

INVITATION FOR TENDER FOR SUPPLY OF EQUIPMENT

Sealed tender offers are invited in two separate sealed covers (Technical and Commercial offers) from eligible manufacturers/suppliers or their direct Indian agents for the supply of the following equipment.

EDDY CURRENT DYNAMOMETER (WATER COOLED)

Please send offers, **ALONG WITH DESCRIPTIVE CATALOGUE/ BROCHURE**. The validity of the bid should be at least four months (120 days) or more from the date of the opening of this tender. Please ensure that your quotation reaches not later than **19.04.2018 at 15:00 Hrs** at the following address:

Dr. V. K. Tewari

**Professor, Agricultural and Food Engineering Department,
Indian Institute of Technology Kharagpur – 721 302, West Bengal, India**

Earnest money of **Rs.10,000/-** is to be deposited in the form of Account payee Demand Draft in favour of IIT Kharagpur, payable at Kharagpur, India. Any bid which is not accompanied with an EMD shall be summarily rejected. Earnest money deposited will be forfeited if the tenderer withdraws or amends its tender or impairs or derogates from the tender in any respect within the period of validity of its tender. No interest will be paid on the earnest money of the unsuccessful bidders.

Tender Reference	IIT/SRIC/AGFE/FTC/VKT/2017-18/EQ-15 Dated: 21.03.2018
Price of Tender Document	NIL
Last Date and Time for submitting the tender document	19.04.2018 at 15:00 Hrs (Indian time)
Time and Date of Opening of Technical Bids	19.04.2018 at 16:00 Hrs (Indian time)
Place of Opening Tender	Department of Agricultural and Food Engineering, Indian Institute of Technology Kharagpur – 721 302, West Bengal, India
Address of Communication	As stated above
Contact Telephone Numbers	+91- 3222 - 28 3152
E-mail	vktfeb@agfe.iitkgp.ernet.in

DETAILED TECHNICAL SPECIFICATIONS FOR

EDDY CURRENT DYNAMOMETER (WATER COOLED)

1. EDDY CURRENT DYNAMOMETER:

1. Rated absorption Power = 30 kW (3250 RPM TO 12000 RPM)
2. Maximum torque = 95 Nm
3. Speed corresponding to Max Torque = 2000 RPM to 3750 RPM
4. Maximum speed = 12000 RPM
5. Torque measurement precision = ± 0.25 FS%, 0.1 Nm resolution
6. Speed measurement precision = ± 0.5 FS %, 1 RPM resolution
7. The direction of rotation both Clockwise & Anti Clockwise.
8. Reaction type Torque Sensor to measure Torque, having 2 mV/V output.
9. 60 - Tooth wheel with magnetic pick up sensor to measure speed.
10. Torque calibrating arms and weights
11. Electro-less Nickel plating on water passages (groove side) of loss plates to ensure that corrosion does not detract from performance.
12. Magnetic heavy duty water strainer - filter.
13. Water Pressure Switch
14. Dyno. Mounting Stool and Hinge mounted guard over Cardan Shaft.
15. The Dynamometer should have CE certification 73 / 23 / EEC: Low voltage directive and 98 / 37 / EC: Machinery directory.
16. Inertia of Dynamometer should be less than < 0.097 kgm²
17. Dynamometer should be supplied with suitable Magnetic filter to filter metal particles & debris from raw water being supplied to the Dynamometer.
18. To suit Engine center height suitable stool should be provided for the Dynamometer.

2. CONTROL SYSTEM

1. The Control system should be completely Digital, this includes Digital Power stage & Digital P, I & D Micro Processor
2. The control systems should be capable to controlling the Dynamometer and the Engine in Constant Position, Constant Torque & Constant Speed Modes.
3. Bumpless Mode transfer facility should be provided in the control system.
4. Interlock with Temp Sensor & Water pressure switch, Wiring, Terminals, connector, Mains Isolator.
5. Digital display for speed, torque, power and Throttle position.
6. Engine start stop panel.
7. Digital Power module for eddy current dynamometer
8. Indicating Accuracy : Speed: $\pm 0.1\%$; Torque : $\pm 0.25\%$ of FSD
9. The Controller should have inbuilt P, I & D Controller cum Indicator for
 - Engine Water Outlet Temperature
 - Engine Water Inlet Temperature
 - Engine Lube Oil Temperature
 - Exhaust Gas Temperature
 - Engine Lube Oil Pressure
10. Serial Interface with PC Based Automation System

3. ENSORS & DATA ACQUISITION MODULE

3.1 Data Acquisition Module: 16 Channels

High Speed Data Acquisition Module having 16 Universal channels, Sampling rate: 100 milli seconds or better (per channel), Baud Rate: 10 Mbps, Protection class: IP 54 for enclosure. Compliance to EN 61000 EMI/EMC is essential to ensure no effect of external noise on the Unit.

