

INTERDISCIPLINARY CENTRE FOR ENERGY RESEARCH

Indian Institute of Science (IISc), Bangalore, INDIA

Tender Notice

Tender Notification Ref No.: ICER/ENQ/TNDR/PK/18-19/01 Date: 14th December 2018

The *Interdisciplinary Centre for Energy Research*, Indian Institute of Science Bangalore, invites tenders for supply of “**High-Speed Rotor Balancing Machine**”. This Invitation for Bids is open to all manufacturers or their dealers specifically authorized by the manufacturers to quote on their behalf for this tender and Indian agent of foreign principals, if any.

The scope of bid includes **Design, Engineering, Manufacturing and supply of Rotor Balancing Machine.**

All the bidders are requested to follow below mentioned **Detailed Technical Requirements**, Terms and Conditions for submission of bids.

1) Technical Requirements:

Description	Specification
Type of balancing	
a) Rotor balancing for 5,000-80,000 rpm	(ISO-1940) Grade 1.0
b) Rotor balancing, up to 5,000 rpm	(ISO-1940) Grade 2.5
Pedestal Details	
i. No. of pedestals	4 nos.
ii. Typical axial pedestal stiffness (Manually variable)	20-200 kg/ micron
iii. Flat top pedestals with provision for mounting different bearing types:	a) Hard Bearings: <i>Ball, roller and taper roller bearings</i> b) Soft bearing: <i>Oil sleeve, Air/Gas (aerostatic and aerodynamic type) and Magnetic (both active and Passive) Bearings</i>
iv. Manual millimetre Steel scale to be attached on the test bed	
v. Provision to mount Accelerometers (Meggitt 42A18) and Proximity sensor (Keyence EX-110V)	M6 holes to be provided on the pedestal
vi. Force sensor for vibration pickups	50 mV/N
Weights and Dimensions	
a) <i>Weights</i>	
i. Maximum weight of rotating member	40 kg

ii.	Maximum weight of rotating member per pair of pedestals	20 kg
iii.	Maximum weight of assembly including Rotor + Stator+ bearings + Bearing housing	120 kg
iv.	Maximum weight of assembly per pair of pedestals	60 kg
<i>b) Dimensions</i>		
i.	Maximum distance between two pedestals (between inner faces)	1500 mm
ii.	Minimum distance between any two pedestals (between inner faces)	35 mm
iii.	Maximum rotor diameter	200 mm
iv.	Maximum assembly diameter including Rotor + Stator + bearings + Bearing housing	300 mm
Machine accuracy and range		
a)	Typical achievable accuracy as per Grade 1.0 (ISO-1940)	0.3 mm-g/kg
b)	Sensitivity per plane at 2500 rpm or more	0.1 g.mm
c)	Balancing speed range	100-80,000 rpm
d)	Balancing level up to 5,000 rpm	As per Grade 2.5 (ISO-1940)
e)	Balancing level above 5,000 rpm	As per Grade 1.0 (ISO-1940)
Motor and Drive Details		
a)	Minimum Motor power	1.5KW
b)	Motor speed	100-20,000 rpm
c)	Electrical drive Control	VFD
d)	Mechanical drive	
i.	Belt drive	Speed range-500-80,000 rpm
ii.	End drive	Speed range- 100-20,000 rpm
e)	Vacuum compatible	Yes
f)	Quantity	1 nos.
Control System and Software Details		
<i>a) Control System</i>		
i.	No. of channels	4
ii.	Interface between Instrumentation and PC	Ethernet
iii.	Software Platform	Windows XP or higher
iv.	Computer P.C	Pentium Celeron or higher available
v.	Filters to cut out spurious vibrations (noise) while measuring unbalance. Synchronous filters (Automatic Speed Tracking Filters) are preferred as these eliminate the need for manual tuning or adjustments.	
<i>b) Software details</i>		
i.	Automatic comparison with Tolerance	

