.R. Madras. If CIF/F.O.R. consignor station, freight charges by passenger train / lorry transport must be indicated. If Ex-Godown, packing, forwarding and freight charges must be indicated.
8. The rate of sales / General Taxes and the percentage of such other taxes legally leviable and intended to be claimed should be distinctly shown along with the price quoted. Where this is not done, no claim for Sales / General Taxes will be admitted at any stage and on any ground whatsoever The taxes leviable should take into consideration that we are entitled to have concessional Sales Tax applicable to non Government Educational Institutions run with no profit motive for which a concession. Sales Tax Certificate will be issued at the time of final settlement of the bill.
9. In case of import, the insurance & Freight charges should not exceed 6% of FOB value. You are requested to quote FOB price as well as CIF, CHENNAI mentioning Freight & Insurance charges separately. No Ex-works pricing is considered.
10. **No Advance Payment will be made for Indigenous purchase.** 100% Payment against Delivery on satisfactory installation for local purchase can be agreed to. For Imports normally payment will be made by Letter of Credit only (**Terms 90 % Payment will be released against dispatch of shipping documents and 10 % will be released after satisfactory installation**). Sometimes The Rule 159 GFR may be allowed (i.e.) 30 % Advance Payment against B.G. (Bank Guarantee) and 70 % Payment after supply (All the B.G. Charges will be borne by the supplier only). **Demurrage charges (if any) will be borne by the supplier & it will be deducted from the balance 10%**. Initial opening of Letter of Credit charges will be borne by us. If any amendment is requested for, the charges for the amendment will be borne by the supplier only. Hence, care should be taken in all respects before opening of Letter of Credit.
11. Goods should be supplied carriage paid and insured.
12. Goods shall not be supplied without an official supply order.
13. Payment: Every attempt will be made to make payment within 30 days from the date of receipt of bill/acceptance of goods, whichever is later.

Yours faithfully,


Head, Central Electronics Centre



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Technical Specification – Vibration Shaker Qty – 1No

1. Vibration Shaker Design:
 - (a) Sine (Pk) -- 650 kgf
 - (b) Random (RMS) -- 600 kgf
 - (c) Shock (Pk) -- 1,350 kgf
 - (d) Usable Frequency -- 5 to 4,000 Hz
 - (e) Maximum Velocity -- 2 m/s
 - (f) Maximum Acceleration -- 100 g
 - (g) Fundamental Resonance Frequency (Bare table) -- 3,500 Hz (nom.) +/- 5%
 - (h) Body Suspension Natural Frequency (Thrust Axis) -- Less than 3 Hz
 - (i) Armature Effective Nominal Weight -- < 7 kg (Magnesium Alloy)
 - (j) Vertical Load Support -- > 300 kg
 - (k) Table Diameter -- > 225 mm (9")
 - (l) Load attachment Points (Standard) -- Stainless steel M8 Inserts
 - (m) Degauss Coil -- Standard
 - (n) Stray Flux Density @152 mm above table < 10 gauss
 - (o) Compressed Air Requirement -- As per cooling requirement
 - (p) System Continuous Duty -- Not less than 7 hours at the full ratings

2. Blower Specifications
 - (a) Blower Power (Full Load) -- ≤ 4 kW (5 HP)
 - (b) Air Flow Rate -- ≥ 650 CFM
 - (c) Air Pressure -- As per cooling requirement

3. Power Amplifier Specifications
 - (a) Rated Output Capacity -- 6 kVA
 - (b) Signal to Noise Ratio -- > 65 dB
 - (c) Amplifier Efficiency -- $> 90\%$
 - (d) Interlock Protection -- Over/under voltage, logic fault, external, temp control power, oil pressure, door open, module O/T
 - (e) Amplifier Power Requirement -- $415 \pm 10\%$ VAC, 50Hz, 3Ph

4. Slip Table Specifications
 - (a) Working area of the table -- 500x500mm
 - (b) Effective Mass (nominal) -- Less than 32kg
 - (c) Thickness -- 40mm
 - (d) Useable Frequency -- up to 2000Hz
 - (e) Material -- Magnesium Alloy
 - (f) 50x50mm grid pattern of the inserts should be provided

5. Head Expander Specifications

- (a) working size of the Head Expander -- 500×500mm
- (b) Effective Mass (nominal) -- Less than 20 kg
- (c) Useable Frequency -- up to 2000Hz
- (d) Material -- Magnesium Alloy
- (e) 50×50mm grid pattern of the inserts should be provided