3.2 PT 100 Sensors

Provided for the measurement of: -

- Engine lube oil temperature
- Dynamometer raw water outlet temperature
- Dynamometer raw water inlet temperature
- Engine fuel inlet temperature
- Engine coolant inlet temperature
- Engine coolant outlet temperature
- Engine Air inlet temperature

3.3. Thermocouple

With CR-AL thermocouple sensor & 3 meter cable for measurement of engine exhaust gas temp.

3.4. Pressure Transmitter

Provided for the measurement of: -

- Engine lube oil pressure, Range: 0 to 10 bar
- Air inlet pressure, Range 0 to 1 bar
- Fuel inlet pressure, Range 0 to 4.5 bar
- Exhaust Back Pressure, Range 0 to 500 mbar
- Barometric pressure, Range 0.8 to 1.2 mbar

3.5. Relative Humidity Sensor

Indian make, Accuracy: +/- 2%, suitable interface would be provided with PC based system.

3.6. Transducer Box With Stand & Swiveling Arm

to house above sensors

4. CONTROL PANEL

- Size of Panel should be atleast 42 U to house Controller, PC, Monitor, PID Controller etc.
- Panel should have IP 57 Protection & should be Rittal Make Only.
- Alarm Annunciator – 8 Channel to indicate faults – Dynamometer Water High Temp, Engine Temp High, Oil High Temp, Low water flow. etc.
- Digital Time Totalizer - 1 No.
- Servo Voltage Stabilizer : 3 kVA

5. ECU THROTTLE

Controller should have feature to directly interface with Engine ECU Throttle (via analogue voltage)

6. PC BASED DYNAMOMETER DATA ACQUISITION & CONTROL SYSTEM

Control Panel mounting stand on ground floor. Consisting of:

- Hardware package including Commercial Grade PC (Latest version), Key board and Printer (Desk jet or Dot Matrix) & Acquisition card modules.
- Touch Screen, Industrial Monitor, Panel Mounted 19"
- Software package for logging the engine test results.
- The systems have following features:
 - Configurable scan channels (16 Analog), 40 user definable formulae and 100 precompiled hard coded software channels (16-bit resolution)
 - Flexible screen design
 - Configurable test results print formats
 - Auto / Manual selector switch. (Manual Mode is redundant to Auto Mode. In case PC system for Auto mode fails, Dynamometer still can be operated in Manual mode)
 - Printer (HP) LaserJet
 - UPS (Champion/APC Make)

7. VOLUMETRIC FUEL CONSUMPTION UNIT ALONG WITH CALIBRATION SET UP

Glass tube assembly (25 + 50 cc) is housed in MS fabricated enclosure with top and bottom supports. Photo sensors are fitted on Glass tube, to regulate specific volume of fuel required during testing. Digital timer (with suitable interface to connect with PC based system) is provided for indication time in seconds for the selected volume of fuel. Least count of timer is 0.1 second. Measurement Accuracy: 0.5% of selected volume whichever is more quantity

Accessories to be Supplied with Fuel Meter: -

- **Header Tank** (15 Ltrs), Capacity with air vent, visual level indicator level switch, barrel pump for filling fuel in header tank
- **MS Fabricated Bracket** for mounting FCMA 04 & Fuel Tank on Wall.
- **Calibration Flask** for periodic calibration check.
- **Legris ½" Ball valves** (Qty 4).
- **Strainer** at Inlet to the Header tank
- Commercial Mico **Diesel Fine Filter** at tank outlet
- **Serial Communication Port** for interface to PC Based Data Acquisition System.

8. COOLING BLOWERS

To carry away the surface heat from the Engine body we have proposed cooling blowers of fixed air flow rate. The Blower would be mounted on LH Side & RH Side of the engine with air mainly directed towards the Engine cylinder block. The air draft across the Engine will help reduce the Engine body temperature (which could exceed during performance test or durability testing).