ii.	Software should resolve the twin plane unbalance separately into static and couple components to facilitate easier and faster balancing of complicated rotor configurations like turbine and compressor blade assemblies.
iii.	The unbalance correction weight and angular location to be Numerical (Digital) display. In addition, unbalance, unbalance tolerance and tolerance status to be displayed for each correction plane.
iv.	Flexible rotor balancing at several speed making correction up to 8 planes
v.	Automatic calculation of correction weights and angular positions applied to a segmented rotor. Should allow between 3 and 99 rotor segments.
vi.	Control software should store and retrieve rotor data of prior rotor designs
vii.	Control Display Modes to have Amount and Angle, polar diagram (live update), Split-Vector, Bode diagram
viii.	Automatic electronic compensation mechanical/machining features such as key ways and keys, according to ISO 8821.
ix.	Automatic electronic compensation of tooling eccentricity and tooling unbalance
x.	Require the raw sensor output from pedestal force sensors
xi.	Provision to enter the type of bearing, Bearing span, Pedestals distance etc.
xii.	The electronic should have all features of low-speed balancing for rigid rotors. In addition, the following additional features for flexible rotor balancing should be available: <ul style="list-style-type: none"> a) Digital display of measured unbalance in component (X-Y co-ordinates) b) Vector display on colour monitor c) Selection of frequency components “1f” or “2f”
Balancing plane configurations	
a)	Both correction planes between pedestals
b)	Both correction planes outside of pedestals (Dumbbell)
c)	One correction plane between pedestals one outside of left pedestal.
d)	One correction plane between pedestals one outside of right pedestals.

e) Both correction planes outside of left pedestals (Double overhung left).
f) Both correction planes outside of left pedestals (Double overhung right).
g) Single-plane modes of the above.
High Speed Balancing Specific Details
<i>a) Vacuum Chamber</i>
i. The machine should be designed for working in a burst proof vacuum chamber which incorporates bed, pedestals and other items. vacuum seal, drive seal, vacuum breaking circuit etc. and vacuum system with instrumentation and ducting to be provided
ii. Vacuum level of 0.1 bar
iii. Quantity of feedthrough connectors for:
a) Electrical wires-4nos
b) Pneumatic hoses-4nos
c) Hydraulic hoses-4nos
d) Cooling tubes-4nos
<i>b) Additional Requirements</i>
i. Provision for Bearing Lubrication: Provision to take out electrical cable and hydraulic, Pneumatic cooling tubes out of the vacuum chamber (IISc will provide specific sizes of the feedthrough to the successful bidder)
ii. The machine should be of HARD BEARING design which permits changing jobs without any calibration or trial runs by simply dialling the job dimensions.
iii. The machine should be designed for the low-speed and high-speed balancing of both rigid and flexible rotors of different lengths and diameters.
iv. Total Warranty for the period of 3 years to be provided (1 year standard + 2 years extended)
v. Software upgradation to be provided free of cost for the period of 5 years.
vi. Standard tool kit to move the pedestals to be provided

2) Vendors scope of supply for the above High-speed Rotor balancing Machine:

- a) Instrumented pedestals with pick-ups, variable stiffness device, support for taking bearings, oil inlet parts, traversing system etc.
- b) Machine bed.

- c) Vacuum chamber with vacuum seal, drive seal, vacuum breaking circuit etc.
- d) Vacuum system with instrumentation and ducting.
- e) Instrumentation, including sensors and PC.
- f) Switchgear + Wires + Cabinet.
- g) Electronic system with software for balancing
- h) Hydraulic station with vacuum proof tanks, piping's, suitable pumps etc. and electricals for the control of hydraulic stations.
- i) Complete vacuum system with electricals and controls.
- j) Drive motor, Pulleys, infinitely variable control system with suitable power, as per machine size.
- k) Tool kit and spare Force sensors.
- l) Supervision of Civil work and erection + commissioning.

3) Mandatory non-technical requirements:

- a) The bidders must enclose a client list, contact details, relevant brochures and compliance certificate (Annexure I) with the tender.
- b) The bidders should be well established firm preferably leaders in the application stated above and must have a proven track record.
- c) Authorization from the OEM/ Principals as in Annexure II
- d) The order should be completed within 16-24 weeks from the date of release of the Purchase Order.

4) Supply and Commissioning requirements:

- a) Demonstration of system accuracy for balancing using our existing rotor of Grade 2.5 of ISO-1940 at IISc.
- b) Demonstration of system accuracy for balancing using our existing rotor of Grade 1.0 of ISO-1940 at IISc.
- c) Technical training regarding machine operation, machine maintenance, low-speed and high-speed balancing procedure to be provided at IISc.