6. Hardware specs of Vibration Controller : 4 input channels, 1 output

- (a) Dynamic range : >92 dB
- (b) Analog-to-digital converter : 24-bit
- (c) Amplitude accuracy : Within $\pm 0.20\%$ of value or $\pm 0.03\%$ of full scale
- (d) Amplitude linearity : $\pm 0.03\%$ of full scale or $\pm 0.2\%$ of measured value, whichever is greater
- (e) Voltage ranges : Application dependent; 27 mV to 10V full Scale, in 3dB steps for Random and Shock, 12 mV to 10V full scale, in 1 dB steps for Sine
- (f) Overload detection : Full scale on all channels, analog and digital detection
- (g) Voltage coupling : AC or DC
- (h) ICP power : 4 mA (20V maximum into open circuit)
- (i) Maximum rated input signal : ± 35 Volts peak
- (j) Sampling rate : 51,200. samples per second minimum
- (k) Multichannel sampling interval : Simultaneous sampling on all channels-no interval
- (l) Frequency accuracy : ± 5 ppm
- (m) Frequency range reduction : Digital decimation and filtering using on-board DSPs
- (n) Anti-aliasing filters
(6 pole analog anti-aliasing filters with a fixed frequency A/D)
 - Analog
 - (i) Type : Filter should match 64X oversampling A/D converter
 - (ii) Cutoff frequency : Fixed at 225 kHz
 - (iii) Alias attenuation : >96dB
 - (iv) Passband ripple : Within ± 0.10 dB
 - Digital
 - (i) Cutoff frequency : Variable
 - (ii) Stopband attenuation : >96 dB at 1.56 times cutoff frequency
 - (iii) Passband ripple : Within ± 0.15 dB
- (o) Channel-to-channel match
 - (i) Amplitude (compensated) : Better than ± 0.25 dB
 - (ii) Phase (compensated) : Better than ± 1.0 degree to 2 kHz
 - (iii) Crosstalk : > -90 dB below full scale

- (p) Offset removal
- (i) Type : Digitally controlled offset rejection
 - (ii) Accuracy (compensated) : Better than $\pm 0.5\%$ of full scale, for each input range
 - (iii) Input impedance : 1 Meg Ohm shunted by < 120 pf
- (q) Connector type : BNC, Pseudo-differential, 10 Ohms to system ground, low side return
- (r) Calibration
- (i) Calibration constants : Internal digital calibration, NIST referenced; Digital calibration constants stored in nonvolatile RAM
- (s) Hardware Processor: Dedicated Floating Point DSP hardware for measurement and Control
- (t) Output Subsystem
- (i) Dynamic range : > 90 dB
 - (ii) Digital-to-analog converter : Precision 16-bit
 - (iii) Maximum output amplitude : ± 12 Volts peak
 - (iv) Maximum output current : 16 mA
 - (v) Voltage range attenuator: Programmable 48-bit
 - (vi) Attenuator range : 0 to -160dB
 - (vii) Attenuator step resolution

0 to -90dB	0.05 dB
-90 to -110dB	0.10 dB
-110 to -135 dB	0.20 dB
 - (viii) Digital

Cutoff frequency:	Variable
Stopband attenuation :	> 96 dB at 1.58 times cutoff frequency
Passband ripple	: Within ± 0.07 dB
 - (ix) Output offset removal

Type:	Digitally controlled rejection of internal and external offsets
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 - (x) Accuracy : Better than $\pm 0.5\%$ of full scale
 - (xi) Output impedance : 60ohms
 - (xii) Unattenuated output: Signal available on separate BNC connector
 - (xiii) Unattenuated output level : 1Volt peak, generated after analog smoothing filter
 - (xiv) Output connector type :BNC
 - (xv) Output type : Pseudo-differential, 10 Ohms to system ground low side return
 - (xvi) Output cable : Designed to drive up to 50 feet of shielded 50 ohm coaxial cable
 - (xvii) Calibration : Automatic Internal digital calibration, NIST referenced
 - (xviii) Calibration constants : Digital calibration constants stored in nonvolatile RAM

(u) General

- (i) Power voltage : 100 to 125 Volts or 200 to 240 Volts
Frequency : 50 Hz
- (ii) Typical power usage : 150 watts
- (iii) Temperature (operating) : 10 deg C to 40 deg C
- (iv) Temperature (non-operating): -25 deg C to 60 deg C
- (v) Humidity : 20% to 80% non-condensing