Specification: -

- Type: Centrifugal - Air Flow: 2750 m³/hr
- Material of Construction: MS
- Drive Arrangement: Direct

9. THROTTLE ACTUATOR TYPE – SERVO MOTOR TYPE AUTOMATIC

Torque output : 15 Nm or higher (response time < 0.5 s)

Max. lever movement: 90 Deg. Position : 0 to 100%

Accuracy : +/- 0.25%

Stroke length : 90.5 mm

Sensor type feedback potentiometer

10. AC MOTORING DYNAMOMETER

The test bench should have facility of Friction measurement. This is possible by using an AC Motor at back end of the Eddy Current Dynamometer. The setup provides facility to execute repeatable Motoring test of an Engine or a part engine for short as well as continuous duty cycles. An AC Motoring Dynamometer of 5.0 kW

capacity shall be provided. Suitable clutching mechanism should be considered for engagement between the Dynamometer & the Motor during Frictional HP Measurement Test. Suitable torque & Speed measurement facility (accuracy 2% of FS) should be provided for the AC Motoring Dynamometer.

11. VFD FOR AC MOTORING DYNAMOMETER

The VFD for the Motoring Dynamometer provides variable frequency and amperage to the 5.0 KW AC Motor for speed control of the test article

- Wide supply voltage fluctuation range: 400 V to 500 V (Rated supply: 3 Ø, 415 V, 50 Hz AC).
- IP 20 Degree of Protection
- Ambient temperature: -10° C to + 55° C.
- Relative humidity: max 95 %
- Compliance to CE with latest trends in the Power Device Technology Incorporated and reliability is ensured.

GENERAL TERMS & CONDITIONS

PLEASE SPECIFICALLY INDICATE THE FOLLOWING POINTS IN YOUR QUOTATIONS AND COMPLY THE TERMS AS MENTIONED HEREUNDER:-

1. TENDERS ARE INVITED COMPLYING THE REQUIREMENT FOR TENDER AS DETAILED IN THE TENDER SPECIFICATION TO BE SUBMITTED IN THE COMPANY'S / FIRM'S LETTERHEAD NEATLY PRINTED / TYPED DULY SIGNED BY AUTHORIZED PERSON WITH THE SEAL OF THE BIDDERS. ALL ENVELOPS CONTAINING THE TENDER SHOULD BE PROPERLY SEALED. SEPARATE ENVELOPS SHOULD BE USED FOR TECHNICAL AND PRICE BID AND INDICATION TO THEIR EFFECT MAY PLEASE BE SUPERSCRIBED ON THE ENVELOP.

THE FOLLOWING DOCUMENTS ARE REQUIRED FROM THE INDIAN AGENTS OF FOREIGN FIRMS:

- 1.1 FOREIGN PRINCIPAL'S PROFORMA INVOICE INDICATING THE COMMISSION PAYABLE TO THE INDIAN AGENT AND NATURE OF AFTER SALES SERVICE TO BE RENDERED BY THE INDIAN AGENT.
- 1.2 COPY OF THE AGENCY AGREEMENT WITH THE FOREIGN PRINCIPAL INDICATING THE NATURE OF AFTER SALES SERVICES, PRECISE RELATIONSHIP BETWEEN THEM AND THEIR MUTUAL INTEREST IN THE BUSINESS.
- 1.3 PLEASE ENCLOSE THE DOCUMENT(S) RELATED TO THE ENLISTMENT OF THE INDIAN AGENT WITH DIRECTOR GENERAL OF SUPPLIES & DISPOSALS (DGS & R) UNDER THE COMPULSORY REGISTRATION SCHEME OF MINISTRY OF FINANCE.
2. TECHNICAL CATALOGUE/LEAFLET SHOULD BE ENCLOSED WITHOUT FAIL. PROVIDE COMPLIANCE STATEMENT WITH RESPECT TO THE TECHNICAL SPECIFICATIONS MENTIONED ABOVE.
3. PLEASE CONFIRM WHETHER YOU ARE AUTHORISED TO QUOTE ON BEHALF OF YOUR PRINCIPALS AND IF SO, PLEASE ENCLOSE A COPY OF SUCH AUTHORISATION WITH YOUR QUOTATION.
4. **PRICE BIDS FOR FOREIGN FIRMS:** PRICES ARE TO BE QUOTED ON 'EX-WORKS' DULY PACKED OR ON "FCA/FOB" INTERNATIONAL PORT" BASIS AND ALSO INCLUDING AGENCY COMMISSION PAYABLE TO YOUR INDIAN AGENTS, IF ANY SHOWING CLEARLY THE FOLLOWING BREAK UP:-

- I) EX-WORKS PRICE
- II) PACKING & FORWARDING
- III) FREIGHT
- IV) ANY OTHER RELEVANT EXPENSES.
- V) TAXES PAYABLE BY THE INSTITUTE

INSURANCE WILL BE PAID BY OUR INSTITUTE SEPARATELY AND SHOULD NOT FORM PART OF THE QUOTED PRICE.