5) Optional requirements

- a) Extended Warranty: 2 years additional Warranty (Standard: 1 year, Additional: 2 years, Total-3 years) to be provided from the date of delivery at IISc, Bangalore.
- b) AMC for 5 Years

TERMS AND CONDITIONS FOR SUBMISSION OF BIDS

Both the Technical and Commercial bid should be put in separate sealed envelopes and both the envelopes should be put in another cover subscribing “**High-speed Rotor Balancing Machine**” and should reach “*The Chairman, Interdisciplinary centre for Energy Research, IISc, Bangalore-560012* on or before **Monday, 14th January 2019**.”

The Technical bid must include all the details of technical specifications of the equipment, compliance certificate along with commercial terms and conditions, **however, without the price component**. The bill of materials printed technical brochure and any other documents to help the technical evaluation of the bid may be enclosed.

1. The commercial bid must include the price of the item(s) in Indian/Foreign currency indicating the breakup of

a) For Goods manufactured within India

- (i) The price of the goods quoted Ex-works including taxes already paid.
- (ii) GST and other taxes like excise duty, entry tax and other applicable taxes which will be payable on the goods if the contract is awarded.
- (iii) The charges for inland transportation, insurance and other local services required for delivering the goods to IISc, Bangalore.
- (iv) The installation, commissioning and training charges including any incidental services, if any with applicable service taxes.

(b) For Goods manufactured abroad

- (i) The price of the goods should be quoted on CIF/DAP Bangalore, India basis.
- (ii) The charges for insurance and transportation of the goods by Air/Sea up to Bangalore India.
- (iii) The agency commission charges, if any.
- (iv) The installation, commissioning and training charges including any incidental services, if any.

2. The invoice to be billed at 5% GST for which concessional GST certificate will be provided to the vendor.

3. Please indicate the import code of the items.

4. If the goods are found to be defective, they have to be replaced / rectified at the cost of the supplier within 15 days from the date of receipt of written communication from us. If there is any delay in replacement / rectification, the warranty period should be correspondingly extended.
5. The terms FOB, FCA, CIF, CIP, etc., shall be governed by the rules prescribed in the current edition of the Incoterms published by the International Chambers of Commerce, Paris.
6. The purchases made by the purchaser for scientific purpose are exempt from excise duty and Custom Duty at a concessional rate is leviable.
7. Conditional tenders shall not be accepted.
8. Bids shall remain valid for minimum of 90 days after the date of bid opening prescribed by the Purchaser.
9. The Purchaser reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to award of Contract, without thereby incurring any liability to the affected Bidder or Bidders.
10. The bidder should have established track record of Design, Manufacturing and supply of Rotor Balancing Machines.
11. Technical support for 3 year must be provided.
12. Onsite inspection of the machine will be done by IISc before the dispatch at IISc cost.

Annexure-I

Note: Compliance Certificate to be enclosed with the technical bid

Description	Comply	Non-comply	Deviation from specifications	Remarks
Type of balancing				
a) Rotor balancing for 5,000-80,000 rpm b) Rotor balancing, up to 5,000 rpm				
Pedestal Details				
i. No. of pedestals				
ii. Typical axial pedestal stiffness (Manually variable)				
vii. Flat top pedestals with provision for mounting different bearing types				
iii. Manual millimetre Steel scale to be attached on the test bed				
iv. Provision to mount Accelerometers (Meggitt 42A18) and Proximity sensor (Keyence EX-110V)				
v. Force sensor for vibration pickups				
Weights and Dimensions				
a) <i>Weights</i>				
i. Maximum weight of rotating member				
ii. Maximum weight of rotating member per pair of pedestals				
iii. Maximum weight of assembly including Rotor + Stator+ bearings + Bearing housing				
iv. Maximum weight of assembly per pair of pedestals				
b) <i>Dimensions</i>				
i. Maximum distance between two pedestals (between inner faces)				
ii. Minimum distance between any two pedestals (between inner faces)				
iii. Maximum rotor diameter				