(w) Personal Computer

- (i) Type Intel Pentium
- (ii) Operating system MS Windows XP/7
- (iii) CPU MHz 2 GHz and higher
- (iv) Memory 1 GB RAM
- (v) Hard disk 500 GB
- (vi) CD ROM Variable speed drive
- (vii) Color monitor : 1280 x 1024 resolution required
- (viii) Networking : Ethernet, 100BaseT connector standard
- (ix) Ports : USB

7. Vibration control system software:

Vibration control software package shall have the following major functions:

(a) RANDOM VIBRATION CONTROL

(True Random - The random output throughout the test created using four overlapping segments for control of significant resonance)

- Frequency range : 10kHz max
- Resolution : 100, 200, 400, and 800, upto 1600 lines

- Units : g-in/s-in; g-m/s-mm; m/s²-m/s-mm
- Spectral alarm/abort limits : Independent positive and negative alarm and abort tolerances for each breakpoint
- Test duration : User-defined, maximum 9999:59:59
- Dynamic Range : up to 90 dB

(b) SINUSOIDAL VIBRATION CONTROL

(Sine Sweep Control software shall be furnished which provides analog quality, Sine sweep generation with no discernable steps and instant dynamic load compensation)

- Frequency range : 5 kHz max
- Resolution : 2000 points per sweep max
- Dynamic Range : > 80 dB with 0.05 dB level step control over the full range
- Level accuracy : Control to within ± 1 dB at a sweep rate of 1 Octave/min through a 600 Hz resonance of a

- Loop time : linear system
- Dynamic Range : < 5 ms for single channel control
- Dynamic Range : up to 90 dB

(c) CLASSICAL SHOCK VIBRATION CONTROL

(Adaptive control algorithm with transfer function updating and coherence smoothing to accurately and quickly compensate for nonlinearities of time varying changes in the dynamic load)

- Dynamic Range : Up to 90 dB
- Types : Half-Sine, Trapezoidal; Saw-tooth waveform
- Pulse duration : 0.1 to 32000 ms
- Pulse amplitude : 0.01 to 500 g
- Rise, Peak, Fall time(trapezoidal) : 0.1 to 10,000 ms
- Units : g-in/s-in; g-m/s-mm, m/s²-m/s-mm
- Frequency range : from 50 Hz to 10 kHz
- Real-time analysis : Pulses and spectra for 1 to 4 channels simultaneously displayed
- SRS Resolution : 1/1, 1/3, 1/6 Octave
- SRS damping : 0.1 to 99 %, user selectable
- Scaling of display : Log/linear, auto-scaled/fixed, full control

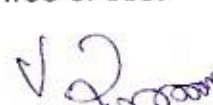
8. SENSORS

Accelerometer 4 No's should be provided as per following specifications

- Type & Qty : Uni-axial- 4 Nos
- Sensitivity ($\pm 10\%$) : 2x 10 mV/g and 2 x 100 mV/g
- Measurement Range : 100 g or more
- Frequency Range ($\pm 05\%$) : 0.5 to 6000 Hz
- Resonant Frequency : > 40kHz
- Overload limit (shock) : ± 5000 g pk
- Weight : < 5gm
- Mounting : Threads

9. ADDITIONAL REQUIREMENT

- (a) Attached CE Compliance certificate along with the quotation for the quoted model.
- (b) 1 year Guarantee/ Warranty from the date of acceptance against manufacturing defects.
- (c) Operating and service manual should be provided in hard and soft copy
- (d) Calibration Certificate to be provided for all the parameters and ranges covering minimum to maximum of ranges at 95% confidence level and K=2 by NIST/ IEC 17025:2005 accredited calibration lab.
- (e) Operational Training should be provided with free of cost
- (f) Installation / Commissioning shall done with free of cost


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- (g) The supplier should quote AMC Charges separately for the period of 2, 3 and 5 years after completion the warranty of the Shaker.

Terms and condition of an AMC:

1. Engineer should visit the CEC, IITM at every quarter for preventive maintenance of Shaker.
 2. Engineer visit will required after the report of failure of the shaker within 24 hours
 3. Preventive maintenance report should be submitted.
 4. Quarterly payment will be done for the AMC after submission of test report.
- (h) Vendor should furnish user list of similar type of Test Facility's supplied by the firm and should be provided along with the quotation with at least five references with details viz. names of user with contact no. etc.
- (i) **Vendor should have the experience of supplying at least 5 similar or larger vibration systems in India.**

cc Jdm


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