PRICE BIDS FOR INDIAN FIRMS: PRICES ARE TO BE QUOTED ON F.O.R., IIT KHARAGPUR, ON DOOR DELIVERY BASIS CLEARLY SHOWING THE BREAK UP.

5. **PERIOD OF VALIDITY:** BIDS SHALL REMAIN VALID FOR ACCEPTANCE FOR A PERIOD OF 120 DAYS FROM THE DATE OF OPENING.
6. INDIAN AGENTS ADDRESS AND PERCENTAGE OF AGENCY COMMISSION INCLUDED IN ABOVE F.O.B./EX-WORKS PRICE. (THIS WILL BE PAID TO THE INDIAN AGENTS IN INDIAN RUPEES ONLY AND NOT IN **FE**). PLEASE ENCLOSE COPY OF AGENCY AGREEMENT ENTERED INTO WITH YOUR

PRINCIPALS INDICATING THE NATURE OF AFTER SALES SERVICES OF INDIAN AGENTS, PRECISE RELATIONSHIP & MUTUAL INTEREST IN THE BUSINESS.

7. **MEASUREMENTS/WEIGHT:** NETT/GROSS OF THE CONSIGNMENT. IN CASE OF AN ORDER, YOU SHALL USE AIR WORTHY PACKAGE (AS APPLICABLE) DULY CERTIFIED WITH DOCUMENTS – PLYTO – SANITARY CERTIFICATE (AS PER QUARANTINE ORDER 2003).
8. **SCOPE OF SUPPLY:** SHOULD INCLUDE FREE INSTALLATION AND COMMISSIONING
9. **PAYMENT TERMS FOR FOREIGN FIRMS**

The offer will be made on a single currency and only one PO will be issued for the entire scope of the supply.

A) 90% PAYMENT THROUGH SIGHTDRAFT/FORIGN DEMAND DRAFT/LC (EXCEPTIONAL CASES)/SWIFT TELE TRANSFER AFTER RECEIPT OF STORE IN GOOD ORDER AND CONDITION AND 10% AFTER SUCCESSFUL INSTALLATION & COMMISSIONING.

B) BANK CHARGES ON LC/SD (WITHIN INDIA APPLICANT ACCOUNT AND OUTSIDE INDIA TO BENEFICIARY ACCOUNT).

PAYMENT TERMS FOR INDIAN FIRMS

A) 100% PAYMENT THROUGH CROSSED ACCOUNT PAYEE CHEQUE / ELECTRONIC TRANSFER AFTER RECEIPT OF STORE IN GOOD ORDER & CONDITION AND SUCCESSFUL INSTALLATION & COMMISSIONING.

B) ENSURE MENTIONING

i) BANK DETAILS OF THE BENEFICIARY, GST NO. AND PAN NUMBER

ii) FULL NAME AND ADDRESS OF THE BENEFICIARY ON WHOM ORDER HAS TO BE PLACED

10. WHETHER ANY EXPORT LICENCE IS REQUIRED FROM YOUR GOVERNMENT, IF SO, PLEASE CONFIRM WITH DETAILS.
11. COUNTRY OF ORIGIN OF THE GOODS IS TO BE MENTIONED.
12. THE INSTITUTE SHALL PROVIDE THE CONCESSIONAL CUSTOMS DUTY AND EXCISE DUTY EXEMPTION CERTIFICATE AS PER GOVT. NOTIFICATION NO. 51/96 CUSTOMS DATED: 23.07.1996 AND CENTRAL EXCISE DUTY EXCEMPTION IN TERMS OF GOVT. NOTOFICATION NO. 10/97 – CENTRAL EXCISE DATED: 01.03.1997 AS AMENDED FROM TIME TO TIME.
13. **LIQUIDATED DAMAGES:** THE STORES SHOULD BE DELIVERED / DISPATCHED TO DESTINATION AND READY FOR OPERATION NOT LATER THAN THE DELIVERY DATE SPECIFIED. IT THE SUPPLIER FAILS TO DELIVER ANY OR ALL THE STORES OR PERFORM THE SERVICE BY THE SPECIFIED DATE, LIQUIDATED DAMAGES AT 1% PER MONTH OR PART THEREOF IN RESPECT OF THE VALUE OF STORES WILL BE DEDUCTED FROM THE CONTRACT PRICE SUBJECT TO A MAXIMUM OF 5%. ALTERNATIVELY, THE ORDER WILL BE CANCELLED AND THE UNDELIVERED STORES PURCHASED FROM ELSEWHERE AT THE RISK AND EXPENSE OF SUPPLIER.
14. **PATENT RIGHTS:** THE SUPPLIER SHALL INDEMNIFY THE PURCHASE AGAINST ALL THIRD PARTY CLAIMS OF INFRINGEMENT OF PATENT, TRADEMARK OR INDUSTRIAL DESIGN RIGHTS ARISING FROM USE OF THE GOODS OR ANY PART THEREOF IN INDIA.