iv. Maximum assembly diameter including Rotor + Stator + bearings + Bearing housing				
Machine accuracy and range				
a) Typical achievable accuracy as per Grade 1.0 (ISO-1940)				
b) Sensitivity per plane at 2500 rpm or more				
c) Balancing speed range				
d) Balancing level up to 5,000 rpm				
e) Balancing level above 5,000 rpm				
Motor and Drive Details				
a) Minimum Motor power				
b) Motor speed				
c) Electrical drive Control				
d) Mechanical drive				
i. Belt drive				
ii. End drive				
e) Vacuum compatible				
f) Quantity				
Control System and Software Details				
<i>a) Control System</i>				
i. No. of channels				
ii. Interface between Instrumentation and PC				
iii. Software Platform				
iv. Computer P.C				
v. Filters to cut out spurious vibrations (noise) while measuring unbalance. Synchronous filters (Automatic Speed Tracking Filters) are preferred as these eliminate the need for manual tuning or adjustments.				
<i>b) Software details</i>				
i. Automatic comparison with Tolerance				
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	display. In addition, unbalance, unbalance tolerance and tolerance status to be displayed for each correction plane.				
iv.	Flexible rotor balancing at several speed making correction up to 8 planes				
v.	Automatic calculation of correction weights and angular positions applied to a segmented rotor. Should allow between 3 and 99 rotor segments.				
vi.	Control software should store and retrieve rotor data of prior rotor designs				
vii.	Control Display Modes to have Amount and Angle, polar diagram (live update), Split-Vector, Bode diagram				
viii.	Automatic electronic compensation mechanical/machining features such as key ways and keys, according to ISO 8821.				
ix.	Automatic electronic compensation of tooling eccentricity and tooling unbalance				
x.	Require the raw sensor output from pedestal force sensors				
xi.	Provision to enter the type of bearing, Bearing span, Pedestals distance etc.				
xii.	The electronic should have all features of low-speed balancing for rigid rotors. In addition, the following additional features for flexible rotor balancing should be available: a) Digital display of measured unbalance in component (X-Y co-ordinates) b) Vector display on colour monitor c) Selection of frequency components “1f” or “2f”				
Balancing plane configurations					
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g) Single-plane modes of the above.				
High Speed Balancing Specific Details				
<i>a) Vacuum Chamber</i>				
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ii. Vacuum level of 0.1 bar				
iii. Quantity of feedthrough connectors for:				
a) Electrical wires-4nos				
b) Pneumatic hoses-4nos				
c) Hydraulic hoses-4nos				
d) Cooling tubes-4nos				
<i>b) Additional Requirements</i>				
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ii. The machine should be of HARD BEARING design which permits changing jobs without any calibration or trial runs by simply dialling the job dimensions.				

iii. The machine should be designed for the low-speed and high-speed balancing of both rigid and flexible rotors of different lengths and diameters.				
iv. Total Warranty for the period of 3 years to be provided (1 year standard + 2 years extended)				
v. Software upgradation to be provided for the period of 5 years.				
vi. Standard tool kit to move the pedestals to be provided				

Annexure-II

MANUFACTURERS' AUTHORIZATION FORM

[The bidder shall require the manufacturer to fill in this form in accordance with the instructions indicated. This letter of authorization should be on the letterhead of the Manufacturer and should be signed by the person with the proper authority to sign documents that are binding on the Manufacturer.]

Date: [insert date (as day, month and year) of Bid Submission]

Tender No.: [insert number from Invitation for Bids]

To: The Chairman, Interdisciplinary Centre for Energy Research, IISc, Bangalore-560012.

WHEREAS

We [insert complete name of Manufacturer], who are official manufacturers of [insert full address of Manufacture's factories], do hereby authorize [insert complete name of Bidder] to submit a bid the purpose of which is to provide the following Goods, manufactured by us [insert name and or brief description of the Goods], and to subsequently negotiate and sign the Contract.

We hereby extend our full guarantee and warranty with respect to the Goods offered by the above firm.

Signed: [insert signature(s) of authorized representative(s) of the Manufacturer]

Name: [insert complete name(s) of authorized representative(s) of the Manufacturer]

Title: [insert title]

Duly authorized to sign this authorization on behalf of: [insert complete name of Bidder]