15. ONLY THOSE BIDDERS WHO'S BIDS HAVE BEEN TECHNICALLY FOUND ACCEPTABLE WILL ONLY BE INVITED FOR PARTICIPATION IN THE PRICE BID.
16. THOSE BIDDERS WHO DO NOT RECEIVE ANY COMMUNICATION FOR PARTICIPATION IN PRICE BID OPENING MEETING MAY PRESUME THAT THEIR BID HAS NOT BEEN ACCEPTED BY THE INSTITUTE.
17. CONDITIONAL OFFER WILL NOT BE ACCEPTED.
18. LATE TENDERS I.E. TENDER RECEIVED AFTER THE DUE DATE AND TIME OF SUBMISSION AS MENTIONED ABOVE SHALL NOT BE ACCEPTED.
19. BIDDERS TO ENCLOSE THE FOLLOWING DOCUMENTS:-

A) INCOME TAX RETURN (3 YRS) AND LATEST SALES TAX RETURN (GST No.), AND PAN NO.

B) BANKER'S SOLVENCY CERTIFICATE

C) SUMMARY OF AUDITED STATEMENT OF ACCOUNTS FOR THE LAST THREE YEARS TO BE ENCLOSED AND FINANCIAL HIGHLIGHTS AND THE KEY PERFORMANCE DURING THE LAST THREE QUARTERS TO BE ENCLOSED AS PER FORMAT:-

COMPANY'S KEY PERFORMANCE

DESCRIPTION	JAN. TO MARCH	APRIL TO JUNE	JULY TO SEPT.
GROSS REVENUE			
PROFIT BEFORE TAX			
PROFIT AFTER TAX			
RETURN ON INVESTED			
CAPITAL (ROIC)			

D) CUSTOMER SATISFACTION CERTIFICATE FROM ONE SUCH ORGANIZATION IS TO BE ATTACHED WITH THE TECHNICAL BID AND PRICE BID.

E) NAME AND ADDRESS OF MINIMUM THREE CLIENTS TO WHOM SUCH EQUIPMENT HAVE BEEN SUPPLIED SHOULD BE MENTIONED.

20. **WARRANTY / GUARANTEE:** THIS COMPREHENSIVE WARRANTY / GUARANTEE SHALL REMAIN VALID FOR **12 MONTHS** AFTER THE GOODS (OR ANY PORTION THEREOF AS THE CASE MAY BE) HAVE BEEN DELIVERED AND COMMISSIONED TO THE FINAL DESTINATION.
21. THE INSTITUTE DOES NOT BIND ITSELF TO OFFER ANY EXPLANATION TO THOSE BIDDERS WHO'S TECHNICAL BID HAS NOT BEEN FOUND ACCEPTABLE BY THE EVALUATION COMMITTEE OF THE INSTITUTE.
22. ALL TENDERS (UNLESS OTHERWISE SPECIFIED) ARE TO BE SUBMITTED / HANDED OVER TO **DR. V. K. TEWARI, AGRICULTURAL AND FOOD ENGINEERING DEPARTMENT, INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR - 721 302** AND ACKNOWLEDGEMENT TO BE OBTAINED.

IMPORTANT

1. IIT Kharagpur authority may accept or reject any or all the bids in part or in full without assigning any reason and does not bind itself to accept the lowest bid. The Institute at its discretion may change the quantity / upgrade the criteria / drop any item or part thereof at any time before placing the Purchase Order.
2. Promptly make arrangements for repair and / or replacement of any damaged item (s) irrespective of settlement of claim.
3. In case of any dispute, the decision of the Institute authority shall be final and binding on the bidders.
4. For any query pertaining to this bid document correspondence may be addressed to **Dr. V. K. Tewari**, at the address mentioned above.

LAST DATE FOR SUBMISSION OF SEALED BIDS: 19.04.2018

- 1) Please Note that the Institute remains closed during Saturdays & Sundays and all specified government holidays.
 - 2) Fax, e-mail Tender will not be accepted.
 - 3) The General Terms and Conditions as stated above relate to supply of stores / equipment /assets etc. and for specific service other terms and conditions of the Institute will apply.
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